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PRE-BID TIE UP FOR 50MW/150MWH BATTERY ENERGY STORAGE SYSTEM HAVING 10 YEARS OF PLANT O&M OF M/S SECI'S 100 MW (AC) SOLAR PV PROJECT (200MWP DC CAPACITY)

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1.	**Section – A:** General Instructions	1
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3.	**Section – C: BESS SPECIFIC TECHNICAL REQUIREMENTS** Introduction, General Instructions, Scope of Work, Technical Requirements, Spares, Scope Matrix, Quality Requirements & Liquidated Damages.	332 (PDF Pages)
4.	**Section - D:** SECI specification for project Electrical SLD Compartment Map	 1149 (PDF Pages) 2 1
5.	**Section – E:** Attachments (To be submitted along with the bid)	Att 1 to 5
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SECTION – A

GENERAL INSTRUCTIONS

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SECTION –A

GENERAL INSTRUCTIONS TO BIDDERS

BHEL is participating in tender for design, engineering, supply, construction, erection, testing & commissioning of 100 MW (AC) Solar PV Project (200MWp DC capacity) along with 50MW/150MWh Battery storage system having 10 years of plant Operation & Maintenance at district Rajnandgaon, Chhattisgarh, India for M/s SECI. The purpose of this specification is to enter a pre-bid tie-up for 50MW/150 MWh Battery Energy Storage System having 10 years plant O&M. Bidder shall be totally responsible for the desired performance of the offered BESS system including survey, planning, design, engineering, manufacturing, testing, insurance, supply, installation and commissioning, comprehensive AMC on Turnkey basis. All required documents against this tender/specification shall be submitted in English only.

The technical requirements specified herein are broad in nature. Bidder shall ensure inclusion of complete scope required for completeness of the BESS system for supply, commissioning, meeting functional guarantees and O&M on as required basis though the same have not been specifically stipulated in the tender documents.

Evaluation methodology :

a. Bidder's PQR documents will be opened first for review and evaluation by BHEL. In case, the bidder's offer do not meet the PQR, then corresponding techno-commercial offer will not be considered for further evaluation in the tender. Technical bids of those bidders who meet PQR shall be opened for review and further consideration.
b. If required during evaluation of PQR and technical offers/bids, vendor should be present at BHEL Electronics Division, Bangalore, for discussions. Further in the event of order, during approval of vendor document by customer, vendor shall accompany BHEL representative for discussions with customer/consultant.

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SECTION – B

PRE-QUALIFICATION REQUIREMENTS

REVISION: 00	Approved: Alok Mandal		
	Prepared	Issued	Date
	Patrali Sanyal	CE-Engg-SCADA	26-Nov-20

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SECTION –B

PRE-QUALIFICATION REQUIREMENTS (PQR)

1. ***The bidder must have the experience of having successfully completed Design, Engineering, Procurement, Construction, Installation, Testing and Commissioning of Grid Connected Battery Energy Storage System (BESS) of at least 03 (Three) Grid connected BESS Plants, each having an individual capacity of 5 MWh (Five Mega Watt Hour) or above in last Five years. Also, such BESS Plant capacity must have been in satisfactory operation for at least 12 (Twelve) months from the date of commissioning.***

   The make of Battery & BMS, EMS and PCS offered for the project shall be same as at least one of the reference plant of minimum capacity 5 MWh running satisfactorily for at least 12 (Twelve) months from the date of commissioning in last 5 years

   a. The bidder shall directly meet the above Qualification requirement. The details establishing Qualification requirement shall be provided as per **Attachment-1**. End user certificate establishing the qualification as per above shall mandatorily be provided in the name bidder.
2. The Bidder should have registered in India under the Companies Act of India, either a Subsidiary Company or a Joint Venture (JV) Company.
3. The responsibility of complete system including Engineering, selection of components, and erection and commissioning, O&M shall be with Bidder. Further, Bidder shall also submit letter indicating availability of service, spares for a minimum of 10 years after supply. The bidder shall provide a declaration to this effect as per **Attachment -2**.
4. The proposed BESS system shall conform to minimum Availability of 99 %. Employer's Requirements shall have to be met without any material deviation, reservation, or omission. The bid shall be technically complete and responsive.
5. If Bidder is not Original Equipment Manufacturer (OEM) for Battery & BMS, EMS and Power Conditioning System (PCS), Then the Bidder shall provide an Authorization letter from OEM for Design, Engineering, Manufacture, Testing, Supply, Erection & Commissioning, O&M including support of spares & services for a period of 10 years from operational acceptance of the corresponding system. The certificate shall be provided as per **Appendix to Attachment – 2.**
6. The bidder shall have sufficient capacities and capabilities w.r.t Design & Engineering, Manufacturing & Testing, Field Organization and resources for erection, testing & commissioning, Quality Assurance, Established Project Management, Man power etc., for carrying out the scope of work part of this tender. Bidder shall provide necessary details to this effect as per **Attachment – 3.**
7. Bidder must meet the Technical Specifications as stipulated in the Tender. Bidder shall provide certificate regarding compliance to provisions of bidding document as per **Attachment – 4**
8. Along with the documents related to PQR above, minimum required documents shall be submitted as per **Attachment - 5**

Note: In case Bidder does not submit details as per above and/ or does not meet the requirements of Pre-qualification requirements stated herein, Offers will be summarily rejected and Bidder's technical offers/proposals shall not be taken up for further evaluation.

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SECTION – C

BESS SPECIFIC TECHNICAL REQUIREMENTS

SECTION - C

INTRODUCTION
GENERAL INSTRUCTIONS
SCOPE OF WORK
TECHNICAL REQUIREMENTS
SPARES
SCOPE MATRIX
QUALITY REQUIREMENTS
LIQUIDATED DAMAGES.

1.1 Introduction

BHEL is participating in tender for design, engineering, supply, construction, erection, testing & commissioning of 100 MW (AC) Solar PV Project (200MWp DC capacity) alongwith 50MW/150MWh Battery storage system having 10 years of plant Operation & Maintenance at district Rajnandgaon, Chhattisgarh, India for M/s SECI.

The purpose of this specification is to enter a pre-bid tie-up for 50MW/150 MWh Battery Energy Storage System having 10 years plant O&M.

The End Client and Project details are as below:

Name of customer	Solar Energy Corporation of India Limited (SECI), New Delhi
Name of the project	100 MW (AC) Solar PV Project (200MWp DC capacity) with 50MW/150MWh Battery storage system.
Location of the project	Rajnandgaon, Chhattisgarh, India

The Project Particulars are enclosed at **Annexure I**.

1.2 General Instructions to Bidder

1.2.1 The bidder shall be totally responsible for the desired performance of the offered BESS system including survey, planning, design, engineering, manufacturing, testing, insurance, supply, installation and commissioning, comprehensive AMC on Turnkey basis. All required documents against this tender/specification shall be submitted in English only. Bidder shall consider the scope pertaining to BESS system alone.

1.2.2 The technical requirements specified herein are broad in nature. Bidder shall ensure inclusion of complete scope required for completeness of the BESS system for supply, commissioning, meeting functional guarantees and O&M on as required basis though the same have not been specifically stipulated in the tender documents.

1.3 Scope of work

Scope of Supply & Work included shall be on turnkey basis comprising of (but not limited to) all survey, design & engineering, procurement/ manufacturing & supply of equipment and materials, testing at manufacturers works, multi – level inspections, packing and forwarding, supply, receipt, unloading and storage at site, associated civil works, services, permits/ approvals, licences, installation and incidentals, insurance at all stages, erection, testing and commissioning of 150 MWh Battery Energy Storage System (BESS) and performance demonstration with associated equipment and materials on turnkey basis along with 10 (Ten) years comprehensive operation and maintenance from the date of Operational Acceptance.

The bidder shall provide sufficient, properly qualified personnel for Installation & Commissioning and O&M of 10 years from operational acceptance. Bidder shall include all raw materials, utilities, lubricants, chemicals, catalysts, consumables, other materials/ supplies and facilities required for successful execution of the project. Bidder shall perform all work and services of whatsoever nature, to properly carry out Pre commissioning, Commissioning & functional guarantees and 10 years of O&M.

Scope of supply and services shall be broadly as follows:

1. Battery Energy Storage System (BESS) of required power and energy capacity including battery Packs with Battery Management System (BMS)
2. Bidirectional Power Conditioning Systems (PCS) with Isolation transformer.
3. Energy Management System (EMS)
4. Step-up transformers
5. Electrical LT & HT switchgear panels
6. Electrical Protection & metering system for LT & HT switchgear panels.
7. Auxiliary supply system
8. DC & AC power cables.
9. Control and communication cables
10. RTU and related accessories for communication with the Plant Energy Management System (EMS)
11. HVAC system
12. Fire-fighting system
13. IP based CCTV system with storage (For BESS as per tender specification).
14. Aux power electrical equipment, UPS , Protection & Metering system for BESS
15. Protection switchgear and other related accessories to be coupled with the Solar PV system at the AC bus.
16. Lightning arrestors
17. HDPE pipes, cable conduits, cable trays and accessories/trenches.
18. Earthing as per relevant standards
19. Control room equipment
20. Testing instruments for maintenance and monitoring of equipment
21. Civil works covering foundations for BESS equipment, supports etc., (Master Control room shall be by employer)
22. Spares, Consumables and Tools & Tackles
23. Installation and Pre-commissioning checks and tests for all equipment
24. Synchronization and Commissioning of plant.
25. 10 (Ten) years comprehensive operation and maintenance from the date of Operational Acceptance

    The Contractor warrants that it has, and will be deemed to have, done everything that would be expected of a prudent, competent and experienced Contractor and in accordance with Good BESS Industry Practices in:

    - assessing all risks which it is assuming under the Contract; and
    - ensuring that the **O&M Price** contain allowances to protect it against any of these risks eventuating, and that it will not make a claim for an increase in the **O&M Price** if any of those risks eventuate

    The minimum O&M requirements shall include but not limited to.

    a. Total Operation & Maintenance of the BESS shall be with the Contractor, after operational acceptance of the plant till culmination of the O&M period and shall include deployment of engineering personnel and technicians.
    b. To provide a detailed training plan for all O&M procedures to Employer's nominated staff, which shall have prior approval from the Employer.
    c. Employ and coordinate the training of contractors' personnel who will be qualified and experienced to operate and monitor the facility and to coordinate operations of the facility with the grid system.

d. To maintain accurate and up-to-date operating logs, records and monthly Operation & Maintenance reports at the facility. Contractor shall keep the measured daily data at regular intervals and provide the same to Employer in electronic form, compatible in CSV format. The right to use the data shall remain with the Employer.
e. Procurement of spare parts, overhaul parts, tools & tackles, equipment, consumables, etc. required for smooth operation and maintenance of the plant as per prudent/ standard utility practices, OEM recommendations for the entire O&M period.
f. To carry out periodic overhauls or maintenance required as per the recommendations of the original equipment manufacturer (OEM) and to furnish all such periodic maintenance schedules at the time of plant commissioning/ start of O&M contract.
g. Handover the system to maintain an inventory of spare parts, tools, equipment, consumables and supplies for the facility's operation along-with required details of recommended spares list with all associated information regarding replacement records, supplier details, tentative cost, storage details, specifications on the basis of replacement frequency and mean time between failures and mean time to restore at the culmination of penultimate year under O&M period.
h. The contractor shall be responsible for all the required activities for the successful running, committed energy generation & maintenance of the Solar Photovoltaic Power Plant.
i. Monitoring, controlling, troubleshooting maintaining of logs & records, registers.
j. Preventive and corrective O&M of the Solar Photovoltaic Power Plant including supply of spares, consumables, wear and tear, overhauling, replacement of damaged components and insurance covering all risks (Fire & allied perils, earth quake, terrorists, burglary and others) as required.
k. The period of Operation and Maintenance will be deemed to commence from the date of completion of performance demonstration/Operational acceptance. O&M contract may further be extended on the mutually agreed terms and conditions for the mutually agreed period.
l. All the equipment required for Testing, Commissioning and O&M for the healthy operation of the Plant must be calibrated, time to time, from the NABL accredited labs and the certificate of calibration must be provided prior to its deployment.
m. The Contractor shall ensure that all safety measures are taken at the site to avoid accidents to his or his sub-contractor or Employer's Workmen. This will include procurement of all safety gadgets during Construction and O&M period including but not limited to, rubber mats of appropriate grade, PPE, rubber gloves and suitable shoes etc.

All approvals, for equipment, items and works, which are not otherwise specifically mentioned in this document but are required for successful completion of the work in all aspects, including construction, commissioning, O&M of BESS Power Plant and guaranteed performance are deemed to be included in the scope of the contractor. Refer **Annexure IV** O&M requirements.

The Project specific BESS capabilities and ratings are enclosed at **Annexure II.**

Special Instructions

1. In the case of a Bidder who offers to supply and install major items of supply under the contract that the Bidder did not manufacture or otherwise produce, the Bidder shall provide the declaration of system integration and spares/ services support and manufacturer's authorization, as per **Attachment – 2 & Appendix to Attachment - 2**. The BESS OEM authorization letter shall confirm that the Bidder has been duly authorized by the manufacturer or producer of the related plant and equipment or component to supply and install that item in the Employer's Country. The Bidder is responsible for ensuring that the

manufacturer or producer complies with the requirements and meets the minimum criteria as specified herein.

2. DETAILS OF DESIGN/ MANUFACTURING CAPABILITIES & CAPACITIES are to be provided as per **Attachment - 3**
3. Certificate of compliance to tender specification shall be provided as per **Attachment - 4**
4. Bill of Quantities and associated technical documents are to be provided as per **Table – 1.**
5. TECHNICAL DOCUMENTS TO BE SUBMITTED ALONG WITH THE BID shall be as per **Attachment – 5.**
6. Security, safety, watch, and ward of all materials at sites shall be the responsibility of the Selected Bidder.
7. Expenses for any other works, supply of material, and providing services required for the successful commissioning and operation of the plant, but not specifically mentioned in this document shall be borne by selected bidder.
8. Safety management to be strictly complied with by the Selected Bidder throughout implementation activity.
9. All local labour, employment, and other issues shall be handled independently by the selected Bidder.
10. The entire responsibility and risk relating towards the manpower working at the Site, and compliance of different statutory regulations like Workman Compensation Act, Employees State Insurance Corporation (ESIC), Factory Act. 1948, Contract Labour Regulation, and Abolition Act 1970, Shop and Establishment Act. 1948, and other Statutory regulatory bodies shall solely lie with the Selected Bidder. The Selected Bidder shall also be solely responsible for payment of wages, provident fund, bonus, retrenchment compensation leave, etc. applicable as per various statutory regulations to their entire workforce, and shall indemnify BHEL/SECI and the eligible consumer against any claim/ effects.
11. The Selected bidder shall provide a comprehensive O&M Manual providing minimum details of
    a. Basic principles of BESS operation.
    b. A small site-specific write-up (with a block diagram) on the BESS – its components, battery packs, inverter, junction boxes and expected performance shall be provided.
    c. Type of battery technology, Make & Model number, Voltage & capacity of inverter and cells, used in the BESS.
    d. Technical characteristics of the entire component are required to be provided. e. DO's and DONT's
    e. About the complete battery energy storage system including battery modules/cell arrangements, power conversion system, monitoring & control devices, heat managements (AC/HVAC), fire protection, EMS functionalities and architecture .
    f. Clear instructions on regular maintenance and troubleshooting of the system
    g. Name, address and contact number of the contact person in case of nonfunctioning of the system

12. **Non Responsiveness and Failure to rectify the problem**
    a. If the Selected Bidder fails to rectify the problem, the rectification the problem shall be taken up by BHEL/ SECI at the expense of the Contractor.
    b. In case of non-responsiveness of the Selected Bidder to carry out the satisfactory O&M work, BHEL/SECI is free to empanel or allocate the work to the other selected company to carry out the operation maintenance activity at the expense of the contractor
    c. BHEL/ SECI reserves the right to make surprise checks/ inspection visits at its own or through authorized representative to verify the O&M activities being carried out by the Selected Bidder. Failure to adhere to above guidelines may result in penal action as assessed and charged by BHEL/ SECI.

1.4 Technical Requirements:

1.4.1 BESS Technical Requirements

The following are the technical requirements to be considered for the BESS system

Annexure III -Technical Requirements of BESS

Annexure IV -O&M Requirements

Annexure V -Special Technical Conditions

Clause 1.6 - Scope Responsibility Matrix between BHEL and BESS Vendor for the scope of package.

With reference to above technical requirements, Bidder scope responsibility shall be governed by the Scope matrix, scope of work and any other specific technical requirements specified elsewhere. Specification of cables, instruments, breakers, DAS etc., shall be as per the SECI tender specification SECI/C&P/NIT/2020/CG100. Bidder technical proposal shall include minimum details as called for elsewhere in the specification.

1.4.2 Safety Requirements

The following along with any other specific safety requirements as specified at **Cl. 1.4.1/ Section C** and **Section D (as applicable for BESS)** are to be complied by the bidder

- Safety of Li-Ion cell shall be ensured as per IEC-62281 and container should have IP-54class of protection.
- Each cell shall be equipped with a flame arrestor to defuse any flammable gas escaped during charge and discharge. In addition to the fire suppression system, the flame arrester is required to prevent the fire from one cell to the adjacent cells and needs to be provided from the perspective of safety as per relevant standards.
- The safety for whole BESS system shall be ensured as per UL-9540.
- Adequate fire protection system should be provided for whole system (cells, modules, PCS etc.).
- Suitable Earthing system should be designed and provided for BESS.
- Temperature rise protection system should be provided for battery and PCS.
- Provision should be provided for AC/DC protection (over/under voltage, over/under current, earth fault protection, over/under frequency for AC, transient/surge protection, breaker failure protection etc.).
- Emergency alarm system should be provided for any malfunctioning of BESS operation.
- Adequate fire protection should be provided to tackle any fire incident likely to arise in battery energy storage system as per the international standard IEC 62897 (for Li-ion) or NFPA 72.A. Different types of fire extinguishers (Sinorix N2, HeptaFlouro Propane or equivalent for electrical safety) shall be installed to take care of fires which are likely to happen and protection from such incident shall be ensured as per International fire code (IFC-ICC).

In addition to above mentioned safety requirements, manufacturer shall be responsible to carry out tests required for safety and performance requirements as per the applicable standards:

1.4.3 Protection System

The following along with any other specific Protection System requirements as specified at **Cl. 1.4.1/ Section C** and Section D (as applicable for BESS) as applicable for BESS are to be complied by the bidder.

Protection system must be capable of monitoring all the operating parameters and sensing all abnormal conditions to isolate the faulty circuit or component without damaging other parts of the system.

Adequate indications/ alarms should also be provided locally as well as at remote control system for identification of faults and taking preventive / corrective actions.

The protection system shall work on following principles:

- The fault is described as internal and external fault. The internal fault is associated with battery system where as external fault is for distribution system. In the external fault, the system shall recover automatically from fault condition when healthy condition detected.
- The protective device closest to fault location shall clear the fault without damaging other part of the system.
- Lightning arrestor shall be installed to protect the whole system from damaging effect of lightning.

Protection system supplied by contractor shall include all the required components such as relay, contactor and switches, for operation of BESS, which may not be specified in this tender specification. The minimum requirements of AC/DC protection system are as below:

AC Protection	**DC Protection**
AC under/over voltage	DC under/over voltage
Over current protection	DC over current relay
Earth fault protection	Ground fault protection
Breaker failure protection	Breaker failure protection
Transient/surge protection	Transient/surge protection
Synchronization check for relay	Synchronization check for relay if any
Loss of phase	------
Over/under current frequency	------

Protection for Temperature Rise: The contractor shall design a protection system for temperature rise in the battery modules/cells, PCS or any other component of the BESS, due to short circuit in any part of the system, failure in temperature controller or sensors or any other internal/ external fault.

Protection for Spillage: Protection shall be provided for electrolyte spills that are related with the type of electrolyte used. It shall have feature to prevent the discharging of electrolyte to nearby installation site.

Emergency Stop: There should be provision of manual and automatic disconnection of the BESS from distribution system if;

1. Protection system failure is detected during self-diagnosis, healthy check.
2. Breaker trip coils or interrupting device.
3. DC supply lost.

1.4.4 Disposal/ Battery Recycling Plan

The Batteries (Management and Handling) Rules 2001: This provides for ensuring safe disposal and recycling of discarded lead acid batteries likely to be used in any equipment during construction and operation stage. Rules require proper control and record keeping on the sale or import of lead acid batteries and recollection of the used batteries by registered recyclers to ensure environmentally sound recycling of used batteries. Contractors will ensure compliance to this Rule.

The following along with any other specific Disposal/ Battery Recycling Plan as specified at **Cl. 1.4.1/ Section C** and Section D (as applicable for BESS) are to be complied by the bidder.

Once battery / system completes its life the contractor will be responsible for dismantling of system and remove the item from the site and handover clear site to owner of the property / site.

a) The supplies of battery cells/modules/pack shall be supported by an extended producer responsibility certificate as and when available, authorization from the battery manufacturer. 'Extended Producer Responsibility' (EPR) means responsibility of any producer of batteries for their products beyond manufacturing until environmentally sound management of their end-of-life products; for channelization of waste batteries to ensure environmentally sound management of such waste. Extended Producer Responsibility may comprise of implementing take back system or setting up of collection centers or both and having agreed arrangements with registered recycler either individually or collectively through a Producer Responsibility Organization recognized by producer or producers in their Extended Producer Responsibility.

b) All batteries that have completed the useful life (battery waste) at the location installed shall be managed in an environmentally sound manner. 'Environmentally sound management of battery waste' means taking all steps required to ensure that batteries are managed in a manner which shall protect health and environment against any adverse effects, which may result from hazardous substance contained in such wastes;

At the end of the life of batteries, final dismantling, removing and recycling batteries from the site is the complete responsibility of vendor.

Once batteries have reached the end of its useful life (even after six years of contract duration), It is the complete responsibility of Contractor to remove batteries from each site and recycle the batteries. Batteries should be in completely discharged condition prior to their disposal and disposed as per the brief plan presented at the time of quality assurance program (refer clause 13). The DC connection terminals of the batteries must be insulated with electric tape to prevent accidental contacts. Incineration must be performed by an approved and permitted waste treatment facility that handles lithium ion batteries. It shall be the responsibility of Contractor to;

- Ensure that used batteries collected are sent to the registered recycling agencies or for disposal;
- Ensure that necessary arrangements are made for safe transportation from site to the premises of recyclers or for disposal;
- Ensure that no damage to the environment occurs during transportation;
- Ensure that batteries are recycled according to relevant guidelines prevailing at the time of disposal.

A detailed report on recycling has to be submitted once the process is complete duly signed by registered recycling agency.

1.4.5 Testing Requirements

The following along with any other specific Testing Requirements as specified **Cl. 1.4.1/ Section C** and Section D (as applicable for BESS) are to be complied by the bidder.

Factory Test

The contractor shall carry out factory acceptance test (FAT) at sub system and module level and it shall include for all component to the extent possible. The contractor shall submit FAT document to approving authority. It shall include following test:

- Visual Inspection of equipment including dimension and overall design Verification of sensors, metering and alarms
- Verification of all control function including remote control, monitoring and communication interface
- Verification of system performance at full/ partial Energy/ Power ratings
- Verification of maintenance and replacement features for unit batteries and other components
- During the FAT, system shall be operated as specified and designed in all the operating states, use cases and duty cycles. It shall meet power/ energy requirements and shall be demonstrated to meet the safety requirements.
- Operation of all control, protective relaying and instrumentation circuits shall be demonstrated by direct tests, if feasible, or by simulating operating states for all parameters that cannot be directly tested. Automatic, local and remote operation of the controls shall be demonstrated.
- BESS shall be verified for operation at temperature extremes defined in specification. For this, if it is not possible for the full system, then independent laboratory certification of operation of critical components and subsystems shall be submitted at the time of FAT.
- During FAT, if something mal-operates then FAT shall be suspended and resumed after rectification of the problem. The system shall not be accepted for shipment until all FATs have been successfully completed.

Site tests

The contractor shall submit a comprehensive plan for site acceptance test to approving authority for approval. SAT plan shall include procedures to test correct system responses to system disturbances and operating scenarios described in the specification.

The test shall include, as a minimum, following:

- Verification of sensors, metering and alarms
- Verification of all control functions including automatic, local and remote control
- Verification of the performance criteria
- Demonstration of all the intended applications
- Demonstration of grid interface protection & control system
- Verification of power quality parameters

1.4.6 National/ International Standards for Battery Energy Storage System

The edition or the revised version of such codes and standards current at the date twenty-eight (28) days/ **7 Days** prior to date of Bid submission shall apply During Contract execution, any changes in such codes and standards shall be applied subject to approval by the Employer and shall be treated separately under relevant provisions of the contract.

The following standards along with any other specific standards as specified **Cl. 1.4.1/ Section C** and Section D (as applicable for BESS) are to be complied by the bidder

Requirements	Standards
BESS	

Requirements	**Standards**
Safety requirements	IEC-62133 or IEC 62620:2014 or UL-1642 or UL-1973 UL-9540 (for every components of BESS)
Performance tests, designations, markings, dimensions and other requirements	IEC 62619/62620
Test methods and requirements to ensure safety during transport other than for recycling or disposal	IEC 62281 or, UL-1973
Tests and requirements for verifying the mechanical behavior	IEC-61959/ IEC-62897
Protection of Stationary Battery Systems	IEEE 1375
Design, Operation & Maintenance of BESS	IEEE 2030.2.1.-2019 or equivalent
Planning & Installation of Electrical Energy Storage System	IEC-62935
Guide for Selection and Use of BMS in Stationary Applications	IEEE 1491
PCS/ PCU	
General and safety requirements	IEC 62040-1 or IEC 62477-1 or Equivalent
Interconnecting distributed resources with electrical power system	IEEE 1547 IEC 61850(communication standard) UL 1741 (testing)
Power conditioners - Procedure for measuring efficiency	IEC 61683 or, Equivalent
Environmental testing	IEC 60068-2 (1,2,14,30)
Switches / Breakers / Connectors	IEC 60947 (1, 2, 3)
Power metering & monitoring devices	IEC 61557-12
Power quality parameters	IEEE 519-2003 or IEC 61000-4 series

No Deviation is allowed and bidders shall provide unconditional acceptance and confirmation of the technical specifications.

1.5 SPARES, TOOLS & TACKLES AND CONSUMABLES

The bidder shall ensure the deployment of all special tools and tackles, required for installation, testing & commissioning and Operation & Maintenance of BESS. Additionally, the contractor shall also furnish list of special tools and tackles for the system (such as switches, measurement & sensing device, transducers etc.), referred by employer during the operation of the system as per the stipulations of the tender.

The supplier shall arrange all erection tools & tackles, implements, scaffoldings, ladders etc., which are required for handling and erection of the equipment and materials.

The minimum list of Mandatory Spares to be considered by bidder is as below. Any other spares required for commissioning / warranty shall also be arranged by the bidder on as required basis. O&M spares for 10 years are to be considered on as required basis. **Mandatory spares related to BESS equipment shall only be considered.**

Mandatory Spares

S. No.	**Equipment/Material**	**Quantity (for each type and rating)**
1	PV Modules	0.25% of total supply **(Not Applicable)**
2	Power Conditioning System	Spares as per OEM recommendation
3	MC4 connectors (including Y-connector if used)	1% of total supply **(Not Applicable)**
4	String Monitoring Unit	10 Nos **(Not Applicable)**
5	Inverter Transformer	1 Nos. of Each Rating
6.	Power Transformer	1 No. – 50 MVA **(Not Applicable)**
7.	Inverter Transformer Spare	
	(i) HV bushing with metal parts and gaskets	2 set
	(ii) LV bushing with metal parts and gaskets	2 set
	(iii) WTI with contacts	2 set
8.	HT Switchgear	
	(i) Vacuum pole	2 nos.
	(ii) Closing coil	2 nos.
	(iii) Tripping coil	2 nos.
	(iv) Spring charging motor	2 nos.
	(v) Relay	2 nos.
	(vi) Meter	2 nos.
	(vii) Current Transformer	2 nos.
	(viii) MCCB	2 nos.
	(ix) MCB	2 nos.

S. No.	Equipment/Material	Quantity (for each type and rating)
	(x) Fuse	10% of total supply
	(xi) Indicating lamp	10% of total supply
	(xii) Rotary switch	10% of total supply
9.	LT Switchgear	
	(i) MCCB	2 nos.
	(ii) MCB	2 nos.
	(iii) Fuse	10% of total supply
	(iv) Relay	2 nos.
	(v) Meter	2 nos.
	(vi) Current Transformer	2 nos.
	(vii) Voltage Transformer	2 nos.
	(viii) Indicating lamp	10% of total supply
	(ix) Rotary switch	10% of total supply
10.	Battery	2% of total supply along with all Cell/ Battery Auxiliary Systems, interconnectors, monitoring devices

1.6 Scope Responsibility Matrix (BV – BESS Vendor and BHEL)

Sl. No	Scope of Work	Basic Engg	Detail Engg	Supply (F&I)	Erection	Comm.	Civil Work	Remarks
1.	Integration of BESS EMS SCADA with PV SCADA	BV	BV	BV	BV	BV	NA	Terminal point shall be Solar PV System
2.	Battery along with the Battery Management System (BMS)	BV	BV	BV	BV	BV	BV	
3.	Supply of Bidirectional Inverter (PCS) with Isolation Transformer.	BV	BV	BV	BV	BV	BV	

Sl. No	Scope of Work	Basic Engg	Detail Engg	Supply (F&I)	Erection	Comm g.	Civil Work	Remarks
4.	Step-up Transformer	BV	BV	BV	BV	BV	BV	
5.	Supply of MV /LV Switchgear/ RMU with protection and metering system.	BV	BV	BV	BV	BV	BV	
6.	Containerized solution with HVAC, fire protection,CCTV system	BV	BV	BV	BV	BV	BV	
7.	Balance of System- for BESS	BV	BV	BV	BV	BV	BV	
8.	Energy Management System (EMS) along with DAS. RTU and related accessories for communication with Solar Plant SCADA / RCC.	BV	BV	BV	BV	BV	BV	Furniture shall also be in the scope of BV. BESS DAS and Network hardware to be placed in PV Control Room (PV Control room by BHEL).
9.	Transformer Breaker with metering and protection equipment.	BV	BV	BV	BV	BV	BV	Interconnection with PV Feeders shall be by BV.
10.	Associated AC/DC power and Cables, Termination kits, Glands, HDPE pipes, PVC Conduits	BV	BV	BV	BV	BV	BV	All Instrumentation, Control, AC/ DC Power Cables shall be by BV Overall system integration including cable laying, terminations, loop checking etc., shall be by BV.
11.	Misc. items not covered above but required to make the system complete	BV	BV	BV	BV	BV	BV	
12.	O&M [Including supply of mandatory spares and O&M spares]	BV	BV	BV	BV	BV	BV	Shall include insurance requirements

Sl. No	Scope of Work	Basic Engg	Detail Engg	Supply (F&I)	Erection	Comm.	Civil Work	Remarks
13.	Unloading, Material Receipt Confirmation	BV	BV	BV	BV	BV	BV	Transit Insurance, Erection and Storage Insurance shall be by BV.

Notes:

1. Civil works for BESS covering pedestal, equipment foundations for transformer/ switchgear panels etc., supports etc. shall be in the scope of BV
2. The above scope matrix provides broad scope division of the BESS system. Any other items/ spares/ consumables required for completion of facilities, demonstration of parameters, O&M etc., required to make the system complete and meet functional guarantees and scope shall be the responsibility of bidder.

1.7 Quality Assurance & Implementation Plan

The Contractor shall establish, document and maintain an effective quality assurance program (A detailed quality plan related to different products such as batteries, BMS, EMS, etc. shall be submitted).

The Quality Assurance Program should be comprehensive and must include all aspects from battery design parameters, layout, manufacturing to commissioning details/ and plans to trial run plan of systems with all technical specifications of the battery and associated equipment, Inspection Test Plan (ITP) or Factory Acceptance Test (FAT) details and disposal plan. Battery disposal plan has to be submitted.

In-addition, validation test shall be performed after each routine/preventive maintenance in-order to ensure the proper functioning of the system and component replaced during maintenance, if any. Accordingly, validation certificate shall be signed by contractor and approved by SECI. In case of any deviations in quality or technical characteristics of battery and associated equipment from the conditions stated in the Specifications, the contractor shall re-ensure that all the deviations are resolved to meet the functional guarantees as stipulated elsewhere in the specification.

Inspection

BHEL/ SECI/ Authorized representative shall have the right to inspect and/or to test the goods to confirm their conformity to the Agreement. The duly authorized representative shall have at all reasonable times access to the contractor premises or works and shall have the power at all reasonable time to inspect and examine the materials and workmanship of the works during its manufacturing or assembling stage.

The contractor shall give at least 15 days of prior written notice of any material being ready for testing& inspection by purchaser/ SECI. Such tests shall be on the contractor's accounts/ expenses except for the expenses of the inspector.

The inspection by BHEL/ SECI and issue of dispatch instruction thereof shall in no way limit the liabilities and responsibilities of the contractor in respect of the agreed/ final approved quality assurance program.

Replacement of rejected material:

Any material supplied against order placed on basis of this tender and found to be defective at any time during the project life on inspection or differing from approved samples or make or specifications will be replaced by the Contractor free of cost or full refund made for the amount paid by BHEL. The contractor must replace or repair any defective portion of the system including replacements or renewals/replacements to be completed in accordance with the scope of work and O&M requirements.

Materials (Quality & Workmanship)

Immediately on award of contract, the contractor shall submit a detailed project report along with validexternal ISO audit report of the company and Implementation plan report within 20 working days having planning and testing strategy with provisions for quality check performance at various stages of the project. The report shall also furnish details of method of checking and inspection and acceptance standards / values.

The contractor has to provide quality assurance certificates to Purchaser for required components of BESS and shall comply with appropriate codes & standards

BHEL/SECI reserves the right to send any material being supplied to any recognized laboratory for testing in cases where the testing/ performance is not found to be satisfactory, wherever necessary and the cost of testing shall be borne by the Bidder. In case the material is found not in order with the technical requirement / specification, the charges along with penalty shall be borne by the bidder.

Bidder shall be responsible to clean and remove all residuals during the installation and Commissioning/ O&M of the system.

Bidder shall provide detailed completion/ commissioning status report from time to time.
NO Deviation is applicable for the tender and the CERTIFICATE OF COMPLIANCE TO PROVISIONS OF BID DOCUMENT is to be provided as per **Attachment – 4.**

1.8 Liquidated Damages/ Penalty

For Delay in Completion (Through Penalty): Applicable rate for Penalty shall be **0.5% per Week** for delay in delivery/ completion of facilities from the Schedule Date of Completion/Contract Period. Maximum deduction for penalty for delay shall be **10%** of the contract value. No bonus will be given for earlier Completion of the Facilities or part thereof.

For Functional Guarantees (FGs) Through Liquidated damages: Functional Guarantees for Performance Ratio (82%), Capacity Utilization Factor (36.5%) and BESS Availability (99%) shall be applicable for the project.

A. The Contractor shall maintain all BESS equipment to ensure Annual Equipment Availability not less than 99%. Equipment Availability includes the availability of Batteries, Battery Management System (BMS), Power Conversion System (PCS), Energy Management System (EMS) as well as the power evacuation system for BESS up to interface with the solar PV arrays.

B. BESS Equipment Availability is the percentage of hours that the BESS is available during the year. The availability guarantee shall begin upon facility commissioning till the end of O&M period. BESS annual equipment availability shall be calculated as follows.

Equipment Availability =

$$[1 - \left(\frac{\sum Accountable\ BESS\ Outage\ duration\ in\ hours\ x\ We}{8760}\right)] \times 100$$

Where:

- W_e, Weightage is $\frac{Outage\ Capacity}{Rated\ Capacity}$, where Outage and Rated Capacity shall be in Energy terms i.e. MWh. Rated Capacity in a given year shall correspond to the daily throughput capacity guarantee for the beginning of the year.

C. Accountable BESS outages are outages caused or necessitated by the BESS equipment that result in reduced capacity or loss of essential function of the BESS. These outages may be initiated by failure of components, loss of battery capacity, operation of protective devices, alarms, or manual action. Such outages include both forced outages due to equipment problems and scheduled outages for BESS maintenance.

D. Accountable BESS outage duration is the elapsed time of accountable BESS outages from the instant the BESS experiences reduced capacity or is out of service to the instant it is returned to service or full capacity. If the BESS experiences reduced capacity but is determined by the Employer to be available for service even if the Employer elects not to immediately return the equipment to full capacity, such time will be discounted from the outage duration.

E. The Procurement specific nameplate ratings shall be as defined in Technical Specifications under Annexure A: (Employer's Requirement). The BESS shall be considered to be under an accountable outage if any of those ratings cannot be met. The BESS shall also be considered to be under an accountable outage if a scheduled (or required) charge cycle cannot be completed.

F. The data required for assessment of the availability of the BESS shall be collected through the Plant's integrated SCADA system.

G. Grid outage hours shall be subtracted from total no. of hours in the year.

H. If the Plane of Array Radiation is less than 2kWh/m2 on a day, the day (i.e. 24 hours) shall be excluded.

I. Liquidated Damages for Shortfall in Equipment Availability If the annual equipment availability for BESS is less than 99% during any year, then Contractor shall compensate the Employer an amount calculated as per the following formula.

$$COM = \left(\frac{99 - EA}{EA}\right) \times C \times E$$

where,

COM is Compensation payable to the Employer in rupees

EA is Annual BESS Equipment Availability
C is Rs. 8/kWh
E is the intended energy output from BESS in kWh during the respective year in 99% availability condition after considering any degradation.

Recovery of Compensation

The above compensations shall be deducted from CPS submitted by the developer.

Scheduling and Forecasting:

The Contractor shall be responsible for appointing a Qualified Coordinating Agency if required by concerned authorities at the Pooling Substation Level for scheduling and forecasting activity. Also, the contractor shall be responsible for carrying out the forecasting and scheduling of the energy generation from the plant facility (In accordance with the Deviation Settlement Mechanism Regulations of the Chhattisgarh Electricity Regulatory Commission). Scheduling given by the Contractors is such that no penalty is levied on the Employer due to any deviation of actual generation from scheduling beyond the allowed limit. If any penalty is imposed on the Employer due to such deviations beyond allowed limit the same shall be recovered from the CPS given by the contractor.

FGs and associated Liquidated damages are also enclosed as per **Annexure VI.** Failure to meet Performance Ratio (82%) and Capacity Utilization Factor (36.5%) by employer for reasons attributable to BESS supplier as per Annexure VI, corresponding complete/ proportionate LD shall be chargeable to BESS Supplier.

NOTE:

1. ***For Technical Bid, Bill of Quantities and associated technical data to be provided as per Table -1.***
2. ***Technical datasheet/catalog of Battery Pack, PCS ,EMS ,HVAC ,Fire fighting System, DCDB and ACDB with Metering & Protection System, CCTV system , Communication system for Remote Control Centre, Workstation PC with Monitor, Power cables, C&I & Communication Cables ,BESS container, BESS architecture and configuration drawing with BoM for each category site, Battery capacity sizing calculations for each category, PCS sizing, EMS communication networking drawings Dimensions of all BESS components etc. are to submitted along with technical offer.***
3. ***For Price Bid, Price Section of Table-1 shall be duly filled. Unit Prices of all individual items & sub-items are STRICTLY to be filled & mentioned.***
4. ***The system shall be complete in all respect and shall not be limited to the above. Any other hardware, software & services required for completion of facilities but not specifically mentioned in the specifications, shall be the responsibility of bidder. All necessary hardware & software shall be supplied as a package to meet the specification requirement and trouble free operation. Please note that all the items required for commissioning for BESS and its connectivity to Grid/Electricl systems is in scope of vendor. All such materials are to be listed down without fail.***

<u>Annexure I</u>
Project Particulars

Design and Engineering	
Proposed AC capacity (MW)	100
Minimum DC Capacity (MWp)	200
Cell/Module Technology	Bifacial, Mono-crystalline PERC
Cumulative Inverter Capacity (Min.)	175 MW
Cumulative Inverter Transformer Capacity (Min.)	175 MVA
Power Transformer Capacity	2*50 MVA
Battery Energy Storage System (BESS)	50 MW/ 150 MWh (Dispatchable)
Origin of manufacturer	Open
O&M period	10 years
Design life of PV Power plant	25 years
Site Location and Land Details (Please refer A NNEXURE A, A3. Special Technical Conditions for details)	
Site coordinates	Refer Annexure E: Project Location
Villages	Rangakathera, Dundera, Dhaba, Kokha, Amlidih, Girgaon, Margaon, Ghugkhwa, Odarbandh, Tolagaon
Tehsil	Dongargaon
District	Rajnandgaon
State	Chhattisgarh
Type of Land	Govt. Land
Owner of Project	Solar Energy Corporation of India Limited
Owner of Land	Chhattisgarh State Revenue Department
Electrical Interconnection Details	
Substation Details	220/132 kV Telkadih Substation
Interconnection Voltage Level	132 kV, through Double circuit Double string transmission line from project site till S/S

Distance to connecting substation (approx.)	31 kMs.
Access	
Nearest Urban Area	Rajnandgaon (25 km)
Nearest Highway	Nagpur – Bhandara – Rajnandgaon – Raipur Highway (AH46 or NH-6)- Adjacent at the southern extreme
Nearest Railway Station	Dongargarh (15 km)
Nearest Domestic Airport	Swami Vivekananda Airport, Raipur (approx. 80 kms)
Performance Guarantee Parameters	
Performance Ratio (PR)	82%
Capacity Utilization Factor (CUF)	36.5%
BESS Availability	99%

<u>Annexure II</u>
Project Specific BESS Capabilities & Ratings

<table>
<tr><th>Item Description</th><th>Requirement</th></tr>
<tr><td>Battery Technology</td><td>Any battery technology with totally Maintenance Free characteristic suitable for operation in sitespecific climatic conditions can be used.</td></tr>
<tr><td>Rated No of Cycles (Minimum)</td><td>4000 cycles at rated energy capacity at 80%

Depth of Discharge (DoD) at 25°C and up to C/3

Rate of Discharge</td></tr>
<tr><td>Power Rating</td><td>50 MW</td></tr>
<tr><td>Watt-hour rating (dispatchable capacity)</td><td>150 MWh ,dispatchable at the beginning of life (i.e. at the time of Commissioning) and minimum throughput capacity at the beginning of each year as per below table:
<table>
<tr><td>Year 1</td><td>147 MWh</td></tr>
<tr><td>Year 2</td><td>144 MWh</td></tr>
<tr><td>Year 3</td><td>141 MWh</td></tr>
<tr><td>Year 4</td><td>138 MWh</td></tr>
<tr><td>Year 5</td><td>135 MWh</td></tr>
<tr><td>Year 6</td><td>132 MWh</td></tr>
<tr><td>Year 7</td><td>129 MWh</td></tr>
<tr><td>Year 8</td><td>126 MWh</td></tr>
<tr><td>Year 9</td><td>123 MWh</td></tr>
<tr><td>Year 10</td><td>120 MWh</td></tr>
</table>
Dispatchable capacity shall not be less than 80% of Beginning of Life capacity at any point of time up to End of Battery Life.</td></tr>
<tr><td>Annual BESS Availability Guarantee</td><td>99%</td></tr>
<tr><td>System ac-dc-ac efficiency*:</td><td>>80%</td></tr>
<tr><td>Reactive Power Rating</td><td>NA</td></tr>
<tr><td>Use case requirements</td><td>Peak Management</td></tr>
</table>

Peak Management	In the Peak Management Use Case scenario, power generated during the early and midday periods shall be stored in the BESS and discharged during peak demand, for 3 hours, after solar generation hours.
Charge-Discharge Cycles	One discharge cycle per day is envisaged.
Ventilation System inside the Container	Should be such as to maintain minimum and maximum Temperature as recommended by the manufacturer for optimum performance of the batteries on continuous basis.
Grid Charging	No
***To be verified as per the procedure described in SECI Tender Specification for Performance Guarantee Tests and to be verified on annual basis as per Schedule. All measurement instruments for conducting the tests shall be maintained by the Contractor.**	

Annexure III
BESS TECHNICAL REQUIREMENTS

DISCLAMIER:

1. Though adequate care has been taken while preparing the Bidding documents, the Bidders/Applicants shall satisfy themselves that the document is complete in all respects. ~~Intimation of any discrepancy shall be given to this office immediately. If no intimation is received from any Bidder within twenty (20) days from the date of notification of NIT/ Issue of the NIT documents, it shall be considered that the NIT documents are complete in all respects has been received by the Bidder~~.
2. ~~Solar Energy Corporation of India Limited (SECI),~~ the Employer, reserves the right to modify, amend or supplement this NIT documents including all formats and Annexures.
3. While this bidding documents have been prepared in good faith, neither Employer or its authorized representatives nor their employees or advisors make any representation or warranty, express or implied, or accept any responsibility or liability, whatsoever, in respect of any statements or omissions herein, or the accuracy, completeness or reliability of information, and shall incur no liability under any law, statute, rules or regulations as to the accuracy, reliability or completeness of this bidding documents, even if any loss or damage is caused by any act or omission on their part.
4. The specifications mentioned for all the equipment which include ~~Solar modules~~, PCU, ~~combiner boxes~~, DC cables, ~~module mounting structures~~, transformer, CT, PT, LT/ HT cables, interfacing panels, switch gears & other associated equipment etc., to complete the power generation and evacuation to the designated substation, in the present bidding documents are for the **reference** only. It is subject to revise/ alter as per the design/ planning/ good engineering practices etc., to be carried out by the selected bidder, to the satisfaction of the Employer or its authorized representatives. It is advised that the bidders must satisfy himself with the prevailing site conditions before design/ plan. The design must be optimized as per the site conditions and directed to achieve the maximum output from the installed capacity at all times. Moreover, the components not separately mentioned, but are required to complete the plant for operation is also included in the scope of bidder and shall be vetted by the Employer or its authorised representatives.

Place:

(Signature)

Date:

Name and Designation of bidder

A Design Philosophy

1 The main objective of the design philosophy is to construct the plant with in-built Quality and appropriate redundancy to achieve high availability and reliability with minimum maintenance efforts. In order to achieve this, the following principles shall be adopted while designing the system.

1.1 Adequate capacity of ~~SPV modules~~, PCUs, Junction boxes etc. to ensure generation of power as per design estimates. This will be done by applying liberal de-rating factors for the array and recognizing the efficiency parameters of PCUs, transformers, conductor losses, system losses, site conditions etc.

1.2 Use of equipment and systems with proven design and performance that have high availability track records under similar service conditions.

1.3 Selection of the equipment and adoption of a plant layout to ensure ease of maintenance.

1.4 Strict compliance with approved and proven quality assurance (QA) systems and procedures during different stages of the project, starting from sizing, selection of make, shipment, storage (at site), during erection, testing and commissioning.

1.5 Proper monitoring of synchronization and recording, to ensure availability of power to the grid.

1.6 The plant instrumentation and control system should be designed to ensure high availability and reliability of the plant to assist the operators in the safe and efficient operation of the plant with minimum effort.

1.7 It should also provide the analysis of the historical data and help in the plant maintenance people to take up the plant and equipment on predictive maintenance.

1.8 System design shall have intelligent protection mechanism which may include very fast responsive microprocessor-based relays etc., so that any disturbance from the grid will not cause any damage to the equipment of the Solar Power Plant.

2 The basic and detailed engineering of the plant shall aim at achieving high standards of operational performance especially considering following:

2.1 SPV power plant should be designed to operate satisfactorily in synchronization with the grid within permissible limits of high voltage and frequency fluctuation conditions. It is also extremely important to safeguard the system during major disturbances, internal and external surge conditions while ensuring safe operation of the plant.

2.2 ~~The Module Mounting Structures shall be designed for optimising the tilt angle and~~

~~elevation of the module to minimise self-shading and maximise the capture of diffuse light.~~

2.3 ~~Shadow free plant layout to ensure minimum losses in generation during the day time.~~

2.4 Higher system voltage and lower current options to be followed to minimise ohmic losses.

2.5 Selection of PCUs with proven reliability and minimum downtime. Ready availability of requisite spares.

2.6 Careful logging of operational data / historical information from the Data Monitoring Systems, and periodical analysis of the same to identify any abnormal or slowly deteriorating conditions.

2.7 The designed array capacity at STC shall be suitably determined to meet the proposed guaranteed generation output at the point of interconnection by the contractor in his bid. The contractor shall take care of first year degradation also by installing additional DC capacity as the CUF calculations will not factor the first-year degradation of the modules.

2.8 Each component offered by the bidder shall be of established reliability. The minimum target reliability of each equipment shall be established by the bidder considering its mean time between failures and mean time to restore, such that the availability of complete system is assured. Bidder's recommendation of the spares shall be on the basis of established reliability.

2.9 Bidder shall design the plant and equipment in order to have sustained life of 25 years with minimum maintenance efforts.

2.10 The work execution planning for supply, erection, commissioning and all other allied works for SPV Power Plant shall be such that it is completed within stipulated time from the date of order/ LOI/ NTP, whichever is later.

3 The specifications provided with this bid document are functional ones; any design provided in this document is only meant as an example. The Contractor must submit a detailed design philosophy document for the project to meet the functional requirements based upon their own design in-line with the above. The bidders are advised to visit the site and satisfy themselves before bidding.

4 All works shall be executed as per Technical Specifications ~~given in Annexure A.2. Annexure A.3~~ lays down Special Technical Conditions with reference to site specific design requirements. However, in case of any conflict in requirements between ~~Annexure A.3 and Annexure A.2, Annexure A.3:~~ Special Technical Conditions shall have precedence

Slump testing equipment	nos.	6
Oven	nos.	2
Physical balance	nos.	1
Thermometer	nos.	4
Burret	nos.	2
Measuring cylinder	nos.	9
Measuring flask	nos.	3
Compression testing machine	set	1
Cube mould for concrete	nos.	10
Mechanical weighing machine	nos.	1 (100kg capacity)
Drum type concrete mixer (for trial mixes)	nos.	1
Proctor testing equipment	set	1

7.2 Notes

7.3 The equipment listed above is indicative and minimum required. Additional equipment, if any, required for successful completion of work shall be provided /arranged by the contractor.

7.4 All test reports/ inspection reports shall be submitted in soft copy also and shall be available at site for easy access to the Engineer.

7.5 Based on the schedule (L2/L3 Network), Quality control & Quality Assurance Work plan shall be finalized by the contractor and the same shall be submitted to Engineer for acceptance/approval.

E Battery Energy Storage System

1 Scope of Works

The Scope of Work covered under this specification shall be but not limited to the following.

1.1 Initial Design and Fabrication

For the initial design and fabrication of the equipment, the Contractor shall

- Design, fabricate, and assemble a fully functional, containerized BESS that meets the requirements delineated herein. This shall include a control system that provides standard input/output channels and appropriate control actions for all

required operational and protective features.

- Fully document the design and expected performance of the BESS by means of documents, drawings, reports, data, and other submittals, as required herein.
- Perform factory acceptance testing of the BESS.
- Conduct design review meetings during initial design and fabrication, in Consultation with the Employer with special reference to the geographical/climatic conditions of the Project site.
- Obtain site-specific data in preparation for developing installation implementation plans.
- Develop site installation/construction drawings, specifications, and calculations.
- Supply any special equipment and tools required for maintenance of the BESS.
- Supply an initial complement of spare parts (as specified in Annexure F: Mandatory Spares) including spare racks for future installation
- Provide warranty for the entire BESS and its constituent equipment.

1.2 Transportation and Site Setup

Interconnection of the BESS with the grid is at the point of common connection (PCC). The Contractor shall be responsible for all equipment and installation activities up to the system side of the PCC. The Contractor will be responsible for completing the necessary work for interconnection point.

1.3 Installation/Interconnection

For installation/interconnection, the Contractor shall

- Develop drawings, specifications, and calculations for Contractor's scope of installation equipment and services (that is, up to the BESS side of the PCC).
- Develop detailed start-up and site acceptance test (SAT) plans.
- Obtain all permits necessary to transport the BESS to the site.
- Ship the BESS to the project site.
- Assemble BESS components on site to produce a functional system (as required).
- Perform start-up testing and SAT of the BESS.
- Provide on-site Contractor representative during installation and/or interconnection activities by the Employer and during start-up and SAT of the BESS by Contractor.
- Obtain permits necessary to prepare the site and to install and interconnect the BESS to the grid.

- Provide a complete set of as-built drawings.
- Provide a training class for the Employer's technicians and maintenance personnel.

1.4 Operation and Maintenance

Employer intends to entrust the operation and maintenance (O&M) of the BESS,as part of the Plant Facilities, on comprehensive basis to the Contractor on turnkey for the O&M Period as specified in this Document. The rates quoted by bidder for Comprehensive O&M of the Plant Facilities on yearly basis for the O&M Period shall be inclusive of the replacement costs if any.

1.5 Definitions

- **PCC** – Point of common connection, the electrical boundary between the Solar PV Power Plant and the electrical network of the utility.
- **Unit battery** – A unit battery is the minimum field-replaceable stored energy component or assembly. It may consist of one or more electrochemical cells, electrically interconnected in any series and/or series–parallel configuration. A unit battery has one (and not more than one) set of positive and negative terminals, by which it is interconnected with the rest of the storage system.
- **PCS** – Power Conditioning System - A switching power supply unit that enables bidirectional power conversion between AC and DC. It is the interface between the DC battery system and the AC system and provides for charging and discharging of the battery.
- **FAT** – Factory Acceptance Test
- **BESS** – Transportable, containerized energy storage system based on commercially available electrochemical storage solutions, capable of receiving, storing and delivering electrical energy at specified rate(s) suitable for the application laid out in the specifications herein. It comprises of unit batteries, battery management system (BMS), PCS, auxiliaries, such as HVAC and fire suppression systems, step-up transformers to match utility grid, ac switchgear, Control Systems etc.
- **BMS** - or Battery Management System, is any electronic system that manages a rechargeable battery (cell or battery pack), including protecting the battery from operating outside its Safe Operating Area, monitoring its state, calculating secondary data, reporting that data, controlling its environment, authenticating it and / or balancing it.

- **Available or Dispatchable or throughput energy** is the sum total of energy (kWh) delivered at the Point of Interconnection of the BESS with the Solar PV array fields when operating at the rated output power.

2 Site-Specific Implementation Requirements

2.1 Procurement-Specific Location and Site Characteristics for Design

Table-1 below lists supply-specific location and site characteristics.

Table 1: Procurement-Specific Location and Site Characteristics

Item	**Characteristic**
Location	Rajnadgaon, Chhattisgarh
Site characteristics:	
Climate Conditions (General)	Tropical type Climate, hot all year round, with a dry season from December to April, and a rainy season from May to November
Precipitation	1500-2000 mm per year
Seismic Zone (Geological Survey of India, 2014)	Seismic zone III
Electrical infrastructure: AC system interconnection requirement at Point of Connection (PCC)	33 kV/415, 50 Hz, 3 phase The BESS will be coupled with the PV System at the AC Bus on the LV (415 V) or the MV (33 kV) side of the Inverter Transformers. The BESS shall be designed for maximum flexibility with regard to site-specific voltages, frequency, phase imbalance, and protection requirements.

2.2 Grid Characteristics

The BESS shall be capable of continuous operation under variable voltage, frequency and phase imbalance conditions at the PCC, as described in Table-1. Information on available fault current and other characteristics of the Utility grid will be provided by the Transmission/Distribution Utility. The Contractor shall confirm, for each Host Utility site, that this information has been received and understood during the site-specific

engineering phase.

2.3 Codes and Standards

The BESS shall comply with the following Codes and Standards or equivalent Indian Standards, as applicable:

Standard/ Code	Description
IEC 61427-2/IS 16270 / UL 1973	Secondary cells and batteries for renewable energy storage for On-grid applications - General requirements and methods of test
IEC 62485-2	Safety requirements for secondary batteries and battery installations - to meet requirements on safety aspects associated with the erection, use, inspection, maintenance and disposal: Applicable for Lead Acid and NiCd / NiMH batteries
IEC 61508	Functional Safety of Electrical/Electronic/Programmable Electronic Safety-related Systems: Applicable for all Battery Energy Storage Systems
IEC 62619:2017/ UL 1642	Secondary cells and batteries containing alkaline or other non-acid electrolytes - Safety requirements for secondary lithium cells and batteries, for use in industrial applications
IEC 62281 / UN 38.3	Safety of primary and secondary lithium cells and batteries during transport: Applicable for storage systems using Lithium Ion chemistries
IEC 61850/ DNP3	Communications networks and management systems. (BESS control system communication)
IEC TS 62933-5-1:2017	Electrical energy storage (EES) systems - Part 5-1: Safety considerations for grid-integrated EES systems - General specification
UL 9540	Standard for Energy Storage Systems and Equipment

3 Technical Specification of Battery Energy Storage System

3.1 Procurement-Specific Ratings and Requirements

Table-2 below specifies project-specific BESS capabilities and ratings for this Project.

Table 2: Supply-Specific Ratings and Requirements for each system

Item Description	**Requirement**
Battery Technology	Any battery technology with totally Maintenance Free characteristic suitable for operation in site-specific climatic conditions can be used.
Rated No of Cycles (Minimum)	4000 cycles at rated energy capacity at 80% Depth of Discharge (DoD) at 25°C and up to C/3 Rate of Discharge
Power Rating	50 MW
Watt-hour rating (dispatchable capacity)	150 MWh ,dispatchable at the beginning of life (i.e. at the time of Commissioning) and minimum throughput capacity at the beginning of each year as per below table: Year 1 – 147 MWh Year 2 – 144 MWh Year 3 – 141 MWh Year 4 – 138 MWh Year 5 – 135 MWh Year 6 – 132 MWh Year 7 – 129 MWh Year 8 – 126 MWh Year 9 – 123 MWh Year 10 – 120 MWh Dispatchable capacity shall not be less than 80% of Beginning of Life capacity at any point of time up to End of Battery Life.
Annual BESS Availability Guarantee	99%
System ac-dc-ac efficiency*:	>80%
Reactive Power Rating	NA

Use case requirements	Peak Management
Peak Management	In the Peak Management Use Case scenario, power generated during the early and midday periods shall be stored in the BESS and discharged during peak demand, for 3 hours, after solar generation hours.
Charge-Discharge Cycles	One discharge cycle per day is envisaged.
Ventilation System inside the Container	Should be such as to maintain minimum and maximum Temperature as recommended by the manufacturer for optimum performance of the batteries on continuous basis.
Grid Charging	No
To be verified as per the procedure described in Annexure-F (Annexure-F: Plant Documentation, Commissioning and Test Procedure) to this Section for Performance Guarantee Tests and to be verified on annual basis as per Schedule. All measurement instruments for conducting the tests shall be maintained by the Contractor.	

3.1.1 The BESS Supplier/sub-Contractor must have experience of having successfully completed Design, Engineering, Procurement, Construction, Installation, Testing and Commissioning of Grid Connected Battery Energy Storage System (BESS) of at least 03 (Three) Grid connected BESS Plants, each having an individual capacity of 5 MWh (Five Mega Watt Hour) or above in last Five years. However, such BESS Plant capacity must have been in satisfactory operation for at least 12 (Twelve) months from the date of commissioning.

3.2 Nameplate Ratings

3.2.1 Overall System Real Power and Energy Ratings

During discharge, the BESS shall be rated to supply at the PCC the continuous net ac real power and ac energy output specified in *Table 2: Supply-Specific Ratings and Requirements* above. These ratings shall be referred to in all project documentation, including this specification, as the nameplate watt rating and the nameplate watt-hour rating. All nameplate ratings shall be achievable over the End of Battery life, as specified in Clause 4.5.1. The nameplate watt-hour rating shall be achievable during discharge for the full range of stated environmental conditions, provided that the

battery is fully charged and the HVAC system (if incorporated in the BESS) has stabilized. In any case, the BESS shall be capable of being discharged at reduced power levels from that specified above. However, in no case will the energy discharged from the battery be greater than the nameplate watt-hour rating.

The Contractor shall clearly state in its O&M manual as well as during design review the expected efficiencies of the major subsystems (battery, PCS) as well as the expected losses from auxiliaries.

Note: The real power level attainable during charging shall be at the Contractor's discretion, so long as the other charging/discharging requirements in this specification are met.

3.2.2 Overall System Reactive Power Rating

In accordance with the VAR-related control modes identified in this specification, if any, the BESS shall be capable of dispatching both leading and lagging reactive power at the PCC, up to the rated VAR capacity specified in Table-2, regardless of whether the battery is being simultaneously discharged or charged. This rating shall be referred to in all project documentation, including this specification, as the nameplate VAR rating. The BESS shall be capable of simultaneously producing real and reactive power as long as no nameplate rating is exceeded. That is, the combination of operation at full nameplate watt rating and full nameplate VAR rating shall not exceed the nameplate VA rating.

4 Design, Fabrication, and Construction Requirements of BESS

4.1 General

The methods and materials specified in this technical specification are intended to represent minimum requirements. Reliance thereon shall not diminish the responsibility for meeting performance and other requirements stated in this technical specification. The design of the BESS shall incorporate the principle of modularity, with a view to reducing life-cycle costs and ease of replenishment of storage capacity while facilitating ease of maintenance, space requirements, and reliability. The design should also facilitate rapid and easy replacement of the unit batteries without significant downtime. Overall, the design philosophy shall be to minimize and optimize all costs to the Employer, not simply initial capital costs or low maintenance costs.

Life-cycle costs include the following: initial system cost, unit battery replacement cost,

periodic equipment upgrades, maintenance costs, auxiliary system energy consumption, charging energy costs (that is, costs due to overall battery and PCS losses), and any other contributors to life-cycle energy cost.

4.2 System-Level Design and Performance Requirements

4.2.1 The major equipment items shall include a battery, battery management system (BMS), PCS, output/isolation transformer, and SCADA which is to be integrated with the solar plant SCADA system defined elsewhere in this document. Additional equipment shall include HVAC, wiring, connectors, protective devices, grounding, junction boxes and enclosures, instrumentation, enclosures, and all other items needed for a fully functional, grid-interactive BESS to meet the requirements set forth in this specification. All systems and components of systems—including electrical storage unit, switching devices in the PCS, components of monitoring and control systems, and components of auxiliary systems— must use proven and previously demonstrated technology. Electrochemical cells, PCS switching devices, and control system hardware and software must be commercially available and in use for other markets. Electrochemical cells must be replaceable (in small orders) with a maximum six-week lead time under normal business conditions. Designs using experimental or otherwise undocumented components are not permitted.

4.2.2 The BESS shall be IEEE 1547 (Standard for Interconnecting Distributed Resources with Electric Power Systems)–compliant, where possible.

4.2.3 The prudent design of the BESS should include careful consideration of resonance and Ferro-resonance.

4.3 Containerization and Transportability

4.3.1 The BESS shall be containerized, using either standard International Organization for Standardization (ISO) 668 shipping containers or custom-designed power equipment centres. The container or containers shall be designed to be drop-shipped onto a properly prepared pad or foundation (such as compacted soil, concrete pad or platform, and so on). When fully installed, all BESS components—including battery racks all auxiliaries, such as HVAC and fire suppression systems, step-up transformers to match grid, ac switchgear, and so on—and tools shall be enclosed in (or on) the containers, even if certain components must be separately shipped and installed at the site.

4.3.2 Containers shall be designed and constructed to meet IP54 requirements. The design and installation of Containers shall meet relevant regulatory requirements for

occupational safety and health under national and state legislations.

4.3.3 All containers and packaging of separately shipped components shall be suitable for land or sea transport, including offering suitable protection of the equipment inside against damage from weather and vibration or shock from transportation.

4.3.4 The containers and their contents shall be designed to be easily prepared for transport, shipped, connected and operated at site. The Contractor shall ensure that all required bracing and shipping stabilization equipment to enable transport is either kept at hand or brought to the site in a timely manner before transport.

4.4 Additional transportability requirements and/or clarifications

4.4.1 In designing for transportability of the lithium-ion batteries, the Contractor shall follow the relevant guidelines (Sub-section 38.3) set forth in the United Nations document "Recommendations on the Transport of Dangerous Goods—Manual of Tests and Criteria" (ST/SG/AC.10/11/Rev.5), with specific reference to obtaining UN38.3 and UN3480 certifications at the battery module and/or container level.

4.4.2 The BESS container or containers shall be of a size and weight to be capable of being transported to project sites with due consideration for the load bearing restrictions imposed by bridges, if any, and climatic conditions in the region.

4.4.3 Containers shall incorporate standard lugs or other means for lifting by crane or shall be properly palletized for movement with forklift trucks, or both.

4.5 Design Life and Life-Cycle Costs

4.5.1 End of battery life – End of battery life is that point in time when the BESS can no longer meet the power and/or energy discharge requirements of this Specification due to age or non-repairable malfunction of the battery subsystem, and/or non-replaceable components. When the system is no longer able to provide these requirements, the system has reached its end of life. Battery End of life shall not be less than 10 years from the date of Commissioning.

4.5.2 It shall be the responsibility of the Contractor to make periodic replacements/replenishments of unit batteries, if and when required, up to the End of Battery Life as described above. Outage time as a result of replacement will also be counted as an "Accountable BESS Outage" for the purpose of computing BESS Availability.

4.6 Reliability, Availability, and Operability of the BESS

The BESS shall be designed for high reliability, defined in the following terms:

Starting reliability: (99% starting reliability means that the unit shall start in 99 of 100 attempts)

Mean-time-to-repair- The time taken from the time of notification of a need for repair to the time of completion of repairs (that is, inclusive of time for arrival of spare parts and repair personnel at the location of the BESS)

Availability

Availability is the percentage of hours that the BESS is available during the year. The availability guarantee shall begin upon facility commissioning. Annual availability shall be calculated as follows:

$$[1 - \left(\frac{\sum Accountable\ BESS\ Outage\ duration\ in\ hours\ x\ We}{8760}\right)\ ] \times 100$$

Where:

- W_e, Weightage is $\frac{Outage\ Capacity}{Rated\ Capacity}$, where Outage and Rated Capacity shall be in Energy terms i.e. MWh. Rated Capacity in a given year shall correspond to the daily throughput capacity guarantee for the beginning of the year as per Clause 3.1.
- *Accountable BESS outages* are outages caused or necessitated by the BESS equipment that result in reduced capacity or loss of essential function of the BESS. These outages may be initiated by failure of components, loss of battery capacity, operation of protective devices, alarms, or manual action. Such outages include both forced outages due to equipment problems and scheduled outages for BESS maintenance.
- *Accountable BESS outage duration* is the elapsed time of accountable BESS outages from the instant the BESS experiences reduced capacity or is out of service to the instant it is returned to service or full capacity. If the BESS experiences reduced capacity but is determined by the Employer to be available for service even if the Employer elects not to immediately return the equipment to full capacity, such time will be discounted from the outage duration.
- The Procurement specific nameplate ratings shall be as defined in Clause 3.1 above. The BESS shall be considered to be under an accountable outage if any of those ratings cannot be met. The BESS shall also be considered to be under an accountable outage if a scheduled (or required) charge cycle cannot be

completed.

- The data required for assessment of the availability of the BESS shall be collected through the Plant's integrated SCADA system.
- Grid outage hours shall be subtracted from total no. of hours in the year.
- If the Plane of Array solar irradiation/insolation is less than 2kWh/m^2 on a day, the day (i.e. 24 hours) shall be excluded.

4.6.1 It shall be possible to fully remove, repair, and replace in the field any failed or poorly performing component, assuming that spare parts, test equipment, and maintenance personnel are on the site. This capability shall be demonstrated in the factory acceptance test (FAT) for unit batteries and other key components.

4.6.2 The BESS shall be capable of unattended operation, with provision of remote monitoring and control.

4.7 Planned Maintenance Outage

The Contractor shall provide a guarantee for the maximum length of time required for this type of maintenance operation.

4.8 Battery Subsystem Design Requirements

4.8.1 Electrochemical Cells

Only cells that are commercially available or for which suitable (not necessarily identical) replacement cells can be supplied on short notice will be allowed. *For both premature cell failures and end-of-battery-life replacement, the Contractor shall guarantee cell availability and the length of down time (hours or days) required to replace cells.* The cells may be supplied as separate, individual units or as group of cells combined into modules. The cells shall meet the seismic requirements for the planned location of the BESS. Cell and module design shall accommodate the anticipated vibrations and shocks associated with the transportation of the BESS and shall resist deterioration due to vibrations resulting from the same. Associated hardware and paraphernalia should also be able to withstand the rigors of transportation. The transport plan shall be shared with the Employer and approved prior to dispatch.

4.8.2 Labelling of the cells or unit batteries shall include manufacturer's name, cell type, nameplate rating, and date of manufacture, in fully legible characters. All cells shall be traceable to the point of origin for purpose of addressing safety issues.

4.8.3 Electrochemical Storage System

4.8.3.1 The storage system may consist of one or more unit batteries. If the storage system consists of more than one unit battery, these may be electrically interconnected in any desirable series and parallel configuration to achieve the overall system storage and power rating requirements.

4.8.3.2 Each electrically series-connected string of unit batteries shall include a means of disconnecting the string from the rest of the system and of providing over-current protection (during a fault). The means of disconnect shall provide for a physical interruption of the string electrical circuit, which shall be visible to anyone servicing the individual unit batteries in the string and shall be capable of being locked or secured in an open position.

4.8.3.3 If the disconnect means consists of removal of a unit battery, the storage system shall be designed to allow maintenance personnel to determine that there is no current flowing in the string and provisions to ensure that the PCS is off before the unit battery is removed. Procedures for maintenance and/or field replacement of unit batteries shall neither require nor recommend removal of the unit battery without first ensuring that no current is flowing in the string circuit.

4.8.3.4 Over-current protection, whether on the ac or dc side, in paralleled unit battery strings shall be sized and coordinated so that currents from other strings do not contribute to a fault in any unit battery string.

4.8.3.5 Where appropriate, dc wiring shall be braced for available fault currents. Protection shall include a dc breaker, fuse, or other current-limiting device on the battery bus. This protection shall be coordinated with the PCS capabilities and battery string protection. The Contractor shall produce a fault analysis and protection coordination study for the battery dc subsystem during final design. *The Employer reserves the right to withhold permission to ship the BESS until the fault analysis has been satisfactorily completed.*

4.8.3.6 Cells, wiring, switch gear, and all dc electrical components shall be insulated for the maximum expected voltages plus a suitable factor of safety.

4.8.3.7 The battery system shall include a system to detect and alarm excessive ground leakage current levels. Ground fault detection shall be enabled for the container or, if more than one electrical series string is installed in the container, for each series string. The detection/trip level shall be field adjustable. The Contractor shall have overall responsibility for the safety of the electrical design and installation of the battery, as well as all aspects of the BESS.

4.8.3.8 The battery system shall include a monitoring/alarm system and/or prescribed maintenance procedures to detect abnormal unit battery conditions and notify proper personnel of their occurrence.

4.8.3.9 Abnormal conditions shall include but not be limited to (1) weak unit batteries that could reasonably be expected to fail to provide rated capacity upon full discharge, (2) high-resistance or open-unit batteries, (3) high-resistance or open external unit battery connections, (4) unit batteries with temperatures exceeding operating thresholds, and (5) internally shorted unit batteries. Unit battery monitoring, whether automatic or manual, should be specified to alert the proper personnel in a timely manner that an abnormal unit battery condition exists or may exist. All alarms shall be part of the control system and shall include remote display or annunciation capability.

4.8.3.10 The unit batteries shall be racked or shall be housed in stackable modules. The unit batteries or cells shall be arranged and installed to permit easy access for equipment and personnel. The moveable units shall be arranged and installed to permit easy access for equipment and personnel to carry out unit removal and replacement activities. For all systems, it shall be possible to remove and replace a prematurely failed unit battery or cell (as appropriate), when system performance specifications cannot be met. The lengths and widths of all aisles and spaces into which personnel may enter in the field for operations and/or routine or unscheduled maintenance purposes, as well as egress routes from these aisles and spaces, shall conform to applicable codes and standards. All racks and metallic conductive members of stackable modules shall be grounded to earth. Racks shall meet the seismic load and road vibration requirements and shall include means to restrain cell movement during seismic events and transport.

4.8.3.11 Provision shall be made for future Augmentation/Replacement by keeping Spare Racks for accommodating Battery Stack Modules capacity as per Annexure F: Mandatory Spares.

4.8.3.12 The design of all modules and racks shall specifically account for the anticipated vibrations and shocks associated with the transportation of the BESS.

4.8.4 Cell/Battery Auxiliary Systems

The cells and battery system shall be supplied with all required and/or recommended accessories. This includes inter-cell connectors and monitoring devices for cell temperature and cell voltage, if required.

4.9 Power Conditioning System Design Requirements

4.9.1 General

4.9.1.1 Standards and Codes

Power Conditioning Unit (PCU) shall comply with the specified edition of the following standards and codes.

Standard	Description
IEC 61683 Ed. 1	Photovoltaic systems - Power conditioners - Procedure for measuring efficiency
IEC 62109-1 Ed. 1	Safety of power converters for use in photovoltaic power systems - Part 1: General requirements
IEC 62109-2 Ed. 1	Safety of power converters for use in photovoltaic power systems - Part 2: Particular requirements for inverters
IEC 61000-6-2 Ed. 2	Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity standard for industrial environments
IEC 61000-6-4 Ed. 2.1	Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Emission standard for industrial environments
IEEE 1547/IEC 62116/UL 1741	Utility-interconnected photovoltaic inverters - Test procedure of islanding prevention measures
IEC 61727 Ed. 2	Photovoltaic (PV) systems - Characteristics of the utility interface
IEC 60068-2-1:2007	Environmental testing - Part 2-1: Tests - Test A: Cold
IEC 60068-2-2:2007	Environmental testing - Part 2-2: Tests - Test B: Dry heat
IEC 60068-2-14:2009	Environmental testing - Part 2-14: Tests - Test N: Change of temperature
IEC 60068-2-30:2005	Environmental testing - Part 2-30: Tests - Test Db: Damp heat, cyclic (12 h + 12 h cycle)

4.9.1.2 The PCS may consist of one or more parallel units. Paralleling may be at the DC or AC terminals. The PCS circuit topology shall be voltage source (that is, the PCS at its AC terminals shall appear to the grid as a voltage source rather than as a current source and, at its DC terminals, shall be capable of reversing current flow in the battery without reversing the polarity of the DC bus).

4.9.1.3 All load-carrying cables within the PCS subsystem shall have a suitable load factor of safety.

4.9.1.4 The PCS shall be housed within one or more appropriate weatherproof and dustproof enclosures, with provisions to prevent moisture condensation and to prevent the entrance of water, airborne salt or dust, rodents, insects, and/or similar materials or pests into air intake/exhaust ports.

4.9.2 Power Conditioning System Rating

The PCS shall be capable of delivering Real power as specified in Table-2. This rating shall be referred to in all project documentation, including this specification, as the nameplate VA rating. To account for losses in the PCS, the DC input power to the PCS will be higher than the rated PCS output power. The available DC input power will be the BESS nameplate watt rating divided by the PCS full load efficiency (as specified in the datasheet) during discharge.

4.9.3 Power Conditioning System Protection and Control

The PCS, in conjunction with the control system, shall be capable of completely automatic, unattended operation, including self-protection, synchronizing and paralleling with the grid, and disconnect. The control of the PCS shall be integrated with the overall BESS controls.

The PCS shall include all necessary self-protective and self-diagnostic features to protect itself from damage in the event of component failure or the excursion of operating parameters beyond a safe or expected range. This includes excursions due to internal or external causes. The self-protective features shall prevent the PCS from being operated in a manner that may be unsafe or damaging. Faults due to malfunctions within the PCS, including commutation failures, shall be cleared by the PCS over-current protection device(s).

4.9.4 Power Conditioning System AC Interface with AC bus

4.9.4.1 The BESS must meet applicable harmonic current and voltage specifications in accordance with applicable standards. Harmonic suppression may be included with the PCS or at the BESS AC system level. However, the Contractor shall design the BESS electrical system to preclude unacceptable harmonic levels in the BESS auxiliary power system.

4.9.4.2 In addition to interconnection standards specified in this document, there may be specific requirements for interconnection, which need to be ascertained by the Contractor in co-ordination with the distribution/transmission utility at site.

4.9.4.3 The PCS transformer may be used to aid in harmonic cancellation and may include

tertiary windings to supply BESS auxiliary power requirements. The transformer must be dry type. The PCS shall include provisions for disconnect on both its AC and DC terminals for maintenance work. Conductor separation must be clearly visible. The detailed maintenance procedure shall be addressed in the O&M manual.

4.9.4.4 Electromagnetic Interference

The PCS shall not produce electromagnetic interference (EMI) that will cause mis-operation of instrumentation, communications, or similar electronic equipment within the BESS.

4.9.4.5 Islanding

The PCS design shall include provisions to limit run-on and islanding as per applicable standards upon the loss of grid. This capability shall be demonstrated to the Employer's satisfaction during the FAT.

4.10 AC System

The BESS AC system includes all switch gear, bus work, cable, connectors, transformers, and protective relaying required for connecting the BESS at the PCC. The Contractor shall design, procure, ship, and assemble on-site all ac interconnection equipment on the BESS side of the PCC. The Contractor shall design, fabricate, ship and install all cabling required for connecting the BESS to the PCC. The BESS AC system shall include potential transformers, current transformers, and any other metering equipment so that the performance monitoring and documentation requirements of this specification can be met. Metering accuracy shall meet applicable standards.

4.11 Protection and Control

4.11.1 The power system (PCS), AC and DC switchgear/protective devices) shall be designed to provide safe, reliable operation with minimum interruption. Reliable operation shall be supported by a sensitive and properly coordinated protection system. The protection system shall be capable of monitoring significant operating parameters and sensing all abnormal operations or fault conditions. It shall isolate the faulted circuits or components without causing damage to other circuits and components of the system. The protection system shall also provide adequate indications and/or alarms for identification of the faulted circuits, components, and abnormal conditions, allowing preventive action and rapid restoration of service.

4.11.2 The BESS shall have at least following protection mechanisms for battery:

- Reverse Polarity
- Over/ Under Voltage
- Over Temp
- Over Charge

4.11.3 The grid may have its own protective schemes at the point of common connection (PCC) that will be the responsibility of the Contractor to fulfil.

4.11.4 Protection shall not be interlocked with the position of any isolating/interrupting devices.

4.11.5 The BESS shall be capable of interrupting line-to-line fault currents and line-to-ground fault currents available at the PCC and flowing in the equipment in either direction for faults on either side of the PCC. Faults due to malfunctions within the BESS shall be cleared by the BESS protective devices.

4.11.6 The BESS must have low-voltage ride-through capabilities according to extant Technical guidelines on connectivity.

4.11.7 BESS should be disconnected from the system and the system operators must be notified if any of the following occur:

- The BESS local interconnection protection system fails
- The interrupting device fails.
- The dc supply is lost

4.11.8 The BESS shall include provisions to protect against transient voltage surges from switching, lightning, and similar causes, in accordance with applicable standards. The overall PCS design shall also limit surges on the dc bus to twice the normal maximum DC bus voltage.

4.12 Auxiliary Power

The BESS shall include an auxiliary power system (separate or same as the Solar Plant auxiliary system) derived from the utility AC bus, the PCS transformer low-side bus, PCS transformer tertiary winding, or similar means with metering. The auxiliary power system shall include all step-down transformers, breakers, fuses, motor starters, relaying, panels, enclosures, junction boxes, conduits, raceways, wiring, and similar equipment, as required for the BESS operation. The auxiliary power system shall include separate potential transformers and current transformers, so that auxiliary power consumption can be measured and electronically recorded in real time, independently of operation of the PCS or of net power flows to and from the battery. The auxiliary power system and/or control system design shall provide for whatever

emergency power is necessary for an orderly system shutdown during abnormal conditions such as a loss of grid power. The auxiliary power system and/or control system design shall also provide for the capability to restart automatically after BESS shutdowns of several days.

5 Control and Communication

5.1 Control System General Requirements

The control system shall be designed to provide for automatic, unattended operation. The control system design shall provide for local manual operation and remote operation or dispatch from a remotely located computer. The control system shall be programmable for establishing or adjusting all parameters, set points, algorithms, limits, and so on that are required for effective operation as described in this specification. The control system shall be designed to prevent externally supplied, control panel or local signals from causing the BESS to operate in an unsafe manner or in a manner that may damage the BESS.

5.2 Control Functions and Protocols

5.2.1 To the extent possible, all BESS control functions and operating modes shall be in accordance with standard functionalities for smart distributed resources, as documented in the IEC 61850-90-7.

5.2.2 The communication protocol for the BESS shall be according to IEEE 1815-2010-Standard for Electric Power Communications—Distributed Network Protocol (DNP3) or IEC 61850.

5.2.3 If data points and/or control functions outside the standard point definitions in DNP3 AN2011-001/IEC 61850 are created by the Contractor, the Contractor shall maintain a systematic log of the same for the purpose of maintaining/facilitating interoperability with future standards/protocols for distributed energy resources

5.3 Additional Control System Functions

5.3.1 Shutdown/Startup/Standby

The start and stop controls shall be as per DNP3 AN2011-001 standard specifications or IEC 61850. The control system shall use these controls for an orderly and safe shutdown, even in the absence of grid power. The control system shall also use these controls for an orderly startup sequence, which shall provide for a safe system reset from any standby or operating condition so that the unit goes through a normal startup sequence in the same way it would when being powered up after loss of power or

being in a shutdown state. The control system shall include provisions for a standby state (that is, BESS available but not charging or discharging), which shall be the end result of a normal startup sequence. It shall also be possible to enter the standby state from any of the other operating states except connect/disconnect.

5.3.2 Initiation of Shutdown

The control system shall initiate shutdown under the following conditions and shall remain in the shutdown state until a reset signal, either local or remote, is initiated. An appropriate alarm shall be set.

- Emergency trip switch.
- Loss of the low-voltage AC or utility grid voltage.
- An AC circuit breaker trip (either side of transformer).
- Door interlock: Initiate shutdown when the door is opened (with appropriate provision for maintenance work). Interlocks shall be self-resetting.
- Smoke/fire alarm.
- Control logic trouble.
- A DC ground fault (field-adjustable setting).
- Remote disable (no reset required).
- grid system faults (balanced and unbalanced; line-to-ground, line-to-line, and three-phase).
- Abnormal frequency
- Abnormal voltage
- Islanding condition.
- Protection or control scheme failures, including the following:
  - Failure of local interconnection protection system
  - Failure of critical breaker trip coil or interrupting device
  - Loss of DC supply

5.3.3 Reset Alarms

For all system-generated alarms, the control system shall provide for the resetting of those alarms. This function is intended for alarms that, after they are set (for example, by a fault condition, as listed above and elsewhere in this specification), must be cleared by operator intervention to allow normal operation to be restored.

5.3.4 Modify Storage Settings

The control system shall provide for modification of various set points and fixed operation/control settings associated with the various control functions.

5.3.5 Event/History Logging

The control system shall provide for the automatic logging of the following information:

- All errors or failures
- All startup and shutdown actions
- All control actions
- All responses to control actions
- All limit violations, including returns within limits

5.3.6 Status Reporting

The control system shall provide for reading and reporting of various BESS- supplied status information in accordance with the data collection and reporting requirements specified in this technical specification.

5.3.7 Time Synchronization

The control system shall provide for synchronization of its real-time clock with a standard time source.

5.3.8 Change Operational Mode

The control system shall support activating/deactivating control functions. The control functions are expected to be executed by command from a remote host, but may also be scheduled.

5.3.9 Perform Self Diagnostics

The control system shall provide for self-diagnostic functions.

5.4 Control System Hardware Requirements

All local control and monitoring system components shall be housed in appropriate controlled environment enclosures either as separate arrangement or in conjunction with Solar Plant SCADA system.

5.5 Control System Self-Protection and Self-Diagnostic Features

5.5.1 The BESS shall include appropriate self-protective and self-diagnostic features to protect itself and the battery from damage in the event of BESS component failure or from parameters beyond the BESS's safe operating range due to internal or external

causes. The self-protective features shall not allow local or remote signals to cause the BESS to be operated in a manner that may be unsafe or damaging to the BESS. All protective operations resulting in a shutdown shall be carried out in an orderly and safe manner, even in the absence of utility power.

5.5.2 Temperature sensors shall be incorporated in critical components within the BESS. The BESS shall alarm and go to standby/fault mode when an over-temperature condition is detected.

5.5.3 The BESS shall alarm upon detection of a DC ground fault. The alarm trip level shall be field adjustable.

5.5.4 Door interlock switches shall be provided for all BESS container doors. The BESS shall alarm and go to shutdown mode when a BESS door is opened. Doors shall be fitted with provisions for external locks.

5.5.5 The BESS shall alarm and go to shutdown mode upon detection of smoke.

5.5.6 Surge-protection devices shall be provided at the input and output terminals of the BESS.

5.6 Control Panel

The BESS shall include a local control panel or console, which is easily accessible, on or within the BESS container. As a minimum, the following operator controls shall be located on the control panel:

- Trip/reset for the BESS AC circuit breaker or contactor.
- Trip/reset for DC circuit breaker(s)/contactor(s).
- PCS on/off.
- Reset toggle or push button. When reset is initiated, the control system shall resume control and proceed to the appropriate operating mode.
- Reset cut-out selector switch to disable remote or local reset signals.
- A selector switch to manually set the operating state (that is, the shutdown, disconnect, or operate state) and to have the control system set the operating state automatically.
- A selector switch to manually set the operating mode and to have the control system set the operating mode automatically.
- The control panel or console shall also include meters, indicators, and displays.

5.7 Performance Monitoring and Data Acquisition

5.7.1 The BESS shall include a (Data Acquisition System) DAS to provide continuous monitoring and display of key operational parameters, as well as permanent archival

of all measured parameters. The DAS shall include sensors, transducers, wiring, signal isolation and conditioning circuitry, and data acquisition and analysis hardware and software as required to perform the functions described in this section. The DAS shall be of standard commercial manufacture and shall use hardened components suitable for operation in the climatic conditions prevailing at site.

5.7.2 The DAS shall measure operational data, as described in this Clause, and shall record all data points to fixed and removable non-volatile memory. The DAS shall be capable of making all monitored data and events available through the DNP3 / IEC 61850 communication interface and shall permit display of current values and recent historical trends on a local screen for all recorded points. In addition, the DAS shall provide panel meter displays of certain operational parameters, as prescribed below.

5.7.3 Provision of monitoring and event data via the communication interface shall adhere to DNP3 AN2011-001 / IEC 61850 to the extent possible and capture at least the following data points:

- Frequency at the AC bus
- AC real power
- Power factor
- Real energy delivered
- Real energy received
- Auxiliary power
- Auxiliary energy
- DC power
- DC voltage
- DC current
- Phase A voltage
- Phase A angle
- Phase B voltage
- Phase B angle
- Phase C voltage
- Phase C angle
- Battery state of charge
- Battery string currents
- Battery temperature

5.7.4 Digital displays, on the BESS Control Panel, shall update at least once per second.

The DAS shall be integrated with the Solar PV SCADA described elsewhere in this Technical Specification either as addendum or within an overall Energy Management System Interface. The DAS shall, at a minimum, provide remote data inquiry from personal computer– based platforms and data file export capabilities in ASCII format on independent media (such as a universal serial bus drive) that are readable on personal computer-based systems.

5.7.5 The DAS shall continuously measure or calculate the data points identified in Clause 5.7.3 and shall make them available via the communication network as specified. All measured parameters shall also be permanently archived in all modes of operation. For continuously varying quantities, the Contractor shall propose for Employer's review and approval an approach to data archiving that is suitable for each quantity measured. The final approach will be decided during product design.

5.7.6 The DAS shall provide unsolicited message capability for reporting critical alarms. The Contractor and the Employer will agree on a list of alarms that are reported the instant they are detected. However, a minimum of following parameters shall be displayed on BESS local control panel, console, or SCADA computer:

- Main temperature Alarm (on system temperature exceeding a predetermined threshold)
- Smoke/fire Alarm (on system detection of smoke/fire)
- DC leakage current (battery leakage current to ground exceeding a predetermined threshold)
- Breaker status (connect/disconnect switch)
- AC voltage OK (system ac voltage exceeding a predetermined threshold)
- Battery temperature alarm (battery temperature exceeding a predetermined threshold)
- Synchronization error shutdown
- PCS fault
- Weak Unit Battery Alarm
- AC system fault
- Control logic problem (problem with the BESS control logic)
- DC fuse blown
- Container door open (BESS container door opening)

5.7.7 The BESS shall include provisions for determining and storing in non-volatile memory the sequence of abnormal events, trips, and/or alarms that cause the BESS to go to

disconnect or shutdown state. It is preferable that this function be implemented separately from the normal operations data acquisition function of the DAS so that failures in the latter (hardware/software failures or power interruptions) will not prevent the permanent logging of abnormal event sequences. The BESS shall include provisions to transmit, at a minimum, the data displayed on the panel meters and the alarm/status indicators to the remote computer.

6 Grounding

A suitable equipment grounding system shall be designed and installed for the BESS as per relevant Codes and Standards for grounding/earthing. This system shall be designed to be tied to an existing site grounding system. The system also shall be adequate for the detection and clearing of ground faults.

All exposed non-current-carrying metal parts shall be solidly grounded. Particular attention shall be given to prevention of corrosion at the connection of dissimilar materials such as aluminium and steel.

7 Wiring

7.1 All wiring shall be continuous for each wiring run; splices are not acceptable.

7.2 Wiring that may be exposed to mechanical damage shall be placed in conduit or armoured.

7.3 Wires shall have identifying labels or markings on both ends. The labels or markings shall be permanent and durable. Stick-on labels will not be allowed. All field wiring between separate equipment items supplied by the Contractor shall be color-coded according to appropriate standards.

7.4 In general and where practicable, control and instrumentation wiring shall be separated from power and high-voltage wiring by use of separate compartments or enclosures or by use of separate wireways and appropriate barrier strips within a common enclosure.

7.5 BESS and PCS control and instrumentation system wiring shall be bundled, laced, and otherwise laid in an orderly manner. Wires shall be of sufficient length to preclude mechanical stress on terminals. Wiring around hinged panels or doors shall be extra flexible and shall include loops to prevent mechanical stress or fatigue on the wires.

7.6 Insulation and jackets shall be flame retardant and self-extinguishing.

7.7 Wiring to terminal blocks shall be arranged as marked on wiring diagrams. Terminal groupings shall be in accordance with external circuit requirements.

7.8 Raceway and cable systems shall not block access to equipment by personnel. There

shall be no exposed current-carrying or voltage-bearing parts.

8 Civil/Structural

8.1 General Requirements

8.1.1 Soil bearing stresses shall not exceed the allowable stresses for the soil parameters, as determined by the Contractor. A minimum safety factor of 1.5 shall be provided against uplift, sliding, and overturning loads. Soil stresses shall be calculated using unfactored loads.

8.1.2 All structures and foundation designs must include suitable evidence to show that their design is commensurate with a minimum of 25-year life.

8.1.3 Unless specifically stated otherwise, the design of all structures, equipment, and foundations shall be based on applicable portions of IS codes, these specifications, and industry standards.

8.1.4 All components shall be painted, coated, or otherwise protected in a manner commensurate with at least 25-year design life. Particular attention shall be given to prevention of corrosion at the connections between dissimilar materials such as aluminium and steel, and steel and concrete.

8.1.5 All structures and foundations shall be designed to resist dead, live, wind, and seismic loads.

8.2 Requirements for Installation

8.2.1 The Contractor shall be responsible for obtaining all required permits and ensuring that all inspections by local authorities are completed as required.

8.2.2 Calculations based on applicable standards shall be supplied to show that the design of the entire BESS will withstand wind speed and/or gusts and other loads specific to the site and that the design meets all applicable structural and transportation codes.

8.2.3 Excavation spoils shall be disposed of as directed by the Employer.

8.2.4 All reinforced concrete work shall be in accordance with relevant Indian Standards. All other materials and installation requirements shall be subject to Employer approval.

9 Mechanical

9.1 All exposed surfaces of ferrous parts shall be thoroughly cleaned, primed, and painted or otherwise suitably protected to survive outdoor conditions for at least 25-year design life of the system.

9.2 Outdoor enclosures shall be weatherproof and capable of surviving intact under the

site environmental conditions specified. Outdoor enclosures shall be equipped to prevent condensation.

9.3 Components mounted inside enclosures shall be clearly identified with suitable permanent designations that also shall serve to identify the items on drawings provided.

9.4 The site temperatures and the effect of temperature on component life shall be considered in developing the thermal design for all components, including the battery and PCS. Irrespective of the heat-removal system design the final rejection of all waste heat from the BESS shall be to the ambient air. Air-handling systems shall include filters to prevent dust intrusion into the BESS.

9.5 The BESS shall include an HVAC or ventilation system designed to maintain battery temperatures at levels acceptable to the Contractor's normal battery warranty conditions, conducive to acceptable battery life, and as required to maintain battery capacity for all seasons/climatic conditions at the site. The air handling/distribution system shall be designed to promote temperature uniformity within the battery.

10 Other Design Requirements

10.1 Noise Levels

The Contractor shall provide for and maintain noise mitigation devices like Noise mufflers at site, if required.

10.2 Fire Protection

10.2.1 The Contractor shall design and install a fire protection system that conforms to good engineering practice, CEA guidelines and considering thermal runaway fire characteristics of the Battery Unit/ Packs provided by the OEM.

10.2.2 The fire protection system design and associated alarms shall take into account that the BESS will be unattended. If required by the type of fire protection system provided, the Contractor shall calculate and take into account the heat content of the battery cell materials in designing an appropriate fire protection system. Separate fire protection systems may be used in the battery, PCS, and control areas.

10.3 Toxic Materials

If any toxic substance can be emitted from the equipment during a failure, fire, or emergency or protective operation, description of the toxic nature of the substances as well as treatment for exposure to it shall be included in the O&M manual. Their treatment and disposal shall be in accordance with the New Hazardous Waste Management Rules 2016 notified by the Government of India.

10.4 Spare Parts and Equipment

The Contractor shall evaluate the design with regard to expected failure rates, modes, and effects; overall BESS reliability; and planned mode of servicing. Based on this evaluation, the Contractor shall recommend and furnish an initial complement of spare parts that are not readily available. For example, these spare parts may include spare unit batteries and a small rectifier to maintain the unit batteries, as well as fuses, printed circuit boards, and switching devices (gate turnoff thyristors [GTOs], silicon-controlled rectifiers [SCRs], insulated gate bipolar transistors [IGBTs], and so on).

11 Maintenance and Repair

11.1 The Contractor shall supply all labour, equipment, and materials needed to maintain the BESS performance and safe operation, including all maintenance required to satisfy the warranty terms and conditions.

11.2 The Contractor shall list all maintenance activities to be carried out under the maintenance contract. For each maintenance item, the list shall include a description of the item, the expected frequency (maintenance interval), the time required to perform the maintenance, any anticipated parts replacement, and any potential problems in carrying out the maintenance.

12 Factory Acceptance Testing of BESS

12.1 The Contractor shall develop and submit to the Employer for its review and approval a comprehensive FAT plan that shall demonstrate that the BESS will meet the requirements of the specification. The Employer shall have the right to request reasonable changes to the test plan.

12.2 Where full-scale testing of larger systems at the factory may be difficult or impossible due to the large system, the FAT shall be carried out at a subsystem or module level and shall consist of tests of 100% of the subsystems or modules that comprise the complete BESS, to the extent possible. In the FAT plan, the Contractor shall clearly state what is being tested and shall fully explain any features or functions of the fully assembled BESS that would not be fully tested in the reduced-scale testing proposed. In such a case, the SAT plan shall further describe how the tests that could not be carried out in the factory will instead be carried out at the site.

12.3 After the Contractor determines that the BESS is fully operational, the Contractor shall conduct a FAT, witnessed by the Employer and/or the Employer's representative. The FAT shall consist of the Contractor demonstrating to the Employer that the BESS is

fully operational and performs as specified. This includes but is not limited to the following:

- Visual inspection of all provided equipment, including dimensions and overall design.
- Verification of proper mechanical construction such as electrical connection torques.
- Verification of sensors, metering, and alarms.
- Verification of all control functions, including remote control and monitoring, and communications interfaces.
- Verification of BESS performance at full and partial power and energy ratings.
- Verification of maintenance and replacement features for unit batteries and other key components.
- Verification of compliance with specifications.

12.4 During the FAT, the BESS shall meet the following:

- Be operated and function as specified and designed in all the operating states, use cases, and duty cycles specified herein
- Meet the power and energy requirements specified herein
- Be demonstrated to meet the safety and response to catastrophic failure requirements specified herein
- Have the efficiencies, response capabilities, and other features specified herein and/or proposed by the Contractor

Note: *The methodology* for measurement of procurement specifications is provided in the Annexure-E to this Section.

12.5 Operation of all control, protective relaying, and instrumentation circuits shall be demonstrated by direct test, if feasible, or by simulating operating states for all parameters that cannot be directly tested. Automatic, local (control console), and remote operation of the controls shall be demonstrated.

12.6 Factory testing shall demonstrate operation at expected temperature extremes at the Employer's site. If this is not possible for the full BESS at the manufacturing facility, independent laboratory certification of operation of critical components and subsystems in the battery, PCS, and control systems shall be submitted at the time of the FAT. The Contractor shall submit to the Employer for approval, 90 days before the FAT, a list of components and subsystems for which independent lab testing certification will be

sought.

12.7 The Contractor shall perform any and all system modifications required during start-up and testing. The testing may be suspended as a result of a BESS malfunction and resumed only on rectification of problem items. Such suspension and resumption will occur at the sole discretion of the Employer.

12.8 The BESS will not be accepted for shipment until all FATs have been successfully completed. In addition, the Employer will verify that all provisions of the contract have been met, including verification of all required submittals, any spare parts delivery, and any required system modifications.

13 Commissioning and Functional Guarantee test procedure

13.1 The Contractor shall develop and submit to the Employer for its review and approval a comprehensive SAT plan that shall demonstrate to the Employer that the BESS will perform as specified at the Employer's site. The Employer shall have the right to request reasonable changes to the test plan.

13.2 The Contractor shall develop and perform SAT procedures to ensure that the BESS will perform as designed and that the system meets the performance criteria specified elsewhere in these specifications. The SAT plan shall include procedures to test operating scenarios described in the specification. These procedures may involve special requirements and/or witnessing by the local independent system operator. To the extent achievable, all use cases and operating modes described in the specification shall be tested.

13.3 After the Contractor has determined that the BESS is fully operational, the Contractor shall conduct the SAT, witnessed by the Employer and/or the Employer's representative. The tests shall include, as a minimum, the following:

- Verification of sensors, metering, and alarms
- Verification of all control functions, including automatic, local, and remote control
- Verification that the performance criteria in the specification can be met or exceeded
- Demonstration of all of the intended uses
- Demonstration of interface protection circuits and functions and control interfaces

13.4 Tests shall demonstrate that the BESS capabilities, efficiencies, response, and features are as proposed by the Contractor.

13.5 Testing shall include, as a minimum, measurement of harmonic content and power

factor at full and partial power levels for both charge and discharge.

13.6 Operation of all control, protective relaying, and instrumentation circuits shall be demonstrated by direct test, if feasible, or by simulating operating states for all parameters that cannot be directly tested. Automatic, local, and remote operation shall be demonstrated.

13.7 The SAT shall also specifically address discovery of problems or failures that may have occurred during or as a result of shipment.

13.8 The Contractor shall perform any required modifications and repairs identified by the testing, before acceptance by the Employer.

13.9 The Employer will not accept the BESS for commissioning until all acceptance tests have been successfully completed and all provisions of the contract have been met.

13.10 Functional Guarantee - Actual Operating Experience

Since it may not be possible, due to system constraints, to test all facets of the BESS function as part of the performance verification tests specified in the preceding sections the actual operating experience of the BESS during the performance guarantee period after initial startup shall be deemed an extension of the performance verification tests. The performance guarantee period shall not be construed as a substitute for the warranty requirements, as specified in the subsequent Clause. Actual operating experience will be documented through Contractor-furnished records, and other system monitoring equipment and associated BESS performance. Documented failure or malfunctions of any BESS component during the performance guarantee period shall be deemed a failure of the system commissioning test. The Contractor shall, at no cost to the Employer, make the necessary repairs, replacements, modifications, or adjustments to prevent the same failure or malfunction from occurring again. The replacement of certain BESS components in response to a system failure may necessitate, at the discretion of the Employer, the duplication of certain performance verification tests, which shall be performed at the Contractor's expense.

14 Warranty

14.1 The Contractor shall provide a warranty for the entire BESS and its constituent equipment.

14.2 At a minimum, the Contractor shall provide an unconditional, 5 (five) -year parts and labour warranty on all BESS equipment except battery (unit or racks). For the battery storage, the warranty shall cover parts warranty including battery nominal capacity ratings in order to meet the End of battery Life condition described in this specification.

14.3 Warranty replacement shall be required for individual unit batteries that degrade in performance to the point at which the BESS cannot meet the requirements specified in this specification up to the End of Battery Life and/or for unit batteries that materially degrade the availability, reliability, safety, or functionality of the BESS.

14.4 The warranty shall guarantee the availability of battery replacements delivered to the site during the battery warranty period. This period, shall, however, not be considered part of the Accountable Outage period for assessing BESS availability.

14.5 Additional warranty requirements are as follows:

- The warranty shall specify the terms and conditions of the warranty, including operating conditions requirements, procedures that must be followed, and all maintenance requirements. The warranty terms shall be easy to understand and shall be clearly stated.
- The warranty shall provide an explicit statement as to the warranted cycle life and the warranted calendar life of the battery.
- The warranty shall include a simple and easy to understand proration formula, if any, to be used in crediting the Employer for unused life or capacity of equipment replaced or repaired.
- The warranty shall specify the scope of service associated with software updates.
- The warranty shall specify the scope of service included in replacement or repair of the equipment.
- The warranty shall specify all labour, materials, shipping charges, and other Employer expenses not included in the warranty.
- The warranty shall specify the estimated time to complete the repairs/replacement required to restore the BESS to the warranted performance level. The time shall be given as the number of working days from the time of Employer's notice to the Contractor that the BESS has failed to meet the performance requirements.

15 Documentation and Submittals

15.1 The Contractor shall furnish complete documentation that will be used for determination of contract compliance, as well as O&M of the BESS.

15.2 Review and acceptance of submittals shall not encumber the Employer or the Host Utility with responsibility for the adequacy or safety of the Contractor's design.

15.3 Titles shall clearly indicate the function of the document, the Employer and location of the facility.

15.4 At a minimum, Contractor's documentation shall consist of the following:

- Construction and installation drawings
- Construction materials submittal
- Equipment drawings and specifications
- Operation and maintenance manual
- Maintenance schedule
- Critical path method project schedule
- Master test plan and procedures
- Quality assurance manual
- Software documentation
- Study reports
- Test reports
- Training manuals

F EMS (Energy Management System)

1 General Requirements

1.1 Energy Management System (EMS) system shall be a controller based system along with required accessories and communication links for integrated, real-time monitoring, efficient operation and control of active power, reactive power as well as voltage at the interconnection point of PV arrays and BESS.

1.2 EMS shall be integrated with the SCADA described under Part B: Electrical System to acquire/monitor real time data of various equipment of Plant facilities and have in built logic/programming to monitor, control, and optimize the performance of Plant facilities as per specification. Contractor shall provide complete EMS system with all accessories, auxiliaries and associated equipment and cables for the safe, efficient and reliable operation of entire Plant facilities and its auxiliary systems. Contractor shall include in his proposal all the Industrial Grade Hardware, Software, Panels, Power Supply, HMI, Gateway, Networking equipment and associated Cable etc. needed for the completeness even if the same are not specifically appearing in this specification.

2.1 EMS functionality for the BESS Control: -

The following operation modes of BESS can be set from the EMS system:-

- Automatic mode: This means that a part of the power quantity of the BESS behaves according to the selected operation mode.

- HMI mode or manual mode: in this mode, the operator has the possibility to:
  - Select the operation point
  - Direct control of active and reactive setpoints of the PCS.
  - Command of the balance of plants
- OFF-mode: A BESS is not producing any power. The system is disconnected form the grid.
- STANDBY-mode: the BESS is connected to the grid, but the IGBT's in the PCS system are in an off-state (i.e. open switching)

Also, the performance of every application mode will be controlled and adaptable by this system.

This energy management strategy will be operated by the SCADA in Main Control Room. Any failure in the process or the control system including instrumentation must be detected and logged. This means that the instrumentation, electronic and electrical equipment shall include those failure detections.

A communication with the SCADA system must be possible to receive set points and transmit set points for each application mode. The SCADA should be able to remotely control the BESS. The EMS should allow the SCADA at least the following:

- Change the operation mode of each BESS independently
- Start/Stop each application mode appointed to a BESS.
- Change the application mode of each BESS (multiple modes can be selected together)
- Select the amount of power dedicated to each selected application mode.
- Specifically, for following use cases considered for the Project:
  - Power ramp rate control
  - Power Curtailment
  - Deviation Settlement Mechanism(DSM)
  - Change the setpoints for the SOC management
  - Direct control of active and reactive setpoint of a PCS
- Adapt the parameters needed for the operation of every application mode

The Communication protocol may be IEC 61850 or MODBUS over a serial or Ethernet connection (Modbus RTU or MODBUS TCP). Other solutions can be proposed but are subjected to the approval of the client.

2 EMS functionality for the Plant Control: -

2.1 The EMS monitors grid and Plant facility variables and should be programmable for selecting the optimum-operating mode of the whole plant w.r.t. active and reactive power, grid voltage, grid frequency, etc. Additionally, it can receive external set points and automatically adapt the Plant Facility behaviour to the new settings.

The EMS shall perform following functionality to Control the Plant facilities: -

- Communication with grid or SCADA
- Communications with PV Inverters, BESS and other power units
- Measuring and processing of the electrical magnitudes at EMS (voltage, current, PF)
- Control capability of PV Inverters, BESS and other power units

The EMS shall allow following operation modes for the Plant facilities:

- Reactive Control (Q Control, setting point of reactive power Q at EMS)
- Power Factor Control (PF Control, setting point of cos(L) at EMS)
- Voltage Control (V closed loop control, setting point of V at EMS)
- Voltage Droop (Reactive power vs Voltage programmable curve or droop)
- Apparent Power Control (S Lim, setting point of S Lim at EMS)
- Active Power Limitation (P Lim, setting point of P Lim at EMS)
- Power Ramp Rate Control (setting point of maximum %Pn/min)
- Frequency Regulation (Power vs Frequency programmable curve or droop)

2.2 In addition to these operating modes, the EMS shall be prepared to work under voltage dips, allowing the inverters to inject the corresponding reactive power to provide the corresponding voltage support at the EMS. The EMS can receive the target values specified by grid operators using a standard protocol (i.e. Modbus TCP/IP) and over different communication media

3 Measurements

To perform the application modes described above, measurements are needed at the Point of Common Coupling (PCC). The measurements are (but not limited to):

- Voltage measurement: This is needed to perform voltage regulation and reactive power compensation
- Output power (Active and Reactive): This will be measured with an accuracy précised by the supplier. The measurement equipment should be class 0.2

2.2 Control & Power Supply Scheme

Contractor shall provide the UPS/ DC Power supply of suitable rating to cater all the load requirements of EMS system and its auxiliaries.

2.3 Software Documentation & Listings

All technical manuals, reference manuals, user's guide etc. in English required for modification/editing/addition/deletion of features in the software of the EMS System shall be furnished. The Contractor shall furnish a comprehensive list of all system/application software documentation after system organization for Employer's review and approval. All The software listings for application software, Project data files etc. shall be submitted by the Contractor. All the EMS Software with license Key shall be handed over to the Owner on the DVD/CD media. All the hardware and software shall be licensed to SECI.

G Performance Measurement Procedure

1 Performance Ratio (PR)

Performance Ratio (PR) test for Operational Acceptance of the plant shall be performed as per the procedure attached in Annexure-C.

2 Capacity Utilization Factor (CUF)

Capacity Utilization Factor of the plant shall be calculated as per the procedure attached in Annexure-C.

~~precedence.~~

B Electrical System

1 Photovoltaic Modules

1.1 Standards and Codes

Photovoltaic Modules shall comply with the specified edition of the following standards and codes.

Standard	Description
IEC 61215-1:2016 Ed.1	Terrestrial photovoltaic (PV) modules - Design qualification and type approval - Part 2: Test requirements
IEC 61215-1-1:2016 Ed.1	Terrestrial photovoltaic (PV) modules - Design qualification and type approval - Part 1-1: Special requirements for testing of crystalline silicon photovoltaic (PV) modules
IEC 61215-1-2 Ed.1	Terrestrial photovoltaic (PV) modules - Design qualification and type approval - Part 1-2: Special requirements for testing of thin-film Cadmium Telluride (CdTe) based photovoltaic (PV) modules
IEC 61730-1:2016 Ed.2	Photovoltaic (PV) module safety qualification - Part 1: Requirements for construction
IEC 61730-2:2016 Ed.2	Photovoltaic (PV) module safety qualification - Part 2: Requirements for testing
IEC 61701:2011 Ed.2	Salt mist corrosion testing of photovoltaic (PV) modules (Applicable for coastal and marine environment)
IEC 62716:2013 Ed.1	Photovoltaic (PV) modules - Ammonia corrosion testing (if applicable)
IEC TS 62804-1:2015 Ed.1	Photovoltaic (PV) modules - Test methods for the detection of potential-induced degradation - Part 1: Crystalline silicon (under conditions of 85°C/85% RH for minimum 192 hours)
As per the Solar Photovoltaics, Systems, Devices and Components Goods (Requirements for Compulsory Registration) Order, 2017, PV Modules used in the grid connected solar power projects shall be registered with BIS and bear the Standard Mark as notified by the Bureau of Indian Standards. Further, PV Modules should have been included in the ALMM list as per MNRE Approved Models and Manufacturers of Solar Photovoltaic Modules (Requirements for Compulsory Registration) Order, 2019.	

1.2 Technical Requirements

Parameter	Specification

Cell type	Mono-crystalline or Multi-crystalline, Bifacial
Module Efficiency (Frontside)	≥ 19.5%
Bifacialitiy Factor, ø (P_{mp} Back / P_{mp} Front at STC)	0.7 ± 0.05
Rated power at STC	No negative tolerance is allowed
Temperature co-efficient of power	Not less than -0.40%/°C
Application Class as per IEC 61730	Class A

Note: Bifaciality Factor shall be verified in accordance with IEC TS 60904-1-2:2019 - Photovoltaic devices - Part 1-2: Measurement of current-voltage characteristics of bifacial photovoltaic (PV) devices. Refer Annexure A to Annexure A: Employer's Requirements.

1.3 Supplier Qualification Criteria

1.3.1 The PV Modules Supplier should have supplied minimum 5 GW capacity globally or 1 GW in India in the past 5 years.

1.4 Component Specifications

1.4.1 The PV Modules glass panel shall be:

(i) Glass-glass Modules, with minimum of 2 mm glass thickness on each side. It shall be laminated using a laminator with symmetrical structure, i.e. heating plates on both sides.

(ii) The glass used shall have transmittance of above 90%.

1.4.2 Void

1.4.3 The encapsulant used for the PV modules should be polyolefin based, UV resistant and PID resistant in nature. No yellowing of the encapsulant with prolonged exposure shall occur. The encapsulant shall have the following properties.

Parameter	**Value**
Gel content	> 75%
Transmittance	>90%
Volume resistivity	> 1×10^{15} Ω.cm
Peeling strength with glass	> 40 N/cm

1.4.4 The sealant used for edge sealing of PV modules shall have excellent moisture ingress protection with good electrical insulation (Break down voltage >15 kV/mm) and with good adhesion strength. Edge tapes for sealing are not allowed.

1.4.5 The module frame shall be made of anodized Aluminium, which shall be electrically

& chemically compatible with the structural material used for mounting the modules. It is required to have provision for earthing to connect it to the earthing grid. The anodization thickness shall not be less than 15 micron.

1.4.6 The material used for junction box shall be UV resistant to avoid degradation during module life. The degree of protection of the junction box shall be at least IP67. Minimum three number of bypass diodes and two number of IEC 62852/EN 50521 certified MC4 compatible connectors with appropriate length of IEC 62930/EN 50618 certified 4 sq.mm copper cable shall be provided. The cable length shall be in accordance with the PV Module wiring strategy and adequate to ensure that the cable bending radius standard is not exceeded.

1.4.7 Each PV Module shall be provided a bar code which is embedded inside the module lamination and must be able to withstand harsh environmental conditions. The bar code data base shall contain the following information. Bar code scanner and database of all the modules containing the following information shall also be provided.

(i) Name of the manufacturer of PV Module
(ii) Name of the Manufacturer of Solar cells
(iii) Type of cell: Mono / Multi
(iv) Month and year of the manufacture (separately for solar cells and module)
(v) Country of origin (separately for solar cells and module)
(vi) I-V curve for the module
(vii) Peak Wattage, I_m, V_m and FF for the module
(viii) Unique Serial No. and Model No. of the module.
(ix) Date and year of obtaining IEC PV module qualification certificate
(x) Name of the test lab issuing IEC certificate
(xi) Other relevant information on traceability of solar cells and modules as per ISO 9000 series.

1.5 Warranty

1.5.1 PV modules must be warranted with linear degradation rate of power output except for first year (maximum 3% including LID) and shall guarantee 80% of the initial rated power output at the end of 30 years.

1.5.2 The modules shall be warranted, against all material/ manufacturing defects and workmanship for minimum of 10 years from the date of supply.

1.5.3 The above warranties shall be backed by third party insurance.

1.6 Approval

1.6.1 The Contractor shall provide Guaranteed Technical Particular (GTP) datasheet and Bill of Materials (BOM) of the module that is submitted for approval along with the datasheets of each component. The component datasheet shall contain all the information to substantiate the compliance for component specifications mentioned above.

1.6.2 The Contractor shall also provide test certificates corresponding to the standards mentioned above along with complete test reports for the proposed module. The tests should have been conducted at a test laboratory compliant with ISO 17025 for testing and calibration and accredited by an ILAC/IECEE member signatory. Laboratory accreditation certificate or weblink along with scope of accreditation shall also be submitted.

1.6.3 The BOM proposed shall be the subset of Constructional Data Form (CDF)'s of all the test reports.

1.6.4 The Contractor shall submit a detailed Manufacturing Quality Plan (MQP) for the PV Module with list of checks/tests performed during incoming material inspection, production, pre-dispatch and package.

1.6.5 The Contractor shall obtain the approval of the proposed module make & model prior to manufacturing/ inspection call.

1.7 Manufacturing and Inspection

1.7.1 The Contractor shall inform the module manufacturing schedule to the Employer at least 15 (fifteen) working days before the start of proposed schedule.

1.7.2 The Employer shall perform material inspection at the Manufacturer's factory before the start of proposed manufacturing schedule. Proof of procurement of components as per the approved BOM mentioning manufacturer name, manufacturing date and relevant test certificate shall be submitted during material inspection for verification.

1.7.3 The Manufacturing shall start only after the clearance by the Employer after the material inspection.

1.7.4 The cells used for module making shall be free from all defects like edge chipping, breakages, printing defects, discoloration of top surface etc. Only Class A solar cell shall be used.

1.7.5 The modules shall be uniformly laminated without any lamination defects.

1.7.6 Current binning of modules shall be employed to limit current mismatch of modules. Different colour codes shall be provided on the modules as well as pallet for

identification of different bins. Maximum three nos. of bins will be allowed for each module rating.

1.7.7 Pre-dispatch inspection of modules shall be performed as per the inspection protocol attached in Annexure – A: PV Module Pre-dispatch Inspection Protocol.

1.8 Transportation, Handling, Storage and Installation

1.8.1 Transportation, handling, storage and installation of modules shall be in accordance with the manufacturer manual so as not to breach warranty conditions. The Standard Operating Procedure (SOP) for the same shall be shared by the Contractor prior to dispatch.

1.8.2 It is required to construct a temporary platform (graded) while keeping the modules at least above the highest flood level. If the contractor scheduled/ planned to mount the modules immediately after the receipt at site, then the module shall be kept in common storage area with proper arrangement.

1.8.3 The stacked modules, in any case, shall be stacked as per the manufacturer's recommendation only and shall be covered with tarpaulin sheet.

2 String Monitoring Unit

2.1 Standards and Codes

Standard/Code	Description
IEC 60529	Enclosure Ingress Protection
IEC 62262	Enclosure Impact Protection
IEC 60269	Fuse
IEC 61643-11	Surge Protection Device
IEC 62852 or EN 50521	Solar cable connector
IEC 60695-2-11	Fire hazard testing

2.2 Construction

2.2.1 SMU enclosure shall be made of UV resistant, fire retardant, thermoplastic material. Enclosure degree of protection shall be at least IP65 and mechanical impact resistance shall be at least IK08.

2.2.2 Not more than two strings can be connected in parallel to a single input of SMU. One spare input terminal along with connector shall be provided for each SMU.

2.2.3 Every SMU input shall be provided with fuses on both positive and negative side. The rating of the fuses shall be selected such that it protects the modules from reverse current overload. The fuses shall be 'gPV' type conforming to IEC 60269-6.

2.2.4 DC switch disconnector of suitable rating shall be provided at SMU output to disconnect both positive and negative side simultaneously.

2.2.5 Type-II surge protective device (SPD) conforming to IEC 61643-11 shall be connected between positive/negative bus and earth.

2.2.6 Resistance Temperature Detector (RTD) type or semiconductor type temperature sensor shall be provided to monitor the cabinet temperature.

2.2.7 MC4 connector conforming to IEC 62852 or EN 50521 shall be provided at each SMU input. Cable gland (double compression metallic) of suitable size for DC cables shall be provided at the SMU output.

2.2.8 UV resistant printed cable ferrules for solar cables & communication cables and punched/ embossed aluminium tags for DC cables shall be provided at cable termination points for identification.

2.2.9 Suitable communication interface shall be provided to communicate the data to SCADA. The following parameters shall be measured/ monitored and made available at SCADA.

(i) String current
(ii) Bus voltage
(iii) Output current
(iv) Cabinet temperature
(v) DC disconnector switch ON/OFF status
(vi) SPD operating status

2.3 Warranty

The SMU unit shall be warranted against all material/manufacturing defects and workmanship for minimum of 5 (five) years from the date of supply.

2.4 Tests

Routine tests and acceptance tests for the assembled unit shall be as per the Quality Assurance Plan (QAP) approved by the Employer.

3 Solar and DC Cables

3.1 Standards and Codes

Cable	From	To	Conductor/ Insulation	Voltage Rating	Applicable Standard
Solar Cable*	Module	SMU	Copper/ XLPO	1.1 kV DC/ 1.5 kV DC	IEC 62930/ EN 50618/

DC Cable	SMU	PCU	Copper or Aluminium/ XLPE	1.1 kV DC/ 1.5 kV DC	IS 7098 Part I
* Cable used for module interconnection shall also be referred as solar cable.					

3.2 Solar cable outer sheath shall be flame retardant, UV resistant and black in colour. Solar cable with positive polarity should have marking of red line on black outer sheath.

3.3 DC cables shall be single core, armoured, Flame Retardant Low smoke (FRLS), PVC outer sheath conforming to IS 7098-I. DC cable with positive polarity should have marking of red line on black outer sheath.

3.4 In addition to manufacturer's identification on cables as per relevant standard, following marking shall also be provided over outer sheath.

(i) Cable size and voltage grade

(ii) Word 'FRNC/ FRLS' (as applicable) at every metre

(iii) Sequential marking of length of the cable in metres at every metre

3.5 Cables shall be sized based on the following considerations:

(i) Rated current of module

(ii) The average voltage drop in the cables (Modules to Inverter) shall be limited to 1.5 % of the rated voltage. The Contractor shall provide voltage drop calculations in excel sheet.

(iii) Short circuit withstand capability

(iv) De-rating factors according to laying pattern

3.6 Warranty

The cables (Solar and DC) shall be warranted against all material/ manufacturing defects and workmanship for minimum of 1 (one) year from the date of supply.

3.7 Tests

Type test, routine test and acceptance tests requirements shall be as per IEC 62930/EN 50618 for solar cables and IS 7098-1 for DC cables.

3.8 Installation

3.8.1 Cable installation shall be as per IS 1255.

3.8.2 Only terminal cable joints shall be accepted. No cable joint to join two cable ends shall be accepted.

3.8.3 Solar cables shall be provided with UV resistant printed ferrules and DC cables shall be provided with punched/ embossed aluminium tags. The marking shall be done with good quality letter and numbers of proper size so that the cables can be identified

easily.

3.8.4 Cable terminations shall be made with properly crimped lugs and passed through cable glands at the entry & exit point of the cubicles. Bimetallic lugs shall be used for connecting Cu bus bar and Al cables or vice-versa.

3.8.5 Solar cables, wherever exposed to direct sunlight and buried underground, shall be laid through Double Wall Corrugated (DWC) HDPE conduits. The size of the conduit or pipe shall be selected on the basis of 40% fill criteria.

3.8.6 Solar cables shall be aesthetically tied to Module Mounting Structure using UV resistant cable-ties suitable for outdoor application.

3.8.7 A.C and D.C cables shall be kept in separate trenches. The horizontal and vertical clearances between power and communication cable shall not be less than 300mm.

3.9 Cable Sealing System

3.9.1 Cable sealing system: Modular multi-diameter cable sealing system consisting of frames, blocks and accessories shall be installed where the underground and over ground cables enter or leave LCR/MCR/BESS enclosures. Cable sealing system shall consist of multi-diameter type peel-able blocks of different sizes to suit the various cables. It should be simple, easy and quick to assemble & re-assemble the cable sealing system. Solid blocks shall not be used on frame. Frames & stay-plate material shall be of galvanized steel and for compression, single piece wedge with galvanized steel bolts shall be used. 30% spare blocks on the frame shall be provided for expansion in future. Cable sealing system should have been tested for fire/ water /smoke tightness

4 Power Conditioning Unit

4.1 Standards and Codes

Power Conditioning Unit (PCU) shall comply with the specified edition of the following standards and codes.

Standard	Description
IEC 61683 Ed. 1	Photovoltaic systems - Power conditioners - Procedure for measuring efficiency
IEC 62109-1 Ed. 1	Safety of power converters for use in photovoltaic power systems - Part 1: General requirements
IEC 62109-2 Ed. 1	Safety of power converters for use in photovoltaic power systems - Part 2: Particular requirements for inverters

IEC 61000-6-2 Ed. 2	Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity standard for industrial environments
IEC 61000-6-4 Ed. 2.1	Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Emission standard for industrial environments
IEC 62116 Ed. 2	Utility-interconnected photovoltaic inverters - Test procedure of islanding prevention measures
IEC 60068-2-1:2007	Environmental testing - Part 2-1: Tests - Test A: Cold
IEC 60068-2-2:2007	Environmental testing - Part 2-2: Tests - Test B: Dry heat
IEC 60068-2-14:2009	Environmental testing - Part 2-14: Tests - Test N: Change of temperature
IEC 60068-2-30:2005	Environmental testing - Part 2-30: Tests - Test Db: Damp heat, cyclic (12 h + 12 h cycle)
CEA Technical Standards for Connectivity to the Grid Regulations 2007 with 2013 Amendment	
As per the Solar Photovoltaics, Systems, Devices and Components Goods (Requirements for Compulsory Registration) Order, 2017, Inverters used in the grid connected solar power projects shall be registered with BIS and bear the Standard Mark as notified by the Bureau of Indian Standards.	

4.2 Supplier Qualification Criteria

4.2.1 The Inverter Supplier should have supplied minimum 5 GW capacity globally or 1 GW in India in the past 5 years

4.3 Technical Requirements

Parameter	Specification
Rated AC power	As per design
Maximum input voltage	1500 V
Rated AC output voltage	As per design
Tolerance on rated AC output voltage	+/-10%
Rated frequency	50 Hz
Operating frequency range	47.5 Hz to 52 Hz
Power factor control range	0.9 lag to 0.9 lead
European efficiency	Minimum 98%
Maximum loss in Sleep Mode	0.05% of rated AC power

Total Harmonic Distortion	Less than 3% at 100% load
Degree of protection	IP 20 (Indoor)/IP 54 (Outdoor)

4.3.1 The rated/ name plate AC capacity of the PCU shall be AC power output of the PCU at 50°C.

4.3.2 Maximum power point tracker (MPPT) shall be integrated in the PCU to maximize energy drawn from the Solar PV array. The MPPT voltage window shall be sufficient enough to accommodate the output voltage of the PV array at extreme temperatures prevailing at site.

4.3.3 The PCU output shall always follow the grid in terms of voltage and frequency. The operating voltage and frequency range of the PCU shall be sufficient enough to accommodate the allowable grid voltage and frequency variations.

4.4 Construction

4.4.1 Power Conditioning Unit (PCU) shall consist of an electronic three phase inverter along with associated control, protection, filtering, measurement and data logging devices.

4.4.2 Every DC input terminal of PCU shall be provided with fuse/MCB/MCCB of appropriate rating. The combined DC feeder shall have suitably rated isolators for safe start up and shut down of the system. One spare DC input terminal shall be provided for each PCU.

4.4.3 Type-II surge protective device (SPD) conforming to IEC 61643-11 shall be connected between positive/ negative bus and earth.

4.4.4 In case external auxiliary power supply is required, UPS shall be used to meet auxiliary power requirement of PCU. It shall have a backup storage capacity of 2 hours.

4.4.5 Circuit Breaker of appropriate voltage and current rating shall be provided at the output to isolate the PCU from grid in case of faults.

4.4.6 The PCU shall be tropicalized and the design shall be compatible with conditions prevailing at site. Suitable number of exhaust fan with proper ducting shall be provided for cooling keeping in mind the extreme climatic condition of the site as per the recommendations of OEM to achieve desired performance and life expectancy.

4.4.7 All the conducting parts of the PCU that are not intended to carry current shall be bonded together and connected to dedicated earth pits through protective conductor of appropriate size. DC negative terminal shall be grounded. In case DC negative

grounding is not possible, appropriate anti-PID device shall be provided.

4.4.8 Dedicated communication interface shall be provided to monitor the PCU from SCADA.

4.4.9 PCU front panel shall be provided with LCD/ LED to display all the relevant parameters related to PCU operation and fault conditions. It shall include, but not limited to, the following parameters.

(i) DC input power
(ii) DC input voltage
(iii) DC input current (for each terminal)
(iv) AC output power
(v) AC output voltage (all the 3 phases and line)
(vi) AC output current (all the 3 phases and line)
(vii) Frequency
(viii) Power Factor

In case of outdoor PCU, PCU without LCD display with provision for Data access over Bluetooth shall be acceptable.

4.5 Operating Modes

Operating modes of PCU shall include, but not limited to, the following modes. These operating modes and conditions for transition are indicative only. The Contractor shall provide the detailed flow chart indicating the various operating modes and conditions for transition during detailed engineering.

4.5.1 Standby Mode

The PCU shall continuously monitor the input DC voltage and remain on Standby Mode until it reaches the pre-set value.

4.5.2 MPPT Mode

When the input DC voltage is above the pre-set value and AC grid connection conditions are fulfilled, the PCU shall enter into MPPT mode.

4.5.3 Sleep Mode

When the AC output power/DC input voltage decreases below the pre-set value for pre-set time delay, the PCU shall switch into Sleep Mode.

4.6 Protection Features

The PCU shall include appropriate self-protective and self-diagnostic feature to protect itself and the PV array from damage in the event of PCU component failure or from

parameters beyond the PCU's safe operating range due to internal or external causes. The self-protective features shall not allow signals from the PCU front panel to cause the PCU to be operated in a manner which may be unsafe or damaging. Faults due to malfunctioning within the PCU, including commutation failure, shall be cleared by the PCU protective devices.

The PCU shall provide protection against the following type of faults, among others.

(i) DC/AC over current
(ii) DC/AC over voltage
(iii) DC reverse polarity
(iv) DC earth fault
(v) AC under voltage
(vi) AC under frequency/over frequency
(vii) Islanding
(viii) Over temperature
(ix) Lightning surges

4.7 Grid Support Functions

4.7.1 Active power regulation

The PCU shall be able to limit the active power exported to the grid based on the set point provided through PCU front control panel. The PCU shall also be able to automatically the limit the active power after an increase in grid frequency above a pre-set value. The ramp rate shall be adjustable during operation and start-up after fault. The applicability of the requirement shall be as per CEA regulation and compliance.

4.7.2 Reactive power control

The PCU shall be able to inject /absorb reactive power to/ from the grid based on the set point provided through PCU front control panel. The same shall be performed automatically with adjustable ramp rate based on dynamic changes in grid voltage or reactive power reference.

4.7.3 Voltage Ride Through

The PCU shall remain connected to the grid during temporary dip or rise in grid voltage as per the LVRT and HVRT requirements of CEA Technical Standards for Connectivity to the Grid Regulations. The PCU shall also be able to inject reactive power during the period of voltage dip.

4.8 Warranty

The complete Power Conditioning Unit shall be warranted against all material/ manufacturing defects and workmanship for minimum of 5 (five) years from the date of supply.

4.9 Tests

4.9.1 Type Tests

The type test certificates as per the standards mentioned above should be from any of the ILAC/IECEE member signatory accredited Test Centres. Laboratory accreditation certificate or weblink along with scope of accreditation shall also be submitted. It is the responsibility of the Contractor to substantiate the compliance for CEA Regulations using test reports.

4.9.2 Routine Tests

Routine tests and acceptance tests shall be as per the Quality Assurance Plan (QAP) approved by the Employer.

5 Inverter Transformer and Auxiliary Transformer

5.1 Standards and Codes

Inverter transformer and auxiliary transformer, wherever applicable, shall comply with the latest edition of the following standards and codes including amendments.

Standard	Description
IS 2026, IEC 60076	Specification of Power Transformers
IS 11171, IEC 60076	Dry-Type Power Transformers
IS 2099, IEC 60137	Bushings for alternate voltage above 1000 V
IS 335, IEC 60296	Insulating oil
IS 3639	Fittings and Accessories for Power Transformers
IS 12063	Degree of protection provided by enclosures
CBIP publication no. 295	
Indian Electricity rules and other statutory regulations	

5.2 Technical Requirements

Parameters	Inverter Transformer	Auxiliary Transformer
VA Rating	As per system design requirement	

Voltage Ratio	33 kV / Inverter output voltage	As per system design
Duty, Service & Application	Continuous Solar Inverter application and converter Duty (Outdoor)	Continuous application (Outdoor/Indoor)
Winding	As per system design requirement	2
Frequency	50 Hz	50Hz
Nos. of Phase	3	3
Vector Group & Neutral earthing	As per system/inverter manufacturer requirement	Dyn11
Cooling	ONAN	ONAN/ AN
Tap Changer	OCTC, No. of steps shall be as per system requirement	
Impedance at 75°C	As per Inverter Manufacturer requirement	As per system requirement
Permissible Temperature rise over an ambient of 50°C (irrespective of tap)		
Top Oil	50°C	As per IS/IEC
Winding	55°C	As per IS/IEC
SC withstand time (thermal)	2 second	2 second
Short Circuit Apparent power	As per system requirement	
Termination	As per system requirement	
Bushing rating, Insulation class (Winding & bushing)	36 kV – porcelain bushings 1.1 kV – epoxy bushings	As per the system requirement
Noise level	As per NEMA TR-1	
Loading Capability	Continuous operation at rated MVA on any tap with voltage variation of +/-3%, also transformer shall be capable of being loaded in accordance with IEC 60076-7	

5.3 Construction

5.3.1 The transformer shall be provided with conventional single compartment conservator with prismatic toughened glass oil gauge. The top of the conservator shall be connected to the atmosphere through indicating type cobalt free silica gel breather with transparent enclosure. Silica gel shall be isolated from atmosphere by an oil seal. Inverter transformers shall be provided with Magnetic Oil Gauge (MOG) with

Flux density	Not to exceed 1.9 Wb/sq.m. at any tap position with combined frequency and voltage variation from rated V/f ratio by 10% corresponding to the tap. Transformer shall also withstand following over fluxing conditions due to combined voltage and frequency fluctuations: a) 110% for continuous rating b) 125% for at least one minute c) 140% for at least five seconds. Bidder shall furnish over fluxing characteristic up to 150%
Air Clearance	As per CBIP

low oil level alarm contact.

5.3.2 It is the responsibility of the Contractor to ensure that the inverter transformer comply with all the requirements of inverter provided by the inverter manufacturer.

5.3.3 Inverter Transformer shall be designed for at least 5% total harmonic distortion (THD) to withstand distortion generated by the inverter as well as possible outside harmonics from the network.

5.3.4 The transformer shall be suitable for continuous operation with a frequency variation of ± 2.5% from nominal frequency of 50 Hz without exceeding the specified temperature rise.

5.3.5 Inverter Transformer shall have shield winding between LV & HV windings. Each LV winding must be capable of handling non-sinusoidal voltage with voltage gradient as specified by the inverter manufacturer. Also, shield winding shall be taken out from tank through shield bushing and the same shall be brought down to the bottom of the tank using copper flat and support insulator for independent grounding.

5.3.6 Neutral bushing of Inverter duty transformer shall be brought outside the tank for the testing purpose. It shall be covered with MS sheet and a sticker “For testing purpose only. Do not earth”. Neutral bushing of auxiliary transformer shall be brought outside the tank for earthing.

5.3.7 Inverter transformer shall have 150 mm dial type Oil Temperature Indicator (OTI) and Winding Temperature Indicator (WTI) with alarm and trip contacts. All indicators shall have accuracy of 1.5%. For inverter transformers, WTI shall be provided for all the windings.

5.3.8 The radiators shall be detachable type, mounted on the tank with shut off valve at each point of connection to the tank, lifts, along with drain plug/ valve at the bottom and air release plug at the top.

5.3.9 Marshalling Box shall be of sheet steel, dust and vermin proof provided with proper

lighting and thermostatically controlled space heaters. The degree of protection shall be IP 55. Marshalling Box of all transformers shall be preferably Tank Mounted. One dummy terminal block in between each trip wire terminal shall be provided. At least 10% spare terminals shall be provided on each panel. The gasket used shall be of neoprene rubber. Wiring scheme (TB details) shall be engraved in a stainless-steel plate with viewable font size and the same shall be fixed inside the Marshalling Box door.

5.3.10 Buchholz relay, double float type with alarm and trip contacts, along with suitable gas collecting arrangement shall be provided.

5.3.11 Inverter transformer shall be provided with spring operated Pressure Relief Device (with trip contacts) with suitable discharge arrangement for oil. For Auxiliary transformers, diaphragm type explosion vent shall be provided.

5.3.12 Filter valve at top the tank and drain cum sampling valve at bottom of the tank shall be provided.

5.3.13 All external surface of the transformer shall be painted with two coats of epoxy-based paint of colour shade RAL 7032. Internal surface of cable boxes and marshalling box shall be painted with epoxy enamel white paint. The minimum dry film thickness (DFT) shall be 100 microns.

5.3.14 LV and HV cable box shall be provided with disconnecting chamber to facilitate the movement of transformer without disturbing cable box and termination.

5.3.15 Air release plug, bi-directional wheel/skids, cover lifting eyes, transformer lifting lugs, jacking pads, towing holes, core and winding lifting lugs, inspection cover, rating plate, valve schedule plate, accessories and terminal marking plates, two nos. of earthing terminals shall be provided.

5.3.16 Rain hoods to be provided on Buchholz, MOG & PRD. Entry points of wires shall be suitably sealed.

5.3.17 The accessories listed above are indicative only. Accessories which are not mentioned above but required for satisfactory operation of the transformers are deemed to be included in the contract without extra charges.

5.3.18 Fire-protection for inverter transformer shall be provided in accordance with relevant CEA regulations as amended time to time.

5.4 Dry Type Auxiliary Transformer

5.4.1 Transformer shall be cast resin encapsulated dry type transformer, made of cold rolled grain-oriented silicon steel laminations of M4 grade or better. Winding

conductor shall be electrolytic grade Copper/Aluminium and insulation shall be Class F or better.

5.4.2 The transformers shall be housed in a metal protective housing, having a degree of protection of IP-23 suitable for indoor installation. The enclosure shall be provided with suitable hardware and accessories required for satisfactory operation of the transformer per the relevant standard.

5.5 Warranty

The transformer shall be warranted for minimum of 5 (five) years against all material/ manufacturing defects and workmanship.

5.6 Testing and Inspection

5.6.1 Type Tests and Special Tests

The following type test and special test reports shall be submitted during detailed engineering. The tests should have been conducted on a similar transformer by NABL accredited laboratory.

5.6.1.1 Type Tests

(i) Lightning impulse (Full & Chopped Wave) test on windings as per IEC 60076-3

(ii) Temperature Rise test at a tap corresponding to maximum losses as per IEC 60076-2

5.6.1.2 Special Tests

(i) Measurement of zero-sequence impedance as per IEC 60076-1

(ii) Measurement of harmonics of no-load current as per IEC 60076-1

(iii) Measurement of acoustic noise level as per NEMA TR-1

(iv) Short-circuit withstand test as per IEC 60076-5

In case the contractor is not able to submit the test reports during detailed engineering, the contractor shall submit the reports of type/special tests either conducted by NABL accredited laboratory or witnessed by Employer.

5.6.1.3 Type and Special tests are not required for auxiliary transformers of rating including 100 KVA and below. However, auxiliary transformer shall have minimum 3 star BEE rating as per BIS guidelines.

5.6.2 Routine Tests

Each completed transformer shall be subjected to following routine tests as per the latest edition of IEC 60076 unless specified otherwise.

(i) Measurement of winding resistance at each tap
(ii) Measurement of voltage ratio between HV and LV windings at each tap
(iii) Check of vector group
(iv) Measurement of no-load loss and no-load current
(v) Measurement of short-circuit impedance and load loss
(vi) Magnetic balance test as per CBIP manual publication no. 295
(vii) Separate source voltage withstand test
(viii) Induced over voltage withstand test
(ix) Measurement of insulation resistance
(x) Marshalling box functional test
(xi) IR Measurement on wiring of marshalling box
(xii) Breakdown voltage test on transformer oil as per IS 335
(xiii) Oil leakage test on completely assembled transformer along with radiators

5.6.3 Tests at Site

After erection at site all transformer(s) shall be subjected to the following tests.

(i) Measurement of voltage ratio
(ii) Check of vector group
(iii) Magnetic balance test
(iv) Measurement of insulation resistance
(v) Breakdown voltage test on transformer oil

In case the equipment is not found as per the requirements of the Technical Specifications of NIT, all expenses incurred during site testing will be to the Contractor's account and the equipment shall be replaced by him at free of cost.

6 HT Switchgear

6.1 Standards and Codes

All equipment provided under HT switchgear shall comply with latest editions and amendments of the relevant IEC standards and IS codes. In particular, the switchgear shall comply with the following standards and codes.

Standard/Code	Description
IS/IEC 62271-1	High Voltage Switchgear and Control gear - Part 1: Common Specifications

IS/IEC 62271-100	High Voltage Switchgear and Control gear - Part 100: AC Circuit Breakers
IS/IEC 62271-102	High Voltage Switchgear and Control gear - Part 102: AC Disconnectors and Earthing Switches
IS/IEC 62271-200	High Voltage Switchgear and Control gear - Part 200: AC Metal Enclosed Switchgear and Control gear for Rated Voltages Above 1 kV and Up to and Including 52 kV
IEC 61869	Instrument Transformers
IS 3231	Electrical relays for power systems protection
IEC 60255	Measuring relays and protection equipment
IEC 61850	Communication networks and systems for power utility automation
IEC 61131-3	Programmable controllers - Part 3: Programming languages
IS 9385	High voltage fuses
IS 9431	Indoor post insulators of organic material for systems with nominal voltages greater than 1000 V up to and including 300 kV
IEC 60099-4	Surge arresters - Part 4: Metal-oxide surge arresters without gaps for A.C. systems
IS 3070-3	Lightning Arresters for Alternating Current Systems - Part 3: Metal Oxide Lightning Arresters Without Gaps
IEC 62052-11	Electricity metering equipment (A.C.) - General requirements, tests and test conditions - Part 11: Metering equipment
IEC 62053	Electricity metering equipment (A.C.) - Particular requirements
IS 14697	AC Static Transformer Operated Watthour and Var-hour Meters, Class 0.2S and 0.5S

6.2 Technical Parameters

Parameter	**Specification**
System Parameters	
Highest system voltage	36 kV
Rated system voltage	33 kV
Rated frequency	50 Hz
Number of phases	3
Power frequency withstand voltage	70 kV (r.m.s.)
Lightning impulse withstand voltage	170 kV (peak)

System fault current	As per system requirement
Circuit Breaker	
Type	Vacuum type
Operating duty cycle	O – 0.3sec – CO – 3min – CO
Short circuit breaking current	As per system requirement
Short circuit making current	2.5 times S.C. breaking current
Re-strike performance class	C2
Mechanical endurance class	M1
Current Transformer	
Accuracy class	0.2 for metering (0.2s for metering at outgoing feeder), 5P20 for protection
Rated VA burden	As per requirement
Insulation class	Class F
Voltage Transformer	
Accuracy class	0.2 for metering, 3P for protection
Rated VA burden	As per requirement
Insulation class	Class F

6.3 Switchgear Panel

6.3.1 The switchgear panel shall be free standing, floor mounted, single front, single tier fully compartmentalized, metal enclosed construction. Each panel shall have separate compartments for circuit breaker, bus bars, cable termination and auxiliary circuit.

6.3.2 The circuit breakers shall be mounted on horizontally withdrawable trucks with locking facility in SERVICE and TEST positions.

6.3.3 The panel enclosure shall be constructed with CRCA steel/Aluzinc sheet. The thickness of load bearing members shall be minimum 3 mm and that of non-load bearing members shall be minimum 2 mm.

6.3.4 All surfaces shall be painted with two coats of epoxy-based paint of colour shade RAL 7032. The minimum dry film thickness (DFT) shall be 100 microns.

6.3.5 The circuit breaker and auxiliary circuit compartments provided on the front side shall have separate concealed hinged doors. Cable and bus bar compartments provided on the rear side shall have separate bolted covers. All doors and covers shall be provided with neoprene/synthetic rubber gaskets to prevent entry of vermin and dust.

6.3.6 Pressure relief device shall be provided in each high voltage compartment of a panel to safely vent the gases in the event of internal arc. Seal-off bushing arrangement shall be provided between the breaker compartment and bus bar/cable compartments to prevent transfer of arc from one compartment to other.

6.3.7 Automatic safety shutters shall be provided to cover up the fixed high voltage contacts on bus bar and cable sides when the truck is moved to TEST position.

6.3.8 Degree of protection shall not be less than IP 5X for auxiliary circuit compartment. However, for remaining compartments it shall not be less than IP 4X. For outdoor panels, degree of protection shall not be less than IP 55.

6.3.9 Mechanical /Electrical interlocks shall be provided to prevent mal-operation and in particular to ensure the following.

(i) The breaker shall be operated only if it is in SERVICE or TEST position.

(ii) Movement of the breaker truck between SERVICE and TEST positions shall be possible only if the breaker is OFF.

(iii) It shall be possible to open the door only when the breaker is in TEST position.

6.3.10 Panel shall be provided with local bus-bar protection

6.3.11 Each switchgear panel shall be provided with thermostatically controlled space heaters, separately for breaker, cable and bus bar compartments, to prevent condensation within the compartment. The space heater shall be connected to 240 V, 50 Hz, single phase AC supply through suitable switch and fuse.

6.3.12 240 V, 5 A, SPN industrial socket-outlet with ON/OFF switch shall be provided in each panel.

6.3.13 Each panel shall be provided with LED lamp rated for 240 V, 50 Hz, single phase AC supply for interior illumination controlled by door switch.

6.3.14 Gapless, metal-oxide surge arrestors shall be provided between line and earth in cable compartment of the switchgear panel.

6.3.15 Suitable lifting hooks shall be provided for each panel.

6.4 Circuit Breakers

6.4.1 Circuit breakers shall be of vacuum type. It shall comprise of three separate identical single pole units operated through the common shaft and shall be fully interchangeable both electrically and mechanically.

6.4.2 The circuit breaker operating mechanism shall be based on motor operated spring charging and it shall be re-strike free, trip free both electrically and mechanically, with anti-pumping feature.

6.4.3 The rated control voltage of the spring charging motor shall be 110 VDC/230 VAC. Closing coil shall operate at all values of voltages between 85% and 110% of rated voltage. Opening coil shall operate correctly under all operating conditions of the circuit breaker up to the rated breaking capacity and at all values of supply voltage between 70% and 110% of rated voltage.

6.4.4 The spring charging motor shall have adequate thermal rating such that continuous sequence of the closing and opening operations is possible as long as power supply is available to the motor. It shall also be possible to charge the spring manually and close the breaker in the event of failure of motor / control supply to motor. Operating handle shall be provided for charging the operating mechanism. After failure of control supply to the motor, one open-close-open operation shall be possible with the energy contained in the operating mechanism.

6.4.5 The motor rating shall be such that it requires not more than 30 seconds for full charging of the closing spring. Closing action of the circuit breaker shall compress the opening spring ready for tripping. When closing springs are discharged after closing the breaker, they shall be automatically charged for the next operation.

6.4.6 Mechanical indicators shall be provided to indicate OPEN/CLOSED positions of the circuit breaker and CHARGED/ DISCHARGED positions of the closing spring. An operation counter shall also be provided. These indicators and counter shall be visible from the panel front door without opening it.

6.5 Relays

6.5.1 All relays shall be microprocessor based numerical type. However, auxiliary relays can be static or electromechanical type. The relays shall be flush mounted on panel front with connections from the inside.

6.5.2 The relays shall be capable of operating continuously between 80 – 120% of auxiliary voltage.

6.5.3 All numerical relays shall have adequate number of freely configurable, optically isolated, Binary Inputs (BI) and potential free Binary Outputs (BO).

6.5.4 All numerical relays shall have minimum four no. of current inputs, three for phase current and one for earth current, suitable for CT secondary current of 1A. The current inputs shall be compatible with both residual connected CT and Core Balance CT (CBCT). In addition, numerical relay in main outgoing feeder shall have three no. of voltage inputs for Under Voltage/Over Voltage protection.

6.5.5 All I/O's shall have galvanic isolation. Analog inputs shall be protected against

switching surges and harmonics.

6.5.6 Making, breaking and continuous capacity of the relay contacts shall be adequate enough for the circuits in which they are used.

6.5.7 The numerical relay shall have the following protection functions with at least two independent protection setting groups. The protection functions shall be selectable from any of the IEC characteristic curves.

(i) Definite time (DT) phase over current protection
(ii) Inverse Definite Minimum Time (IDMT) phase over current protection
(iii) Definite time (DT) earth fault current protection
(iv) Inverse Definite Minimum Time (IDMT) earth fault current protection
(v) Under Voltage protection
(vi) Over Voltage protection

6.5.8 Transformer feeder protection relay shall have provision for the following protection functions.

(i) Buchholz alarm & trip
(ii) Oil Temperature Indicator (OTI) alarm & trip
(iii) Winding Temperature Indicator (WTI) alarm & trip
(iv) Pressure Relief Valve (PRV) trip
(v) Magnetic Oil Gauge (MOG) alarm

6.5.9 All numerical relays shall have provision for measurement and storage of electrical parameters such as voltage, current, frequency, active power, reactive power etc.

6.5.10 The numerical relay shall be able to record faults and events in non-volatile memory.

(i) Fault record – At least 5 recent faults including the protection function operated, operating phase(s), voltages and currents along with date and time stamp.
(ii) Event record – At least 200 events with date and time stamp.

6.5.11 The numerical relay shall have trip circuit supervision facility to monitor the circuit breaker trip circuit both in pre-trip and post-trip conditions. The relay shall also be able to provide circuit breaker monitoring, CT and VT supervision.

6.5.12 The numerical relay shall have self-diagnostic feature with separate output contact for indication of any internal relay failure.

6.5.13 The numerical relay shall have RS-232/RS-485/RJ-45/USB ports on front side for local communication with PC and on rear side for remote communication to SCADA system.

6.5.14 The numerical relay shall have feature for time synchronization through the SCADA System / networking.

6.5.15 The numerical relay shall be provided with backlit alphanumeric LCD to access protection settings, measurement parameters, fault and event records. Read and write access to protection settings shall be password protected.

6.6 Instrument Transformers

6.6.1 Instrument transformers shall be completely encapsulated cast resin type, suitable for continuous operation at the ambient temperature prevailing inside the switchgear enclosure, when the switchgear is operating at its rated load and the outside ambient temperature is 50°C.

6.6.2 Polarity marks shall indelibly be marked on each instrument transformer and at the lead terminals at the associated terminal block.

6.6.3 Voltage transformers shall be single phase units. Bus voltage transformers shall be housed in a separate panel on withdrawable truck.

6.6.4 HRC fuses of suitable rating shall be provided on primary side of voltage transformers. For secondary side, four pole Miniature Circuit Breakers (MCB) shall be provided with its supervision facility.

6.7 Earthing

6.7.1 An earth bus made of copper shall be provided throughout the length of the panel. It shall be bolted to the framework of each panel and brazed to each breaker earthing contact bar.

6.7.2 The earth bus shall have sufficient cross section to carry maximum fault current without exceeding the allowable temperature rise.

6.7.3 All non-current carrying conductors of the panel shall be connected to the earth bus. All joints to the earth bus shall be made through at least two bolts. Hinged doors shall be earthed through flexible earthing braid of adequate cross section. Suitable provision shall be provided at each end of the earth bus for connection with Owner's Earth conductor.

6.7.4 Positive earthing of the breaker truck and frame shall be maintained when it is in the connected position and in all other positions whilst the auxiliary circuits are not totally disconnected.

6.7.5 All metallic cases of relays, instruments and other panel mounted equipment shall be connected to earth bus by independent copper wires of size not less than 2.5 sq. mm with green colour insulation.

6.7.6 Instrument transformer secondary neutral point shall be earthed at one place only on the terminal block. Such earthing shall be made through links so that earthing of one circuit may be removed without disturbing the earthing of other circuits.

6.7.7 Separate earthing trucks shall be provided for earthing of busbars and incoming/outgoing feeders. The trucks shall have voltage transformer to indicate presence of voltage prior to earthing. An audible alarm shall also be provided in case of voltage on the earthing terminal. Integral earth switches may also be considered instead of earthing trucks. The earthing truck/switch shall have short circuit withstand capability equal to that of the associated switchgear panel.

6.7.8 The interlocks shall be provided to ensure the following.

(i) It is not possible to rack-in the earthing truck/close the earthing switch when the breaker truck is in SERVICE position.

(ii) It is not possible to rack-in the breaker truck into SERVICE position when earthing truck is connected/earthing switch is in closed position.

6.8 Bus bar

6.8.1 Bus bar shall be made of copper or aluminium with uniform cross section throughout their length. They shall be adequately supported on insulators to withstand electrical and mechanical stresses due to specified short circuit current.

6.8.2 All bus bars joints shall be thoroughly cleaned and anti-oxide grease shall be applied. Plain and spring washers shall be provided to ensure good contacts at the joints and taps. Wherever aluminium to copper connections are required, suitable bimetallic connectors or clamps shall be used.

6.8.3 Bus bars shall be provided with heat shrinkable sleeves of suitable insulation class throughout their length with proper colour coding. All bus bar joints and taps shall be shrouded.

6.8.4 Bus bar support insulators shall be made of non-hygroscopic, arc and track resistant, high strength material suitable to withstand stresses due to over voltage and short circuit current.

6.8.5 The Contractor shall submit busbar sizing calculation for specified continuous and short time current ratings during detailed engineering.

6.9 Measuring Instruments

6.9.1 All the measuring instruments shall be digital, flush mounting type with communication facility.

6.9.2 All feeders except main outgoing feeder shall be provided with digital Multi-Function

Meter (MFM). Tri Vector Meter (TVM) shall be provided for the main outgoing feeder (in the HT Panel). Accuracy class of MFM shall be 0.2 and that of TVM shall be 0.2S.

6.9.3 Measuring instruments shall have provision to display the following parameters.

(i) Line and phase voltages
(ii) Line and phase currents
(iii) Active power, Reactive power, Apparent power
(iv) Frequency
(v) Power factor
(vi) Total Harmonic Distortion (THD)

6.10 Wiring and Terminal blocks

6.10.1 All internal wiring shall be done with 650 V grade, 1.5 sq.mm. PVC insulated stranded flexible copper wire. For CT secondary circuits, 2.5 sq.mm copper wire shall be used.

6.10.2 Wire terminations shall be made with solderless crimping type tinned copper lugs, which shall firmly grip the conductor. Insulation sleeves shall be provided at all the wire terminations.

6.10.3 Printed identification ferrules, marked to correspond with panel wiring diagram shall be provided at both ends of each wire. The ferrules shall be firmly located on each wire so that they cannot move or turn freely on the wire. Wire identification shall be done in accordance with IS 11353.

6.10.4 The Contractor shall be solely responsible for the completeness and correctness of the internal wiring and for the proper functioning of the connected equipment.

6.10.5 All internal wiring to be connected to the external equipment shall terminate on terminal blocks. Terminal blocks shall be rated for 650 V, 10 A and made of non-inflammable material.

6.10.6 CT and VT secondary circuits shall be terminated on stud type, non-disconnecting terminal blocks.

6.10.7 At least 10% spare terminals shall be provided on each panel and these spare terminals shall be distributed on all terminal blocks.

6.11 Warranty

The HT panel unit shall be warranted for minimum of 5 (five) years against all material/ manufacturing defects and workmanship.

6.12 Testing and Inspection

6.12.1 Type Tests

The switchgear panel shall be of type tested design. The following type test reports shall be submitted during detailed engineering. The tests should have been conducted on the similar equipment by NABL accredited laboratory.

Test	**Standard**	**Relevant IEC Clause**
Switchgear Panel		
Dielectric tests		
Power frequency voltage test	IEC 62271-200	6.2.6.1
Lightning impulse voltage test	IEC 62271-200	6.2.6.2
Dielectric tests on auxiliary and control circuits	IEC 62271-200	6.2.10
Measurement of the resistance of the main circuit	IEC 62271-200	6.4.1
Temperature-rise tests	IEC 62271-200	6.5
Short-time withstand current and peak withstand current tests	IEC 62271-200	6.6
Verification of the IP coding	IEC 62271-200	6.7.1
Verification of making and breaking capacities	IEC 62271-200	6.101
Mechanical operation test	IEC 62271-200	6.102
Internal arc test	IEC 62271-200	6.106
Circuit Breaker		
Mechanical operation test at ambient air temperature (M2 Class)	IEC 62271-100	6.101.2
Basic short-circuit test-duties	IEC 62271-100	6.106
Relays		
Vibration tests	IEC 60255-21-1	
Shock and bump tests	IEC 60255-21-2	
Seismic tests	IEC 60255-21-3	
Electromagnetic compatibility requirements	IEC 60255-26	
Product safety requirements	IEC 60255-27	
Common requirements	IEC 60255-1	

Functional requirements	Relevant parts of IEC 60255-100 series	
Current Transformers		
Temperature-rise test	IEC 61869-2	7.2.2
Impulse voltage withstand test on primary terminals	IEC 61869-2	7.2.3
Tests for accuracy	IEC 61869-2	7.2.6
Short-time current tests	IEC 61869-2	7.2.201
Voltage Transformer		
Temperature-rise test	IEC 61869-3	7.2.2
Impulse voltage withstand test on primary terminals	IEC 61869-3	7.2.3
Test for accuracy	IEC 61869-3	7.2.6
Short-circuit withstand capability test	IEC 61869-3	7.2.301

In case the contractor is not able to submit the test reports during detailed engineering, the contractor shall submit the reports of type/special tests either conducted by NABL accredited laboratory or witnessed by Employer.

6.12.2 Routine Tests

Routine tests and acceptance tests shall be as per the Quality Assurance Plan (QAP) approved by the Employer.

7 AC Cables

7.1 Standards and Codes

All AC Cables shall conform to the following standards and codes.

IS 7098	Crosslinked polyethylene insulated PVC sheathed cables, Part 1: For working voltage up to and including 1100 V
IS 7098	Crosslinked Polyethylene Insulated Thermoplastics Sheathed Cables Part 2: for Working Voltages from 3.3 kV up to and Including 33 kV

7.2 All AC cables shall be flame retardant, low smoke (FRLS) type designed to withstand all mechanical, electrical and thermal stresses develop under steady state and transient operating conditions.

7.3 Only terminal cable joints shall be accepted. No cable joint to join two cable ends shall

be accepted. However, cable joints may be allowed if the route length is more than maximum available drum length subject to Employer's approval.

7.4 In addition to manufacturer's identification on cables as per relevant standard, following marking shall also be provided over outer sheath.

(i) Cable size and voltage grade

(ii) Word 'FRLS' at every metre

(iii) Sequential marking of length of the cable in metres at every metre

7.5 Cables shall be sized based on the following considerations:

(i) Rated current the equipment

(ii) Maximum voltage drop in LT cable (from inverter to inverter transformer) shall be limited to 0.5% of the rated voltage. For HT cables (from inverter transformer to interconnection point), maximum voltage drop shall be limited to 0.5 % of the rated voltage. The Contactor shall provide voltage drop calculations in excel sheet.

(iii) Short circuit withstand capability as per design for 1s.

(iv) De-rating factors according to laying pattern

7.6 Warranty

All cables shall be warranted for minimum of 1 (one) year against all material/ manufacturing defects and workmanship.

7.7 Testing

Type routine and acceptance tests requirements shall be as per relevant standards for all cable sizes.

7.8 Installation

7.8.1 Cable installation shall be as per IS 1255.

7.8.2 Cables within transformer yard and switchyard shall be laid through RCC cable trench with supports.

7.8.3 Cable terminations shall be made with properly crimped lugs and passed through cable glands at the entry & exit point of the cubicles. Bimetallic lugs shall be used for connecting Cu bus bar and Al cables or vice-versa.

7.8.4 All AC cables shall be provided with punched/embossed aluminium tags. The marking shall be done with good quality letter and numbers of proper size so that the cables can be identified easily.

8 Auxiliary Supply System

8.1 Scheme for Auxiliary supply system shall be submitted by contractor during detailed

engineering for the approval by Employer.

8.2 It shall mainly comprise of auxiliary transformer, AC distribution board(s) (ACDB), Battery & battery charger system, emergency lighting network, Uninterrupted power supply (UPS), distribution cables and metering & protective devices.

8.3 Auxiliary system shall be provided with two independent sources for reliable auxiliary power supply.

8.4 Following consideration shall be taken into account while sizing the auxiliary transformer:

(i) 20% future load margin

(ii) 20% design margin

(iii) Total connected load at 0.8 power factor

9 LT Switchgear

9.1 Standards and Codes

All equipment provided under LT switchgear shall comply with latest revisions and amendments of the relevant IEC standards and IS codes. In particular, the switchgear shall comply with the following standards and codes.

Standard/Code	Description
IS/IEC 61439-1	Low-voltage switchgear and control gear assemblies - Part 1: General rules
IS/IEC 61439-2	Low-voltage switchgear and control gear assemblies - Part 2: Power switchgear and control gear assemblies
IEC 60947-1	Low-voltage switchgear and control gear - Part 1: General rules
IEC 60947-2	Low-Voltage Switchgear and Control gear: Circuit Breakers
IEC 60947-3	Low voltage switchgear and control gear: Part 3 Switches, disconnectors, switch-disconnectors and fuse combination units
IEC 60947-4-1	Low-voltage switchgear and control gear - Part 4-1: Contactors and motor-starters - Electromechanical contactors and motor-starters
IEC 60947-5-1	Low-voltage switchgear and control gear - Part 5-1: Control circuit devices and switching elements - Electromechanical control circuit devices
IEC 62052-11	Electricity metering equipment (a.c.) - General requirements, tests and test conditions - Part 11: Metering equipment

IS 694	Polyvinyl chloride insulated unsheathed-and sheathed cables/ cords with rigid and flexible conductor for rated voltages - up to and including 450/750V
IEC 61869	Instrument Transformers
IS 3043	Code of practice for earthing
IEC 60255	Measuring relays and protection equipment - Part 1: Common requirements

9.2 Technical Parameters

System Details	
Rated system voltage	415 V ± 10%, 3 Phase, 50Hz, 4 wire, Neutral Solidly Earthed
Digital Multifunctional Meter (MFM)	
Accuracy class	0.5 class for main distribution board at main control room and 0.5 class for DB at inverter room(s)
Communication with SCADA	RS485 communication with Modbus RTU
Current transformer (CT)	
Type	Cast Resin Bar Primary
Voltage class and frequency	650V, 50Hz
CT Secondary Current	1 or 5 A
Class of insulation	Class F
Accuracy class & burden	
a) For Protection	5P20, 5VA PS Class for REF and core balance CT (CBCT)
b) For Metering	Class 0.5, 5VA (min)
Minimum primary earth fault current to be detected by CBCT	1 A
Instrument Security Factor for metering CT	5
Voltage transformer (VT)	
Type	Cast Resin
Accuracy class	0.5
Rated Voltage factor	1.1 continuous, 1.5 for 30 seconds
Class of insulation	E or better

Moulded case circuit breaker (MCCB)	
Rated voltage	415V
Release	Thermal-Magnetic/Microprocessor
Rated current	As per system requirement
Poles	4 poles
Rated insulation level	690V
Rated ultimate and service short circuit breaking Capacity	As per system requirement
Rated Making capacity (as per system requirement)	2.1 X Short circuit breaking Capacity
Utilization category	A

9.3 Constructional Details

9.3.1 The panel shall be metal enclosed, free standing, floor mounted, modular type with compartmentalized construction having degree of protection of IP 24 (Indoor) and IP54 (outdoor) as per IS/IEC 60529. All doors and covers shall be provided with neoprene gaskets to prevent entry of vermin and dust.

9.3.2 All switches, push buttons etc. shall be operated front and shall be flush/semi-flush mounted.

9.3.3 The panel shall be fabricated from 2 mm CRCA sheet steel for frame & load bearing surfaces. Partitions may be fabricated from 1.6 mm CRCA if no components are mounted on them.

9.3.4 Cable entries shall be from bottom. The opening of cable entry shall be covered by 3mm thick gland plates with proper sealing to avoid water and rodent entry.

9.3.5 Earthing bus bar of suitable cross section shall be provided throughout the length of panel.

9.3.6 The panel shall be duly wired with suitable size of 1.1kV, PVC insulated cable and terminals shall be brought out for cable connections. 10% spare terminals subjected to minimum one of each rating shall be provided on each distribution switchgear. All wire shall have ferrules as per wiring diagram.

9.3.7 The panel shall be painted with 2 coats of primer after pre-treatment and 2 coats of Polyurethane / epoxy paint with shade as decided by the Owner.

9.3.8 The panel shall be of dead front construction suitable for front operated and back maintained functioning.

9.3.9 240 V, 5 A, 3 pin industrial socket-outlet with ON/OFF switch shall be provided in

each panel.

9.3.10 Each panel shall be provided with LED lamp rated for 240 V, 50 Hz, single phase AC supply for interior illumination controlled by door switch.

9.3.11 Suitable lifting hooks shall be provided for each panel.

9.3.12 Each switchgear panel shall be provided with thermostatically controlled space heaters to prevent condensation within the enclosure. The space heater shall be connected to 240 V, 50 Hz, single phase AC supply through suitable switch and fuse.

9.3.13 Earth leakage relay with Core balance CTs (CBCT) shall be provided on main incoming feeders having phase CT ratio more than 50/1A. CBCT's shall be circular window type with window size based on the overall diameter of the cables, to be finalized during detailed engineering.

9.4 Warranty

Distribution panels (ACDB and DCDB) shall be warranted for minimum of 1 (one) year against all material/ manufacturing defects and workmanship

9.5 Testing

Routine test and acceptance tests requirements shall be as per relevant standards for all cable sizes.

10 Uninterrupted Power Supply

10.1 Standards and Codes

Standard/Code	Description
IEC 62040-1	Uninterruptible power systems (UPS) - Part 1: General and safety requirements for UPS
IEC 62040-2	Uninterruptible power systems (UPS) - Part 2: Electromagnetic compatibility (EMC) requirements
IEC 62040-3	Uninterruptible power systems (UPS) - Part 3: Method of specifying the performance and test requirements

10.2 General Requirements

10.2.1 The Uninterrupted Power Supply (UPS) system shall be designed to supply power to following loads (but not limited to).

(i) Data logger / SCADA

(ii) Fire Detection/ Alarm Panel

(iii) HMI of SCADA

(iv) Emergency Lighting

(v) Inverter's Auxiliary supply (if applicable)

(vi) HT panel auxiliary

(vii) CCTV

10.2.2 Sizing of UPS shall be done considering the above-mentioned load at power factor of 0.8 lagging inclusive of 10% design margin at 50 ˚C.

10.3 System Description

10.3.1 The UPS shall automatically provide continuous, regulated AC power to critical loads under normal and abnormal conditions, including loss of input AC power. The UPS system shall consist of the following major equipment.

(i) UPS Module

(a) Insulated Gate Bipolar Transistor (IGBT) Converter

(b) Insulated Gate Bipolar Transistor (IGBT) Inverter

(c) Digital Signal Processor (DSP) using Pulse Width Modulation (PWM) for Direct Digital Control (DDC) of all UPS control and monitoring functions

(d) Static bypass switch

(ii) Battery system for 2 hours

(iii) Battery protective and disconnect device

(iv) Maintenance bypass switch

(v) LCD display panel and LED indications

(vi) Integrated UPS Communications Protocols capable of communicating with SCADA system

10.3.2 The UPS shall meet the following minimum specifications.

Parameter	**Specification**
Topology	Online double conversion UPS
Input	
Voltage	230 V ± 10% AC
Frequency	50 ± 5 Hz
Power factor	0.95
Output	
Voltage	230V ± 1% AC
Frequency	50 Hz
Power factor	0.8

Battery	
Type	Sealed, Maintenance-Free (AGM) battery
Capacity	100% UPS load for 2 hours
Monitoring and communication	
LED Indicators	Load on Inverter, Battery operation, Load on Bypass, Overload, LCD Fault, UPS Fault
Electrical contacts	Closing contacts for each of the following conditions: 1. Unit on Battery 2. Low Battery 3. Summary Alarm 4. UPS On 5. Input Fail
Local Display	LCD/ LED
SCADA communications	RS-232 & RS-485 Interface Port
Overall efficiency	>90%
Electrical Protection	Input/ output under voltage, over temperature, overload, Short circuit, battery low trip

10.3.3 The UPS shall be forced air cooled by internally mounted fans. The fans shall be redundant in nature to ensure maximum reliability. The fans shall be easily replaceable without the use of special tools.

10.3.4 Contractor shall provide the Operation & Maintenance Manual and mandatory spare parts list along with the equipment

10.4 Warranty

UPS shall be warranted for minimum of 5 (five) years and batteries shall be warranted for a minimum of 2 (two) years against all material/ manufacturing defects and workmanship

10.5 Tests

10.5.1 Routine tests and acceptance tests on final product shall be done as per QAP approved by the Employer.

10.5.2 On completion of installation and commissioning of the equipment on site tests shall be carried out with the max. available load, which does not exceed the rated continuous load. An on-site test procedure shall be submitted by contractor include a check of controls and indicators after installation of the equipment.

11 Battery and Battery Charger

11.1 Standards and Codes

Standard/Code	Description
IEC 60896-22:2004	Stationary lead-acid batteries - Part 22: Valve regulated types - Requirements
IEC 60896-21:2004	Stationary lead-acid batteries - Part 21: Valve regulated types - Methods of test
IS 1652	Specification for stationary cells and batteries, lead acid type (with plante positive plates)
IS 8320	General requirements and methods of tests for lead acid storage batteries.
IS 15549	Stationary Regulated Lead Acid Batteries

11.2 General

110 V DC system (Battery, Battery Charger & DCDB) in accordance with this specification and standards stated herein, shall comprise of the following.

(i) Sealed Maintenance Free (VRLA) Battery complete with racks & accessories.
(ii) One No. Float charger.
(iii) One No. Float cum Boost charger.
(iv) DC Distribution Board (DCDB)

11.3 Battery

11.3.1 Battery shall be used to supply the following loads with back up of two hours in case of complete power failure:

(i) Trip and closing coil of HT circuit breaker
(ii) Spring charging motors for HT circuit breaker
(iii) Annunciator and Indication circuit of HT panel
(iv) Auxiliary supply to protection relays

11.3.2 The battery sizing shall account for suitable temperature correction factors, ageing factors of 1.25, design margin of 1.25 & depth of discharge of 80%.

11.3.3 The design of the battery bank and sizing calculation along with the data sheet for the battery and battery charger shall be submitted for approval.

11.3.4 Battery voltage – 220V dc or 110V dc

11.4 Battery Charger

11.4.1 The Float Charger shall be used to supply normal DC loads and float charging current

of charged battery. The Float cum Boost charger shall be designed to supply boost charging current requirement of the associated battery as well as to supply normal DC load. After full discharge of battery bank, the Float Cum boost charger shall be capable of charging the battery to its full capacity in 8 hours duration while supplying normal DC load.

11.4.2 The float charger shall have both auto and manual voltage regulation arrangements with provision of selector switch.

11.4.3 Suitable filter circuits shall be provided in all the chargers to limit the ripple content (peak to peak) in the output voltage and current to 2% and 5% respectively.

11.4.4 Digital Outputs shall be configured for connection to the SCADA to monitor the outputs like charger output current, output voltage, float/boost mode, etc.

11.4.5 The charging equipment shall be housed in a free standing, floor mounted compartmentalized panels. Panel shall have provision for bottom cable entry with removable undrilled cable gland plate of 3.0 mm thickness.

11.4.6 The panel shall be of CRCA sheet steel construction having thickness of at least 2.0 mm. Degree of protection provided by the enclosure to the internals of charger shall be IP-42.

11.4.7 The instruments, switches and indicating lamps shall be flush mounted on the front panel.

11.5 DC distribution board (DCDB)

11.5.1 DCDB shall be a separate panel but shall form an integral part of a battery charger panel board.

11.5.2 Doors and covers shall be provided with neoprene gaskets to prevent entry of vermin and dust. Also, door shall be provided with lock and key arrangement to prevent unauthorized access to the board.

11.5.3 DCDB shall have adequate number of outgoing feeders with double pole, DC MCBs. At least 20% feeders shall be provided as spare.

11.6 Warranty

Batteries and battery charger shall be warranted for minimum of 2 (two) years against all material/ manufacturing defects and workmanship.

11.7 Tests

Routine tests and acceptance tests shall be as per the Quality Assurance Plan (QAP) approved by the Employer.

12 Earthing

12.1 Standards and Codes

Earthing system shall comply with latest revisions and amendments of the relevant IEC standards and IS codes. In particular, earthing system shall comply with the following standards and codes.

Standard/Code	Description
IS 3043	Code of Practice for Earthing
IEC 62561-2	Requirements for conductors and earth electrodes
IEC 62561-7	Requirements for earthing enhancing compounds
IEEE 80	IEEE Guide for Safety in AC Substation Grounding
IEEE 142	IEEE Recommended Practice for Grounding of Industrial and Commercial Power Systems
Indian Electricity Rules	

12.2 General Requirements

12.2.1 Earthing system shall be designed based on system fault current and soil resistivity value obtained from geo-technical investigation report. Earth grid shall be formed consisting of number of earth electrodes sufficient enough to dissipate the system fault current interconnected by earthing conductors.

12.2.2 The earth electrode shall be made of high tensile low carbon steel rod, molecularly bonded by high conductivity copper on outer surface with coating thickness not less than 250 micron as per relevant standards. Suitable earth enhancing material shall be filled around the electrode to lower the resistance to earth. Inspection chamber and lid shall be provided as per IS 3043.

12.2.3 Earth conductors shall be made of copper bonded steel or galvanized steel of sufficient cross section to carry the fault current and withstand corrosion.

12.2.4 Earth conductors buried in ground shall be laid minimum 600 mm below ground level unless otherwise indicated in the drawing. Back filling material to be placed over buried conductors shall be free from stones and harmful mixtures.

12.2.5 Earth electrodes shall not be situated within 1.5m from any building whose installation system is being earthed. Minimum distance between earth electrodes shall be two times the driven depth of the electrode.

12.2.6 Transformer yard and switchyard fence shall be connected to the earth grid by one GS flat and gates by flexible lead to the earthed post.

12.2.7 All welded connections shall be made by electric arc welding. For rust protection, the welds should be treated with red lead compound and afterwards thickly coated with bitumen compound.

12.3 Earthing of PV array field

12.3.1 All PV Modules, Module Mounting Structures (MMS) and String Monitoring Unit (SMU) structures in the PV array field shall be bonded to the earthing system by two distinct connections.

12.3.2 Each PV Module frame shall be earthed using copper wire of sufficient cross section. The copper wire shall be connected to the earth hole provided in the module frame using suitable arrangement in line with the manufacturer recommendation. The earthing arrangement shall use stainless washers to prevent galvanic corrosion between aluminium frame and copper wire. In order to achieve effective earthing, serrated washers shall be employed to penetrate the anodization layer of the module frame.

12.3.3 Continuous copper earthing wire shall be run to connect a group of modules and both ends of the loop shall be bolted to the DC earth grid using bimetallic lugs and stainless-steel fasteners. The copper earthing wire shall be routed in such a way to avoid physical contact with the module aluminium frame.

12.3.4 The connection between MMS and DC earth grid shall be bolted or welded. Portion of the MMS which undergoes welding at site shall be coated with two coats of cold galvanising and anti-corrosion paint afterwards.

12.3.5 Earth electrodes of the DC earth grid shall be uniformly distributed throughout the PV array field so that optimum earth resistance is offered to leakage current flowing from any module frame or MMS.

12.3.6 SMU equipment earthing point shall be connected to the DC earth grid using flexible copper cable of sufficient cross section as recommended by the manufacturer. The connection with the DC earth grid shall be done using suitable bimetallic lugs and stainless-steel fasteners.

12.4 PCU Earthing

DC negative bus bar of the PCU shall be earthed to avoid Potential Induced Degradation (PID). DC negative bus bar and PCU equipment earth shall be bonded to the PCU earth bus and connected to earth electrodes through flexible copper cable of sufficient cross section as mentioned by the manufacturer. The interconnection of PCU

earth electrodes with DC earth grid shall be as per PCU manufacturer recommendation.

12.5 Transformer Earthing

12.5.1 Inverter transformer neutral shall be floating, not to be earthed. However, recommendation of inverter manufacturer shall also be taken into account.

12.5.2 Transformer tank, cable box, marshalling box and all other body earth points shall be earthed.

12.5.3 Inverter transformer shield shall be earthed separately using minimum two no. of earth electrodes. Earthing conductor between shield bushing and earth electrodes shall be copper flat of suitable size not less than 25 x 6 mm.

12.5.4 Neutral and body of the auxiliary transformer shall be earthed.

12.6 Inverter Room and Main Control Room Earthing

12.6.1 Metallic enclosure of all electrical equipment inside the inverter room and main control room shall be connected to the earth grid by two separate and distinct connections.

12.6.2 Cable racks and trays shall be connected to the earth grid at minimum two places using galvanized steel flat.

12.6.3 SCADA and other related electronic devices shall be earthed separately using minimum two no. of earth electrodes.

12.7 Switchyard Earthing

The metallic frame work of all switchyard equipment and support structures shall be connected to the earth grid by means of two separate and distinct connections.

Switchyard shall be shielded against direct lightning stroke by provision of over head shield wire or earth wire or spikes(masts) or a combination there of as per CEA regulations 2010 (Technical standards)- 42(2)(C).

12.8 Tests

Type test reports for earthing electrode, earth enhancing compound and its associated accessories shall be submitted during detailed engineering for approval.

On completion of installation, continuity of earth conductors and efficiency of all bonds and joints shall be checked. Earth resistance at earth terminations shall be measured and recorded.

The earth plate shall be provided to facilitate its identification and for carrying out periodical inspection.

13 Lightning Protection System

13.1 Lightning Protection System (LPS) for entire plant against direct lighting strokes shall be provided as per IEC 62305:2010 or NFC 17-102:2011.

13.2 Protection level for the entire plant shall be Level-I.

13.3 LPS as per IEC 62305

Location of air terminals shall be designed as per rolling sphere method.

13.4 LPS as per NFC 17-102

Lightning Protection System shall consist of following accessories.

(i) Early Streamer Emission (ESE) air terminal

(ii) Highly insulated poly-plastic adaptor to fix the ESE air terminal with the FRP mast

(iii) Fiberglass Reinforced Plastic (FRP) mast

(iv) Coupler to connect FRP mast with GI mast

(v) Galvanized Iron mast with base plate and guy wire kit

(vi) Down-conductor: PVC insulated flexible copper cable of suitable size complying with EN 50164-2 or equivalent standard. It shall be routed along the mast with suitable fixings and connecters

(vii) Test joint with each down conductor

(viii) Lightning event counter complying with EN 50164-6 or equivalent standard. It shall be fixed at suitable height in series with the down conductor.

(ix) Earth termination system in accordance with NFC 17-102. Earth electrodes shall comply with the EN 50164-2 or equivalent standard. Earth enhancing compounds complying with EN 50164-7 or equivalent standard, may be used where soil resistivity is higher and making it impossible to achieve system resistance within specified limit.

13.5 Accessories listed above are indicative only and any other fittings or accessories, which are usual or necessary for satisfactory operation of the lightning protection shall be provided by the Contractor without extra charges.

13.6 Necessary foundation/anchoring for holding the lightning mast in position to be made after giving due consideration to shadow on PV array, maximum wind speed and maintenance requirement at site in future.

13.7 The product shall be warranted for minimum of 2 (two) years against all material/

manufacturing defects and workmanship.

13.8 Type test reports as per IEC 62305:2010 or NFC 17-102:2011 shall be submitted during detailed engineering for approval.

14 Communication Cables

14.1 Optical Fibre Cables

14.1.1 Optic Fibre cable shall be 4/8/12 core, galvanized corrugated steel taped armoured, fully water blocked with dielectric central member for outdoor/ indoor application so as to prevent any physical damage.

14.1.2 The cable shall have multiple single-mode or multimode fibres on as required basis so as to avoid the usage of any repeaters.

14.1.3 The outer sheath shall have Flame Retardant, UV resistant properties and are to be identified with the manufacturer's name, year of manufacturing, progressive automatic sequential on-line marking of length in meters at every meter on outer sheath.

14.1.4 The cable core shall have suitable characteristics and strengthening for prevention of damage during pulling.

14.1.5 All testing of the optic fibre cable being supplied shall be as per the relevant IEC, EIA and other international standards.

14.1.6 The Contractor shall ensure that minimum 100% cores are kept as spare in all types of optical fibre cables.

14.1.7 Cables shall be suitable for laying in conduits, ducts, trenches, racks and underground buried installation.

14.1.8 Spliced/ Repaired cables are not acceptable. Penetration of water resistance and impact resistance shall be as per IEC standard.

14.2 Communication Cable (Modbus)

14.2.1 Data (Modbus) Cable to be used shall be shielded type with stranded copper conductor. Cable shall have minimum 2 pair each with conductor size of 0.5 Sq.mm. Cable shall be flame retardant according to IEC 60332-1-2.

14.2.2 Cable shall be tested for Peak working voltage of not less than 300 V and shall be suitable for serial interfaces (RS 422 and RS 485).

14.2.3 Communication cable shall be laid through underground with suitable HDPE ducts.

15 SCADA

15.1 General Requirements

15.1.1 The Contractor shall provide complete SCADA system with all accessories, auxiliaries and associated equipment and cables for the safe, efficient and reliable operation and monitoring of entire solar plant and its auxiliary systems.

15.1.2 The Contractor shall provide all the components including, but not limited to, Hardware, Software, Panels, Power Supply, HMI, Laser Printer, Gateway, Networking equipment and associated Cables, firewall etc. needed for the completeness.

15.1.3 SCADA System shall have the provision to perform the following features and/or functions:

(i) Web enabled Operator Dashboards: Showing key information on Generation, Performance and Current Status of various equipment in Single Line Diagram (SLD) format with capability to monitor PV array string level parameters.

(ii) Real time Data Logging with Integrated Analytics & Reporting: Logging of all parameters - AC, DC, Weather, System Run Hours, Equipment Status and Alarms as well as derived/ calculated/ integrated values. The SCADA User interface shall be customizable and enable Report Generation and Graphical Analysis.

(iii) Fault and System Diagnostics with time stamped event logging.

(iv) Support for O&M Activities: The interface shall allow integration with Surveillance System(s), Module Cleaning System and various other O&M support systems to provide a Data Analysis and Decision Support System for smooth and efficient Plant Operations.

(v) AI based Distributed Analytics for Predictive Maintenance, trend analysis and Alerts.

(vi) Generate, store and retrieve user configurable Sequence of Event (SOE) Reports.

(vii) Interface with different field equipment in the plant and work seamlessly with field equipment supplied by different companies.

(viii) Transfer of plant data reliably, to an Owner designated server or Cloud on any kind of remote network including low bandwidth and wireless links such as 2G/3G/VSAT

(Note: Telecom Lease line connection, if required for transferring data from Plant over internet shall be taken by Contractor in the name of Employer for O&M period)

15.1.4 The Control system shall be designed to operate in non-air-conditioned area.

However, the Contractor shall provide a Package/ Split AC of suitable capacity decided by heat load requirement in SCADA room at Main Control Room.

15.2 Architecture

15.2.1 The SCADA System shall be built over Industrial IoT architecture with integrated Analytics, secure web access, enterprise software and Database.

15.2.2 Data acquisition shall be distributed across MCR and LCRs while plant level data aggregation shall be done in both local and remote server (as specified by Owner).

15.2.3 Analog and Digital IO modules shall have integrated processor for distributed IO processing and control.

15.2.4 Data communication system shall be built over fibre optic cables/ wireless network with high bandwidth TCP/IP communication (Fast Ethernet or 802.11a/b/g/n) across all Inverter and Control Rooms with Internet/Intranet access at Main Control Room. Firewall shall be provided for network security.

15.2.5 Plant SCADA Server shall have Industrial Grade server hardware running SCADA & Monitoring Software with data storage (complete plant data) space for 2 years.

15.2.6 Plant data for monitoring and control operations should be accessible without dependence on external network.

15.2.7 A virtual/cloud server running SCADA & Monitoring Software shall be configured in parallel with Plant Server to enable easy access to plant data from outside the plant without having to login to plant server. Effectively, the plant data shall be replicated in both places i.e. between systems at the Plant Server and Remote Server to provide data redundancy for complete plant data.

Note: Configuration of Cloud server and procurement of associated subscription services shall be in the scope of the EPC Contractor.

15.2.8 Operator Workstation/PC shall be of Industrial Grade for browser-based access to plant data from Plant or remote server. Plant control & SLDC/Utility related operations shall only be initiated through browser-based interface requiring no client software or database to be installed on the Workstation. All critical software and Plant Data shall be installed/stored on local and remote servers only with user access control for protecting the software and data assets from accidental deletion or corruption.

15.2.9 Internet/Intranet at Plant: Public or private network access shall be provided at the plant through any broadband/VSAT connectivity of 50 Mbps or higher bandwidth. In case no broadband/VSAT connectivity can be provided at the plant, a 3G/4G data card from any Internet Service Provider (ISP) may be provided. SCADA system shall

be capable of sending all plant data in real time to the Remote Server.

15.2.10 GPS based Time Synchronization System: The SCADA system shall have a Master/Slave Clock system along with antenna, receiver, cabinet and internal interconnection cables. All SCADA controllers, servers, OWS and communicating equipment shall be synchronized to the GPS clock.

15.3 Industrial IoT Controllers & Data Acquisition

The Plant SCADA and Monitoring System may use one or more IIoT Controllers at each Inverter Control Room and MCR for the purpose of data acquisition and data forwarding to the Local and Remote SCADA Servers. The IIoT Controllers shall meet the following minimum requirements:

15.3.1 The IIoT Controllers shall be distributed in nature and work independently of other IIoT Controllers or any central controller in the system.

15.3.2 Shall be capable of supporting wide range of field protocols to communicate with different field equipment (Modbus over RS485/Ethernet,/IEC 61850 etc.)

15.3.3 Shall have local storage for a minimum of 2 weeks (in case of network failure).

15.3.4 Provide web-based interface to configure the controller for various equipment in the field.

15.3.5 IO Functionality: Shall support status monitoring of VCBs & Trip relays on RMU/HT/BESS & Transformer panels through distributed DI/AI modules.

15.3.6 Controls: Shall be capable of Controlling breakers (ON/OFF). Both ON/OFF and Parameter control of inverters shall be supported.

15.3.7 Data Communication with Servers: Shall send the data collected, from all the equipment at Inverter Control Room and/or Main Control Room, to the Monitoring & Control Server.

15.3.8 Controllers shall be capable of sending data over Internet connections USB data cards.

15.3.9 Shall not require a static public IP address, at the plant for the purpose of remote access.

15.4 Functionalities

15.4.1 The SCADA system shall monitor instantaneous and cumulative electrical parameters from all DC& AC Equipment including inverters, string combiner boxes, weather station, MFM, Transformer, BESS, Switchgear (LT & HT Panels) and Plant EMS Controller at regular intervals not greater than one minute.

15.4.2 The SCADA system shall monitor Instantaneous and cumulative environment parameters from weather sensors or data loggers as well as BESS parameters at same interval as electrical parameters and provide PR, CUF, State of Charge (SoC) etc. on the fly.

15.4.3 The SCADA system shall provide Alarms and Alerts on equipment faults and failure in less than 5 seconds. Alarms on status change of hardwired DI shall also be provided.

15.4.4 The SCADA system shall provide configurable alerts on any parameter crossing settable thresholds. The list of such parameters shall be finalised in consultation with the Owner.

15.4.5 The SCADA system shall enable integration with other sub-systems at the plant for supporting O&M activities. The list shall include but not limited to:

(i) Surveillance Cameras,

(ii) Module Cleaning System – For monitoring of water usage and efficacy of cleaning process.

15.4.6 The SCADA system shall have user-friendly browser-based User Interface for secure access from anywhere, for minimum ten concurrent connections from the Operator PC or other securely connected laptop/mobile, for plant monitoring, O&M, daily reporting, and analysis. A dashboard providing summary details of total plant generation, day's export, irradiance, Inverter Control Room level generation and performance indicators like PR and CUF.

15.4.7 Reporting: The SCADA system shall provide downloadable reports in Excel/PDF, configurable for equipment parameters across the plant.

15.4.8 The system shall have Configurable Analysis page for self-configured as well as on demand Analytics charts.

15.4.9 The SCADA system shall be extensible to include maintenance of O&M schedules and related activities for plant equipment as per the O&M Manual.

15.4.10 Connectivity shall be provided to Owner's Data Monitoring Centre. Data collected by Plant SCADA shall be replicated in real-time, using industry standard interfaces such as Web Services, OPC-UA, data files, as required – with Owner's Central Monitoring System. The data recording intervals for different parameters from different devices in the solar plant shall be considered when creating schedules to "push" the data from Plant SCADA to Owner's Data Monitoring Centre.

15.4.11 Mobile User Interface: summary of plant performance and issues should be

accessible in a mobile Native UI or browser UI.

15.4.12 Data Communication to SLDC: SCADA system shall provide required interface to integrate with TRANSCO-SLDC, in compliance with grid code, to send any parameters specified by SLDC.

Note: The methodology and specification of SLDC interface will be provided separately by SLDC/TRANSCO and it shall be the responsibility of the Contractor to determine the same.

15.4.13 Power Plant Control: SCADA system shall provide required interface to the local SCADA operator to set various power control modes (active/reactive power/frequency/PF) through the inverters over industry standard communication protocols like Modbus over TCP/IP.

15.4.14 Forecasting and Scheduling: SCADA shall provide day ahead and week ahead forecasting and scheduling for power generation at the plant as per SLDC/Utility stipulations.

15.4.15 Predictive Maintenance: SCADA system shall have in-built or pluggable frameworks to support AI based Predictive Maintenance for all key equipment including inverters, transformers and switchgear at the plant.

15.4.16 All programming functionalities shall be password protected to avoid unauthorized modification.

15.4.17 The Contractor shall provide software locks and passwords to Employer for all operating & application software. Also, the Contractor shall provide sufficient documentation and program listing so that it is possible for the Employer to carry out modification at a later date.

15.5 Earthing

15.5.1 Two isolated electronic earth pits near to SCADA panel at every Inverter and Control Room with < 1 Ohm resistance shall be provided. One earth pit shall be used for protective/body earth and the other to be used for Signal Earth.

15.5.2 Apart from providing separate earth pits, manufacturer specified earthing recommendations shall be followed for all communicating equipment connected to SCADA. This includes but is not limited to SMBs, Inverters, WMS and Switchgear panels.

15.6 Communication Cable Laying

15.6.1 All RS485, IO and CAT6 cables shall be laid in separate conduits with a minimum

separation of 1.5ft from AC/DC power cables all along.

15.6.2 Power cables shall be laid deep in the trenches first. Data cables shall be laid in separate conduits after partially filling the trenches to ensure minimum 1.5 ft separation between power and communication cables all along the trench.

15.6.3 IO Cables between switch gear panels and SCADA panel shall be laid on separate cable trays, with a minimum of 1.5ft separation from trays carrying AC Power cables.

15.6.4 RS485 & CAT6 cables between switch gear panels or Inverters and SCADA panel shall be laid on separate cable trays, with a minimum of 1.5ft separation from trays carrying AC Power cables.

15.7 Control Cabinets / Panels / Desks at Main Control Room

15.7.1 The cabinets shall be IP-22 protection class. The Contractor shall ensure that the temperature rise is well within the safe limits for system components even under the worst condition and specification requirements for remote I/O cabinets.

15.7.2 The cabinets shall be totally enclosed, free standing type and shall be constructed with minimum 2 mm thick steel plate frame and 1.6 mm thick CRCA steel sheet or as per supplier's standard practice for similar applications.

15.8 Software Licences

The Contractor shall provide software license for all software being used in Contractor's System. The software licenses shall be provided for the project and shall not be hardware/ machine-specific.

15.9 Hardware at Main Control Room

15.9.1 The Hardware as specified shall be based on latest state of the art Workstations and Servers and technology suitable for industrial application & power plant environment.

15.9.2 The Local Monitoring & Control Server and the Operating Work station, to be deployed in the Plant Control Room, shall have the following server hardware and operating system along with accessories:

Plant Server	
Server Hardware	Hex/Octal Core Xeon, 32GB RAM (expandable to 64 GB RAM), 8 X 2TB SATA hard discs in RAID 5 configuration, 4 Nos. of 2TB external USB hard disc (for backup), dual power supplies, 2 LAN ports, LCD console, keyboard & mouse.

	The Server hardware shall be housed in a rugged fan-cooled, and rodent-proof Server Rack.
Operating System	Operating System and Database shall be of enterprise scale (RedHat Linux or equivalent Linux OS or Windows OS, Oracle/MySQL or equivalent DB), with required AMC for 5 years.
Accessories	1. Monitor: Min 22" LED Flat Monitor with non-interfaced refresh rate min. 75 Hz. 2. Keyboard: ASCII type 3. Pointing Device: Mouse 4. Intelligent UPS (on line): Minimum 2 hour battery backup.
Operator Workstation	
Hardware	i7 CPU running at 3.0 GHz or faster with 8GB RAM, 500GB hard disk, 32" LED monitor, keyboard and mouse, 4 USB ports, LAN port
Operating System	Windows operating system with necessary tools, anti-virus software.
Accessories	1. Screen Display Unit: Min 50" LED Flat Monitor with wall mounted arrangement for the display of SCADA screen 2. A4 size monochrome laser printer. 3. UPS of required capacity with 2 hour battery backup.

15.9.3 All network components of LAN and Workstations shall be compatible to the LAN, without degrading its performance.

15.10 Factory Acceptance Test (FAT)

FAT procedure shall be submitted by bidder for approval. SCADA shall communicate with all third devices which are part of solar plant and same shall be demonstrated during the FAT.

16 Power Transformer

16.1 Standards and Codes

Power Transformer shall comply with the latest edition of the following standards and codes including amendments.

Standard	Description
IS 2026, IEC 60076	Specification of Power Transformers
IS 2099, IEC 60137	Bushings for alternate voltage above 1000 V
IS 8468	On-load tap changers
IS 335, IEC 60296	Insulating oil
IS 3639	Fittings and Accessories for Power Transformers

16.2 Technical Requirements

Parameter	Specification
Rated Capacity	As per system design
Rated Voltage	33 kV / 132 kV
Duty & Service	Continuous duty & Outdoor
Number of phases	3
Frequency	50 Hz
Vector group	As per system requirement
Impedance at principal tap and 75°C	10%
Tap changer	On Load Tap Changer (OLTC) on HV side +5% to -15% with steps of 1.25%
Power frequency withstand voltage (winding & bushing)	LV – 70 kV (rms) HV – 275 kV (rms)
Lightning impulse withstand voltage (winding & bushing)	LV – 170 kVp HV – 650 kVp
Permissible temperature rise over an ambient of 50°C (irrespective of tap)	
Top oil	50°C
Winding	55°C
Fault level & duration	As per system requirement
Short-circuit withstand time (Thermal)	2 second
Bushing	HV – 145 kV oil filled condenser bushing LV – 36 kV porcelain bushing
Termination	As per system requirement

Noise level	As per NEMA TR-1
Loading capability	Continuous operation at rated MVA on any tap with voltage variation of +/-3%, also transformer shall be capable of being loaded in accordance with IEC 60076-7
Flux density	Not to exceed 1.9 Wb/sq.m. at any tap position with combined frequency and voltage variation from rated V/f ratio by 10% corresponding to the tap. Transformer shall also withstand following over fluxing conditions due to combined voltage and frequency fluctuations: a) 110% for continuous rating b) 125% for at least one minute c) 140% for at least five seconds The Contractor shall furnish over fluxing characteristic up to 150%
Air clearance	As per CBIP

16.3 Tank

16.3.1 The Transformer tank and cover shall be fabricated from high grade low carbon plate steel of adequate thickness. The tank and the tank cover shall be of welded construction. All seams and joints shall be welded and where practicable, they shall be double welded. The tank so welded shall be reinforced by stiffener of structural steel for general rigidity.

16.3.2 The transformer top shall be provided with a detachable tank cover with bolted flanged gasket joint. Lifting lugs shall be provided for removing the cover. The surface of the cover shall be suitably sloped so that it does not retain rain water.

16.3.3 The main tank body of the transformer, excluding tap changing compartments and radiators, shall be capable of withstanding pressure of 760mm of Hg.

16.3.4 Inspection hole(s) with welded flange(s) and bolted cover(s) shall be provided on the tank cover. The inspection hole(s) shall be of sufficient size to afford easy access to the lower ends of the bushings, terminals etc.

16.3.5 Suitable guides shall be provided for positioning the various parts during assembly or dismantling. Adequate space shall be provided between the cores and windings and the bottom of the tank for collection of any sediment.

16.3.6 All bolted connections to tank shall be fitted with suitable oil-tight gasket, which shall give satisfactory service under the operating conditions. All gaskets shall be closed design (without open ends) and shall be of one piece only. Gasket of nitrile rubber or

equivalent shall be used. Gaskets of neoprene and / or any kind of impregnated / bonded core or cork only which can easily be damaged by over-pressing are not acceptable. Use of hemp as gasket material is also not acceptable.

16.3.7 Lifting lugs shall be provided on all parts of the transformer requiring independent handling during assembly or dismantling. In addition, the transformer tank shall be provided with lifting lugs and bosses properly secured to the sides of the tank for lifting the complete transformer assembly with oil either by crane or by jacks.

16.3.8 The transformer tank shall be supported on a structural steel base equipped with forged steel single flanged wheels suitable for moving the transformer completely with oil. The wheels shall be bi-directional and mounted on swivels which may be turned through 90° when the tank is jacked up and capable of being locked in position parallel to and at right angles to the longitudinal axis.

16.4 Core

16.4.1 The transformer core shall be built up with high-grade non-ageing cold rolled grain oriented (CRGO) silicon steel laminations having high permeability and low hysteresis loss. The thickness of lamination shall be 0.27 mm or less.

16.4.2 The transformer shall be so designed that the flux density in the core shall not exceed 1.7 tesla at rated voltage and rated frequency. The maximum flux density in any part of core or yoke at 10% continuous over voltage condition shall not exceed 1.9 tesla.

16.4.3 The laminations shall be free of all burrs and sharp projections. Each sheet shall have an insulating coating resistant to the action of hot oil.

16.4.4 The core shall be rigidly clamped to ensure adequate mechanical strength and to prevent vibration during operation and transportation. The clamping structure shall be designed to minimize eddy current loss.

16.4.5 The design of magnetic circuit shall be such as to avoid static discharges, development of short circuit paths within itself or to the earthed clamping structure and production of flux components at right angles to the plane of the laminations which may cause local heating.

16.4.6 The core shall be provided with lugs suitable for lifting the complete CCA of the transformer. The CCA shall be fixed with the tank so that it does not shift when transformer is moved or during short circuit.

16.4.7 The insulation of core to bolts and core to clamp plates shall be able to withstand a voltage of 2 kV RMS for one minute.

16.4.8 The core shall not be earthed at multiple locations. Terminal shall be brought on top

of tank and earthed through link. Core and Frame terminals should be brought out on transformer top so as to enable megger.

16.5 Winding

16.5.1 The conductor for winding shall be made of electrolytic grade copper. The winding shall be so designed that all coil assemblies of identical voltage ratings shall be interchangeable and field repairs can be readily done without special equipment.

16.5.2 The coils shall be supported between adjacent sections by insulating spacers and barriers. Bracings and other insulation used in the assembly of the windings shall be arranged to ensure a free circulation of the oil and to reduce hot spots in the windings.

16.5.3 The insulation paper shall be of high quality and the value of degree of polymerization shall not be less than 1200 DPv.

16.5.4 Materials used for insulation and assembly of the windings shall be insoluble, non-catalytic and chemically inactive in the hot transformer oil and shall not soften or otherwise get affected under the operating conditions.

16.5.5 All threaded connections shall be provided with locking facilities. All leads from the winding to the terminal board and bushings shall be rigidly supported to prevent injury from vibration. Guide tubes shall be used where practicable.

16.5.6 The conductor shall be transposed at sufficient intervals in order to minimize eddy currents and equalize the distribution of currents and temperature along the windings.

16.5.7 Windings shall be subjected to a shrinkage treatment before final assembly, so that no further shrinkage occurs during service. Adjustable device shall be provided for taking up any possible shrinkage of coils in service if required.

16.5.8 The windings shall be clamped securely in place so that they will not be displaced or deformed during short circuits. The assembled core and windings shall be vacuum dried and suitably impregnated before removal from the treating tank. The copper conductors used in the coil structure shall be best suited to the requirements and all permanent current carrying joints in the windings and the locks shall be welded or brazed.

16.6 Insulating Oil

The oil for first filling together with 10% extra shall be supplied with the transformer. The oil shall comply in all respects with the provisions of the latest edition of IS 335 (as amended up to date). Particular attention shall be paid to deliver the oil free from moisture having uniform quality throughout in non-returnable steel drums.

16.7 On-Load Tap Changer

16.7.1 On-Load Tap Changer (OLTC) shall be designed for remote control operation from Remote Tap Change Control (RTCC) Panel in the control room in addition to being capable of local manual as well as local electrical operation. The OLTC shall include the following.

(i) An oil immersed tap selector and arcing switch or arc suppressing tap selector, provided with reactor or resistor for reduction of make and break arcing voltages and short circuits.

(ii) Motor driven mechanism

(iii) Control and protection devices

(iv) Local /Remote tap changer position indicator

(v) Manual/Electrical operating device

(vi) Pressure relief device

16.7.2 The OLTC shall be so designed that the contacts do not interrupt arc within the main tank of the transformer. The tap selector and arcing switch or arc suppressing selector switch shall be located in oil filled compartment. The compartment shall be provided with Oil Surge Relay. It shall be designed so as to prevent oil in the tap selector compartment from mixing with the oil in the transformer tank.

16.7.3 The contactors and associated gear for the driving motor shall be housed in a local kiosk mounted adjacent to or on the transformer. The degree of protection of the complete arrangement shall be IP 55 or better. The motor shall be suitable for operation with three phase, 415 V, 50 Hz external power supply.

16.7.4 RTCC Panel

Remote Tap Change Control (RTCC) Panel shall include, but not limited to, the following.

(i) Automatic Voltage Regulator with SCADA compatibility

(ii) Under voltage relay to monitor the taper changer control voltage

(iii) Raise and lower push button

(iv) Tap position indicator

(v) Indication lamp showing tap changing in progress

(vi) Alarms and Annunciation

(vii) Any other accessory required for satisfactory operation or required during detail engineering

16.8 Bushing

16.8.1 The bushings shall have high factor of safety against leakage to ground and shall be so located as to provide adequate electrical clearances between bushings and grounded parts. Bushings of identical voltage rating shall be interchangeable.

16.8.2 All bushings shall be equipped with terminals suitable for bimetallic connection. Each bushing shall be so coordinated with the transformer insulation that all flash over will occur outside the tank.

16.8.3 HV bushings shall be 145 kV voltage class, oil filled condenser type and hermetically sealed. The bushings shall have provision for measurement of capacitance and loss factor without dismantling of the bushing. The bushings shall be removable without disturbing the Bushing Current Transformers if any. LV bushings shall be 36 kV voltage class, porcelain type. The oil used for the oil filled type bushings shall be the same as that used in the transformer.

16.9 Radiators

16.9.1 Radiators provided shall have sufficient cooling surface to limit the temperature rise to the values as specified in the 'Technical Requirements'. The radiators shall be seamless and made of mild steel/CRCA with minimum thickness not less than 1.2 mm. It shall be suitably braced to protect them from mechanical shocks.

16.9.2 The radiators shall be connected to the tank by machined steel flanges with adequate gaskets to avoid oil leakage. Each radiator unit shall be provided with butterfly type or positive operated gate type oil leak proof shut-off valve which can be fastened in either closed or open position and separate oil tight flange for each tank connection for use when the radiator unit is detached. Each radiator unit shall have a lifting arrangement and oil drain at the bottom and a vent at the top.

16.9.3 It shall be possible to take out any of the radiator unit without disturbing the transformer. The radiators shall be so designed as to prevent any accumulation of water on the outer surface or formation of gas pockets when the tank is being filled.

16.10 Accessories

16.10.1 Conservator

The conservator shall have air cell type constant oil preservation system to prevent oxidation and contamination of oil due to contact with moisture. The conservator shall be provided with separate compartment for OLTC. No separate conservator tank shall be provided for OLTC. The conservator shall be fitted with oil filling hole, cap

and drain valve. Prismatic toughened glass oil level gauge and 150 mm Magnetic Oil Gauge (MOG) with low oil level alarm contact shall also be provided.

16.10.2 Silica gel breather

The top of the conservator shall be connected to the atmosphere through indicating type cobalt free silica gel dehydrating breather with transparent enclosure. Silica gel shall be isolated from atmosphere by an oil seal. The capacity of breather should be such that it can contain minimum 5 kg silica gel for main conservator compartment and minimum 1 kg silica gel for OLTC conservator compartment. The GI pipe connecting breather with conservator should be seamless and no joint is permitted.

16.10.3 Buchholz relay

Buchholz relay, double float type with alarm and trip contacts, along with suitable gas collecting arrangement shall be provided. The relay shall be provided with a test cock suitable for a flexible pipe connection for checking its operation and taking gas sample. A copper or stainless-steel tube shall be connected from the gas collector to a valve located about 1200 mm above ground level to facilitate sampling when the transformer in service. The relay shall be provided with shut off valve on the conservator side as well as on the tank side.

16.10.4 Pressure Relief Device

Pressure Relief Device shall be provided on main tank and OLTC for rapid release of any pressure in transformer which may endanger the equipment. The device shall operate at a static pressure of less than hydraulic test pressure of transformer tank/OLTC chamber. The terminal box of the PRD shall be water tight with protection class IP 56 or better as per IEC 60529. Electrically insulated contact shall be provided for trip signal.

16.10.5 Temperature Indicators

16.10.5.1 Oil Temperature Indicator (OTI)

150 mm dial type temperature indicator with ‘Maximum’ reading pointer and resetting device shall be provided. The indicator shall have adjustable, electrically independent, potential free alarm and trip contacts. A temperature sensing element suitably located in a pocket on top oil shall be provided. Accuracy class of OTI shall be 1.5% or better.

16.10.5.2 Winding Temperature Indicator (WTI)

A device for measuring the hot spot temperature of each of the winding shall be provided. It shall comprise the following.

(i) Temperature sensing elements, one each on HV and LV winding.

(ii) Image coil.

(iii) Auxiliary CTs, if required to match the image coil.

(iv) 150 mm dial type temperature indicator with 'Maximum' reading pointer and resetting device with adjustable, electrically independent, potential free alarm and trip contacts.

(v) Calibration device.

The winding temperature indicator shall be responsive to the combination of top oil temperature and winding current, calibrated to follow the hottest spot temperature of the transformer winding. Accuracy class of WTI shall be 1.5% or better.

16.10.6 Marshalling Box

Marshalling Box shall be of sheet steel, dust and vermin proof provided with proper lighting and thermostatically controlled space heaters. The degree of protection shall be IP 55. One dummy terminal block in between each trip wire terminal shall be provided. At least 10% spare terminals shall be provided on each panel. The gasket used shall be of neoprene or synthetic rubber. Wiring scheme (TB details) shall be engraved in a stainless-steel plate with viewable font size and the same shall be fixed inside the marshalling box door.

16.10.7 Valves

The transformer shall be provided with the following (but not limited to) valves.

(i) Two nos. of filter valves, one at top and another at bottom on diagonally opposite corners

(ii) Two nos. of sampling valves at top and bottom of the tank

(iii) Drain valve on main tank

(iv) Drain valves on main and OLTC compartment of conservator

(v) Valves (for nitrogen injection and oil drain) as required by firefighting system

All valves shall be constructed of stainless steel, brass or gun metal except of shutoff valve for radiator and cooler. For radiator and cooler, valve shall be made up of gun metal or cast iron.

16.11 Painting

16.11.1 Before painting or filling with oil, un-galvanized parts shall be completely cleaned and

free from rust, scale and grease. All external rough surfaces on casting shall be filled by metal deposition. The interior of transformer tank and other filled chambers and internal structural steel work shall be cleaned of all scale and rust by send blasting or other approved method. These surfaces shall be painted with an oil resisting varnish or paint.

16.11.2 Except for nuts, bolts and washers, all external surfaces shall receive a minimum of three coats of paint. The primary coat shall be applied immediately after cleaning. The second coat shall be of oil paint of weather resisting nature. The final coat shall be of a glossy, oil and weather resisting non-fading paint. The paint shade shall be as provided by the Employer during detailed engineering.

16.11.3 All internal surfaces of mechanism chambers and kiosk except those which have received anticorrosion treatment, shall receive three coats of paint applied to the thoroughly cleaned metal surface. The final coat shall be of light coloured anti-condensation mixture.

16.11.4 Any damage to paint work incurred during transport and erection shall be made good by thoroughly cleaning the damaged portion and by applying full number of coats of paints.

16.12 Transportation

16.12.1 Transformer tank is filled with oil or pure dry nitrogen/ air depending upon the transport weight limitations. Necessary arrangement shall be ensured to take care of pressure drop of nitrogen or dry air during transit and storage till completion of oil filling during erection. A gas pressure testing valve with necessary pressure gauge and adaptor valve shall be provided.

16.12.2 Bushings shall be crated, packed and transported as per standard guide lines of the Bushing Manufacturer. All care should be taken to avoid any damage of the porcelain due to vibration during transport.

16.12.3 Special attention shall be paid in packing the accessories & spares to avoid moisture ingress. All parts shall be adequately marked to facilitate field erection.

16.13 Warranty

The power transformer shall be warranted for minimum of 5 (five) years against all material/ manufacturing defects and workmanship.

16.14 Testing and Inspection

16.14.1 Type Tests and Special Tests

The following type test and special test reports shall be submitted during detailed engineering. The tests should have been conducted on the similar transformer by NABL accredited laboratory.

16.14.1.1 Type Tests

(i) Lightning impulse (Full & Chopped Wave) test on windings as per IS 2026-3/IEC 60076-3

(ii) Temperature Rise test at a tap corresponding to maximum losses as per IS 2026-2/IEC 60076-2. Dissolved Gas Analysis (DGA) shall be conducted on oil sample taken before and immediately after temperature rise test. Gas analysis shall be as per IS 9434/IEC 60567 and results will be interpreted as per IS 10593/IEC 60599.

16.14.1.2 Special Tests

(i) Short circuit withstand test as per IS 2026-5/IEC 60076-5

(ii) Measurement of zero-sequence impedance as per IS 2026-1/IEC 60076-1

(iii) Measurement of harmonics of no-load current as per IS IEC 60076-1

(iv) Measurement of acoustic noise level as per NEMA TR-1

In case the contractor is not able to submit the test reports during detailed engineering, the contractor shall submit the reports of type/special tests either conducted by NABL accredited laboratory or witnessed by Employer.

16.14.2 Routine Tests

Each completed transformer shall be subjected to following routine tests as per the latest edition of IEC 60076 unless specified otherwise.

(i) Measurement of winding resistance at each tap

(ii) Measurement of voltage ratio between HV and LV windings at each tap

(iii) Check of vector group

(iv) Measurement of no-load loss and no-load current at 90%, 100% & 110% of rated voltage

(v) Measurement of short-circuit impedance and load loss at principal and extreme taps

(vi) Magnetic balance test & magnetizing current test as per CBIP manual publication no. 295

(vii) Separate source voltage withstand test

(viii) Induced over voltage withstand test

(ix) Measurement of insulation resistance and polarization index

(x) Measurement of tan delta and capacitance of winding

(xi) Core isolation test

(xii) Marshalling box functional test

(xiii) IR Measurement on wiring of marshalling box

(xiv) Test on on-load tap changer

(xv) Breakdown voltage test on transformer oil as per IS 335

(xvi) Jacking test followed by D.P. test

(xvii) Oil leakage test on completely assembled transformer along with radiators

17 Nitrogen Injection Fire Protection System

Nitrogen Injection Fire Protection System (NIFPS) shall use nitrogen as fire quenching medium. The protection system shall prevent transformer oil tank explosion and possible fire in case of internal faults. In the event of fire by external causes such as bushing fire, OLTC fire, fire from surrounding equipment etc., it shall act as a fast and effective fire extinguisher without any manual intervention.

17.1 Standards and Codes

All the equipment of NIFPS shall comply with the latest edition of the following standards and codes including amendments.

Standard	**Description**
IS 10028-2	Code of practice for selection, installation and maintenance of transformers; Part 2: Installation
IS 7285-2	Refillable Seamless Steel Gas Cylinders - Specification Part 2: Quenched and Tempered Steel Cylinders With Tensile Strength Less Than 1100 MPa (112 kgf/mm^2)
CEA Technical Standards for Construction of Electrical Plants and Electric Lines Regulations, 2010 with 2015 amendment	
CEA Measures relating to Safety and Electric Supply Regulations, 2010 with 2015 amendment	
CBIP Manual on Transformers, Publication No. 317	

17.2 Technical Requirements

Parameter	**Specification**
Fire extinction period from commencement of nitrogen injection	30 second (maximum)

Total time duration to bring oil temperature below flash point	30 minute (maximum)
Fire detector heat sensing temperature	141°C
TCIV setting for normal operation to ensure no obstacle for transformer breathing	40 litre per minute
TCIV setting for operation during abnormal flow of oil	60 litre per minute
Capacity of nitrogen gas cylinder	10 m^3 gas at pressure of 150 kg/cm^2 for up to 60,000 litre of oil 20 m^3 gas at pressure of 150 kg/cm^2 for above 60,000 litre of oil

17.3 System Components

NIFPS shall broadly consists of the following components. However, all other components which are necessary for fast, reliable and effective working of the fire protection system shall be deemed to be included in the scope of supply. The NIFPS shall have provision for SCADA connectivity.

17.3.1 Fire Extinguishing Cubicle

The Fire Extinguishing Cubicle (FEC) shall be made of CRCA sheet of minimum 3 mm thick with Polyurethane painting. The degree of protection shall be IP55 or better. It shall have hinged split doors fitted with high quality tamper proof lock. The following components shall be provided in the FEC.

(i) Nitrogen gas cylinder with regulator and falling pressure electrical contact manometer. The nitrogen gas cylinder should have been certified by Bureau of Indian Standards and approved by Chief Controller of Explosives, Government of India.
(ii) Oil drain pipe with mechanical quick drain valve
(iii) Control equipment for draining of oil and injecting nitrogen gas
(iv) Pressure monitoring switch for backup protection for nitrogen release
(v) Limit switches for monitoring of the system
(vi) Butterfly valve with flanges on top of the cubicle for connecting oil drain pipe and nitrogen injection pipe
(vii) Panel lighting
(viii) Oil drain pipe extension of suitable sizes for connecting pipes to oil pit

17.3.2 Control Box

Control box shall be placed in the Master Control Room (MCR) for monitoring, automatic control and remote control. The rated control voltage of the control box shall be 110 VDC. The control box shall have suitable indications, alarms, switches and push buttons for complete monitoring and control of the system.

17.3.3 Transformer Conservator Isolation Valve

Transformer conservator isolation valve (TCIV) shall be fitted in the conservator pipe line between conservator and buchholz relay which shall operate for isolating the conservator during abnormal flow of oil due to rupture / explosion of tank or bursting of bushing. The valve shall not isolate conservator during normal flow of oil during filtration or filling or refilling. Locking plates shall be provided with handle for pad locking. It shall have proximity switch for remote alarm and indication glass window for visual inspection for physical checking of the status of valve. The TCIV shall be of the best quality and proven design as malfunctioning of TCIV could lead to serious consequences.

17.3.4 Fire Detector

Adequate number of fire detectors shall be fitted on top cover of the transformer and OLTC with brackets. Heat sensing temperature of the fire detectors shall be 141°C.

17.3.5 Signal Box

Signal box shall be mounted way from the transformer preferably near the marshalling box for terminating the cables from TCIV & fire detectors and to further connection to control box at the MCR. The degree of protection of the signal box shall be IP 55 or better.

17.3.6 Cables

The interconnecting cables shall be Fire Retardant Low Smoke (FRLS) type. Cables passing along the top of the transformer shall be Fire Survival type.

17.3.7 Pipes

Heavy duty pipe connecting the transformer tank for oil drain and for nitrogen injection shall be provided. Pipes, complete with supports, connections, flanges, bends and tees etc. shall be supplied along with the system.

17.3.8 Other Items

(i) Doors and covers of all the panels (FEC, Control box, Signal box, etc.) shall be provided with neoprene gaskets.

(ii) All the panels and piping system shall be painted with enamelled paint.

17.4 Protection Philosophy

17.4.1 The NIFPS shall have the operating modes and operate on receipt of corresponding activation signals.

17.4.1.1 Auto Mode

A. Fire Prevention

The system shall operate on receipt of all the following three signals.

(i) Differential relay trip

(ii) Operation of Buchholz relay (OR) Pressure Relief Device (OR) Rapid Pressure Rise Relay

(iii) Master trip (OR) Tripping of LV / HV circuit breaker in series

B. Fire Extinction

The system shall operate on receipt of all the following three signals.

(i) Operation of fire detector

(ii) Operation of Buchholz relay (OR) Pressure Relief Device (OR) Rapid Pressure Rise Relay (OR) Oil Surge Relay

(iii) Master trip (OR) Tripping of LV / HV circuit breaker in series

17.4.1.2 Remote Manual Mode

The system shall operate on receipt of both the following signals.

(i) Master trip (OR) Tripping of LV / HV circuit breaker in series

(ii) Operation of emergency operating switch on the control box

17.4.1.3 Local Manual Mode

In case the system fails in Auto Mode / Local Remote Mode (OR) Power Failure, the system can be operated manually from the Fire Extinguisher Cubicle.

17.4.2 On receipt of all required activating signals, the system shall drain pre-determined volume of oil from top of the tank through outlet valve to reduce tank pressure and simultaneously inject nitrogen gas at high pressure through inlet valves for stirring the oil and thus bringing the temperature of oil below flash point to extinguish the fire. Transformer conservator isolation valve shall block the flow of oil from conservator tank.

18 Control and Relay Panel

18.1 Standards and Codes

All equipment provided under Control and Relay Panel shall comply with latest editions and amendments of the relevant IEC standards and IS codes. In particular, the C&R Panel shall comply with the following standards and codes.

Standard/Code	Description
IS 3231	Electrical relays for power systems protection
IEC 60255	Measuring relays and protection equipment
IEC 61850	Communication networks and systems for power utility automation
IEC 61131-3	Programmable controllers - Part 3: Programming languages
IS 9385	High voltage fuses
IS 9431	Indoor post insulators of organic material for systems with nominal voltages greater than 1000 V up to and including 300 kV
IEC 60099-4	Surge arresters - Part 4: Metal-oxide surge arresters without gaps for A.C. systems
IS 3070-3	Lightning Arresters for Alternating Current Systems - Part 3: Metal Oxide Lightning Arresters Without Gaps
IEC 62052-11	Electricity metering equipment (A.C.) - General requirements, tests and test conditions - Part 11: Metering equipment
IEC 62053	Electricity metering equipment (A.C.) - Particular requirements
IS 14697	AC Static Transformer Operated Watthour and Var-hour Meters, Class 0.2S and 0.5S

18.2 Construction

18.2.1 The control and relay panel shall be free standing, floor mounted, simplex type, metal enclosed construction. The panel enclosure shall be made of CRCA steel sheet. The thickness of load bearing members shall be minimum 3 mm and that of non-load bearing members shall be minimum 2 mm.

18.2.2 All external surface shall be painted with two coats of epoxy-based paint of colour shade RAL 7032. Internal surface shall be painted with epoxy enamel white paint. The minimum dry film thickness (DFT) shall be 100 micron.

18.2.3 Controls, indications, relays, meters and other instruments shall be flush mounted on the front of the panel. Door shall be provided at the rear of the panel. All doors and

removable covers shall be provided with neoprene or synthetic rubber gasket.

18.2.4 The panel shall be dust, moisture and vermin proof with degree of protection not less than IP 4X as per IEC 60529.

18.2.5 Cable entry shall be through the bottom of the panel. Gland plate of thickness not less than 3 mm shall be provided.

18.3 Relays

18.3.1 All relays shall be microprocessor based numerical type. However, auxiliary relays can be static or electromechanical type. The relays shall be flush mounted on panel front with connections from the inside.

18.3.2 All relays shall be capable of operating continuously between 80 – 120% of auxiliary voltage.

18.3.3 All numerical relays shall have adequate number of freely configurable, optically isolated, Binary Inputs (BI) and potential free Binary Outputs (BO). All I/O's shall have galvanic isolation. Analog inputs shall be protected against switching surges and harmonics.

18.3.4 All numerical relays shall have sufficient number of current and voltage inputs required for all the required protection functions.

18.3.5 The numerical relay shall provide choice of ANSI/IEC/IEEE relay characteristic curves with wide protection setting ranges through a minimum of two protection setting groups.

18.3.6 Making, breaking and continuous capacity of the relay contacts shall be adequate enough for the circuits in which they are used.

18.3.7 All numerical relays shall have provision for measurement and storage of electrical parameters such as voltage, current, frequency, active power, reactive power etc.

18.3.8 The numerical relay shall be able to record faults and events in non-volatile memory.

(i) Fault record – At least 5 recent faults including the protection function operated, operating phase(s), voltages and currents along with date and time stamp.

(ii) Event record – At least 200 events with date and time stamp.

18.3.9 The numerical relay shall have trip circuit supervision facility to monitor the circuit breaker trip circuit both in pre-trip and post-trip conditions. The relay shall also be able to provide circuit breaker monitoring, CT and VT supervision.

18.3.10 The numerical relay shall have self-diagnostic feature with separate output contact for indication of any internal relay failure.

18.3.11 The numerical relay shall have two serial communication ports, one on front side for

local communication with PC and another on rear side for remote communication with SCADA system as per IEC 61850.

18.3.12 The numerical relay shall have feature for time synchronization through the SCADA System / networking.

18.3.13 The numerical relay shall be provided with backlit alphanumeric LCD or LED to access protection settings, measurement parameters, fault and event records. Read and write access to protection settings shall be password protected.

18.3.14 Necessary software and hardware to up/down load the data to/from the relay from/to the PC shall also be provided.

18.4 Protection Scheme

The following protection schemes shall be implemented for the protection of power transformer and its feeder.

(i) Biased Differential Protection with Second Harmonic Restraint
(ii) Non-directional Over Current and Earth Fault Protection
(iii) Restricted Earth Fault Protection
(iv) Under Voltage and Over Voltage Protection
(v) Buchholz Alarm and Trip
(vi) OTI Alarm and Trip
(vii) WTI Alarm and Trip
(viii) PRV Trip
(ix) MOG Alarm
(x) OSR Trip

The above-mentioned protection schemes are indicative only. All the protection schemes required for safe and reliable operation of power transformer and the feeder shall be provided.

18.5 Measuring Instruments

18.5.1 All measuring instruments shall be enclosed in dust proof, moisture resistant cases and flush mounted on the panel.

18.5.2 Analog Ammeter and Voltmeter with selector switch shall be provided. Accuracy class shall be 0.5 or better. Instrument dial shall be with white scale, black pointer and black numerals.

18.5.3 Digital Multi Function Meter (MFM) of accuracy class 0.2 or better shall be provided. It shall have communication capability for integration with SCADA. MFM shall be able

to measure line & phase voltages, line & phase currents, active power, reactive power, apparent power, power factor and frequency.

18.6 Control Switches

All control switches shall be rotary operated type with adequate making, carrying and breaking current ratings. The control switches shall be pistol grip type, lockable with spring return to normal position. They shall be flush mounted on the panel with shrouded terminals.

18.7 Indications

All indicating lamps shall be flush mounted LED type with supply voltage of 110 VDC. Lamp covers shall preferably be screwed type and moulded from heat resisting material. Indicating lamps shall be provided for R, Y, B PT supply, Breaker ON & OFF, Auto trip, Spring charged, Trip circuit healthy, etc.

18.8 Annunciation

Flush mounted static type annunciator with sufficient number of windows to accommodate all trip and alarm signals shall be provided. Separate audible annunciation for alarm and trip shall be provided by means of buzzer and hooter. Visual annunciation shall be by flickering of facia. Push buttons for test, accept and reset shall also be provided.

18.9 Earthing

18.9.1 An earth bus made of copper or aluminium shall be provided throughout the length of the panel and bolted to the framework of the panel. The earth bus shall have sufficient cross section to carry maximum fault current without exceeding the allowable temperature rise.

18.9.2 All non-current carrying conductors of the panel shall be connected to the earth bus. All joints to the earth bus shall be made through at least two bolts. Hinged doors shall be earthed through flexible earthing braid of adequate cross section. Suitable provision shall be provided at each end of the earth bus for connection with earth grid.

18.9.3 All metallic cases of relays, instruments and other panel mounted equipment shall be connected to earth bus by independent copper wires of size not less than 2.5 sq. mm with green colour insulation.

18.9.4 Instrument transformer secondary neutral point shall be earthed at one place only on the terminal block. Such earthing shall be made through links so that earthing of one

circuit may be removed without disturbing the earthing of other circuits.

18.10 Mimic Diagram

Coloured mimic diagram made of metal or plastic with symbols to facilitate exact representation of the system shall be fixed on the front of control panel. Semaphore indicators shall be incorporated in the mimic diagram for indicating position of circuit breakers, isolators and earthing switches. The rated control voltage of semaphore indicator shall be 110 / 220 VDC.

18.11 Wiring and Terminal Blocks

18.11.1 All internal wiring shall be done with 1100 V grade, 2.5 sq.mm. PVC insulated stranded flexible copper wire. For CT secondary circuits, 4 sq.mm copper wire shall be used.

18.11.2 Wire terminations shall be made with solderless crimping type tinned copper lugs, which shall firmly grip the conductor. Insulation sleeves shall be provided at all the wire terminations.

18.11.3 Printed identification ferrules, marked to correspond with panel wiring diagram shall be provided at both ends of each wire. The ferrules shall be firmly located on each wire so that they cannot move or turn freely on the wire. Wire identification shall be done in accordance with IS 11353.

18.11.4 The Contractor shall be solely responsible for the completeness and correctness of the internal wiring and for the proper functioning of the connected equipment.

18.11.5 All internal wiring to be connected to the external equipment shall terminate on terminal blocks. Terminal blocks shall be rated for 1100 V, 10 A and made of non-inflammable material.

18.11.6 CT and VT secondary circuits shall be terminated on stud type, non-disconnecting terminal blocks.

18.11.7 At least 10% spare terminals shall be provided on each panel and these spare terminals shall be distributed on all terminal blocks.

18.11.8 Screw driver operated stud type test terminal block shall be provided.

18.12 Accessories

(i) Thermostatically controlled space heater with switch for isolation

(ii) 240 V, 15 A industrial socket with ON/OFF switch

(iii) LED lamp controlled by door switch

18.13 Warranty

The control and relay panel unit shall be warranted for minimum of 5 (five) years against all material/ manufacturing defects and workmanship.

18.14 Testing and Inspection

18.14.1 Type Tests

The Contractor shall submit type test report of the panel for degree of protection as required by the Technical Specifications as per IEC 60529. The test should have been conducted by NABL accredited laboratory.

18.14.2 Routine Tests

Routine tests and acceptance tests shall be as per the Quality Assurance Plan (QAP) approved by the Employer.

19 132 kV Switchyard Equipment

19.1 Standards and Codes

All equipment provided shall comply with latest editions and amendments of the relevant IEC standards and IS codes. In particular, the switchyard equipment shall comply with the following standards and codes.

Standard/Code	Description
IS/IEC 62271-100	High Voltage Switchgear and Control gear - Part 100: AC Circuit Breakers
IEC 60376, IS 13072	Specification of technical grade sulfur hexafluoride (SF6) for use in electrical equipment
IS/IEC 62271-102	High Voltage Switchgear and Control gear - Part 102: AC Disconnectors and Earthing Switches
IEC 61869	Instrument Transformers
IS 2099	Bushings for alternating voltages above 1000 Volts
IS 2544	Porcelain post insulators for systems with nominal voltage greater than 1000 Volts
IS 335, IEC 60296	Insulating oil
IS/IEC 60034	Rotating electrical machines
IS 996	Single-phase AC industrial motors for general purpose
IS 3070, IEC 60099-4	Surge arresters - Part 4: Metal-oxide surge arresters without gaps for A.C. systems
Indian Electricity Act, CBIP manual, CEA rules and guidelines	

19.2 General Technical Parameters

System Parameters	Specification
Highest system voltage	145 kV
Rated system voltage	132 kV
Rated frequency	50 Hz
Number of phases	3
Power frequency withstand voltage I. To earth II. Across Isolating distance	 275 kV (rms) 315 kV (rms)
Lightning impulse withstand voltage I. To earth II. Across Isolating distance	 650 kV (peak) 750 kV (peak)
System fault current	As per system requirement
Minimum Creepage distance	25 mm/kV of highest system voltage
System neutral earthing	Effectively earthed

19.3 Circuit breaker

19.3.1 Technical parameters

Parameters	Specification
Type	Outdoor SF6
Operating duty cycle	O – 0.3sec – CO – 3min – CO
Short circuit breaking current	As per system requirement
Short circuit making current	2.5 times of Short circuit breaking current
Rated break time	100ms
Re-strike performance class	C2
Mechanical endurance class	M1
First pole to clear factor	1.5 (As per IEC 62271 – 100)
Reclosing	Three phase high speed auto reclosing
Auxiliary contacts	As required plus 4NO and 4NC contacts per pole as spare. The contacts shall have continuous rating of 10A and breaking capacity of 2A with circuit time constant of minimum 20 milliseconds at 220V DC

19.3.2 Circuit breakers shall be of SF6 type. It shall comprise of three separate identical single pole units operated through the common shaft and shall be fully interchangeable both electrically and mechanically.

19.3.3 The circuit breaker operating mechanism shall be based on motor operated spring charging and it shall be re-strike free, trip free both electrically and mechanically, with anti-pumping feature.

19.3.4 Circuit breaker shall be provided with two independent set of trip circuit connected to separate fuse or MCB controlled DC supplies for greater reliability.

19.3.5 The rated control voltage of the spring charging motor shall be 110 VDC/230 VAC. Closing coil shall operate at all values of voltages between 85% and 110% of rated voltage. Opening coil shall operate correctly under all operating conditions of the circuit breaker up to the rated breaking capacity and at all values of supply voltage between 70% and 110% of rated voltage.

19.3.6 The spring charging motor shall have adequate thermal rating such that continuous sequence of the closing and opening operations is possible as long as power supply is available to the motor. It shall also be possible to charge the spring manually and close the breaker in the event of failure of motor / control supply to motor. Operating handle shall be provided for charging the operating mechanism. After failure of control supply to the motor, one open-close-open operation shall be possible with the energy contained in the operating mechanism.

19.3.7 The motor rating shall be such that it requires not more than 30 seconds for full charging of the closing spring. Closing action of the circuit breaker shall compress the opening spring ready for tripping. When closing springs are discharged after closing the breaker, they shall be automatically charged for the next operation.

19.3.8 Temperature compensated SF6 gas density monitor and pressure switches along with pressure indicator shall be provided to monitor and regulate the density of SF6 gas in breaker respectively in each pole. It shall be possible to dismantle the monitor without any seepage of SF6 gas.

19.3.9 Interrupter assembly shall be provided with an absorbing product box to eliminate moisture and SF6 decomposition products.

19.3.10 10% of total SF6 gas requirement shall be supplied in separate container as spare in addition to the required SF6 gas to fill the breaker installed at site.

19.3.11 Mechanical indicators shall be provided to indicate OPEN/CLOSED positions of the circuit breaker and CHARGED/ DISCHARGED positions of the closing spring. An operation analyzer shall be provided to record contact travel against time and measure opening time. These indicators and counter shall be visible from the panel front door without opening it.

19.3.12 Control cabinet shall be free standing, floor mounted, single front, metal enclosed construction. It shall be constructed with CRCA steel/Aluzinc sheet. The thickness of load bearing members shall be minimum 3 mm and that of non-load bearing members shall be minimum 2 mm. All external surface shall be painted with two coats of epoxy-based paint of color shade RAL 7032. Internal surface shall be painted with epoxy enamel white paint. The minimum dry film thickness (DFT) shall be 100 microns. Degree of protection shall not be less than IP5X.

19.3.13 Control cabinet shall be provided with thermostatically controlled space heaters to prevent condensation within the compartment. The space heater shall be connected to 240 V, 50 Hz, single phase AC supply through suitable switch and fuse. It shall also be provided with LED lamp rated for 240 V, 50 Hz, single phase AC supply for interior illumination controlled by door switch and a 240 V, 15 A, SPN industrial socket-outlet with ON/OFF switch.

19.3.14 The bidder shall furnish complete literature regarding assembly, maintenance and charging procedures as applicable to SF6 breakers.

19.4 Isolator

19.4.1 Technical parameters

System Parameters	**Specification**
Service	Outdoor
Type of Isolator	Mechanically gang operated, Double break or centre break with earthing switch
Operating Mechanism a) Isolator b) Earth switch	 Motor Manual
Auxiliary contacts	As required plus 4NO and 4NC contacts per pole as spare for isolator and earth switch each.
Short time current	As per system requirement
Safe duration of over load a) 150% of rated current b) 120% of rated current	 5 minutes 30 minutes

19.4.2 Isolators shall be outdoor type with blades rotating in horizontal plane, suitable for electrical as well as manual operation and local/remote operation.

19.4.3 Isolator and earth switch shall be capable of withstanding dynamic and thermal effects of system fault current in closed position and should not open under influence of fault current and wind pressure together.

19.4.4 Isolator shall be provided with heavy duty, self-aligning, high pressure current

carrying contacts and moving blades made up of highly conductive, corrosion resistant, hard drawing electrolytic copper alloy. Copper contacts shall be silver-plated with minimum 25-micron thickness.

19.4.5 Arcing horns on the fixed and moving contacts, if required shall be of 'make before and break after' type.

19.4.6 Each single pole of isolator shall be provided with suitable galvanized steel base channels with holes and designed for mounting on a lattice supporting structure. The bas shall be rigid and self-supporting.

19.4.7 Operating mechanism for isolator and earth switch shall provide quick, simple and effective operation and shall be provide on opposite ends.

19.4.8 Control cabinet/operating mechanism box shall be constructed with CRCA steel/Aluzinc sheet of minimum 3 mm thickness. All external surface shall be painted with two coats of epoxy-based paint of colour shade RAL 7032. Internal surface shall be painted with epoxy enamel white paint. The minimum dry film thickness (DFT) shall be 100 microns. Degree of protection shall not be less than IP5X. It shall be provided with thermostatically controlled space heaters to prevent condensation within the compartment, LED lamp for interior illumination controlled by door switch and an industrial socket-outlet with ON/OFF switch.

19.4.9 Support insulators for Isolator and earth switch shall be solid core type made up of homogenous and vitreous porcelain.

19.4.10 Mechanical indicators shall be provided to indicate OPEN/CLOSED position of the isolator.

19.4.11 Following fail safe type electrical and mechanical interlocks are required between Isolator & earthing switch and Isolator & circuit breaker:

(i) Prevention of opening of isolators on load.

(ii) Prevention of closing of earth switch, when line isolator is closed.

(iii) Prevention of closing of line isolator, when earth-switch is closed.

(iv) Prevention of opening of isolator, when circuit breaker is closed and vice versa.

(v) Provision shall be made for pad locking the mechanism of isolator and earthing switches in both, the 'close' and 'open' position.

19.5 Instrument transformer

19.5.1 Technical parameters

Parameter	Specification
Current Transformer	

Accuracy class	0.2S for metering 5P20 for protection
Rated VA burden	As per requirement
Insulation class	Class E
Rated Short time thermal rating	As per system requirement
Rated short time dynamic rating	80kA
Partial discharge level	10 Pico Coulomb maximum
No. of terminals in Terminal box	As required plus 10 terminals as spare
Voltage Transformer	
Accuracy class	0.2 for metering 3P for protection
Rated VA burden	As per requirement
Insulation class	Class E
Standard reference range of frequencies for which the accuracies are valid	96% to 102% for protection and 99% to 101% for measurement
Partial discharge level	10 Pico Coulomb maximum
Rated voltage factor	1.2 continuous and 1.5 for 30 sec.
No. of terminals in Terminal box	As required plus 10 terminals as spare

19.5.2 Instrument transformers shall be dead tank type, hermetically sealed single-phase units, oil immersed, self-cooled suitable for outdoor installations and shall be supplied with common marshalling box for a set of three single phase units.

19.5.3 Polarity marks shall indelibly be marked on each instrument transformer and at the lead terminals at the associated terminal block.

19.5.4 The insulators shall have cantilever strength of more than 600 kgf.

19.5.5 Secondary terminals of instrument transformer shall be brought outside in a terminal box constructed with CRCA steel/Aluzinc sheet of minimum 3 mm thickness. All external surface shall be painted with two coats of epoxy-based paint of colour shade RAL 7032. Internal surface shall be painted with epoxy enamel white paint. The minimum dry film thickness (DFT) shall be 100 microns. Degree of protection shall not be less than IP5X. It shall be provided with thermostatically controlled space heaters to prevent condensation within the compartment, LED lamp for interior illumination controlled by door switch and an industrial socket-outlet with ON/OFF switch.

19.5.6 CTs shall be suitable for high speed auto reclosing.

19.5.7 HRC fuses of suitable rating shall be provided on primary side of voltage transformers. For secondary side, four pole Miniature Circuit Breakers (MCB) shall be provided.

19.5.8 Wiring and Terminal blocks of instrument transformers

19.5.8.1 All internal wiring shall be done with 650 V grade, 1.5 sq.mm. PVC insulated stranded flexible copper wire. For CT secondary circuits, 2.5 sq.mm copper wire shall be used.

19.5.8.2 Wire terminations shall be made with solderless crimping type tinned copper lugs, which shall firmly grip the conductor. Insulation sleeves shall be provided at all the wire terminations.

19.5.8.3 Printed identification ferrules, marked to correspond with panel wiring diagram shall be provided at both ends of each wire. The ferrules shall be firmly located on each wire so that they cannot move or turn freely on the wire. Wire identification shall be done in accordance with IS 11353.

19.5.8.4 The Contractor shall be solely responsible for the completeness and correctness of the internal wiring and for the proper functioning of the connected equipment.

19.5.8.5 All internal wiring to be connected to the external equipment shall terminate on terminal blocks. Terminal blocks shall be rated for 650 V, 10 A and made of non-inflammable material.

19.5.8.6 CT and VT secondary circuits shall be terminated on stud type, non-disconnecting terminal blocks.

19.5.8.7 At least 10% spare terminals shall be provided on each panel and these spare terminals shall be distributed on all terminal blocks.

19.6 Warranty

All switchyard equipment shall be warranted for minimum of 5 (five) years against all material/ manufacturing defects and workmanship.

19.7 Testing and Inspection

19.7.1 Type Tests

All switchyard equipment shall be of type tested design. Type test reports as per the relevant IEC/IS standards shall be submitted during detailed engineering. The tests should have been conducted on the similar equipment by NABL accredited laboratory. In case the contractor is not able to submit the test reports during detailed engineering, the contractor shall submit the reports of type/special tests either conducted by NABL accredited laboratory or witnessed by Employer.

19.7.2 Routine Tests

Routine tests and acceptance tests shall be as per the Quality Assurance Plan (QAP) approved by the Employer.

20 Illumination

20.1 Standards and Codes

LED luminaires shall be tested at independent laboratory as per the following test standards.

Standard/Code	Description
LM79-08	Electrical and Photometric Measurements of Solid-State Lighting Products
LM 80-15	Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays and Modules

20.2 General specification

20.2.1 This specification covers design, supply and installation of uniformly Illumination system along the peripheral & internal roads, main control room & inverter rooms, switchyard and other facilities including entry points/gate(s) inside the plant area.

20.2.2 The Contractor shall furnish Guaranteed Technical Particulars of the LED luminaires, from renowned brands available in the market for approval of Employer.

20.2.3 Lighting system shall work on the auxiliary supply and same shall be incorporated in auxiliary loads. The Contractor shall provide minimum 20% of total lighting points as emergency lighting points, fed from UPS DB or DCDB as per scheme adopted by the Contractor. Indoor and outdoor emergency lights shall be provided at each inverter room, main control room, security room and main gate.

20.3 Lighting Levels

20.3.1 The average LUX level of 10 lm is to be maintained in switchyard. However, a lux level of 20 lm ((10+10) additional switchable on requirement only) is to be maintained in switchyard on transformer.

20.3.2 The lighting system for outdoor and indoor areas of solar power plant shall be designed in such a way that uniform illumination is achieved. Average LUX level to be maintained in different areas shall be as under:

Area	LUX
Control Room and equipment rooms	300

Office	300
Battery & other rooms	150
Internal/Periphery Roads	4
Transformer yard/Switchyard	20
H – pole and metering point	10

20.3.3 The lighting level shall take into account appropriate light output ratio of luminaires, coefficient of utilization maintenance factor (of 0.7 or less) to take into account deterioration with time and dust deposition and illuminance uniformity [Uo] shall be min 0.3.

20.4 LED Luminaire for Outdoor Applications

20.4.1 LED luminaires shall meet the following parameters.

Parameter	**Specified Value**
Input voltage	170 - 260 V
Input Frequency	50 Hz +/-1 Hz
Power Factor	0.90 (Minimum)
Luminaire efficacy	> 90 lumens per watt
Beam Angle	Minimum 120°
Total Harmonic Distortion	< 10 %
Working Humidity	10% - 90% RH (Preferably Hermetically sealed unit)
Degree of Protection	Minimum IP 65 (for Outdoor fixtures)
Luminaire Casing	Powder coated metal / Aluminium.
Colour Temperature	5700 K (cool day light)
Colour Rendering Index	> 65
Moisture protection in case of casing damage	IP 65 (driver unit shall preferably be totally encapsulated)

20.4.2 The LED luminaire (outdoor) housing, heat sink, pole mounting bracket, individual LED reflectors and front heat resistant tempered glass should be provided.

20.4.3 The LED luminaire (outdoor) housing should be made of non-corrosive, high-pressure, die-cast aluminium and the housing should be power coated grey, so as to ensure good weatherability. Each individual LED source should be provided with an asymmetrical distribution high reflectance aluminized reflector, which should ensure that the light distribution of the luminaire is suitable for road lighting applications (wide beam distribution) and should ensure high pole to pole spacing.

20.4.4 The luminaire should be provided with in-built power unit and electronic driver.

20.4.5 The luminaire should be suitable for standard street light poles and should be suitable for side entry and bottom entry (post top).

20.4.6 GI Lighting pole of suitable diameter capable of withstanding system and wind load, shall be provided with average Zn coating thickness of 80micron. The street light poles shall have loop in loop out arrangement for cable entry and light fixture / wiring protected with suitably rated MCB.

20.4.7 All outdoor lighting system shall be automatically controlled by synchronous timer or photocell. Provision to bypass the timer or photocell shall be provided in the panel.

20.4.8 Lighting panels shall be earthed by two separate and distinct connections with earthing system. Switch boxes, junction boxes, lighting fixtures, etc. shall be earthed by means of separate earth continuity conductor. Cable armour shall be connected to earthing system at both the ends. Proper earthing of street light poles shall be ensured.

20.4.9 Junction box for lighting shall be made of fire retardant material. The degree of protection shall be IP55 for outdoor JB.

20.4.10 Lighting cables, wherever exposed to direct sunlight, shall be laid through Double Wall Corrugated (DWC) HDPE conduits.

20.5 LED Luminaire/Lamps for Indoor Applications

20.5.1 LED luminaire/lamps shall have minimum 3-star BEE rating.

20.5.2 All indoor LED luminaire/lamps shall be supplied with proper diffuser to avoid direct visibility of LED and suitable heat sink for longer life.

20.6 Warranty

All luminaires shall be warranted against all material/ manufacturing defects and workmanship for minimum of 2 (two) years from the date of supply.

21 Weather Monitoring System

As a part of weather monitoring system, the Contractor shall provide the following measuring instruments with all necessary software and hardware required to integrate with SCADA.

21.1 Pyranometer

21.1.1 The Contractor shall provide minimum 6 (six) number of secondary standard pyranometers (ISO 9060 classification) along with necessary accessories, two numbers each for measuring the incidental solar radiation at horizontal, inclined plane of array and albedo at each site.

21.1.2 Specification of the pyranometer shall be as follows.

Parameter	Specification
Spectral Response	0.31 to 2.8 micron
Time response (95%)	Maximum 15s
Nonlinearity	±0.5%
Temperature Response	±2%
Tilt error	<±0.5%
Zero offset thermal radiation	±7 W/m^2
Zero offset temperature change	±2 W/m^2
Operating temperature range	0°C to +80°C
Non-stability	Maximum ±0.8%
Resolution	Minimum +/- 1W/m^2
Output	Analog output: 4 – 20 mA Serial output: RS485

21.1.3 Each instrument shall be supplied with necessary cables. Calibration certificate with calibration traceability to World Radiation Reference (WRR) or World Radiation Centre (WRC) shall be furnished along with the equipment. The signal cable length shall not exceed 20m. The Contractor shall provide instrument manual in hard and soft form.

21.1.4 Downward facing pyranometer to measure albedo shall be mounted at least 2 m above uniform surface. To avoid reflections, masts/mounting pole shall be painted with black, non-reflective paint. To minimize shading, the pyranometer shall be mounted on boom (minimum length 1 m) extending towards the equator.

21.2 Temperature Sensor

The Contractor shall provide minimum 3 (three) temperature sensors (1 (one) for ambient temperature measurement with shielding case and 2 (two) for module temperature measurement) at each site. The temperature sensor shall be Resistance Temperature Detector (RTD)/ Semiconductor type with measurement range of 0°C to 80°C. The instrument shall have valid calibration certificate.

21.3 Anemometer

Contractor shall provide minimum one no. ultrasonic wind sensor (no moving parts) for wind speed and direction monitoring.

Parameter	Specification

Velocity range with accuracy limit	0-60m/s with +/-2% accuracy @12 m/s; Resolution: 0.01m/s
Wind direction range with accuracy limit	0 to 360° (No dead band) with +/-2° accuracy @12 m/s; Resolution: 1°
Mounting Bracket	Anodized Aluminium bracket to reduce corrosion, all mounting bolts of SS
Protection Class	IP66
Output	RS232 and RS485

21.4 Data logger and Data Acquisition System

Data logger for the weather monitoring station should have the following features:

21.4.1 Provision for analog, digital and counter type inputs for interfacing with various type of sensors

(i) Analog Input

- Adequate nos. for all analog sensors with redundancy
- Provision for operation in different current and voltage ranges as per connected sensors
- Accuracy of +/-0.1% of FS

(ii) Digital Inputs

- Adequate no. of Digital inputs and outputs for the application

(iii) Provision for RS232 and RS485 serial outputs

(iv) Built-in battery backup

(v) Connectivity and Data transmission:

- RS485 MODBUS interface for data collection and storage on SCADA
- Web interface with provision for user login to enable viewing and downloading of weather data in XLS/ CSV format
- Communication protocol should support fast data transmission rates, enable operation in different Frequency bands and have an encryption-based data security layer for secure data transmission

(vi) Display Settings: Graphic LCD screen which should be easily accessible and should display relevant details like all sensor values, battery strength, network strength etc.

(vii) Provision of Time synchronization from telecom time or server time

(viii) Data Storage: Provision for at least 2 MB internal Flash Memory and at least 8 GB Micro SD card (expandable)

(ix) Protection level: IP65

22 CCTV Camera

22.1 CCTV Cameras along with monitoring stations (sufficient numbers) and all other accessories required for its proper operation must be installed to have complete coverage of following areas for 24 hours.

(i) Main entry: Covering all the entry/exit

(ii) Along the Plant Perimeter: Covering complete perimeter of Plant Area to capture all possible intrusion

(iii) Control Rooms: Covering Entry/Exit and Equipment Rooms

(iv) Switchyard

22.2 Monitoring stations of the CCTV Network shall be installed in Main Control Room.

22.3 The CCTV system shall be designed as a standalone IP based network architecture. System shall use video signals from different cameras at defined locations, process the video signals for viewing on monitors at control room and simultaneously record all video streams using latest compression techniques.

22.4 Camera shall be colour, suitable for day and night surveillance (even under complete darkness) and network compatible.

22.5 It shall be possible to control all cameras i.e., PTZ auto/ manual focus, selection of pre-sets, video tour selection etc. The software shall support flexible 1/2/4 windows split screen display mode or scroll mode on the display monitor for live video.

22.6 The system shall support video analytics in respect of the following:

(i) Video motion detection

(ii) Object tracking

(iii) Object classification

(iv) Camera server shall be provided with sufficient storage space to storage recordings of all cameras at HD mode for a period of 15 days. All recordings shall have camera ID, location, date and time of recording.

23 Fire Alarm System

23.1 Standards and Codes

Standard/Code	Description

IS 2189	Selection, Installation and Maintenance of Automatic Fire Detection and Alarm System Code of Practice
IS 2171	Portable Fire Extinguishers, Dry Powder (Cartridge Type)
IS 8149	Functional requirements for twin CO_2 fire extinguishers (trolley mounted)
IS 2546	Galvanized mild steel fire bucket
National Building code 2016	

23.2 Contractor shall ensure the compliance of fire detection and alarm system as per relevant standards and regulations. The installation shall meet all applicable statutory requirements and safety regulations of state/central fire department/body or any other competent authority in terms of fire protection.

23.3 Firefighting system for the proposed power plant for fire protection shall be consisting of but not limited to:

(i) Sand buckets
(ii) Portable fire extinguishers (CO_2 and dry powder type)
(iii) Microprocessor based fire alarm panel
(iv) Multi sensor smoke detectors
(v) Hooter cum strobe
(vi) Manual call points
(vii) Cables from sensor to fire Panel.

23.4 Minimum two numbers of fire extinguishers (CO_2 and Foam type each, of capacity 10 kg having BIS certification marking as per IS: 2171) shall be provided at every building/ encloser, transformer yard and switchyard. However, contractor must comply with existing building code for fire protection and relevant IS codes.

23.5 Four numbers of stand with four sand buckets on each stand shall be provided in the Transformer Yard. Sand buckets inside the building shall be provided at strategic locations as decided during detailed engineering.

23.6 Digital output from the fire detection system shall be integrated with SCADA

23.7 Contractor shall submit the plan for fire and smoke detection system for the Employer's approval.

24 Testing Instruments

The Contractor shall provide the following set of instruments for on-site testing.

24.1 Earth resistance tester

Parameter	Specification
Display	Backlit LCD or LED display
Range	Earth Resistance: up to 2000 Ω Earth Voltage: 200 V
Accuracy	± (2% + 5)
Safety Ratings	IP 56
Programmable Limits setting	Enabled
Accessories	
Earth Ground Stakes (4 Nos)	
Three cable reels with cable length up to 20 m	
Carry Case-1 (capable of handling tester along with accessories)	
1 set of spare battery	

24.2 Array tester

Parameter	Specification
Display	Backlit LCD or LED display
Functionality	All electrical tests required by IEC 62446-1:2016
Memory	Up to 200 records & USB downloadable to Computer
Accessories	
A set of two, 4mm fused leads for extra protection during installation tests.	
Leads which enable the array tester to connect directly to PV arrays	
1 set of spare battery	

24.3 Insulation tester

Parameter	Specification
Display	Backlit LCD or LED display
Insulation Test Range	0.1 MΩ to 10 GΩ
Test Voltage	250V, 500V, 1000V, 5000V
Test Voltage accuracy	+20% on positive side only no negative variation is allowed
Insulation Test Current	1 mA nominal
Auto Discharge	Discharge time< 0.5 Second for C = 1

Open Circuit test Voltage	>4 V, <8 V
Accessories	
Heavy duty Test Lead Set – 4 Nos.	
Carry Case with sufficient space for accommodating accessories.	

24.4 Digital Multimeter

Parameter	**Specification**
Display	Backlit LCD or LED display; Minimum resolution: 5 ¾ places for DC, 4 ¾ places for AC
Measuring Category	1000V CAT III as per IEC Standard 61010-1; wave shape independent RMS measurement (True RMS) suitable for operation in the site conditions.
Additional Functions	Resistance (Ω), Temperature (°C), Continuity, Diode, Capacitance, Frequency, Duty cycle measurement
Accessories	
Temperature Probe	
Silicon Test Lead	
Alligator Clip	
Carry Case with sufficient space for accommodating accessories.	

24.5 Clamp meter

Parameter	**Specification**
Display	Backlit LCD or LED display
Measuring Category	1000V CAT III as per IEC Standard 61010-1; wave shape independent RMS measurement (True RMS) suitable for operation in the site conditions.
Current Range	AC&DC Current up to 1000A/400 A
Voltage range	AC&DC Voltage upto 1000V
Additional Functions	Resistance, continuity, diode and non-contact voltage detection, Active, Reactive and Apparent Power, THD, PF
Accessories	
Test leads	

Electrical test leads
Probe light & extender
Carry Case with sufficient space for accommodating accessories.

24.6 Infra-red thermal imaging camera

Parameter	Specification
Spectral response	8 µm to 14 µm (LW)
Temperature-sensitivity and calibration range	–20 °C to +120 °C
Atmospheric air temperature	-10 °C to +40 °C
Thermal sensitivity	NETD ≤ 0.1 K at 30 °C
Geometric resolution	640 x 480 pixels
Photo camera resolution	Approx. 30 times of IR camera resolution
Absolute error of measurement	< ± 2 K
Adjustable parameters	Emissivity, ambient temperature
Adjustable functions	Focus, temperature level and span
Measurement functions	Measuring spot, measuring area with average and maximum temperature
Calibration	The measuring system (Camera, lens, aperture and filter): The camera has to be traceably calibrated at least every two years. The calibration has to be documented. If the camera is not compliant, it has to be readjusted by the manufacturer.
Documentation	Storing of the infrared picture with the radiometric data

24.7 Digital lux meter

Parameter	Specification
Range	0 – 1000 lux
Accuracy	± (2% + 5)
Resolution	1 lux
Display	3½ digits, Backlit LCD/LED

24.8 All testing equipment shall possess valid calibration certificate issued from approved NABL labs.

24.9 Instruments of superior rating is allowed after seeking consent of the Employer.

24.10 Maintenance, calibration, up keeping, repair & replacement of these tools will be in the scope of the Contractor under the O&M Contract.

24.11 It is Contractor's responsibility to arrange for tools, tackles, logistics, test kits, manpower, experts etc. required for trouble free operation of Plant.

25 Power evacuation system

25.1 The contractor has to do the power evacuation and integration to and with the designated substation via either overhead transmission line or underground cables at specified grid voltage with all necessary infrastructure such as protection switchgears and metering systems as per the requirement of the STU/Employer.

25.2 The power evacuation system for the plant shall be as per the local DISCOM requirement and appropriate approval. The contractor shall get the route approval from the Employer and TSTRANSCO/TSNPDCL as the case may be prior to start of the construction. Any changes in the route or scheme introduced by DISCOM at any point of the time prior to commissioning shall be complied without any additional cost to the Employer.

25.3 The ROW for the TL/UG cable shall be obtained prior to the construction of the line from the concerned authorities.

25.4 Overhead Transmission Line

In case the power evacuation is planned with overhead transmission line for plant internal and external evacuation, the design of tower and its accessories shall be as per the DISCOM's requirement and the design shall be submitted to Employer for approval/ accord.

25.5 Underground cable

In case the power evacuation is planned with underground cable for plant internal evacuation, the cable shall be approved by the Employer. However, in case of external power evacuation, the evacuation plan shall be as per DISCOM's requirement and the same shall be submitted to Employer for approval/ accord.

C Civil, Mechanical and Plumbing Works

1 General Requirement

1.1 This section of Technical Specifications describes detailed technical and functional requirements of all civil, structural, mechanical & plumbing works included in the scope.

1.2 ~~This excludes design, supply and installation of Galvanised 220 kV and 132 kV~~

~~Transmission Line towers, Tower extensions & accessories and 11 kV, 22 kV & 33 kV transmission poles & accessories which shall be designed following latest guidelines of respective SEB (State electricity board) and got approved from SEB/STU before execution. In absence of SEB/ STU guidelines REC (Rural electrification corporation) standards shall be followed. Poles at corner with angle > 100 shall be provided with 4-pole structure or lattice tower. Use of Pre-stressed cement concrete spun poles is not acceptable. Approved copies of these designs & drawings shall be submitted to the employer for reference and record.~~

1.3 Standards & Codes

1.3.1 All design and construction of civil works shall conform to relevant Indian standards such as BIS, IRC, MORTH, NBC etc.

1.3.2 Design of steel structures shall conform to IS: 800, 801 or 802 as applicable. Design of concrete structures shall conform to IS: 456. For design of liquid retaining structure IS: 3370 shall be followed. Only in case of non-availability of Indian standard, equivalent American or British standard may be used for design with prior approval of the Engineer and the contractor shall submit proper justification for the same along with his request to the Engineer for review and approval, and the decision of the Engineer shall be final and binding.

1.3.3 All the design/ drawings shall be prepared/ approved either by in-house Engineering Team of the contractor (or by his Engineering Consultant) with qualified engineering staff with relevant experience in successful design of solar SPV plants.

1.3.4 The design calculations for MMS, RCC structure, Steel structure, Foundation system including piling, Road work, Drainage work, etc. shall be submitted for prior approval of Engineer before commencement of construction.

1.3.5 As per project requirements, the Employer may ask for approval of all civil designs and drawings by a Chartered Civil/ Structural Engineer.

1.4 The design calculations shall be supplemented with a neat sketch showing the structure geometry, node and member nos., lengths of various typical members, support points and type of supports, types of materials & type of sections with properties considered in analysis & design. The report shall also include back-up calculations for various loads adopted in design, brief write-up on primary load cases and design load combinations considered and conclusions on design results (with supporting sketches) for easy reference and clarity. Where a computer program (other than STAAD) is used for analysis and design, the contractor shall include a write-up on

the computer program used along with examples for validation check. Design Input (format suitable to the programme used and also in STAAD format) and output file shall also be given in the design report and in soft copy to facilitate its review and approval by the Engineer.

1.5 The methodology for construction of MMS and its foundations, Road & drainage works and Procedure for pile load test shall also be submitted for prior approval of Engineer before start of these works.

2 Topographical Survey

2.1 ~~The contractor shall be responsible for detailed Topographical Survey of the proposed project site~~. The work shall be carried out through an agency with relevant experience and qualified survey team.

2.2 The Topographical survey shall be conducted at 20m x 20m grid, or as directed by the Engineer, only with the help of digital surveying instruments like Total Station/ Auto level.

2.3 The Contractor shall carry the Bench Mark from nearest GTS Bench mark or any other established source like Railway station, Permanent PWD/ WRD structure etc. as approved by the Engineer, by fly-levelling and establish two permanent bench marks (PBM) at site. All subsequent transfer of levels shall be carried out with respect to these PBMs. The work shall also include constructing permanent reference pillars (RP) at suitable locations as directed by the Engineer. These reference pillars shall be labelled permanently with their respective coordinates and reduced levels for future use. The Permanent Bench Marks (PBM) and reference pillars (RP) shall be shown on the survey drawings.

2.4 While carrying bench mark to the project site, levels shall also be established on the permanent objects like culverts etc. at least on one object in every 1 (one) km if available along with route with adequate description about the objects. These levels shall be maintained at site & also mentioned in the survey report to facilitate locating these objects later on.

2.5 The survey work shall be carried out in UTM grid system. The contractor shall also establish the latitudes and longitudes and UTM coordinates of all the corners of the project site. At least 50m width of the adjoining plots and surrounding areas shall also be covered in the survey for correlation with adjoining plots and facilities. The grids for the survey work shall be established in N-S & E-W direction (corresponding to Geographical North or Plant North) as directed by the Engineer.

2.6 Positions, both in plan and elevation, of all natural and artificial features in the area like waterways, railway tracks, trees, cultivation, houses, fences, pucca and kutcha roads including culverts and crossings, foot tracks, other permanent objects like telephone posts and transmission towers etc. are to be established and subsequently shown on survey maps by means of conventional symbols (preferably symbols of survey of India Maps). All hills and valleys within the area/areas are to be surveyed and plotted on maps by contours. Any unusual condition or formation on the ground, locations of rock outcrops (if visible on the surface) and springs/falls, sand heap/dune, possible aggregate deposits etc. shall also be noted and plotted on contour maps. The C/L coordinates of existing road & cross drainage (CD) works (culverts etc.) at intermediate points & at corners/ intersections and width of carriage way of the road shall be recorded with their position on the contour maps.

2.7 The record of measurement of all Reduced Levels (RL) shall be submitted in digital format, (in x, y z coordinate system) along with preliminary contour plan of the site, for Engineer's review before submission of final contour map. The contour interval shall be as required for proper representation of the topography however it shall not be more than 0.5m. The Contractor shall submit survey maps of the site in 1:10,000 scale indicating grid lines and contour lines, demarcating all permanent features like roads, railways, waterways, buildings, power lines, natural streams, trees, sand dunes etc. Present use of the site i.e. mining, quarrying, agriculture etc., existing drainage pattern of the site, possibility of water logging and high flood level of the area shall also be captured in the document. The project plot boundary with coordinates of all corner points along with coordinate grid of 50m x 50m interval shall be marked on the contour map.

3 Geotechnical Investigations

3.1 The contractor shall be responsible for detailed Geotechnical investigations at the proposed project site for the purpose of foundation design for various buildings, structures, HT lines, MMS etc. and other design/ planning requirements. The investigation work shall be carried out through any Govt. approved/ NABL accredited agency. The contractor shall submit the credentials of the proposed agency along with relevant certificates in support thereof for verification/ approval of the Investigation Agency by the Engineer.

3.2 The scope of work includes execution of complete soil exploration including boring and drilling with rotary drilling rig, standard penetration test (SPT), collecting disturbed (DS)

and undisturbed samples (UDS), collecting ground water samples, trial pits, electrical resistivity tests (ERT), field & laboratory CBR tests, conducting laboratory tests on collected samples of soil & ground water and preparation and submission of report. SPT shall be carried out in all types of soil deposits and in all rock formations with core recovery up to 20% met within a borehole (BH). SPT test shall be conducted at every 1.5m interval or at change of strata. The starting depth of SPT shall be 0.5m from ground level. UDS shall be collected at every 1.5m interval or at change of strata. The min. size of trial pit shall be 2.0mx2.0mx2.5m deep.

3.3 The field investigations shall mainly include drilling of min. 5m deep BHs (50% of total No. of boreholes shall be 10m deep), conducting SPT and collecting Disturbed (DS) and Undisturbed samples (UDS), conducting in-situ CBR test for approach road to the plant, internal roads & peripheral road; Trial pits(TP) and Electrical resistivity tests (ERT). Number and location of BHs, California bearing ratio (CBR) tests, ERTs and TPs shall be decided as per the project layout, site topography and soil conditions in consultation with the Employer. The proposed locations shall fairly represent the total project site to get the complete required geotechnical information. The BH near MCR and ICR shall be 10m deep. There shall be minimum 1 nos. of BH per 5 acres of the area (However, total number of boreholes shall not be less than 5), 3 nos. of Trial pits, 5 nos. of CBR test & ERT, 5 nos. of Ground water samples for laboratory investigations. The soil/ rock samples for laboratory investigations shall be collected from each borehole and trial pit in sufficient nos. (Note- In case the project plot is divided in to number of discrete blocks separated from each other, min. 3 nos. of bore holes, 2 trial pits, 2 ERT and 2 CBR tests shall be taken per such block with at least 1 No. of BHs per 5 acres as specified above).

3.4 The proposed Geotechnical investigation plan indicating proposed locations of TPs, BHs, water sample collection points, CBR test & ERT shall be submitted to the Employer for review and approval before start of work.

3.5 Laboratory tests shall be conducted on DS & UDS samples and ground water samples in sufficient no. & shall include, Soil classification, Grain size analysis including Hydrometer analysis, determination of Bulk and dry density, Specific gravity, Natural moisture content, Atterberg limits, Tri-axial shear tests (Unconsolidated Undrained – UU) on UDS, Undrained shear test, Consolidation tests, Unconfined compression tests (UCS), Free swell index, chemical analysis of soil and water samples to determine the carbonates, sulphates, chlorides, nitrates, pH, Organic matter and any other chemicals

harmful to concrete and reinforcement/ steel. Laboratory tests on rock samples shall be carried out for Hardness, Specific Gravity, Unit Weight, Uniaxial Compressive Strength (in-situ & saturated), Slake Durability etc. Laboratory CBR test on soaked samples shall also be conducted on min. 5 no. of soil samples to ascertain the suitability of soil for sub-grade and requirement of any treatment of subgrade soil in case of CBR <2% as per IRC requirements.

3.6 After completion of field and laboratory work, the contractor shall submit a Geotechnical Investigation Report for Engineer's approval. All bore log details and lab test results shall be presented in the report as per provisions of relevant BIS standards indicating BH coordinates, Existing GL, Depth of water table, Method of drilling etc. The report shall include a Map showing the locations of various field tests including coordinates, calculations and recommendations for foundation type and safe bearing capacity (SBC) for various Plant buildings (ICR, MCR etc.) and Open installations, Switch Yard structures & Sub-Station (as applicable), Transformer foundation, HT lines (as applicable), MMS foundation etc. corresponding to settlement of 25mm.

3.7 The report shall include the study for "Liquefaction potential assessment of the ground and suggestions for any ground improvement measures" as required.

3.8 The report shall also include ground water analysis (water sample collected from bore well) to ascertain its suitability for construction purposes, recommendations for type of cement, grade of concrete & minimum cement content as per prevalent soil characteristics with respect to presence of aggressive chemicals and environment exposure conditions as per relevant BIS specifications. However, minimum grade of concrete shall be as specified under Cl.13.0 'Concrete Works'.

3.9 In case the contractor wishes to adopt concrete pile foundation for MMS supports the Geo-tech. report shall also include the calculations, based on soil properties, for safe pile capacity under direct compression, lateral load and pull out as per IS:2911. For single pile, Lateral load capacity shall be min. of the values obtained as per IS:2911 & Brom's method corresponding to free pile head. The report shall also include recommendations about type of pile, its depth and dia. to be used.

3.9.1 In coastal areas and in marshy or swelling type soil, under reamed or driven precast concrete pile shall be used. In case contractor wishes to use helical piles the design, fabrication and installation shall conform to IBC (International building code).

3.9.2 The contractor shall carry out field trials for initial load test on pile to verify the pile design to confirm the safe load carrying capacity under direct compression, Lateral

load and Pull out. The min. of the two values (design value as per soil characteristics & field test results) shall be adopted.

3.9.3 The nos. of piles to be tested under each category shall be finalized corresponding to geotechnical characteristics at site, plot area etc. However, minimum 5 nos. of piles shall be tested {min. 3 nos. in each block (block size < 25 acre) and min. 5 nos. in each block (block size.25 acres) if the plant site is divided in discrete blocks separated from each other} under each category of load.

3.9.4 The locations of test piles shall be distributed over the plant site and to be finalized in consultation with Engineer. In case the MMS column is fixed using base plate-anchor bolt assembly, the adequacy of provided pile reinforcement in job (working) pile corresponding to the set of test loads shall be reviewed by the contractor for any additional requirement of reinforcement and the same shall be provided in the pile to be cast for initial load test.

3.9.5 In case the Contractor proposes to embed the Column leg in the pile for fixing, the test pile shall be provided with embedded column leg as per approved design and any dowels as required for application of test load. The drawing for the Test pile shall be submitted to Engineer for his approval before casting the test pile. The load test on pile shall be conducted after min. of 28 days from the date of casting. In case the contractor desires to conduct the test earlier than 28 days, he may use suitable higher-grade concrete or if there is substantial evidence from earlier cube test results on design grade concrete to demonstrate the early gain of required compressive strength prior to application of the test load.

3.9.6 However, under no circumstances the test shall be conducted before 15 days of the date of casting the pile. All the dial gauges and hydraulic jack assembly shall be properly calibrated as per the requirements of relevant BIS standards and valid calibration certificate to this effect from Govt. / NABL accredited Test agency shall be submitted to the Engineer before use.

3.9.7 The contractor shall submit detailed methodology for conducting the tests in line with IS: 2911 (Part 4) for Engineer's approval before commencement of any test. After completion of these tests the contractor shall compile the test results and submit the report in a proper format as specified in the BIS standard with recommendations/ conclusions for Engineer's approval. The pile work shall start only after approval of the final pile design duly verified/ confirmed with initial load test results.

3.10 All buildings and Plinth for Open installations (MCR, ICR etc.), Transformer yard,

Switchyard and Sub-station area shall have levelled ground as detailed under Cl. No. 5 below.

4 Other Investigations

4.1 The contractor shall also obtain and study other input data at proposed project site for design of the project from metrological department/ local govt. authorities. This shall include data related to Rainfall, Maximum & Minimum ambient Temperature, Humidity, HFL etc.

4.2 The contractor shall carry out Shadow Analysis at proposed site and accordingly design strings and array layout with optimum use of space, material and man power. In case of large variations in topography (3° to the horizontal) the study shall also include the effect of topographical variations on array layout and MMS structure design adequacy and stability. The contractor shall submit all the details/ design to the Engineer for review/ approval.

4.3 The contractor shall also identify potential quarry areas for coarse and fine aggregates to be used for concrete and shall carry out the concrete mix design for concrete grades to be used in construction of all concrete works (M25 and above) before start of construction. However, for piling M25 concrete with nominal mix of (1:1:2) may be used. For grades of concrete less than M25 to be used in PPC works, nominal mix as specified in IS:456 may be used. The concrete mix shall be designed for each source of cement and aggregates as per provisions of IS:10262 Standard and confirmed through 28 days compressive strength of concrete trial mix samples. Target mean strength of concrete for mix design shall be based on σ (standard deviation) = 5.. The concrete mix design shall be carried out through NABL accredited Laboratory or any Govt. agency approved by the Engineer. In case the contractor proposes to use RMC, the same shall conform to IS: 4926. The Contractor shall submit the Concrete mix design proposed to be used by the RMC for review and approval by the Employer. (Reports of periodic quality tests for the supply concrete batch shall be maintained by the RMC supplier as per approved Quality Plan and the same shall be submitted to the Employer for review and record).

5 Area Grading and Land Development

5.1 The Finished Grade Level (FGL) of the proposed plant shall be fixed with reference to the highest flood level (HFL) and surrounding ground profile at proposed site to avoid flooding of plant site. The data regarding HFL at proposed site shall be obtained from

the metrological department by the contractor. In case of absence of this data, the contractor shall assess the required information through local site reconnaissance. The area at and around (up to 25m beyond external wall/ area including access road & parking whichever is minimum) all buildings/ plinth for open installations (ICR, MCR etc.), transformer yard and switch-yard shall be uniformly levelled at suitable RL (i.e. FGL) to be finalized considering topography and HFL at site. The minimum plinth level of all buildings/ open installations shall be 450mm above FGL. Module mounting structure foundation/ Pile cap or any other pedestal shall be min. 200mm above FGL. Top of transformer foundation pedestal shall be min, 500mm above the FGL.

5.2 A detailed drawing for site levelling and grading (if necessary) shall be submitted by the contractor before commencement of construction of all buildings,plinth for open installation and transformer/switchyard works. The estimated volume of cutting and filling shall also be marked on the Grading drawings for reference. The final grade levels to be adopted for different blocks shall be clearly marked on the Plant Layout/ Array Layout drawing.

5.3 It is envisaged that the MMS are installed on natural/ existing ground without any levelling or grading of the area. Contractor shall accordingly consider the effect of the existing ground slope on the design of MMS structure as specified elsewhere in the specifications. If any ground undulations at column locations are observed the same shall be filled up with PCC (1:3:6) up to surrounding ground level immediately after pile installation before start of erection of other MMS members. In case of pile, the PCC fill shall extend min. 500mm outside pile cap all around and remaining area may be filled up with local soil properly compacted.

5.4 The contractor is responsible for making the site ready and easily approachable by clearing bushes, felling of trees (mandatory permissions/ licenses/ statutory clearances from competent authorities if required for cutting of trees, blasting or mining operations, disposal of waste material etc. shall be obtained by the contractor), cutting, filling with selected excavated earth or borrowed earth including identifying borrow areas. Except in exceptional cases (with approval of the Engineer), filling shall be made up of cohesive non-swelling material. The filling for levelling/ reclaiming the ground/ area shall be done in layers not more than 150mm of compacted thickness in case of cohesive (clayey) soils and 250mm compacted thickness in case of granular (sandy) soils with compaction up to 95% (of modified proctor density) and 80% (of relative density) respectively. The slope at edge of graded areas shall not be steeper than 1:1.5

(1 Vertical: 1.5 Horizontal) in cutting and 1:2 (1 Vertical: 2 Horizontal) in filling. In case of filling with rock material, the edges shall be provided in line with provisions of relevant BIS standard.

5.5 It shall be ensured that the land is grading and levelling is done properly to ensure for free flow of surface run-off and the grade levels shall be fixed with respect to high flood level at site, drainage pattern and system requirements. It shall be ensured that the land is used optimally to have maximum solar power generation considering full utilization of the plot areas. It is advisable to follow the natural flow of water at the ground as far as possible for drainage design.

5.6 In case the filled up earth is brought from outside the plant or borrow areas (when the material inside plant area is not found suitable for grading work or if directed by the Engineer), the contractor shall carry out all required soil investigations to ascertain the suitability of the borrowed soil for land development and filling purposes. Contractor's scope shall also include arranging land lease, getting all necessary statutory approvals for mining, payment of necessary challan etc. Excess earth, if any, shall be disposed of properly at location as directed by the Engineer.

6 Roads

6.1 Suitable approach road (as applicable) from nearest public road up to plant Main gate, Access road from Main gate to Main control cum office room (MCR), Internal roads connecting MCR and other facilities/ buildings/ open installations like Local control room(s) (LCR)/ Inverter control room(s) (ICR), Sub-station & Switch yard (as applicable) etc. and peripheral road along inside of the boundary fence/ wall shall be provided for safe and easy transportation of men, material and equipment during construction and maintenance.

6.2 The Approach road connecting nearest public road and the Main gate shall be of 4.5m wide carriage way with 0.5m wide shoulders on either side. The access road connecting Main gate and MCR and internal access road(s) connecting MCR to various facilities/ buildings/ open installations shall be of 3.75m wide carriage way with 0.5m wide shoulders on either side while the peripheral road shall be of 2.5m wide carriage way with 0.5m shoulders on either side. The top of road (TOR) elevation shall be minimum 150 mm above FGL to avoid flooding of roads during rains. The roads shall be provided with alongside drains as per design requirements of drainage system for effective disposal of storm water and to avoid cross flow of storm water over the road. The roads shall be designed as per IRC SP-72 corresponding to traffic category T3 and critical

field CBR value of the subgrade. Shoulder shall be of min. 150mm thickness.

6.3 However, following minimum road section details shall be followed:

(i) Topping: Surface dressing with gravel or gravel-soil mixture conforming to Cl. 402 of MORD specifications for rural roads published by IRC (MORD specs). However, for sites with average annual rainfall > 1500mm, either 2 course surface bituminous dressing conforming to Cl. 505 of MORD specs or 20 mm thick open graded pre-mix carpet + Type – B or Type –C seal coat conforming to Cl. 506 of MORD specs. shall be provided.

(ii) Base course WBM (CBR>100%) conforming to Cl. 405 of MORD specs: 75mm compacted thick, Grade III

(iii) Base course WBM (CBR>100%) conforming to Cl. 405 of MORD specs: 75 mm compacted thick, Grade II

(iv) Granular/ gravel sub-base course (CBR>20%), conforming to Cl. 401 of MORD specs: 175 mm compacted thick, compacted to 100% of max dry density

(v) Compacted subgrade: 300mm thick below sub-base (non-expansive soil with max. dry density > 1.65 kN/m3) conforming to Cl 303 of MORD specs, compacted up to 98% of standard proctor density in layers of 150mm thickness. In case of expansive soils like black cotton soil suitable treatment as per Cl. 403 of MORD specs shall be provided before laying sub-base course.

(vi) Gravel Shoulders conforming to Cl 407 of MORD specs: 150mm compacted thick, compacted to 100 % of max. dry density

6.4 Soaked CBR value of sub-grade shall not be less than 2%. Where the CBR of the subgrade is less than 2 % a capping layer of 100 mm thickness of material with a minimum CBR of 10 % is to be provided in addition to the sub-base required for CBR of 2 %. When the subgrade is silty or clayey soil and the annual rainfall of the area is more than 1000 mm, a drainage layer of 100 mm over the entire formation width should be provided conforming to the gradation given in Chapter 6 of IRC SP-20. This layer will form a part of the designed thickness of sub-base.

6.5 In case of no-availability of murrum in the nearby areas of the project site, suitable other screening/ blending material for WBM construction may be used conforming to provisions of IRC SP 20.

6.6 The construction of road shall conform to MORD specifications for Rural roads published by IRC..

6.7 Drain, cable or any other crossing shall be provided with RCC box or precast concrete

pipe culvert. The culvert design shall conform to relevant IRC standard. The pipes for road culverts shall be of minimum class NP3 conforming to IS 458 with min. soil cover of 750mm above the pipe. In case of soil cushion less than 750mm the pipe shall be provided with 100 mm thick M20 reinforced concrete encasement with 10 dia. reinforcement rods @ 150mm c/c both ways. However, the water supply pipe for module cleaning and service/ drinking water shall be routed through Medium class GI steel pipe of required dia. conforming to IS: 1161.

6.8 Minimum dia. of casing pipe to be used at any facility like electric cable, water pipe line etc. shall be 150mm.

6.9 Maintenance pathways of min. 1.0m width shall be provided between SPV arrays for easy movement of maintenance staff, tools, equipment and machinery, washing of modules etc. The pathway area shall be generally levelled and well compacted manually/ mechanically. Areas of depression, valley zones or wherever there is noticeable change in topography, shall be levelled by laying min. 100mm thick PCC M10 or precast concrete paver blocks (min. 60mm thick, Grade M60) matching the top finished surface with ground topography/ grade to avoid accumulation of water in the region and allowing its free flow to keep the area devoid of mud/ sludge.

6.10 The design and drawings for approach road, all internal roads and culverts shall be submitted to the Engineer for approval before execution.

7 Surface/ Area drainage

7.1 The contractor shall design and construct storm water drainage network for smooth disposal of storm water from the plant to the nearest available drainage outlet.

7.2 The storm water drainage system shall be designed and planned to ensure no water stagnation in the plant.

7.3 The plant drainage system shall be designed for maximum hourly rainfall intensity and relevant time of concentration.

7.4 The design shall conform to the provisions of IRC SP 42 and best Industry practices. (The design rainfall shall be taken as max. hourly rainfall at 25 years return period at project site as provided in the Isopluvial map of the relevant subzone annexed with Flood Estimation Reports of Central Water Commission (CWC).

7.5 The coefficient of run-off for estimation of design discharge shall be considered as per catchment characteristics, however it shall not be less than 0.6.

7.6 The drainage scheme shall be designed considering the plant plot area and the surrounding catchment area contributing to the plant area drainage as per the

topography.

7.7 The storm water drainage system shall be a network of open surface drains (with rectangular or trapezoidal cross section) and shall generally be designed to follow the natural flow of water and ground contours.

7.8 Suitable size plant peripheral drain as per design (min. 500mm wide x 500mm deep) along inside of plant boundary wall/ fence shall be provided for smooth channelization of outside storm water and to avoid flooding in the plant. The size of all internal and road side drains shall not be less than 450mm (bottom width) x 500mm (depth).

7.9 All trapezoidal drains shall have side slopes not steeper than 1:1 and shall be lined with either brick or RR masonry/ concrete or stone slabs as suitable to the site conditions. The min. Thickness of the lining shall be 115mm for brick masonry, 75mm for concrete slabs, 150mm for RR masonry and 100mm for stone slabs. The lining shall be in CM (1:4) and the joints shall be raked and pointed with CM (1:3), however, the joints in lining of plant peripheral drain may be left without pointing.

7.10 In case of rectangular drain, the thickness of the wall shall be checked against structural stability under action of the design loads as specified in Cl. No. 10.0 'Design Loads'. However, Min. thickness shall be 230mm for brick masonry, 300mm for RR masonry and 125mm for RCC work, except for garland drain around buildings where the min. wall thickness can be 115mm, 200mm and 100mm respectively for brick masonry, RR masonry and RCC work.

7.11 The structural design of drains shall be as per provisions of relevant BIS standards and good industry practice.

7.12 The drain outfall shall be connected to the nearest existing natural drain(s)/ water body outside plant premises and it shall be ensured that the drainage water shall not re-enter the plant nor encroach/ flood in the adjacent property/ plot.

7.13 The proposed drainage scheme along with design calculations and drawings shall be submitted to the Engineer for review/ approval before start of construction.

7.14 The contractor shall also explore for providing rain water harvesting system for water conservation by constructing suitable collection wells along the drains or through provision of detention ponds etc. The scheme for rain water harvesting along with design calculations shall be submitted for approval.

8 Peripheral boundary Wall/Fence

8.1 The plant peripheral boundary shall be provided with either Chain link or barbed wire fencing or masonry boundary wall as specified.

8.2 The boundary fence/ wall shall be provided along the Solar PV plant boundary to demarcate the plant boundary and to keep away the unauthorised access to the plant. The fence/ wall shall be provided with Main entry gate. The fencing/ wall shall be with 2.5m height above grade level including 400mm dia. GI concertina wire along with 3 no. of barbed wires on either arm to be fixed on Y shape angle brackets. The main gate shall be min. 6.0m wide (clear) (4.5 m carriage way + 1.5m wicket gate).

8.3 Chain link fencing

8.3.1 The fencing shall be of Chain link (GI or poly coat GI as specified) mesh fabric with internal, corner and stay posts of RCC (min 200mm x 200mm size, M30 grade) or Hot dipped GI angle (min. ISA 75x75x6 mm), as applicable, along with 230 thick brick/ 300 thick RR masonry toe wall, with 100mm thick M15 PCC foundation (min. width 450mm and min. depth 450 mm below GL).

8.3.2 Intermediate, corner and stay posts shall be supported with min. 300 mm dia. and 850 mm deep (below GL) piles in cement concrete (nominal mix 1:1:2). The column posts shall be extended in to the pile up to 800mm with 50mm cover at the bottom. The pile shall project 150mm above GL. The toe wall shall project 150mm above GL. The intermediate, corner and stay posts shall be supported by angle struts that shall have the same foundation as that of the main posts.

8.3.3 The brick masonry toe wall shall be plastered with 15thick CM (1:4) plaster on both faces and shall have min. 50 thick PCC (1:2:4) coping finished smooth and projecting 35mm on either side of the wall with top sloping inwards..

8.3.4 Spacing of intermediate posts shall not be more than 2.5m. Every 10th intermediate post shall be provided with a stay post while every corner post shall be provided with two stay posts on either side.

8.3.5 Joints in RR masonry shall be properly raked and pointed with CM (1:3).

8.3.6 In case of pond/ drain crossing the fence, RCC beam of adequate size supported on RCC columns on either side and suitable grill of MS square rods (vertical spacing not more than 150mm) of min. Size 25x25 mm and min. 3 no. horizontal 20 SQ MS rods or 50 mm x 8 mm thick flats secured to RCC beam and columns; shall be provided in place of toe wall for smooth flow of water.

8.3.7 The GI chain link mesh fabric (40x40 mm with min. wire gauge 3.15mm, both ends twisted) and fencing shall conform to IS: 2721. Poly coat GI chain link mesh (50x50mm) shall conform to ASTM 668 and fencing shall conform to ASTM 668.

8.3.8 Each fence panel, in lieu of tie wire, shall be provided with 35x35x3mm GI edge angle

at top and bottom with mesh fabric firmly secured to them and to intermediate support angles.

8.3.9 All MS sections shall be painted with 2 coats of epoxy paint of approved make and shade over 2 coats of suitable primer.

8.4 Boundary wall

The boundary wall structure shall be a RCC beam-column structure with wall of either brick (min. 230mm thick), concrete block (min. 200mm thick) or of Pre-cast RCC columns and wall panels (min. 75mm thick). The top of the wall shall be provided with concrete coping (min. 50mm thick with 40mm projection on either side).

8.5 Barbed wire fencing

The details of barbed wire fencing shall be same as those for chain link fencing except providing barbed wires (4mm dia.) in place of chain-link mesh. There shall be 10 no. of barbed wires which shall be equally placed along the fence height. The Barbed wire shall be of type 'Iowa' and class designation 1 with chromate conversion coating and shall conform to IS: 278. Every bay of the fence shall also be provided with one GI diagonal line wire of 4mm dia. conforming to IS: 280..

8.6 Main Gate

8.6.1 The Main entry gate of size as specified under clause no. 8.0 (2.5m height) shall of rugged design with solid MS steel sections (25x25mm). The spacing of vertical members shall not be more than 150 mm.

8.6.2 The gate shall be complete with MS flat guide track, castor wheel(s), GI fittings & fixtures like hinges, aldrop, locking arrangement, posts etc.

8.6.3 The main gate shall be of 2.5m height and shall have 4.5m wide Gate for vehicular movement and an adjacent 1.5m wide wicket gate for pedestrian movement.

8.6.4 Area near the main gate extending from 500 mm (min) outside the gate to 2700 mm (min) inside the gate, shall be brought to Top of Road elevation with respect to the approach road at main gate for full width of the gate. This shall be achieved by providing 200 mm thick PCC (1:2:4) over 100 mm thick PCC (1:4:8) further underlain with 300 mm thick well compacted boulder soling with interstices filled with sand, resting over well compacted subgrade.

8.6.5 The gate shall be provided with the Project name plate (2.5mx 1m, 3mm thick MS plate). The gate shall be painted with 2 coats of epoxy paint over 2 coats of suitable primer.

8.6.6 The column posts of the gate shall be supported through RCC pedestal and footing. Min. depth of foundation shall be 1200mm below NGL.

8.7 All design and drawings for peripheral boundary fence/ Wall and Main gate shall be submitted for Engineer's approval before execution.

9 Plant Layout

9.1 The contractor shall submit drawing showing proposed Project Plant and SPV module Layout.

9.2 The Plant and SPV module layout shall be a comprehensive drawing showing various requirements of the project like, Reference coordinate grid, Geographical and Plant North, Layout of boundary fence including coordinates of all corner points, Location of main entrance gate and any other access gates as per project needs, Block wise FGL, Layout of main approach road to the plant, Internal and peripheral roads, Security Room/ cabin (s), all Buildings and Open installations with coordinates, Temporary Storage yard/ facility to be used by the contractor during construction, Proposed Array layout, Lightening arrester, UG/Over ground water Tank(s), Storm water drains, Corridor for buried cables etc.

9.3 The cable corridor shall be laid through clear gap between arrays and shall not be laid below modules for easy maintenance.

9.4 All the facilities and buildings shall be presented with suitable Legend.

9.5 The drawing shall be in suitable scale to have proper representation of the information.

9.6 The Plant & SPV module layout drawing shall be submitted by the contractor for review/ approval by the Engineer.

10 Design Loads

10.1 Unless otherwise specified elsewhere, Dead load, Live load, Wind load and Seismic load for buildings and structures shall be considered as per provisions of relevant BIS standards.

10.2 The following minimum imposed load as indicated for some of the important areas shall, however be considered for the design. If actual expected load is more than the specified minimum load, then actual load is to be considered.

S. No.	Area	Imposed (Live) Load
1	Roof	1.50 kN/ Sqm
2	Building floors (GF) & Grade Slab	10.00 kN/ Sqm

3	RCC Floors (General)	5.00 kN/ Sqm
4	Outdoor platforms, Stairs, Landing and Balconies, Walkway, Chequred plate & Grating (except cable trench cover)	5.00 kN/ Sqm
5	Road culverts & allied structures over drain & pipe crossings subjected to vehicular traffic	Design for Class – 'AA' loading (Wheeled & Tracked both) and check for Class – 'A' loading as per IRC Standard
6	Underground structures such as Sump, Pit, Trench, Drain, UG tank etc.	In addition to Earth pressure and Ground water table at FGL, a surcharge of 20kN /Sqm (10kN/Sqm for drains) shall also be considered. The structure shall be designed for following criteria – (a) Inside empty with outside fill+ surcharge and water table at GL & (b) Inside water with no fill & water table outside
7	Pre-cast and chequred plate cover over cable trench	4.00 kN/ Sqm
8	Main access & Internal Roads	As per IRC SP 20 corresponding to vehicular traffic of 150 commercial vehicles per day and critical in-field CBR

10.3 Primary Loads

(i) Dead Load (DL)

(ii) Live Load (LL)

(iii) Wind Load (WL) – Both along ±X & ±Z horizontal direction

(iv) Seismic Load (EL) – Both along ±X & ±Z horizontal direction

10.4 Basic wind speed (V_b) at project site shall be taken as per IS 875 (part-3) unless

otherwise specified elsewhere.

10.5 To calculate the design wind speed (V_z), the factors K_1 (probability factor or risk coefficient), K_2 (terrain roughness and height factor) and K3 (topography factor) shall be considered as per IS 875 (Part-3) (However, minimum values for K_1, K_2 and K_3 shall be 1.0, 1.05 and 1.0 respectively)

10.6 Topography factor 'k_3' shall be taken as 1.0 upto upwards slope of 3°. For topography with upward slope greater than 3°, the value of 'k_3' shall be calculated as per Annexure-C of IS 875 (Part-3).

10.7 In case of plant site within 60 km of sea coast, the importance factor for cyclonic region, 'k_4' shall be taken as 1.15. Provisions of IS: 15498 shall also be followed to ensure general safety of the structure.

10.8 To calculate the design wind pressure 'p_d', factors 'k_a' (area averaging factor) and 'k_c' (combination factor) shall be taken as 1.0. (The factor 'k_d' shall be taken as 1.0 in case of plant site within 60km of sea coast).

10.9 The Seismic Load shall be considered corresponding to Earth quake zone at site as per IS: 1893 (Part- 4) with Importance factor 1.5. Ductile detailing as per IS 13920 shall be followed in concrete structures except in case of concrete support structure upto plinth level supporting open installations of inverter transformers and control panels at ICR/LCR, wherein the detailing shall conform to IS 456 and SP 34.

10.10 <u>Notes for MMS Design</u>

10.10.1 WL shall be considered as detailed below for estimation of WL under primary loads:

(i) WLx (downward), WLz (downward): Load due to positive pressure on design tilt angles of MMS members for wind acting in both (±X, ±Z) directions.

(ii) WLx (upward), WLz (upward): Load due to negative pressure on design tilt angles of MMS members for wind acting in both (±X, ±Z) directions.

(iii) WLx (member load), WLz (member load): Load due to wind action on side (exposed) face of respective MMS members (drag force) for wind acting in both (±X, ±Z) directions.

- ±WLx (member load, transverse to MMS table): Load due to wind action of column, front and back bracing, longitudinal bracing
- ±WLz (member load, along length of MMS table): Load due to wind action of column, rafter front and back bracing, longitudinal bracing

10.10.2 For estimation of design wind loads on purlins (Table 8 of IS 875- Part 3), WL

(downward) and WL (upward) on modules (laid in the profile of mono slope canopy) shall be applied such that the center of pressure should be at (0.3 × length of canopy) from windward end (for simplicity, the wind load distribution may be taken as triangular with max. value at windward end). Solidity ratio (∅) shall be taken as 0.5.

10.10.3 In design of MMS (for height of structures less than 10 m from ground), 20% reduction in wind pressure as per Note under Cl. 6.3 of IS 875 – Part 3 is not permitted in case of purlins (members supporting modules), which shall be designed against action of WL corresponding to full wind pressure.

10.11 Design Load combinations

10.11.1 Appropriate Load factors in LSM design for concrete structures and appropriate Factor of safety in WSM design (ASD) for all steel structures including MMS shall be considered as per relevant BIS standard. No increase in permissible stress is permitted in design of MMS.

10.11.2 Following load combinations shall be considered in design:

- For MMS Design:
  - (i) DL+LL
  - (ii) DL+LL ± WLx (upward) ± WLx (member load)
  - (iii) DL+LL ± WLx (downward) ± WLx (member load)
  - (iv) DL+LL ± WLz (upward) ± WLz (member load)
  - (v) DL+LL ± WLz (downward) ± WLz (member load)
  - (vi) DL+LL ± ELx
  - (vii) DL+LL ± ELz
- For RCC and Steel structures except MMS:
  - (i) DL+LL
  - (ii) DL+LL ± WLx
  - (iii) DL+LL ± WLz
  - (iv) DL+LL ± ELx
  - (v) DL+LL ± ELz

10.11.3 All buildings, structures and foundations shall be designed to withstand loads corresponding to worst design load combination.

11 Foundations (General)

11.1 Contractor shall design all foundations for buildings, equipment, HT line Towers, Switch

yard structures, Transformer, MMS & other structures as per relevant BIS standards and recommendations of Geotechnical investigation report.

11.2 No foundation for MMS, buildings, switchyard equipment and structures, sub-stations, HT line towers, transformers, etc. shall rest on filled-up ground. However, minor structures like cable trench, cable rack, pipe pedestal, etc. may rest on filled-up soil with max. safe bearing capacity for design considerations not more than 3 T/Sqm.

11.3 Min. depth of foundation for all buildings and plinth for open installations shall be 1.5 m below NGL. For all other structures, min. depth of foundation shall be 1.0 m unless specified otherwise.

11.4 All foundations of a building shall be founded at same RL (Reduced level) with respect to foundation depth below lowest NGL (Natural ground level) in the building area. The Levels shall be obtained with reference to the already established TBM using digital survey instrument such as Total Station/ Auto Level.

11.5 All design & drawings shall be submitted to the Engineer for approval before execution.

12 MMS Foundation

12.1 Module mounting structure (MMS) may be supported on isolated/ strip footing or pile foundation.

12.2 <u>Bored cast-in situ, Driven precast or under reamed Concrete pile</u>

12.2.1 In case the contractor proposes to provide bored cast-in-situ concrete pile; the type, dia. and length of pile shall be as per recommendations of Geotechnical investigation report corresponding to prevalent soil characteristics at site. However, the min. dia. and depth of the pile shall be 300mm (Min 350 mm for column depth more than 175 mm) and 1800mm respectively except when very hard strata/ rock (N>100) is encountered at a higher level, the pile shall be extended in to the hard strata minimum 1.5 times the diameter of the pile with total depth of the pile not less than 1200mm below cut-off level.

12.2.2 As specified above, the MMS support shall project minimum 200mm above FGL (Finished grade level) to avoid any damage to the MMS column/sub support due to direct contact of rain water/ surface run-off. This shall be ensured through either single stage construction of entire pile length including portion above FGL or by providing a collar (to be cast in second stage) which shall project min. 75mm in plan beyond the pile face and shall extend min. 250mm below GL.

12.2.3 For proper bonding, the surface of first stage concrete shall be made rough by

trowelling and cleaning out laitance and cement slurry by using wire brush on the surface of joint immediately after initial setting of concrete. The prepared surface should be clean watered to get saturated dry condition when fresh concrete is placed against it. The prepared surface shall be applied with a suitable bonding agent before construction of pile cap/ collar as required.

12.2.4 In case the column post/stub is supported through base plate-anchor bolt assembly, the same shall only be provided through RCC pile cap to be designed as per provisions of relevant BIS standard with min. clear overhang of 75mm. The pile shall embedded min. 50mm in the pile cap and the pile reinforcement shall be extended in to the pile cap for proper anchorage.

12.2.5 In case of collapse of foundation strata during drilling of the pile bore, removable steel liner shall be used to maintain design depth and diameter of the pile for proper concreting.

12.2.6 The design & installation of piles shall conform to IS: 2911.

12.2.7 The bore shall be free from water before poring of pile concrete. For under water concreting tremie shall be used.

12.3 Helical/ Screw Pile

12.3.1 The design, manufacture, testing and installation of Helical/ Screw pile shall conform to ICB-2009 and Practice Note 28- "**Screw Piles: Guidelines for Design, Construction & Installation,** ISSN 1176-0907 October 2015 (IPENZ Engineers New Zealand)"

12.3.2 The design of pile shall be undertaken and verified by a suitably qualified geotechnical or structural Chartered Engineer with experience in the design of helical/screw piles.

12.3.3 The pile shall be designed and manufactured in accordance with accepted engineering practice to resist all stresses induced by installation into the ground and service loads.

12.3.4 The steel grade for pile shaft, helix plates and other accessories shall be with min. Fy 350 MPa. Min. thickness (BMT) of shaft and helix plate shall be 6 mm and 8 mm respectively in case of coastal installations and soils containing aggressive chemicals and at other project sites it shall be respectively 5 mm and 6 mm. Cap plate and col base plate shall be min. 12 mm thick and of min. grade E-250 conforming to IS:2062.

12.3.5 All materials shall be hot dip galvanized conforming to relevant BIS standard with min. thickness of galvanization 80 microns.

12.3.6 Wherever the pile shaft is required to be infilled with concrete grout, the same shall be of min. grade M30 (anti shrink).

12.3.7 The allowable axial design load (Direct compression & Pull out), Pa, of helical piles shall be the least of the following values:

(i) Sum of the areas of the helical bearing plates times the bearing capacity of the soil or rock comprising the bearing stratum.

(ii) Capacity determined from well-documented correlations with installation torque.

(iii) Load capacity determined from initial load tests.

(iv) Axial capacity of pile shaft.

(v) Axial capacity of pile shaft couplings.

(vi) Sum of the axial capacity of helical bearing plates affixed to pile.

12.3.8 The lateral allowable load capacity of the pile shall be calculated using P-Y analysis and shall be verified with field trials. The allowable design lateral load shall be equal to the min. of (i) the total lateral load producing max. lateral deflection of 5mm and (ii) 50% of the total lateral load at which the lateral displacement increases to 12mm.

12.3.9 Dimensions of the central shaft and the number, size and thickness of helical bearing plates shall be sufficient to support the design loads.

12.3.10 The Design Report shall include following details.

(i) Design loads

(ii) Geotechnical Strength Reduction Factors and supporting methodology

(iii) List of design standards

(iv) Design methodology and how specific loads such as seismic, lateral and settlement are addressed

(v) Founding stratum

(vi) Estimated length

(vii) Connection design and details between pile shaft & pile cap plate and Col base plate

(viii) Pre-production and production load testing to support design including acceptance criteria.

12.3.11 Helical piles shall be installed to specified embedment depth and torsional resistance criteria as per design. The torque applied during installation shall not exceed the maximum allowable installation torque of the helical pile

12.3.12 Special inspections shall be performed continuously during installation of helical pile foundations. The information recorded shall include installation equipment used, pile

dimensions, tip elevations, final depth, final installation torque and other pertinent installation data as required.

12.3.13 The installation of piles shall be done by an agency having adequate experience in helical pile construction.

12.3.14 The method statement for pre-production load testing (initial test) and construction of Helical Pile shall be submitted for review and approval. The method statement shall comply following requirements:

12.3.14.1 Helical pile pre-production load testing

The Piling Contractor shall provide a method statement for the pre-production load testing. The method statement shall be submitted 2 weeks prior to pile installation for testing and shall contain the following information (as a minimum):

- Programme of the testing, detailing the timing and sequence of each load test including any additional investigations proposed
- The general arrangement of the equipment
- A method for measuring the displacement at the head and toe of each test pile
- Template for the Pile load test report
- Confirming the criteria for determining the acceptability of the compression, tension and lateral load tests
- A contingency plan in the event that a load test is deemed not acceptable
- A procedure for verifying the capacity for each individual pile, this may include correlating the installation torque for each pre-production pile with the load test results
- All pile load tests shall be supervised by suitably experienced personnel, who are competent to operate, monitor and record each test throughout its duration. Each pile load test shall be continuously monitored throughout its duration.

12.3.14.2 Helical Pile Construction

The contractor shall provide a method statement for each piling operation to be undertaken in executing the Works. The method statement shall describe all proposed equipment and detail the construction sequence. The method statement shall be submitted with the tender and shall contain the following information (as a minimum):

- Programme of the works, detailing the timing and sequence of individual portions of the works

- Full details of the installation plant to be used, including manufacturer's information and proof of servicing/recent upkeep and calibration
- Proposed phasing of excavation/filling operations such that the design stresses in the piles (and any supporting frames) are not exceeded
- The contingency plan to be adopted, to minimize disruption and delay, in the event of encountering obstructions
- Anticipated noise levels (measured in dB) and vibration levels (measured in mm/sec) arising from piling operations (if applicable)

12.3.15 The Piling Contractor shall nominate a suitably experienced, professionally qualified engineer, as the "Piling Supervisor".

12.3.16 Unless specified else were, the field trials for initial load tests on concrete and helical/ screw pile shall conform to IS: 2911 (Part 4) & Practice Note-28 (IPENZ Engineers New Zealand) as applicable. The no. and location of such tests shall be as per the provisions stipulated under Cl. No. 26.8.

12.3.17 Contractor shall also carry out routine tests on 0.5 % of the total no. of working/ job piles as per provisions of IS: 2911 (Part 4). In case of unsatisfactory results, min. no. of routine tests may be increased up to 2% of the total no. of working/ job piles as per the directions of the Engineer.

13 Module Mounting Structure (MMS)

13.1 The module mounting structure design shall generally follow the existing land profile. The top of the table shall be in one plane.

13.2 In MMS analysis the column support shall be assumed at EGL/NGL.

13.3 In case of topographical variations more than 3°, the contractor shall carry out detailed study of its effect on array layout, shadow analysis and structural stability of MMS.

13.4 The structure shall be designed to allow easy replacement of any module and shall be in line with site requirements.

13.5 The MMS stub/ column, rafter, purlin, ties and bracing members shall conform to following Indian standards.

- IS: 2062 – Hot rolled Medium and High tensile structural steel
- IS: 811 – Cold formed light gauge structural steel sections
- IS: 1161 – Steel tubes for structural purposes
- IS: 4923 – Hollow steel sections for structural use

- Minimum grade of steel for sections conforming to IS: 811 & IS: 4923 shall be E350 conforming to IS: 2062 and Y_{St} 310 conforming to IS: 1608 respectively.

13.6 The contractor can also propose new light gauge structural steel or structural aluminum sections other than specified in IS: 811 subject to approval of the Engineer. In this case the contractor shall submit his proposal stating the technical advantages of the proposed sections for Engineer's review along with supporting literature and sample design calculations conforming to present specifications at the time of bidding.

13.7 The minimum thickness excluding anti corrosive treatment (BMT) of various elements of MMS structure shall be as following:

- Stub/ column – 3.15mm,
- Rafter – 2.5mm &
- Purlin & other members – 2.0mm

13.8 The primary loads and load combinations for design of MMS structure shall be as specified under Clause No. 10. The design shall be done by Working stress method and no increase in allowable stress shall be permitted.

13.9 The maximum permissible deflection/ side sway limits for various elements of MMS under serviceability conditions shall be as following:

- Lateral deflection/ side sway for Column – Span/ 240
- Vertical deflection for Rafter and Purlin – Span/ 180
- Lateral deflection for Purlin – Span/240

13.10 In case of natural frequency in first mode less than 5 Hz, the design of the MMS structure shall also be checked against dynamic effects of wind as per provisions of IS – 875 (Part-3) using gust factor method.

13.11 The purlins shall be provided with min. following tie/sag rods or angles or channels:

- 1 no., in the mid of each span and shall connect all the purlin members
- 1 no., diagonal, at each corner in end spans

13.12 Lateral restraint to compression flange if any due to PV panels is not permitted in purlin design.

13.13 The vertical diagonal bracing shall be provided in end spans and every alternate span of each unit (table) of MMS.

13.14 MMS shall support SPV modules at a given orientation & tilt and shall absorb and transfer the mechanical loads to the ground properly.

13.15 Welding of structure at site shall not be allowed and only bolted connections shall be

used.

13.16 The MMS structure shall be hot dip galvanized with minimum GSM 610 kg/ sqm and/or minimum coating thickness of 80 microns for protection against corrosion. Galvanization shall conform to IS-2629, 4759 & 4736 as applicable.

13.17 It is to ensure that before application of this coating, the steel surface shall be thoroughly cleaned of any paint, grease, rust, scale, acid or alkali or any foreign material likely to interfer with the coating process.

13.18 The bidder shall ensure that inner side is also provided with galvanization coating.

13.19 The galvanization shall be done after fabrication of members and cutting of holes to ensure galvanization of all cut/ exposed edges.

13.20 In case the proposed section is made up of Aluminum, anodized coating shall be Gr. AC25 and shall conform to IS: 1868.

13.21 The array structure shall be so designed that it will occupy minimum space without sacrificing the output from SPV panels at the same time.

13.22 Two numbers of anti-theft fasteners of stainless steel on two diagonally opposite corners for each module shall be provided. All fasteners both for MMS connections and fixing of PV Module shall be adequately protected from atmosphere and weather prevailing in the area.

13.23 Fasteners and washers to be used for erection of mounting structures and those for fixing Module over MMS shall be of stainless steel grade SS 304 & SS 316 with property class A2-70 conforming to relevant ISO standard and must sustain the adverse climatic conditions to ensure the life of the structure for 25 years.

13.24 Min. diameter of bolt for MMS connections shall be 10mm (12 mm in case of single bolt connection for seasonal tilt) except at column-rafter connection, where it shall not be less than 12mm (not less than 16mm in case of single bolt connection for seasonal tilt). In case of fixed tilt, min. two number of bolts shall be provided at each joint.

13.25 Modules shall be clamped or bolted with the structure properly. The material of clamps shall be Al / SS having weather resistant properties. Clamp/bolt shall have EPDM rubber washer and shall be designed in such a way so as not to cast any shadow on the active part of a module.

13.26 The MMS foundation shall be designed as per Cl. No. 12.

13.27 MMS column post supported with base plate secured to foundation shall be fixed with galvanized high strength “J” bolts conforming to specifications of IS: 4000/ IS: 1367 and relevant IS code Installation of foundation bolts and embedment of column leg in

foundation concrete shall be done by using template to ensure proper alignment. The underside of base plate shall be provided with anti- shrink grout.

13.28 In case the contractor proposes to extend the column leg to embed it in the pile/pedestal as an alternate fixing arrangement, the column member shall be extended for full depth of the pile (100mm cover at tip of the pile) with an end plate of min. 4mm thickness to be welded at the bottom of column leg. (However, for plants in coastal area or in case of marshy soil the column post shall be supported only with base secured to foundation through base plate and anchor bolt assembly and no embedment of column leg in foundation is permitted)

13.29 The array structure shall be grounded properly using maintenance free earthing kit.

13.30 The bidder/manufacturer shall specify installation details of the PV modules and the support structures with appropriate diagram and drawings.

13.31 The Bidder should design the structure height considering highest flood level at the site and the finished grade level. The minimum clearance between the lower edge of the module and the finished grade shall be the higher of (i) Highest flood level + 100mm and (ii) 500 mm, as applicable

13.32 The length of one unit (Table) of MMS shall not generally be more than 20m.

13.33 The contractor shall submit the foundation and structural design basis for MMS along with the list of reference standards in his Bid duly certified by a Chartered Engineer having adequate successful experience in similar works which shall be finalized with the prospective bidder during pre-award. The MMS shall be designed to optimise tilt angle and elevation to minimise self-shading and maximise the capture of diffuse light by Bifacial Modules. The Bifacial Module frames shall be rail-edge mounted in landscape configuration to minimise losses.

13.34 The contractor shall submit the detailed design calculations and drawings for MMS structure, bill of materials and their specifications/ standards to the Employer for approval before start of fabrication work as per the engineering work program (L2 schedule) as finalized during kick-off meeting.

13.35 The length of any cold formed section (CFS) shall not be more than 5.5 m.

13.36 In case of seasonal tilt, the front and back bracing members (subject to seasonal rotation) shall be connected to rafter or column through gusset plate and shall not be connected directly to the column or rafter.

13.37 The purlin splice shall be near the zone of contra-flexure, i.e. within a distance of 0.15L to 0.25L from the support, where L is the respective span within which splicing is

located.

13.38 The purlin splice shall comprise of flange and web splice plates and splice design shall conform to Annexure-F of BIS:800. For simplicity in fabrication, the splice member may be of CFS channel section without lips (CU). There shall be min. four number of bolts on either sides of joints in web zones and one number of bolt on either side of joint in flange zones.

13.39 For same member type, same section shall be used.

13.40 When any sag or tie member to the purlin (rod, angle or channel) is provided, it shall not be considered in modelling the structure for analysis except its effect as lateral support to the purlin members in strength design.

14 Concrete Works

14.1 Construction of all RCC works shall be done with approved design mix as per IS 456 and the materials used viz. Cement, coarse & fine aggregate, Reinforcement steel etc. shall conform to relevant BIS standards.

14.2 The min. grade of concrete shall be M25 (M30 in coastal areas/marshy soil) for all RCC works except liquid retaining structures like underground water tank, septic tank, etc. where minimum grade of concrete shall be M30 (M35 in coastal areas/marshy soil).

14.3 Cement higher than 43 Grade shall not be used in construction.

14.4 Unless otherwise specified elsewhere, PCC shall be of min. grade M10 (nominal mix 1:3:6) except for mud mat, back filling of ground pockets or leveling course which shall be of grade M7.5 (nominal mix 1:4:8).

14.5 Reinforcement steel shall be of high strength TMT bars of grade Fe500 D conforming to IS: 1786.

14.6 Unless specified otherwise for grouting works anti shrink ready mix grout of approved make or cement mortar (CM) grout with non-shrink compound shall be used. The grout shall be high strength grout having min. characteristic strength of 35 N/mm^2 at 28 days.

15 Miscellaneous Steel Works

15.1 Unless otherwise specified elsewhere, all structural steel work shall be designed as per provisions of IS: 800 with working stress method of design (WSD).

15.2 Structural steel hot rolled sections, flats and plates shall conform IS: 2062, structural Pipes shall be medium (M)/ high (H) grade conforming to IS: 1161, chequered plate shall conform to IS: 3502 and Hollow steel sections for structural purposes shall conform to IS: 4923.

16 Buildings and Plinth for Open Installations

16.1 General Requirement

16.1.1 Plant buildings and plinth for open installations are required to be constructed for housing the electrical equipment/ panel (Local Control Room Building - LCR) and Control room cum office cum store (Main Control Room Building - MCR) for operation and maintenance of Photovoltaic Solar Power Plant. Security room at main gate & Security cabin(s) (at strategic locations) shall also be provided to secure the plant from any theft/ burglary/unauthorized entry.

16.1.2 Unless otherwise specified elsewhere, all buildings and plinth for open installations except Security room/ cabin shall have RCC framed structure. Masonry partition walls shall be provided for Kitchen, Pantry, Battery room and Toilet units. For other rooms AL Glass partitions shall be provided. The plinth for open installations and equipment area shall be designed with OEM requirements. The security room/ cabin(s) shall be of prefabricated structure.

16.1.3 All buildings shall have provision of adequate windows for natural light & ventilation, fire safety provisions and shall be designed as per provisions of National building code (NBC).

16.1.4 The contractor shall submit the proposed equipment layout drawings to the Engineer for approval before development of Architectural drawings. The building layout, exterior elevations shall be aesthetically designed following good architectural practices to get a pleasant look. Horizontal/ vertical bands through projections/ groves in external plaster may be provided to break the monotony. Roof slab shall have projection of 450mm beyond external walls with RCC parapet wall of 450 mm clear height all-around which shall form a projected band at roof level. For weather protection all doors and windows shall be provided with 450mm wide RCC chajja. However, chajja for rolling shutter shall be 750mm wide.

16.2 Functional requirements

16.2.1 MCR Building

For operation & maintenance of SPV Plant, unless otherwise specified elsewhere, Control room cum office area of MCR building shall provide following facilities.

- Air-conditioned area (with provision of split A/C unit of adequate capacity) for SCADA room (min. carpet area 12m^2), Conference room (min. carpet area 20 m^2) & Supervisor cabin and office area (min. carpet area 20 m^2)
- Inverter/ Switchgear, equipment room(s) as per OEM requirements

- Store cum record room (min. carpet area 15 m^2)
- Battery room as per requirement
- Toilet block with separate gents and ladies wash room facilities (min. total carpet area 12 m^2)
- Pantry with service platform and utensil washing facilities (min. carpet area 5 m^2)
- Suitable provision for passage (for smooth movement of O & M personnel), cable trenches, operating area etc. (min. clear width 1500mm)

16.2.2 LCR/ ICR

- Inverter and associated equipment shall be installed on plinth as open installations. They shall generally comprise of data loggers, battery, inverter, electrical panels, etc. as per requirements and as per approved system drawings.
- There shall be suitable provision for easy/smooth passage of O&M personnel, cable trench, operating area, etc.
- The plinth supporting the ICR/LCR equipment shall have RCC framed structure with foundations, columns and beams up to plinth level (FFL).
- The size and clear head room (below soffit of beam) for LCR/ICR shall be provided as per system/O&M requirements.
- In case of indoor installation of inverters, MCR and LCR/ICR building shall not be clubbed together unless specified otherwise.
- However, when LCR/ICR and MCR building facilities are clubbed in one single building, the Equipment area (inverter room) and Office cum Control room area shall be separated by a brick wall with provision of internal entry door.
- MCR building shall have separate main entry to office area plus a provision of fire exit door.
- The size of inverter/HT panel room shall be provided as per system requirements.

16.2.3 Security Room/ Cabin

16.2.3.1 Contractor shall provide required number of pre-fabricated security cabins at strategic locations & at corners of the plot and 1 nos. security room at Main entry gate.

16.2.3.2 The Security room shall be of min. size 3m x 3m x 2.75m height. The Security cabin shall be of min. size 1.2 x 1.8m x 2.5m height.

16.2.3.3 Security room/ cabin shall be a pre-engineered & pre-fabricated structure. The walls and roof of the building shall be fabricated with double skin insulated sandwiched

Al-Zn alloy coated high tensile steel metal panels (BMT- 0.5mm, Al-Zn alloy coating -150 GSM total on both sides). The insulation shall be of PUF with min. density 40 kg/ cum and adequate thickness. Roof shall be provided with suitable slope, not less than 10° to the horizontal (approx. 1V:6H) for proper drainage of rain water and shall project 300mm beyond the walls. The make and (color) shade of pre- coated metal panels shall be subject to approval by the Engineer. Min. thickness of color coating shall be 20 micron (DFT) excluding prime coat 5 micron (DFT). The coating system shall confirm to IS: 15965.

16.2.3.4 The Main security room shall be provided with one Aluminum (AL) glazed door (0.75m wide x 2.1m height) on one face and AL glazed sliding windows (1.2m width x 1.0 m height) with AL grill on remaining three sides. Security cabin shall have one AL glazed door (0.75m widex2.1m height) and 1 no. AL sliding window (0.8m width x 1.0 m height) with AL (anodized) grill on one side. All glazing shall be of clear float glass with thickness of 4mm for window and 6 mm for door panel.

16.2.3.5 The door and windows shall be provided with all necessary fitting and fixtures like handles, tower bolts, mortise lock for door, stays, door stopper etc. All AL sections for doors and windows shall be anodized (min. average thickness 25 microns) or polyester powder coated (min. DFT 50 microns) with approved color shade for protection against weather.

16.2.3.6 Specially coated/ SS self-drilling screws/ fasteners conforming to class 3 as per ASTM: 3566.1 and 3566.2 shall only be used for all connections.

16.2.3.7 Anchor/ foundation bolts shall conform to IS: 5624 and IS 800.

16.2.3.8 The Security Cabin may be installed on concrete M20 skid platform (min. 250 mm thick, over 250 mm thick compacted rubble soling with interstices filled with sand). The top of skid shall be 200 mm above FGL. The concrete skid shall be provided with shrinkage reinforcement (8 dia @ 200 c/c both ways) near top surface. The concrete skid shall project 200mm beyond the walls.

16.2.3.9 The Security Room shall be supported on RCC framed structure with foundations, columns and plinth beams with 450 high plinth above FGL.

16.2.4 Portable Cabin

16.2.4.1 Portable cabin shall be of size 15 x 10 x 8.6 feet (clear dimensions i.e. available volume) for MCR and Store Room. For other buildings, appropriate sizes as per available space and design may be proposed.

16.2.4.2 The main fabrication of the structural frame work shall be integral and all welded (CO2 welding) type to comprise of the bottom, top, side & overall frame work. Self-draining roof and desired door-window with Insulation & electrical fittings inside the cabin. The structure should be durable, fire proof, light, sturdy, termite and water proof.

16.2.4.3 The Portable cabin for MCR shall have provision for partition walls for a Supervisor Room and seating area for 4 O&M personnel.

16.2.4.4 Detailed Specifications

Component	**Description**	**Reference Standard**
Bottom/base frame	100 mm specially formed channel	IS 2062 for MS or IS 808 for Rolled section
Top frame	75 x 75 sq. mm pipes/tubes	IS 4923 (tube) IS 1239 (pipe)
Stiffeners Bottom	100 x 50 mm specially formed channels	IS 2062 or IS 808
Stiffeners Top	45 x 45 x 5 mm & 45 x 45 x 5 mm M.S Tee	IS 2062 or IS 808
Side Post	Specially formed 3.15 mm M.S post section	IS 2062
Side wall stiffeners	Specially formed 2.00 mm M.S channels	IS 2062 or IS 808
Panelling outside	M.S Corrugated sheet (10 gauge)	IS 2062
Internal wall panelling	8 mm Pre-laminated sheet for wall	
Roof outside	M.S Plain sheet (18 gauge) with efficient drain of rain water and to avoid collection of dust leaves etc on the roof	IS 2062
False ceiling	5 mm 100% water proof sheet	-
Bottom flooring	10 mm MS Chequered Plate	IS 2062
M.S door	50 mm insulated M.S Door of size- 3' x 6'6" with hydraulic door closer, locks, handles. Doors shall be fixed with heavy gauge	IS 2062 For Hinge – IS 1341/1992 For Hydraulic Door Closer – IS 3564/96 Type-2

	MS hinges Weather shed for door.	
Insulation	1.At four side walls by 50 mm Glass wool insulation covered with 8 mm pre-laminated sheet 2. At ceiling by 100 mm Glass wool insulation covered with 5 mm pre-laminated sheet (100% water proof) (All the Glass wool density-24)	Glass wool; IS 8183/93

16.2.4.5 Accessories

Wiring	Concealed wiring – PVC conduits using fire resistance wires
Electrical Fitting/cabin	1. Tube lights – 02 nos. 2. Door lights – 01 no. 3. Fans – 01 no. 4. Switches & sockets: 6 amps – 01 no. & 16 amps – 01 no.
Furniture (for MCR)	Office Chairs with swivel mechanism, wheels and adjustable height - 6 Nos., 4 seater Round Discussion Table –1 No., Supervisor Desk Table with Drawers for Supervisor – 1 No.,
Painting	Phosphating the cabin internally and painting with coat of epoxy primer (anti corrosive paint) & two coat of epoxy texture paint (corrosion resistant paint) of reputed make. The external surface of the cabin shall be painted with two coats of epoxy texture paint (corrosion resistant paint) of reputed make. The roof of the cabin painted with polyurethane paint.
M.S Racks with shutter OR Storage Cup board	M.S Storage Cupboard - 06 nos. Each Cup board made of M.S with full height door of size-4' 10" (width)x 2'6" (depth) x 6'(ht) comprising with 02 partitions at 2 ft height
Dummy plate	Size- 3'5" x 3'5"

16.2.4.6 The portable cabin for MCR shall be provided with adequate number of split type air conditioning units and fans.

16.2.5 Pre-Engineered Building (PEB)

16.2.5.1 General:

The PEB shall be made of structural steel construction with double skinned metal roofing and wall cladding of appropriate profile. PEB shall be complete with painting, metal fascia, metal gutter, rain water down comers, sun-shades, openings, etc., along with associated structural steel, cladding and roofing work insulation, Trims & Flashings. Each item of PEB like panels, masonry, plastering, flooring, foundation, fittings etc. shall be suitable for complete life of solar plant. The construction methodology for PEB shall also be submitted to the Employer/Owner for approval before start of works.

16.2.5.2 Structure and material specification

Component	**Description**	**Reference Standard**
Primary Structural Members: including the transverse rigid frames, columns, corner columns, end wall wind columns, beams, truss member, base pate.	Steel frame members with minimum thickness 4 mm with minimum yield strength of 345 MPa	IS2062 min Grade E250 Quality BR/ ASTM A572-12 Grade 50
Secondary Members: including the purlins, Girts, eave struts, bracing, flange bracing, base angles, clips, flashings and other miscellaneous	Minimum thickness 3.15 mm. Secondary members for purlins and Girts shall have minimum yield strength of 345 MPa. Miscellaneous secondary members shall have minimum yield strength of 250 MPa.	IS 811 or ASTM A1003-12 steel sheets conforming to ASTM A1011-12b Grade 50

structural parts. Suitable wind bracings sag rods to be reckoned while designing the structure.		
Wall Cladding	Insulated wall cladding or roofing shall consist of double skin metal cladding with Poly Urethane Foam (PUF). PUF must be made of continuous method PU foam and must be CFC free, self-extinguishing, fire retardant type with density 40 +/-2 kg/m3 and thermal conductivity 0.019-2.2 W/(m.K) at 10°C. The PUF panels shall be a factory made item ready for installation at site.	
Design Parameters and Design Loads:		
Dead Load:	Self-Weight of Structure including Purlins, Sheeting, Girts, Bracings, weight of turbo ventilators to be added as Dead load etc. Imposed Load (Live Loads) Live loads shall be as per IS – 875. For sloped roofs up to 10 deg. it shall be 0.75 KN/M².	
Wind Load:	Design wind speed factors shall be as per IS: 875-III, however the minimum value of these factors shall be considered as K1 = 1.0, K2 = 1.0 & K3 = 1.0 for the design of PEB.	
Earthquake Load:	All PEB structures shall be designed for Seismic forces. Vertical Deflection and Horizontal Sway	

	Limits: a) Limiting Deflection: The limiting permissible vertical deflection for structural steel members shall be as per IS 800 2007. b) The limiting permissible horizontal deflection for as per IS 800 2007 code where 'h' is height of building at eaves.	
Paint and Coating:	Steel shall be colour coated with total coating thickness of 25 microns (nominal) dry film thickness (DFT) comprising of silicon modified polyester (SMP with silicon content of 30% to 50 %) paint or Super Durable Polyester(XRW) paint of 20 microns (nominal) on one side (exposed face) on 5 micron (nominal) primer coat and 10 microns (nominal) SMP or Super Durable Polyester paint over 5 micron (nominal) primer coat on other side. SMP and polyester paints system shall conform to Product type 4 as per AS/ANZ 2728. The structural steel shall be hot-dipped galvanized, conform to IS: 4759 or relevant Indian standard	
Plinth Protection:	750mm wide plinth protection minimum 75 mm thick of cement concrete 1:3:6 (1cement : 3 coarse sand : 6 graded stone aggregate 20 mm nominal size) over 75 mm bed of dry brick ballast 40 mm nominal size well rammed and consolidated and grouted with fine sand including finishing the top smooth, shall be provided around the Pre-Engineered Building.	
Rolling shutter:	Rolling shutter (Hand operated) shall be fabricated from 18 gauge steel and machine rolled with 75 mm rolling centres with effective bridge depth of 12 mm lath sections, interlocked with each other and ends locked with malleable cast iron clips to IS:2108 and shall be designed to withstand a wind load without excessive deflection. Metal rolling shutters and rolling grills as IS: 6248.	

Windows Frame:	Aluminium black powder coated section, frame shall be of 92x31 mm, minimum 16G thick as per approved design. Tinted glass and aluminium grill shall be provided.
Roof Insulation and type	Both metal sheets shall have an under insulation of minimum 70 mm thick PUF with density 40 +/- kg/m3 and thermal conductivity 0.019-2.2 W/(m.K) at 10°C with gutters and down take pipes along with Flashing & Top cap of required size and colour complete with all necessary hardware. Roof shall be projected at-least 300 mm from the wall. Stiffening ribs / subtle fluting for effective water shedding and special male / female ends with full return legs on side laps for purlin support and anticapillary flute in side lap shall be provided. Both upper and lower sheets shall be separated through spacers and fastened through zinc /zinc-tin coated self-drilling screws. The fastener size shall be calculated as per the design or manufacturers recommendations. Contractor may also alternatively made the PEB roofing with composite slab (RCC slab with permanent formwork). The composite slab scheme, design and drawings shall be subject to approval from Employer/Owner before start of work.
Wall Insulation	All voids of external and internal metalled walls shall have an under insulation of minimum 60 mm thick PUF with density 40 +/- kg/m3 and thermal conductivity 0.019-2.2 W/(m.K) at 10°C with proper supports etc. as approved. Both the walls should be separated by spacers system made up of cold formed steel bars and fastened through zinc /zinc-tin coated self-drilling screws.

16.3 The Design and drawings shall be submitted for approval prior to fabrication and installation.

17 Flooring, Skirting and Dado

17.1 Store area, Equipment Area

40 mm thick Cement concrete (IPS) flooring (1:2:4), aggregate size 10 mm down, conforming to IS 2571 with 2mm thick Heavy-duty epoxy coating (Industrial grade) of approved make on top as per manufacturer specifications and 10mm thick matching skirting of 100mm height.

17.2 SCADA Room, Control cum Office Room, Supervisor Room and Lobby

1200 mm X 1200 mm thick Heavy duty vitrified tile (8mm thick or more) flooring with matching skirting of 100mm height.

17.3 Battery Area/Room

Acid/ Alkali resistant tile flooring and 2100 height dado, Floor and dado tiles - 20mm and 12 mm thick respectively. However, in case of maintenance free batteries, vitrified tile (8mm thick) flooring and dado shall be provided.

17.4 Toilet

- 40 mm thick Ceramic tile (8mm thick) flooring and glazed tile (6mm thick) 2100 height dado.
- 20mm thick Granite stone finish over platform for wash basin.

17.5 Pantry

40 mm thick heavy duty vitrified tile (8 mm thick) flooring and glazed tile (6mm thick) 2100 mm height dado, 20mm thick Granite stone finish over service platform.

17.6 Passage/ Corridor

40 mm thick Heavy duty vitrified tile (8mm thick) flooring with matching skirting of 100mm height.

17.7 Steps

Kota stone (20 thick) or 50 thick cement concrete (IPS) flooring conforming to IS 2571.

17.8 All items shall be of reputed make. Only Items with approved samples by the Engineer shall be used.

18 Doors and Windows

18.1 Doors, windows, louvers and ventilators shall be made of AL sections (minimum average thickness for windows and ventilators- 2.0mm, for partitions and doors- 2.5 mm), industrial grade, anodized (grade AC25, min. thickness 25 micron conforming to

IS: 1868) or with polyester powder coating (Total DFT 50 microns conforming to IS: 13871) and shall be of approved make & colour shade. All sections, fittings and fixtures shall be anodized (min. thickness of coating 20 micron). The window and door shutters shall be of clear float/ wired/ ground glass as per design/ functional requirements. The doors in toile area shall be of steel frame with solid core (MDF) flush shutter, 35mm thick, with laminated finish on both sides conforming to IS: 2202.

18.2 AL Louvers, duct/ ventilation openings shall be provided as per functional requirement.

18.3 All doors, windows and ventilators shall be provided with all necessary fittings and fixtures like handles, tower bolts, wind stays, hinges etc. of heavy duty anodized AL. All doors shall be provided with hydraulic door closure of required capacity.

18.4 All windows shall be provided with suitable AL grill of anodized sections with adequate thickness for security purposes.

18.5 Clear float glass for window and door shutter shall be of min 4mm and 6mm thickness respectively. Wired/ ground glass where provided shall be of min thickness 6mm.

18.6 Entrance door and door in passage shall be min. 1.5m wide (double leaf) x 2.1 m height while door for Conference room and Store room shall be min. 1.2m wide x 2.1m height. All other doors shall be min. 1.0m widex2.1m height except for WC which may be of 0.8m width.

18.7 Rolling shutters shall be of required size and shall be made of cold rolled steel strips with adequate gauge thickness (min. 18 gauge) and shall conform to IS 6248. Rolling shutter shall be provided with all fixture, accessories, paintings etc. all complete and shall be mechanically operated type.

19 Roofing

19.1 The roof of all buildings shall be provided with min. slope of 1:100 for effective drainage of rain water. The slope shall be achieved either by application of screed concrete of grade 1:2:4 (with 12.5mm down coarse aggregate) with min. 25mm thick CM 1:4 layer on top to achieve smooth surface to facilitate application of water proofing treatment.

19.2 The water proofing treatment shall be in situ five course water proofing treatment with APP (Atactic Polypropylene) modified Polymeric membrane over roof consisting of first coat of bitumen primer @ 0.40Kg per sqm, 2nd & 4th courses of bonding material @ 1.20 kg/sqm, which shall consist of blown type bitumen of grade 85/25 conforming to IS : 702, 3rd layer of roofing membrane APP modified Polymeric membrane 2.0 mm thick of 3.00 Kg/sqm weight consisting of five layers prefabricated with centre core as 100 micron HMHDPE film sandwiched on both sides with polymeric mix and the

polymeric mix is protected on both sides with 20 micron HMHDPE film. The top most layer (5th layer) shall be finished with brick tiles of class designation 10 grouted with cement mortar 1:3 (1 cement: 3 fine sand) mixed with 2% integral water proofing compound by weight of cement over a 12 mm layer of cement mortar 1:3 (1 cement: 3 fine sand) and finished neat. The water proofing treatment shall be extended over golla/ fillet and inner face of the parapet up to 450mm height.

19.3 The corners at parapet wall and slab shall be provided with 50 thick fillet/ golla in CM 1:3 with neat finish.

19.4 Required no. of rain water down take pipes min. 100mm dia. PVC pipes (UV resistant), with 450x450mmx15mm deep khurra and MS grill at inlet shall be provided for rain water disposal.

20 Plinth protection and drain

20.1 750mm wide plinth protection with min. 75mm thickness of PCC (1:3:6) over 75 mm thick bed of dry brick ballast, 40mm nominal size well rammed and consolidated and grouted with fine sand, shall be provided around all the buildings.

20.2 A peripheral drain (except for Security room/ cabin) of min. internal size 250mm x 250mm with brick walls in CM 1:6 over 75mm thick PCC (1:3:6) bedding with 12mm thick plaster in CM 1:5 and 25thk PCC (1:3:6) coping at top shall be provided along the periphery of the plinth protection for collection and disposal of rain water from building roof.

21 Plinth filling for buildings

Plinth beam, when provided, shall be taken minimum 200mm below FGL. The plinth filling below Ground floor (GF) for all buildings shall be provided with following specifications.

(i) Well compacted sub-grade
(ii) Well compacted boulder soling with interstices filled with sand over compacted sub-grade.
(iii) 75mm thick PCC 1:3:6 over (ii)
(iv) 100mm thick PCC 1:2:4 over (iii)
(v) 40mm thick floor finish over (iv)

22 Anti- termite Treatment

In case of presence of termites at the project site, an anti-termite treatment shall be provided for all foundation pits and building plinth in MCR building conforming to IS: 6313 to control entry of termites

23 Plumbing & Sanitary Works

23.1 Toilet block shall have following min. fittings:

- Wall mounted WC (Western type) 390 mm high with toilet paper roll holder, low height flushing tank and all fittings
- A set of 2 wall mounted Urinals (430 x 260 x 350 mm size) with flushing tank and all fittings (Gent's wash room only)
- Wash basin (550 x 400 mm) over concrete platform with all fittings including 2-pillar cocks
- Wall mirror (600 x 450 x 6 mm thick clear float glass) with hard board backing
- CP brass towel rail (600 x 20 mm) with C.P. brass brackets – one each in common area and bathroom (bathroom if applicable)
- Soap holder and liquid soap dispenser one each in common area and bathroom (bathroom if applicable)
- Shower and mixer for hot and cold water in bathroom (if applicable)
- Ventilators – Mechanical exhaust facility of adequate capacity
- Overhead PVC water storage tank – Capacity 1000 litres (common for both wash rooms) (2000 litres in case bathroom is to be provided)

23.2 Pantry room shall be provided with kitchen sink cum drain board and provision for installation of Water Cooler.

23.3 One toilet room with provision of WC and Wash basin shall be provided at Security Room near main gate.

23.4 Necessary plumbing lines for MCR building and Security Room near main gate.

23.5 All sanitary ware, fittings and fixtures shall be of reputed Make and Type and approved by the Engineer. All fittings, fastener, grating shall be of CP brass conforming to relevant BIS standards.

24 Painting & Other Finishes

Painting and white wash/ colour wash for the buildings shall conform to relevant BIS standards. The make and colour shade of the finish shall be as advised and approved by the Engineer.

Internal Walls except toilets & battery room	Acrylic emulsion (for MCR) & Oil bound distemper (for LCR/ Security Room)
Battery room	Acid/ Alkali resistant tiled dado of 2100 mm height & Acid resistant resin-based epoxy paint above dado (Vitrified tile flooring and dado with oil bound distemper in case of maintenance free batteries)
Toilet	Oil bound distemper
External Walls	All weather proof cement based acrylic emulsion paint, exterior grade
MMS foundations/ Earth pit Enclosure	Cement paint
Underside of roof slab	White wash
Air-conditioned areas	Underside of roof slab- Under deck insulation with 50mm thick mineral wool, min. density 45 kg/ m3 and Gypsum board false ceiling with GI grid/ Gypsum tile (600x600 mm x 12 thick) false ceiling with AL grid as per manufacturer's details
Structural steel work	2 coats of synthetic enamel paint over 2 coats of suitable primer

25 Air conditioning & Ventilation for MCR and Other Buildings

25.1 All buildings shall be equipped with appropriate numbers of fans for effective heat dissipation.

25.2 In MCR building, the supervisor room, Conference room and SCADA room shall have split type air conditioning units.

26 Fire Extinguishers

26.1 All buildings shall be installed with required no. of fire extinguishers as per relevant BIS standard and NBC. LiquefiedCO_2/ foam/ ABC type fire extinguisher shall be upright type of capacity 10kg conforming to IS: 2171, IS: 10658.

26.2 The fire extinguisher shall be suitable for fighting fire of Oils, Solvents, Gases, Paints, Varnishes, Electrical Wiring, Live Machinery Fires, and all Flammable Liquid &Gas.

27 Sand buckets

27.1 Sand buckets shall be wall mounted made from at least 24SWG sheet with bracket fixing on wall conforming to IS: 2546.

27.2 All buildings shall be provided with required no. of sand buckets as per relevant BIS

standard and NBC. 4 No. of Bucket stands with four buckets on each stand shall be provided in the Transformer Yard.

28 Sign Boards and Danger Boards

28.1 The sign board containing brief description of major components of the power plant as well as the complete power plant in general shall be installed at appropriate locations of the power plant as approved by Engineer

28.2 The Signboard shall be made of steel plate of not less than 3 mm. Letters on the board shall be with appropriate illumination arrangements.

28.3 Safety signs, building evacuation plan and direction signs, assembly points shall also be placed at strategic locations.

28.4 The Contractor shall provide to the Engineer, detailed specifications of the sign boards.

29 Masonry Work

29.1 The masonry work shall be of bricks, laterite blocks (as per site conditions) or concrete blocks.

29.2 All external walls of buildings shall be 230mm and internal walls shall be 230mm or 115mm as per requirements.

29.3 All concrete block masonry walls shall be min. 200mm thick.

29.4 Brick work shall be in cement mortar (CM) 1:6 & 1:4 for 230 mm and 115 mm thick brick wall respectively unless specified.

29.5 Unless otherwise specified elsewhere, Bricks shall be of class designation 7.5 conforming to IS: 1077, IS: 2212 & IS: 3495.

29.6 All concrete blocks shall be of min. compressive strength of 7.5 N/mm2 and shall be of Grade-A conforming to IS: 2185.

29.7 The laterite blocks shall conform to IS: 3620.

29.8 All buildings shall be provided with suitable damp-proof course (DPC). The DPC shall be with PCC (1:2:4) using 6 down coarse aggregate and water proofing admixture. The min. thickness of DPC shall be 40mm.

29.9 The construction of brick masonry shall conform to IS: 2212. Construction of Concrete block masonry shall conform to IS: 2572.

30 Plastering, Pointing & Coping Works

30.1 All brick masonry work shall be provided with plaster.

30.2 Wall and ceiling plaster shall be in cement mortar (CM) 1:6 and 1:3 respectively.

30.3 Thickness of plaster shall be 18mm and 12mm respectively for rough and smooth

surface of the masonry wall. The ceiling plaster shall be 6mm thick.

30.4 All joints in stone masonry shall be raked and pointed in cement mortar (CM) 1:3 except specified otherwise.

30.5 Exposed top surface of brick or stone masonry shall be provided with 25 mm thick plain cement concrete (PCC) coping (1:2:4) with trawl finish. All exposed coping shall be provided with suitable slope and projection for easy drainage of water.

30.6 All door and window chajja shall be provided with 10mm wide drip course.

31 Building Water Supply & Plumbing Works

31.1 C-PVC pipes shall be used for all internal building water supply works while all external water supply pipes shall be uPVC conforming to relevant BIS standard.

31.2 Rain water pipe shall be of PVC conforming to relevant BIS standard.

31.3 All sewerage, waste water and ventilation pipes shall be of HDPE conforming to relevant BIS standard.

31.4 MCR building and Security room shall be connected to Sewage treatment facility including all associated works like Manholes etc.

32 Sewage Treatment facility

32.1 The Contractor shall design & provide soak pit and RCC Septic tank for treatment of sewage and waste water from MCR building and Security room. The septic shall be designed as liquid retaining structure conforming to IS:3370 for design loads as specified under Cl. No. 35. However, in case of ground water within 1.5m of finished grade level or the soil strata being of low permeability (permeability ≤ 10^{-6} m/s) where septic tank and soak pit arrangement is not effective, suitable packaged sewage treatment plant of reputed make/manufacture shall be provided. The sewage treatment facility shall be of required capacity and of proven design suitable for total of 15 people.

32.2 The design and drawings shall be submitted for approval prior to execution.

33 Pipe & Cable Trenches

33.1 All trenches inside the building and transformer area shall be of RCC. The min. wall and base slab thickness shall be 100mm for depth ≤ 850mm and 150mm for depths > 850mm.

33.2 The trench shall be designed for loads as specified under 'Design Loads'. External trenches shall be kept min. 100mm above FGL to avoid entry of rain water. In case of straight length of the trench being more than 40m, suitable expansion joints with PVC water stop shall be provided.

33.3 Internal trenches (inside buildings) shall be provided with chequred plate (min. 8mm thick with stiffening angle ISA 50x50x6 @ 750 mm c/c for trench width greater than 800 mm) covers while external trench shall have precast concrete covers.

33.4 Min. thickness of precast cover shall be 50mm. Both bearing edges of the cable trench and all edges of pre-cast concrete covers shall be provided with min. 50x50x6 mm edge protection angle with lugs.

33.5 The trench cover (chequered or pre – cast both) shall be provided with suitable lifting hooks.

33.6 As required suitable MS insert plates shall be provided on trench wall to support the cable rack/ pipe.

33.7 The trench bed shall have a slope of approx. 1(V):250(H) along and 1(V):50(H) across the length of the trench. The cable trench shall have a dewatering sump (s) of size 450x450x450 mm depth at suitable location to facilitate collection & pumping out of rain water from the trench.

33.8 The external buried cables shall be laid in excavated trench as specified under specifications for Electrical works. The sand for filling shall be of Grade – IV conforming to IS: 383.

34 Transformer Yard Civil Works

34.1 Transformer and equipment foundations shall be founded on piles/isolated spread footings or block foundation depending on the final geotechnical investigation report and functional requirements.

34.2 In case of transformer oil tank capacity ≥ 2000 litres, the transformer foundation shall have its own soak pit which would cover the area of the transformer and cooler banks, so as to collect any spillage of oil in case of emergency. The retention capacity of the soak pit shall be equal to volume of the transformer oil (excluding free space above gravel) and it shall be filled with granite stone gravel of size 40mm, uniformly graded, with 200 mm free space above gravel fill.

34.3 In case of transformer oil tank capacity more ≥ 20000 litres, the soak pit shall be connected to a separate burnt oil pit through discharge pipe (300 mm dia) and shall be suitably sized to accommodate full oil volume (excluding free board above inlet pipe) of the transformer connected to it, without backflow. In this case the capacity of the soak pit may be reduced to min. 1/3rd of the total transformer oil volume. The burnt oil pit shall be further connected to oily water drainage system. The water shall be discharged into the nearest drain by gravity flow or pumping after suitable treatment as

per statutory and code provisions.

34.4 Both, the transformer soak including side walls and the burnt oil pit shall be of RCC and shall be provided with sump (min. 500 mm x 500 mm x 400mm deep) and slope of 1:50 in concrete screed of 1:1 – ½:3 to the floor slab towards the sump pit. The oil collection pit shall be provided with 20mm dia. MS rung ladder with 2 coats of epoxy paint over 2 coats of primer, a manhole & removable RCC cover. The inside of oil collection pit shall be plastered with 6 mm thick CM 1:6 and painted with 2 coats of epoxy paint over 2 coats of primer.

34.5 The area around the transformer and equipment shall be covered with uniformly graded granite stone gravel of size 40mm.

34.6 The area shall be provided with galvanized chain link fence of height min 1.8m with 3.5m wide gate. The specifications for fencing shall be similar to those specified under Cl. No. 31.3 except fence post which shall be of MS angle (ISA 65x65x6) spaced at 2.5 m c/c.

34.7 The Gate of size 3.5m shall be of MS pipe (medium class conforming to IS: 1161) frame with hard drawn steel wire fabric mesh (50x50mmx3mm thick conforming to IS: 1566) including all accessories and fittings. MS angle posts shall conform to IS 2062.

34.8 In addition to main gate a wicket gate of MS pipe (medium class conforming to IS: 1161) frame with 1.0 m width with hard drawn steel wire fabric (50x50x3mm thick conforming to IS: 1566) shall be provided for man entry for maintenance purpose.

34.9 The transformer yard fencing work shall conform to CEIG requirements.

34.10 The requirement of fire barrier wall between transformers shall be as per Electricity Rules and IS: 1646 recommendations. Minimum wall thickness shall be 230mm for RCC wall and 300mm for masonry wall.

35 Potable Water Supply & PV Module Cleaning System

35.1 The contractor shall design and install the effective module cleaning system.

35.2 A regular supply of suitable quantity of water shall be ensured by the contractor to cater day-to-day requirement of drinking water and for cleaning of PV modules during entire O&M period.

35.3 The Contractor shall estimate the water requirements for cleaning the photovoltaic modules at least once in two week or at closer frequency as per the soiling conditions prevailing at site, in order to operate the plant at its guaranteed plant performance. Also, the contractor is required to plan the water storage accordingly with provision of a tank of suitable capacity for this purpose. However, min. consumption of 2 Ltr / Sqm

of surface area of SPV module shall be considered in estimation of required quantity of water storage.

35.4 Water used for drinking & PV module cleaning purpose shall generally be of potable quality and fit for cleaning the modules with TDS generally not more than 75 PPM. In case of higher salt contents, the water shall be thoroughly squeezed off to prevent salt deposition over module surface. However, water with TDS more than 200 PPM shall not be used directly for module cleaning without suitable treatment to control the TDS within acceptable limits. The water must be free from any grit and any physical contaminants that could damage the panel surface.

35.5 If required, for settlement of any grit/ unacceptable suspended particles in the water a settling tank shall be installed before the inlet of the storage tank. Suitable arrangement for discharge/ disposal of sediment/ slush shall be provided in silting chamber by gravity disposal in surface drain or with provision of sludge sump and pump of adequate capacity.

35.6 The module cleaning system shall include construction of RCC tank or supply and installation of Ground mounted PVC tank (s) of required storage capacity, pumps (including 1 No. standby pump), water supply mains and flexible hose pipes, taps, valves (NRV, Butterfly valve, Ball valve, Gate valve, PRV, scour valve etc.), Water hammer arrester(s), pressure gauge, flow meter etc. as per the planning & design.

35.7 In case of over ground water storage tank, the contractor shall check its effect on plant performance through shadow analysis. The PVC storage tank shall conform to IS: 12701. The valves shall conform to IS: 778. A suitable metal sheet canopy for protection from direct sunlight shall be provided over the tank area.

35.8 The water supply mains could be either of GI, uPVC or HDPE, however, the vertical pipe connecting supply main to the discharge point shall be of GI.

35.9 Masonry chamber shall be provided for Main gate valve at pump end. Whereas, as per requirements, at other locations either a masonry or GI/ HDPE pipe chamber may be provided.

35.10 Module cleaning procedure and pressure requirement at discharge point shall be as per the recommendation of PV module manufacturer. However, discharge pressure at outlet shall not be less than 5 kgf/cm2(0.5 MPa)

35.11 All the pipes thus laid shall be buried in ground at least 150mm below FGL or laid above ground clamping on suitable concrete support blocks. In case of above ground piping only GI pipes shall be used.

36 Underground Water Tank

36.1 The top of the UG tank shall be 250 mm above FGL.

36.2 The tank shall have clear free board of 300mm above MWL.

36.3 The tank bottom shall have a slope of 1:100 towards drainage sump (500x500x500 mm deep). The slope shall be provided either in structural slab or in screed concrete (1:2:4) trawl finished. 1000x1000 mm size Manhole in roof slab and 20 mm MS rung ladder shall be provided for easy access to the storage tank and silting chamber for periodic cleaning. The manhole shall be covered with RCC precast cover. 50x50x6 mm MS angle with lugs shall be provided around precast cover and tank slab opening for edge protection. Rungs shall be painted with 2 coats of epoxy paint over 2 coats of primer.

36.4 The underground RCC tank shall be designed for following load conditions:

- External earth pressure + hydrostatic pressure due to ground water table (to be considered at FGL for design purposes) + Surcharge of 20 kN/ Sqm and Tank Empty.
- Tank full up to MWL and no external loads

36.5 The design shall conform to IS: 3370 with maximum crack width of 0.1mm for wall, bottom slab and roof slab. Min. grade of concrete shall be M30 (M35 in coastal areas, marshy and saturated soils) conforming to IS: 456. Suitable construction joints shall be provided as per provisions of IS: 3370 (Part 1). Water proofing admixture conforming to relevant BIS standard and of approved make shall be added to concrete as per manufacturer's recommendations.

36.6 The underground water tank shall be tested for water tightness as per the provisions of IS 3370 (Part-4). In case any leakage is noticed the same shall be repaired by injection of cement grout installing suitable nozzles around affected areas. Outside face of water tank in contact with water and soil and underside of roof slab shall be painted with 2 coats of epoxy paint.

37 Transmission Line Structures

37.1 Galvanized 220 kV and 132 kV Transmission Line towers, Tower extensions & accessories and 11 kV, 22kV, 22kV & 33 kV transmission poles, towers & accessories shall be designed following latest guidelines of respective SEB (State electricity board)/ STU (State transmission utility) and get approved from them before execution. In absence of SEB/ STU guidelines REC (Rural Electrification Corporation) standards may be followed. Support at corner with angle > 100 shall be provided with a 4-pole structure or a lattice tower structure. Use of PCC spun pole and RCC pole is not

acceptable.

37.2 Approved copies of these designs & drawings shall be submitted to the employer for reference and record.

38 Miscellaneous structures

38.1 Support structure for weather monitoring device

38.1.1 Weather monitoring device shall be mounted on tubular steel pole of required height. The pole shall conform to IS: 2713.

38.1.2 The pole shall be secured to an independent RCC foundation structure through Base plate and Anchor bolt assembly.

38.1.3 200 long 20 dia. rods shall be welded to the pole at 300 mm C/c for access to the device for maintenance purpose.

38.1.4 The support structure shall be hot dip galvanized.

38.2 Support structures for SMU

38.2.1 SMU shall not be supported from MMS and shall have an independent structural steel supporting frame of galvanized ISMC 75 with transverse diagonal bracings of ISA 65x65x6 to each column post.

38.2.2 Column post and bracings shall be supported with 300 mm (min.) diameter and 850 mm (min.) deep below GL piles in cement concrete (nominal mix 1:1:2). The column post and bracings shall be extended into the piles upto 800 mm with 50mm cover at the bottom.

38.2.3 The pile shall project 200 mm above GL.

38.2.4 The support structure shall hot-dip galvanized and of adequate height to ensure min. ground clearance of 1.0 m to SMU unit.

38.3 LA Mast and Foundation

38.3.1 The LA mast shall be a self-supporting structure with GI tubular pole of required height. The pole shall confirm to IS: 2713.

38.3.2 The pole shall be supported on RCC pedestal and foundation structure through Base plate & Anchor bolt assembly.

38.3.3 200 mm long, 20 dia rods shall be welded to the pole at 300 mm c/c for access to the device for maintenance purposes.

38.3.4 The support structure shall be hot-dip galvanized. Min depth of foundations shall be 1200 mm below GL.

D Quality Assurance and Inspection of Civil Works

1 Introduction

1.1 This part of the specification covers the sampling, testing and quality assurance requirement (including construction tolerances and acceptance criteria) for all civil and structural works covered in this specification.

1.2 This part of the technical specification shall be read in conjunction with other parts of the technical specifications, general technical requirements & erection conditions of the contract which covers common QA requirements. Wherever IS code or standards have been referred they shall be the latest revisions.

1.3 The rate for respective items of work or price shall include the cost for all works, activities, equipment, instrument, personnel, material etc. whatsoever associated to comply with sampling, testing and quality assurance requirement including construction tolerances and acceptance criteria and as specified in subsequent clauses of this part of the technical specifications.

1.4 The QA and QC activities in all respects as specified in the technical specifications/ drawings / data sheets / quality plans / contract documents shall be carried out at no extra cost.

1.5 The contractor shall prepare detailed construction and erection methodology scheme which shall be compatible to the requirements of the desired progress of work execution, quality measures, prior approvals from statutory authorities etc. if any and the same shall be got approved from the Engineer.

1.6 If required, work methodology may be revised/ reviewed at every stage of execution of work at site, to suit the site conditions, work progress commensurate with project schedule by the contractor at no extra cost to the Engineer

2 QA and QC Manpower

2.1 The contractor shall nominate one overall QA coordinator for the contract detailing the name, designation, contact details and address at the time of post bid discussions.

2.2 All correspondence related to Quality Assurance shall be addressed by the contractor's QA coordinator to the Engineer.

2.3 Employer/ Consultant shall address all correspondence related to Quality issues to the contractor's QA coordinator. The contractor's QA coordinator shall be responsible for co-ordination of Quality activities between various divisions of the contractor and their sub-vendors on one hand & with Engineer on the other hand.

2.4 The contractor shall appoint a dedicated, experienced and competent QA & QC in-

charge at site, preferably directly reporting to the Project Manager, supported as necessary by experienced personnel, to ensure the effective implementation of the approved QAP.

2.5 The contractor shall finalize and submit a deployment schedule of QA & QC personnel along with their details to Engineer for approval/ acceptance and further shall ensure their availability well before the start of the concern activity.

3 Laboratory and Field Testing

3.1 The contractor shall make necessary provisions to provide all facilities required for QA & QC activities by setting up a field laboratory for QA and QC activities in line with the indicative field QA & QC laboratory set-up.

3.2 The Laboratory building shall be constructed and installed with adequate facilities to meet the requirement of envisaged test setup. Temperature and humidity controls shall be available wherever necessary during testing of samples.

3.3 The quality plan shall identify the testing equipment/ instrument, which the contractor shall deploy and equip the field quality laboratory for meeting the field quality plan requirements.

3.4 The contractor shall furnish a comprehensive list of testing equipment/ instrument required to meet the planned/scheduled tests for the execution of works for Engineer's acceptance/ approval.

3.5 The contractor shall mobilize the requisite laboratory equipment and QA & QC manpower at least 15 days prior to the planned test activity as per the schedule of tests.

3.6 In case contractor desires to hire the services of any established laboratory nearby for any field tests then he shall ensure that the subject laboratory is well equipped with all requisite testing facilities and qualified QA & QC staff and this shall not affect in anyway the work progress.

3.7 All equipment and instruments in the laboratory/ field shall be calibrated before the commencement of tests and then at regular intervals, as per the manufacturer's recommendation and as directed by the Engineer. The calibration certificates shall specify the fitness of the equipment and instruments within the limit of tolerance for use. Contractor shall arrange for calibration of equipment and instruments by an NABL / NPL accredited agency and the calibration report shall be submitted to Engineer.

3.8 The tests which cannot be carried out in the field laboratory shall be done at a laboratory of repute. This includes selected IITs, NCB, CSMRS, reputed government / autonomous laboratories / organizations, NITs and other reputed testing laboratories.

The test samples for such test shall be jointly selected and sealed by the engineer and thereafter these shall be sent to the concerned laboratory through the covering letter signed by Engineer. Test report along with the recommendations shall be obtained from the laboratories without delay and submitted to Engineer.

3.9 Based on the schedule of work agreed with the Engineer and the approved FQP, the contractor shall prepare a schedule of tests and submit them to the Engineer and organize to carry out the tests as scheduled/agreed.

4 Sampling and Testing of Construction Materials

4.1 The method of sampling for testing of construction materials and work / job samples shall be as per the relevant BIS / standards / codes and in line with the requirements of the technical specifications / quality plans.

4.2 All samples shall be jointly drawn, signed and sealed wherever required, by the contractor and the engineer or his authorized representative.

4.3 The contractor shall carry out testing in accordance with the relevant IS standards/ codes and in line with the requirements of the technical specifications / quality plans. Where no specific testing procedure is mentioned, the tests shall be carried out as per the best prevalent engineering practices and to the directions of the Engineer.

4.4 All testing shall be done in the presence of Engineer or his authorized representative in a NABL accredited / Govt. Laboratory acceptable to Engineer.

4.5 The test samples shall be jointly selected and sealed and signed by the Site-in-charge and thereafter these shall be sent to the concerned laboratory.

4.6 The test report along with the recommendations shall be obtained from the laboratory without delay and submitted to Engineer.

5 Purchase and Service

5.1 All structural steel shall be procured only from main steel producers In case of non-availability of some of the sections with main steel producers, the contractor may propose to procure the sections from the re-rollers of the main steel producers, the name of such re-rollers will have to be cleared by the Engineer for which details such as BIS approval, main steel producer's approval, past experience for production of sections of specified material, details of machines, plant, testing facilities etc.

5.2 Confirmation that the process control and manufacturing of steel sections by re-rollers shall be same as that of main steel producers, that billets for re-rolling will only be sourced from main steel producers shall be furnished with regard to re-roller.

5.3 For Module Mounting Structures (MMS), sources of steel other than those specified under this clause may also be used subject to the condition that they otherwise meet the requirements of the Technical Specifications / Bid documents. Even after clearance of re-rollers, induction of billets with identified and correlated Mill test certificates (MTC) in the process of re-rolling, sampling of steel, quality checks thereof and stamping of final product for further identification and correlation with MTC prior to dispatch shall be the responsibility of the contractor and these shall be performed in presence of the authorized representative of the main Contractor.

5.4 Reinforcement steel shall be procured only from main steel producers and Mill test certificates (MTC) shall be obtained and submitted to the Engineer for correlation.

6 Field Quality Plan

6.1 Well before the start of the work, the contractor shall prepare and submit the Field Quality Plans to Employer for approval, which shall detail out for all the works, equipment, services, quality practices and procedures etc. in line with the requirement of the technical specifications to be followed by the contractor at site.

6.2 This FQP shall cover all the items / activities covered in the contract / schedule of items required, right from material procurement to completion of the work at site.

6.3 An Indicative Field & Manufacturing Quality Plan for civil, structural and MMS works is enclosed with this specification for reference as Annexure-B.

7 General QA Requirements

7.1 The contractor shall ensure that the works, BOIs and services under the scope of Contract, whether manufactured or performed within contractor's works or at his subcontractor's premises or at the project site or at any other place of work, are in accordance with Technical specification, applicable standards / codes, approved drawings / data sheets / quality plans and BOQ. All the works, BOIs and services shall be carried out as per the best prevalent engineering practices and to the directions of the Engineer.

Equipment	UOM	Approx. Qty.
Cube moulds for cement testing	nos.	4
Sieve shaker	nos.	1
Sieve for sand, coarse and fine aggregate	set	1
Sieve for coarse aggregate	set	1

Slump testing equipment	nos.	6
Oven	nos.	2
Physical balance	nos.	1
Thermometer	nos.	4
Burret	nos.	2
Measuring cylinder	nos.	9
Measuring flask	nos.	3
Compression testing machine	set	1
Cube mould for concrete	nos.	10
Mechanical weighing machine	nos.	1 (100kg capacity)
Drum type concrete mixer (for trial mixes)	nos.	1
Proctor testing equipment	set	1

7.2 Notes

7.3 The equipment listed above is indicative and minimum required. Additional equipment, if any, required for successful completion of work shall be provided /arranged by the contractor.

7.4 All test reports/ inspection reports shall be submitted in soft copy also and shall be available at site for easy access to the Engineer.

7.5 Based on the schedule (L2/L3 Network), Quality control & Quality Assurance Work plan shall be finalized by the contractor and the same shall be submitted to Engineer for acceptance/approval.

E Battery Energy Storage System

1 Scope of Works

The Scope of Work covered under this specification shall be but not limited to the following.

1.1 Initial Design and Fabrication

For the initial design and fabrication of the equipment, the Contractor shall

- Design, fabricate, and assemble a fully functional, containerized BESS that meets the requirements delineated herein. This shall include a control system that provides standard input/output channels and appropriate control actions for all

ANNEXURE - IV

10 YEARS PLANT O&M
(TO BE READ FOR THE SCOPE OF BESS)

Annexure - C

10 Years Plant Operation & Maintenance of 100 MW (AC) Solar PV Project (200MWp DC capacity) along with 50MW/150 MWh Battery Energy Storage System at Rajnandgaon, Chhattisgarh, India

1. CONTRACTOR'S OBLIGATIONS

1.1. Services

During the Term of the Contract, the Contractor shall perform the services in accordance with the Operation and Maintenance Scope of work as described in Annexure 1 (Scope of Work for Operation and Maintenance) (hereafter the "Services"), and also in accordance with the other conditions as prescribed related to the operational performance under ANNEXURE A (Employer's Requirement) of the Bid Document:

1.2. The Contractor shall be deemed to have allowed correct and sufficient O&M Price to cover all its obligations under the Contract and to have allowed the necessary resources to enable it to perform the Services to the standards and in the manner required. The Contractor's failure to acquaint itself with or assess any applicable condition shall neither relieve it from the responsibility for performing its obligations under the Contract nor entitle the Contractor to any additional costs or any other relief.

1.3. To the extent the Contractor reasonably believes that it is necessary to enhance the overall performance or safety of the Plant, the Contractor may propose changes and improvements to the Plant [(including the software included with respect thereto)]. The Contractor shall ensure that no modification of any equipment, change of software settings or any other alteration of equipment shall:

(i) cause a negative impact on the performance of the safety and reliability of the Plant;
(ii) adversely impact the Warranties;
(iii) adversely affect the warranties provided by the Contractors under the Contract;
(iv) conflict with the requirements under the contract; or
(v) bypass any protective equipment.
(vi) Violates any National/International Trade & IPR laws.

1.4. Any proposed modifications/changes shall not be carried out without the approval of the original equipment manufacturer and the Employer and in accordance with Performance Standards, and Technical Specifications. The Employer shall be notified of the proposed modifications along with reasons and technical note for such

modifications, changes, alterations, etc., and after the modifications are carried out in accordance with the contract, an alterations activity report is to be shared with the Employer.

1.5 The Contractor shall, while rendering the Services, observe and comply with all the Applicable Laws, Good Solar, BESS Industry Practices, Ministry of New & Renewable Energy (MNRE), Ministry of Power (MoP), CEA, CERC, POSOCO, SLDC, Local DISCOM & TRANSCO guidelines and Performance Standards pursuant to the contract. The Employer shall have the right to, to the extent applicable to Services rendered by the Contractor, conduct monthly audit on Applicable Laws, health, safety and environment and all other relevant compliances. The Contractor shall provide all necessary access and supporting documents during audit which are applicable to the same. However, such audits will be planned well in advance in coordination with the Contractor, without affecting the site operation plan.

1.6 The Contractor shall provide and make available as necessary, all such skilled, experienced and qualified labour and other competent personnel as are required to perform the Services the Contractor shall ensure that its Personnel hold and continue to maintain all qualifications and licenses as required under Applicable Law to allow its Personnel to lawfully undertake performance of the Services and carry out the Contractor's other obligations under the contract. For works/services being performed on a continuous basis, the O&M Price shall be deemed to include and the Contractor shall obtain all required Government Approvals and bear any costs related thereto (including any shift or permitted overtime working, allowances, wage orders, night shift differentials, etc.).

1.7 The Contractor shall ensure that all its Personnel deployed for providing the Services have undergone adequate safety training and are appropriately skilled, qualified and experienced in performing the Services for solar farms of a similar size, scope and complexity as the Plant. The Contractor shall be responsible for all matters relating to labour relations, working conditions, training, employee benefits, safety programs and related matters pertaining to its Personnel. The Contractor shall at all times have full supervision and control over its Personnel and shall at all times maintain appropriate order and discipline among its Personnel.

1.8 Contractor shall be solely liable for and, at its sole cost and expense, arrange for the response, reporting, removal, transportation, disposal, investigation, cleanup or other

remedial action (in all cases by licensed, insured, competent and professional contractors in a safe manner and in accordance with Applicable Laws) for any hazardous substances/waste existing at, in, on or under the Project.

1.9 The Contractor shall ensure availability of such Consumable Parts, Spare Parts, and Contractor's Equipment as may be necessary for the performance of the Services. The Contractor shall ensure that such Contractor's Equipment does not interfere with the operational or structural integrity of the Plant

1.10 The Contractor shall make available to the Employer the Reference Documents set forth in the Reference Documents and shall also provide the Employer with updates and revisions to the Reference Documents to the extent such updates and revisions are necessary and applicable to the performance of the Services. The Contractor shall provide the Employer with a latest version of update available of all the Reference Documents at the time of termination of the contract.

1.11 The Contractor acknowledges and agrees that other contractors of the Employer may be present at the Plant and it shall cooperate with such other contractors to allow the performance of its and their respective obligations to occur concurrently.

1.12 The Contractor shall through relevant agencies, if applicable, promptly investigate all accidents, damage or destruction, diagnosis, assessment of any potential consequential effects, estimating cost of repair, arranging for any remedial action required, making of any claims under the insurance policies and co-operating with and making reports required by the Employer or insurers.

1.13 The Contractor shall ensure that any Warranties provided under the Project Contracts are not invalidated or adversely affected by any act or omission of the Contractor during the period of such warranties.

1.14 The EMS and SCADA system shall be connected with the Plant and the Contractor shall make arrangements to provide monthly reports from the SCADA system. The Contractor shall arrange to connect the Plant to the SCADA system operating at the Site enabling the remote operation of the Plant by the Contractor and to provide access to information pertaining to the Plant to the Employer's Representative at Site and SLDC. The Employer may collect the data generated by the SCADA system in respect of the Plant from the Contractor. And the Employer will facilitate such data transfer by installing an OPC server at site.

1.15 Upon the expiry or earlier termination of the contract, the Contractor shall arrange to provide and install an additionally extended terminal from the SCADA system at the Site to enable the Employer to continue to access data relating to the Plant, at no Additional Cost and upon such terms as may be mutually agreed between the Parties at such time of expiry or earlier termination of the contract as the case may be.

1.16 The Contractor shall further provide support for the operation and maintenance of any Employer installed scope including any third-party support as may be required by any relevant Government Authority.

1.17 The Contractor shall notify and communicate to the Employer about any condition which may cause any malfunction or failure in the Project.

1.18 The Owner, at its discretion, may carry out periodic Fire Safety Audits of the project including Battery Energy Storage Systems by qualified agencies after duly notifying the EPC Contractor in accordance with the extant guidelines for grid connected storage systems, OEM installation recommendations and thermal runaway characterization of the Battery Storage systems. The EPC Contractor shall be obligated to ensure compliances as per the recommendations in the Audit Report at no extra cost to the Employer.

2. FUNCTIONAL GUARANTEES/WARRANTIES

2.1. Technical and Functional Performance Guarantee

2.1.1 The Contractor shall be responsible for meeting the performance guarantee of the Plant Facility (Applicable Individual guarantees for Solar PV Plant and BESS) as described in the contract.

2.1.2 In case of failure to meet the functional guarantees as described in section 2.1.1 above, the Contractor shall be liable to pay applicable Liquidated damages as described in the Bid Document and represented in Annexure-2 of this Annexure C.

2.2. General Repair Warranty

2.2.1. All repairs and replacements performed by the Contractor pursuant to the contract, shall cover a warranty for defects in materials and workmanship for the entire terms of O&M contract.

2.2.2. The Contractor shall disassemble, repair or, replace and reinstall any defective Equipment parts and/or re-perform any defective work covered by this warranty, at no cost or expense to the Employer.

2.2.3. In the event that Contractor replaces Parts that failed during the final year of the Term in accordance with its obligations under the Contract, Contractor hereby warrants to Employer that the replacement Parts installed in the Plant Equipment during such period shall not fail due to a defect for one (1) year following the date of installation of such replacement Parts; provided that in no event shall any such warranty extend beyond earlier of (i) the period that is one (1) year following the expiration of the Term or (ii) the date of any termination of the contract for reasons other than attributable to Contractor. During such period, if the contract is not in effect for any reason other than being terminated by Employer for cause, Contractor's obligation will be limited to supplying all needed Parts on to the Site delivered basis. For the avoidance of doubt, this Clause may survive the termination or expiry (as the case may be) of the contract for a period of one (1) year.

2.2.4. During Defect Liability Period if any repair and replacement are done, then the warrantee of the equipment shall be extended from the data of such repair and replacement to the period of original equipment warrantee w.r.t. that replaced component.

2.2.5 Any latent defect which may not come to knowledge or discovered in the course of normal inspection/operation during two years from the operational acceptance but, may arise within a period of 5(five) years from expiry of warranty period of two years, shall be under warranty by free replacement/rectification.

2.2.6 The acceptance of the equipment by employer shall in no way relieve contractor of his obligations under the contract.

2.3. Guarantee of compliance in relation to Curtailment Plans (acoustic or other curtailment plans)

The Employer may communicate to the Contractor some curtailment plans either linked to acoustic requirements; load management, or Applicable Law, the ("**Curtailment Plans**").

The Contractor shall ensure compliance with all Curtailment Plans provided by the Employer in accordance with Performance Standards and Technical Specifications. If either the Contractor or the Employer detects a variation with respect to the Curtailment Plans or in noise emission the Contractor will, at its own expense, characterise the problem, isolate the source of the problem and propose solutions to solve the problem to Employer (at the Employer' expenses in all cases other than cases where it's ascertained that the deviation was caused by a non-respect of the obligations under the contract).

2.4. Grid Connection and balance of electricity commitments

The Contractor acknowledges that to allow the Employer to inject the energy generated by the Plant Facility to the Grid and be eligible for the full tariff under the PPA, the Plant and the Contractor must comply with the requirements prescribed by Applicable Law, Good Solar/BESS Industry Practices, Performance Standards and the Grid documents and that failure to comply with such requirements may cause the Employer to either: (i) not be able to collect the tariff energy injected; and/or (ii) be subject to penalties payable to the Grid operator and/or the Discom and/or the power purchaser and/or any Government body. The Contractor therefore undertakes to diligently comply the requirements referred to Grid Connection and balance of electricity commitments, as prescribed under the Grid documents as provided by or on behalf of the Employer from time to time (or of which the Contractor otherwise becomes aware), and/or with the reasonable requests of the Employer associated with the compliance therewith.

3. **PERFORMANCE STANDARDS**

3.1 Contractor shall perform its obligations under the contract in compliance with the contract and otherwise, as applicable, in accordance with the following order of precedence (collectively, the "Performance Standards") as from time to time in force:

3.1.1 the Applicable Laws, and the requirements from the Grid Operator/SLDC;

3.1.2 the Permits and all the related documents;

3.1.3 the terms of the contract;

3.1.4 the functional Guarantee;

3.1.5 the Reference Documents including the manufacturers recommendations;

3.1.6 Employer's health and safety manuals and procedures and ESMP;

3.1.7 the Site Regulations;

3.1.8 environmental Social management plan as attached in the bidding document, provided by the Employer, as updated from time to time through the Employer's written notice to the Contractor;

3.1.9 the Equator Principles and the Equator Principles Requirements;

3.1.10 Good Solar/BESS Industry Practice;

3.1.11 Any relevant and reasonable instructions issued by the Employer, relevant to the scope of the contract, to the Contractor at least 15 days before the implementation of such instructions without any cost to the Contractor.

3.1.12 [The terms of insurances directly relating to the Project] and

3.1.13 [Comply with all operation and maintenance obligations as set out under the PPA or do anything which results in a breach of the Employer's obligations under the PPA.]

3.1.14 The World Banks applicable operational policies and procedures Performance Standards on Environmental and Social Sustainability, as published by the following link to be implemented by the contractor,

https://www.ifc.org/wps/wcm/connect/554e8d80488658e4b76af76a6515bb18/Final%2B-%2BGeneral%2BEHS%2BGuidelines.pdf?MOD=AJPERES; https://www.ifc.org/wps/wcm/connect/66b56e00488657eeb36af36a6515bb18/Final%2B-%2BElectric%2BTransmission%2Band%2BDistribution.pdf?MOD=AJPERES&id=1323162154847 and

3.2 If there is any inconsistency between the Performance Standards, [it shall be interpreted in the order of precedence listed above provided that(i) the application of a Performance Standard does not derogate, breach, contradict, obstacle or circumvent the application of a Performance Standards appearing above such standard in the above order of precedence, and, in addition, (ii) provided that this

such application does not cause a breach of Performance Standards or the Parties shall discuss and agree upon the manner in which such conflict shall be resolved.

3.3 Notwithstanding any other provision in the contract, the Contractor shall have no responsibility or obligation:

(a) to save and to the extent that the Contractor is required to do so pursuant to the provisions of Additional Services, to ensure that the Plant complies with the requirements of Applicable Law, Permits, if and to the extent that the same are introduced or amended following the Commencement Date; or

(b) subject to Additional Services, to ensure that the Plant or the Plant (as a whole or in part) complies with any noise or acoustic emissions requirements under Applicable Laws Permits.

Without prejudice to the foregoing, the Contractor is required to comply with the quality of supply limits determined in accordance with the Applicable Law and the Contractor will be deemed to have knowledge of its content.

3.4 The Contractor shall not do or omit to do anything in the performance or discharge of its obligations or the exercise of its rights under the contract or in breach of the contract, which would cause any breach of any of the terms of the Supply Contract, Works Contract, the Applicable Law, the Permits or the terms of any Permits or the Direct Contract, and should the Contractor be in breach of the Performance Standards, it shall, on demand of the Employer, indemnify the Employer against any direct Losses arising from a breach of this Clause by the Contractor, always subject to the aggregate liability cap of the Contractor (except as otherwise agreed herein).

3.5 If the Contractor is aware of a conflict between any of the above requirements, it shall inform the Employer accordingly and the Parties shall discuss and agree upon the manner in which such conflict shall be resolved.

4. EXCLUSIONS

4.1. General

(a) Force Majeure events as per GCC clause 37 of the contract condition

4.2. The rights of the Contractor under Exclusions shall only apply to the extent that the Excluded Risk Event has caused actual delays or substantial interference to the performance of the Contractor's obligations under his Contract, which could not have

been mitigated by the Contractor's best efforts, and to such portions of Contractor's obligations directly affected by such delays or interference.

4.3. Notification of Excluded Risk Event

To the extent Contractor has actual knowledge of any loss or damage to the Plant caused by or arising from an Excluded Risk Event, it shall give Employer immediate notice of the same and provide a written report to Employer within five (5) Business Days; and the employer and Contractor shall be mutually agreed upon within (30) business day. However, that any failure of Contractor to provide such notice shall not waive, prejudice or otherwise affect the other provisions in Exclusions, except to the extent that the failure to timely notify Employer results in any additional damage or loss to the Plant. Notwithstanding the foregoing, in case of delay to provide the aforementioned notice, the Contractor shall be liable towards the Employer for any additional damage or loss caused by the delay to notify the Employer.

5. ADDITIONAL SERVICES

5.1. Employer may, with respect to the Plant, request that Contractor perform work, provide services, or supply other equipment or parts, not included within Services for the successful operation of the plant for 10-year duration. Any such requested service or supply that the Parties mutually agree to in writing shall, subject to any specific terms and conditions agreed with respect to such service or supply, be an "**Additional Service**".

6. SERVICE PERSONNEL

6.1. Contractor shall provide the Services and any Additional Services to be performed on Site using a sufficient number of suitably skilled, qualified and experienced (including any licensing, certifications or training required by Applicable Laws or the local transmission system operator) and adequately equipped and properly trained Personnel and/or Subcontractors, all appropriately skilled and experienced in their

respective trades or occupations as may be reasonably necessary to fulfil its obligations hereunder in relation to the Services and Additional Services

6.2. The Employer may request the Contractor to remove (or cause to be removed) any Person or Subcontractor employed on the operation of the Plant, including the Contractor's Representative if applicable, who:

(i) engages in material or persistent misconduct or lack of reasonable care;
(ii) carries out duties incompetently or negligently;
(iii) fails materially to conform with any provisions of the Contract;
(iv) engages in conduct which is prejudicial to safety, health or the protection of the environment or in violation of any related Performance Standards or Applicable Laws;
(v) engages in conduct which might reasonably result in a breach of any provision of the contract and threaten public health, safety or security.

6.3. The Employer shall give notice to the Contractor of the same giving reasons and request the Contractor to replace such Personnel with a suitable candidate. The Contractor shall then as soon as reasonably possible but no later than seven (7) days upon receiving such notice from the Employer, Contractor will look in to the facts and claims of the case in all sincerity and deploy the required actions with the notice to the Employer.

6.4. Contractor shall have full supervision and control over its Personnel at the Site and shall maintain appropriate order and discipline among such personnel and shall cause any Subcontractor to maintain similar standards with respect to such Subcontractor’s personnel at the Site.

6.5. The Contractor shall be responsible for all matters relating to labour relations, working conditions, training, employee benefits, employee drug testing in accordance with the Contractor’s standard drug testing policy, safety programs and related matters pertaining to its employees and other Personnel engaged by the Contractor. The Contractor shall at all times have full supervision and control over its employees and other personnel engaged by it and shall at all times maintain appropriate order and discipline among its Personnel and shall cause any Subcontractor (or any subcontractor appointed by such Subcontractor) to maintain similar standards with respect to such Subcontractor’s or any subcontractor appointed by such Subcontractor) employees and Personnel.

6.6. The Employer shall have the right, acting reasonably and following prior notification, to require the Contractor to remove from the Site any employee or Personnel of the Contractor or any of its Subcontractors (or any subcontractor appointed by such Subcontractor) engaged in activity which presents a risk of injury to persons or property at the Site.

7. **SAFETY PRECAUTION**

7.1 During performance of the Services, Contractor shall:

7.1.1 comply with the safety standards and any safety procedures established by Contractor and same shall be approved by employer after the Commencement Date;

7.1.2 take all precautions required by Applicable Laws or Site Regulations, or otherwise according to the Performance Standards, for the health and safety of Contractor, its Affiliates and Subcontractors in the performance of the Services and any other Persons with temporary or perpetual access to the Site; [provided that the foregoing shall not limit Employer's responsibility for the safety of the Site as provided in Safety Precautions.

8. **CONSUMABLES, SPARE PARTS, TOOLS AND EQUIPMENT**

8.1 During the Term, Contractor shall provide equipment Spare Parts and Consumables and Tools, all as part of the Services and without Additional Cost to the Employer in accordance with the contract. Unless otherwise specified in the contract, the Contractor shall provide the Employer with an initial Spare Parts inventory. At the end of the Term or upon termination of the contract, the Supplier will replenish the equal quantity of the Spare Parts and Consumables and Tools as provided during the start of Contract.

8.2 <u>Consumables and Tools</u>

Contractor shall supply Consumables and Tools to the extent required for performance of the Services. All Consumables provided by Contractor in the performance of its Services, shall be compatible with the applicable requirements of the Reference Documents and Applicable Laws.

8.3 <u>Equipment and Spare Parts</u>

Contractor shall supply Equipment and Spare Parts to the extent required for its performance of the Services and to maintain its obligations thereunder. The Contractor has the right to use renovated Equipment and Spare Parts. If the Contractor intends to use any refurbished Major Components, it will seek prior written approval from the Employer. Contractor's right to procure and use renovated / refurbished Spare Parts is subject to: (i) standards of good workmanship and Good Industry Practice; (ii) compliance with the applicable requirements of the Reference Documents; (iii) the Spare Part(s) are of the type being replaced or of another type insofar as same does not invalidate any applicable Type Certification of the Equipment (iv) the same warranty as equivalent new parts in terms of scope, nature and duration, (v) being renovated in conformity with the original equipment manufacturer's standards, and (v) being listed in the monthly maintenance report when used (track record of the Part).All such renovated/refurbished parts will be allowed by Employer only for any long lead items and also considering uninterrupted generation from the Project. However, the contractor shall immediately reinstate and order new items in order to replace the refurbished items provided for emergency purposes.

8.4 Inspection of Replaced Parts

Contractor shall give to the Employer seven (7) days' notice of the time when the Replaced Part is being transported to the Site. Contractor shall permit Employer to inspect, at Employer's sole cost and expense, any Part which is removed and replaced by a Spare Part pursuant to Consumables, Spare Parts, Tools and Equipment (such Part, a "Replaced Part"); provided however, any such inspection:

(i) must not include physical alteration or disassembly of such Replaced Part; and

(ii) must not result in any material increased costs to Contractor or delay Contractor in the performance of its obligations under the contract or any Contract with, or warranty from, its Subcontractors, unless Employer agrees to cover such material increased cost.

8.5 Tools and Equipment

Contractor shall furnish its service personnel with such tools, instruments, or materials tools and equipment and equipment as are necessary to perform the Services (the "**Contractor's Equipment**").

8.6 Prices of Consumables, Spare Parts and Contractor's Equipment

Subject to GST, Taxation & Import Duties, the O&M Price payable to Contractor under the contract shall include (in addition to other components included in such Price) the Costs of any and all Equipment, Consumables, Spare Parts and Contractor's Equipment required in connection with the performance of the Services.

8.7 Risk of Loss or Damage to Consumables, Spare Parts and Contractor's Equipment

Contractor shall:

(i) be responsible at its own cost for the safe transportation and delivery to Site and adequate storage; of all Consumables, Spare Parts, and Contractor's Equipment, in each case, required for the carrying out of the Services;

(ii) bear the risk of loss and damage to all such Consumables and Spare Parts during transportation to the Site and, thereafter up to the date of their incorporation by Contractor into the Plant; and

(iii) at all material times bear all risk in any and all Contractor's Equipment on or off the Site and whether remaining separate or temporarily attached to the Plant.

8.8 Title

Contractor shall retain title to any and all Contractor's Equipment on or off the Site and whether remaining separate or temporarily attached to the Plant until transfer of Title occurs. Title to any Spare Part (or other Part) or Consumables provided by Contractor pursuant to the contract shall pass to the Employer upon:

(i) incorporation by Contractor in the Plant free and clear of any Lien; or

(ii) in the case of Additional Services, the date (if later) on which payment is made in full for such Spare Part or Consumable.

Title to any Replaced Part shall vest in Contractor upon such replacement, except if the Parties agree differently from time to time. In case of Additional Services, Employer shall retain title to any Replaced Part.

9. COMMUNICATION AND REPORTING

During the Term, Contractor shall exchange information and reports on daily, weekly, monthly, quarterly and annual basis:

9.1 Monthly Reports

Contractor shall provide Employer with the Monthly Performance Report by no later than the fifth (5th) day from the end of each month.

9.2 Emergency Notices

Upon obtaining actual knowledge thereof, Contractor shall promptly notify Employer verbally (with written notice to follow within three (3) Days) of any emergency or other hazardous condition or occurrence that Contractor reasonable believes could cause an immediate threat to the safe operation of the Plant and/or the safety of Persons.

If, by reason of an emergency arising in the course of, as a result of or otherwise in connection with and during the performance of the Services, any protective or

remedial work is necessary as a matter of urgency to prevent damage to the Plant, the Contractor must immediately perform that work, provided that, Contractor shall have no obligation to perform such portions of the protective or remedial work which would be in violation with the Performance Standards, be a material breach of the contract or would cause a threat to the safety of Persons or property or would otherwise not be reasonably practicable or possible; and provided further, that Contractor shall have no obligation to retrofit or upgrade the Plant except if otherwise agreed.

Without prejudicing the liability attributable to the Contractor for failure to comply with the provisions of the paragraph above, it is clarified that if the Contractor does not perform the protective or remedial works referred to above immediately, the Employer may appoint a Replacement Contractor to perform such works. If the work (or parts thereof) which were performed or caused to be performed by the Employer is work which the Contractor was liable to do at its own expense under the contract, the costs incurred by the Employer as a result of appointing a Replacement Contractor shall be [substantiated to the Contractor on an open book basis and be] considered due and payable to the Employer and Invoices and Payment and Set Off shall apply. It is further clarified that the impact of Replacement Contractor's actions shall not be considered as an Excluded Risk Event.

9.3 Meetings

A representative of each of Contractor and Employer (the "**Representatives**") shall meet (either at the Site or alternatively at such other location as may be agreed between the Parties) at quarterly intervals or such other period as is agreed especially for the purposes set forth below:

(i) to discuss projected dates for performance of the Services and the Additional Services in the following quarter;
(ii) to discuss, the calculated Measured Average Availability of the Plant Facility (Solar and BESS) for the past quarter under Annexure 2 [Functional Guarantees]; and
(iii) to review the Services and Additional Services performed in the past quarter.

9.4 Visitors Log Book

Contractor shall provide Employer with a log book for the Plant to record the identity and activity of all visitors to site. Such log book will be kept at the entry Gate location

of Plant. The Contractor shall cause that all personnel and representatives of each Party or any third parties visiting the [site] shall be required to record their identity, the date, time and purpose of any visit to site, the nature of any work performed thereon and such other details for which log books may reasonably be used. It is clarified that the Contractor shall not permit unauthorised third party access to the Site unless such third parties have been authorised by the Employer, are required to inspect or access the Site in accordance with Applicable Law or for performance of Services. Copies of these logs shall be provided to the Employer within ten (10) Business Days following its written request. Contractor shall create a digital back up of such logs at least every month. The log book shall be in English only.

9.5 Annual Calendaring of Maintenance Services.

At the latest two (2) months after the beginning of commencement date, each year during the Term thereafter, the Contractor shall send to the Employer the projected dates and times for the immediately following period during which the Contractor shall perform the Maintenance/Preventive Services on the Plant, with the parties using reasonable efforts to minimize any Plant downtime during Operational Sunny periods (the "**Maintenance Services Calendar**". Such Maintenance Services Calendar may be postponed by the Employer for 5 business days); provided, that the Maintenance Services Calendar shall be developed in accordance with the Operating Manual and the terms of the contract. The dates and times in the Maintenance Services Calendar may be amended thereafter by mutual Contract of the Parties. For clarity, the Maintenance Service Calendar shall include a maintenance plan established in accordance with the Maintenance Manual.

9.6 Status Reviews

As reasonably required, or requested by the Employer, the Representatives shall meet to discuss and review (i) the information contained in the Monthly Performance Reports, (ii) the availability of the Plant, (iii) any technical issues which may have arisen with respect to the performance, availability or maintenance and servicing of the Plant Equipment, (iv) Maintenance Services and Repair Services performed during the preceding calendar month, (v) any and all failures by a Plant equipment, and (vi) Maintenance Services to occur during the next following a calendar month.

10. **Contractor's Permits**

Prior to the time in which such Permits are required in order to perform when the relevant Services and/or Additional Services, as applicable, are to be performed,

Contractor shall obtain and maintain, as applicable, throughout the Term of the Contract all Permits (the "Contractor Permits") required by the Applicable Law, Good Solar/BESS Industry Practices, Performance Standards and Technical Specifications which should be issued in the name of Contractor or are otherwise attributable or necessary to the provision of the Services and/or Additional Services, other than such Permits as are required to be obtained by Employer pursuant to *Employer Permits*.

11. **Contractor's Manager**

On or prior to the commencement of the Term, Contractor shall designate a duly qualified and experienced person to manage and administer the Contractor's activities and shall provide notice thereof to the Employer, to act as its manager and coordinator of the contract on Contractor's behalf (the "**Contractor's Manager**"). The Contractor's Manager shall not have authority to amend or modify the contract or accept any commitment which would have an effect on the contract. In case the manager is on leave with prior intimation to employer, the deputy manager with equivalent qualification shall be provided at site by the Contractor

12. **Cooperation with other Subcontractors**

Contractor acknowledges and agrees that the Employer or Other Subcontractors of Employer may be present at the Site and agrees, at no cost or expense to the Employer, to reasonably cooperate with such Other Subcontractors to allow the performance of its and their respective obligations to occur concurrently. Employer shall inform the Other Subcontractors of the clear demarcation of Contractor's scope of work so as to ensure non-interference in such work and operations by Employer's Other Subcontractors.

13. **Reserved Rights**

13.1 <u>Plant</u>

To the extent Contractor believes, in its reasonable discretion, that it is necessary to enhance the overall performance or safety of the Plant, Contractor may propose to Employer changes and improvements to the Plant (including the software included with respect thereto) and implement such changes or improvements proposed after obtaining the prior written consent of the Employer; provided that such changes and/or improvements shall not (i) be in conflict with the Performance Standards**;** (ii) adversely impact the technical performance of the Plant or the safety of the Plant**;** (iii) adversely impact the Availability Warranty in Annexure 2 [Functional Guarantees] (iv)

increase the cost of operating the Plant; (v) place the Employer in breach of the technical requirements of the Power Purchase Contract; (vi) impair or vitiate any obligations of the Contractor under the contract; (vii) adversely affect the Supply Contract Warranties and the Works Contract Warranties; or (viii) result in non-compliance with the Type Certificate.

13.2 The Contractor shall only have the right to implement such changes or improvements if it has received the prior written consent of the Employer and such changes and improvements are carried out at no cost to the Employer and in accordance with Reserved Rights.

14. CERTAIN NOTIFICATIONS BY CONTRACTOR

14.1 Contractor shall, upon obtaining actual knowledge thereof, promptly give the Employer notice of:

(i) any events or facts or observations that the Contractor believes could be reasonably likely:

(a) to have a material adverse effect on the operation of any of the Plant or the performance of the Employer's obligations under the contract; or

(b) to cause an immediate threat to the safe operation of the Plant (or any Plant therein) and/or the safety of Persons; provided that, in the case of this Clause, the Contractor shall provide immediate verbal notice of such event, fact or observation to the Employer with notice to follow within three (3) Business Days);

(ii) any actual or proposed event that the Contractor believes would be reasonably likely to have a material adverse effect on the operation of any of the Plant or the performance of either Party's obligations under the contract;

(iii) any (a) violation of Applicable Laws, or Permit, by the Contractor's agents, officers, directors, employees, representatives and Subcontractors, Employer or any Other Subcontractor; or (b) any notices of Liens (or claims of Liens) or investigations by Governmental Authorities related to the Plant;

(iv) any actual or contemplated change in Law that Contractor believes would be reasonably likely to have a material adverse effect on the operation of any of the Plant or the performance of either Party's obligations under the contract.

14.2 If the Contractor does not comply with its obligations under Certain Notifications by Contractor, the Contractor shall, subject to Limitations of Remedies and Liability, indemnify the Employer for any loss the Employer may suffer as a consequence, including, without limitation, compensation pursuant to Employer's Obligations.

15. ASSIGNMENT AND SUBCONTRACTING

15.1 The Contractor shall not sublet, transfer or assign the contract or any part thereof without the prior written permission of Employer. The Contractor shall not subcontract any of the Services having a value of more than 30% of the Annual O&M Price of the concerned year, except upon the Employer's advance written approval of the subcontracting of such works. Such approval shall refer to the specific identity of the Subcontractor and to the scope and terms of the subcontract. In any event, the Contractor shall not subcontract all, or materially all of the Operation and Maintenance Services or the ultimate supervision of the performance of such services.

15.2 The Contractor agrees and acknowledges that any review, by approval of, or failure to approve, or rejection by the Employer as to any Subcontractor shall not relieve the Contractor of any of its obligations under the contract, and the Contractor shall be liable hereunder to the same extent as if any such Subcontract had not been entered into. The Contractor shall at all times ensure and cause the Subcontractors not to commit any act or omission which could release, void, impair or waive any guarantee or warranty on the Plant or any part thereof.

15.3 The Contractor shall supervise and direct the work of all Subcontractors and be fully responsible for the performance of the Subcontractors and to the methods, techniques, sequences and procedures of, and for coordinating the work of the Subcontractors and to the acts and omissions of all Subcontractors and their

employees, directors, officers, advisors, agents and representatives, and those of their subcontractors ("Subcontractors' Parties). With regard to any Subcontract and Subcontractor's Parties, in particular, Contractor shall ensure that all wages, labor, health and safety and social related obligations are duly performed and timely discharged in accordance with Applicable Laws. It is agreed that if the responsibility of any such payments is transferred to the Employer pursuant to Applicable Law, the Employer shall have the right to adjust all such payments against the dues to the Contractor under the contract or otherwise recover the same from the Contractor under any other Contract. It shall be at Contractor's sole responsibility to ensure the payment and discharge of all its obligations with regard to the Subcontracts and shall indemnify the Employer and any Employer Indemnified Parties for any losses incurred by such parties in relation to the Subcontracts or to Subcontractor's Parties.

16. **Inspection and Testing**

16.1 The Contractor must provide the Employer, independent engineer, Grid Operator, Grid Administrator, and any other Contractor or Contractors employed by the Employer and their respective nominees, or other inspectors where required under the Applicable Law, the Permits, the Finance Documents and/or the Grid documents (collectively hereinafter referred to as the "**Project Parties**"), with access at any time to any place where the Services are being performed in order to inspect the progress and the manner of the Services, provided that the Employer (or its designated representatives) gives the Contractor twenty four (24) hours prior written notice.

16.2 The Project Parties and their respective nominees will have the right to examine and have access to documents relating to the Services.

16.3 The Contractor must carry out all tests and/or inspections of the Plant or Spare Parts in a lawful, professional, timely, safe and environmentally responsible manner as may be necessary to ensure the safe, reliable, efficient, and optimal operation of the Plant and in accordance with the Performance Standards, Applicable Laws and Good Solar/BESS Industry Practice. All these tests and inspections are to be carried out at the Contractor's expense, as part of Services.

16.4 The Project Parties and their respective nominees are entitled to attend any test and/or inspection.

16.5 Whenever the Contractor is ready to carry out any test and/or inspection, the Contractor must give at least ten (10) days' advance notice to Employer of such test and/or inspection and of the place and time. The Contractor shall make its best efforts

to obtain from any relevant third party or manufacturer any necessary permission or consent to enable the Project Parties to attend the test and/or inspection.

16.6 The Contractor must provide the Employer with a report of the results of such test and/or inspection within five (5) days after the completion of that test or inspection in question.

16.7 If the Employer and/or any of the Project Parties fail to attend the test and/or inspection, or if it is agreed between the Parties that the Employer and/or any of the Project Parties will not attend, then the Contractor may proceed with the test and/or inspection in the absence of the Employer's and/or any of the Project Parties' inspector and provide the Employer with a report in the approved form of the results.

16.8 If any Spare Parts or the Plant fails to pass any test and/or inspection, the Contractor must either rectify or replace those Spare Parts or repair the Plant and promptly repeat the test and/or inspection upon giving notice.

16.9 The Contractor agrees that neither the performance of a test and/or inspection of Spare Parts or the Plant, nor the attendance by the Employer's and/or any of the Parties' inspector nor the issue of any test report will release the Contractor from any of its obligations under the contract.

16.10 <u>Inspection during the Term and at the End of the Term:</u>

During the Term, the Plant may be submitted to a general inspection performed by a Contractor selected by Employer:

16.10.1. Inspection during the Term

From time to time during the Term, but not more than once every year (being specified that any additional tests and inspections instructed by the Employer under this Clause will be for the Employer's account unless the tests or inspections were necessary as a result of the failure of the Contractor to fulfil its obligations under the contract);

16.10.2. End of Contract inspection: six (6) to twelve (12) months before the end of the Term, at the convenience of the Employer.

Subject to the Employer's reasonable advance notice as to the date of such inspection, Contractor is required to attend and assist the Employer and the designated inspector in performing such tests, without additional cost.

16.10.3. The final report shall be sent to the Contractor by the Employer and if any defect or damage found, same shall be rectified/replaced.

16.10.4. Without relieving Contractor from its obligations and without limiting Employer's ability to reasonably pursue the reliefs available to it, if applicable:

(i) Contractor shall, promptly following receipt of the report, submit to the Employer (a) a recovery plan to remedy all breaches, defects and malfunctions detected in the report for which the Contractor is liable and shall perform such remedial actions without delay, and (b) provide detailed measures to be put in place to prevent such defaults from recurring;

(ii) if the Contractor fails to timely complete all remedial actions before the end of the Term, the Employer shall be entitled, at Contractor's cost and risk, to employ a Replacement Contractor to perform the works.

16.11 Employer Site Visit

16.11.1. If Employer decides to visit the Plant, Contractor shall provide personnel on the Site for mutual inspection with no additional cost to Employer. If the Contractor is reasonably unable to attend such visit for unexpected reasons and/or safety reasons, Contractor shall immediately inform the Employer. As the case may be, the Contractor shall reschedule a new visit within the next seven (7) days. Rescheduling of the visits thereof shall no occur more than once per year the Employer shall adhere to the HSE practices of the Contractor.

16.11.2. If, upon request of the Employer made in accordance with Employer Site Visit, the Contractor does not provide dedicated personnel for such visits, subject to the aforementioned rescheduling allowance, any downtime of Plant Equipment(s) to perform the inspections thereof shall be considered as unavailable for the purpose of availability calculation described in Annexure 2 [Functional Guarantees] [(however never exceeding eight (8) hours per given visit)]. Notwithstanding the foregoing, Employer may request that Contractor provide personnel on the Site for additional inspections as an Additional Service.

16.11.3. If, upon request of the Employer made in accordance with Inspection and Testing, for inspection of the Plant, the Contractor provides access to have services in the Plant Equipment examined available for inspection and Employer

does not carry out such inspection, then any downtime of Plant Equipment(s) to perform the inspections thereof shall be considered as available for the purpose of availability calculation described in Annexure 2 [Functional Guarantees]

17. HAZARDOUS SUBSTANCES AND HAZARDOUS SITE CONDITIONS

17.1 Contractor shall not, nor shall it permit any other Person to bring any Hazardous Substances on the Site, other than Hazardous Substances to be used by Contractor or any Subcontractor in a manner that:

(i) does not violate any Applicable Laws, or Permits; and

(ii) is consistent in quantity and with Good Solar/BESS Industry Practices for operating and maintaining solar energy conversion plants, such as motor fuels, solvents and lubricants (collectively, "**Permissible Materials**").

17.2 Contractor shall bear all responsibility and liability for:

(i) any Hazardous Substances that are not Permissible Materials belonging to the Contractor or present on site; or

(ii) the handling of, or failure to handle, Permissible Materials in violation of Applicable Laws or otherwise in any manner that constitutes negligence or willful misconduct by Contractor or any Subcontractor.

17.3 Contractor shall use Hazardous Substances in performance of the Services in accordance with the Performance Standards, Applicable Laws and Good Solar/BESS Industry Practices and shall not:

(i) utilize, or permit or cause any Subcontractor to utilize, on the Site such Hazardous Substances as are prohibited under Applicable Law from being used in India; or

(ii) import or use at the Site such Hazardous Substances as are prohibited under Applicable Law.

17.4 Contractor shall maintain a regularly updated log of all material safety data sheets for all hazardous substances used in connection with performance of the Services at or near the Site, which shall be available for Employer to review upon reasonable request. Contractor shall maintain an accurate record and current inventory of all hazardous substances used in performance of the Services at or near the Site, which record shall

identify quantities, location of storage, use and final disposition of such hazardous substances.

17.5 Contractor shall arrange and agree for the disposal, transportation, reporting and certification (including provision of waste disposal vouchers and other certificates as required by Applicable Law or Permits) of Hazardous Substances, including waste disposal vouchers, brought onto and released at the Site by Contractor or its Sub Contractors, which are expected to include but not be limited to used oil, grease and ethylene glycol, to the extent required by Laws, in each case, by licensed, insured, competent and professional Contractors in a safe manner and in accordance with Laws. As between the Parties, Contractor shall be solely liable for any response, removal, investigation, clean-up or other remedial action required by any Laws related to any Contractor,

17.6 In the event Contractor encounters any Hazardous Substance or other hazardous conditions at the Site that are inconsistent with the Performance Standard or would reasonably be expected to impact the performance of Contractor's obligations hereunder, Contractor shall promptly report the condition to Employer. In such event, Contractor shall stop work and remove, or take other actions necessary to remedy the hazards associated with, any Contractor Hazardous Substances such that Contractor can resume work.

17.7 The Contractor shall indemnify and hold harmless the Employer against any fine, penalty or third-party Claim incurred as a result of non-compliance by the Contractor with the terms of the contract, Applicable Laws, Good Solar Industry Practice and more specifically, with its obligations under Hazardous Substances and Hazardous Site Conditions.

18. EMPLOYER'S OBLIGATIONS

During the Term, Employer shall perform the following obligations:

18.1 Access

18.1.1. On and from the Commencement Date, Employer shall provide the Contractor (and its Subcontractors) full, free and safe Access to the Plant for the purpose of enabling Contractor to fulfil its obligations under the contract.

Notwithstanding the foregoing, the Contractor shall be required to perform any works (including obtaining permits for such works) related to the Access to the Site required

for the delivery of any Spare Parts, if so requested by the Employer in writing, on the Time to time Basis.

18.1.2. The Employer shall give to the Contractor and the Contractor's personnel unrestricted Access to the Site to enable Contractor and the Contractor's personnel to carry out all elements of the Services at any time from the Commencement Date until the end of the Term. Such Access shall include the provision by the Employer of:

(i) such keys or access codes as may be required by the Contractor to gain unhindered access to the Site (as the case may be);

(ii) Access to the access roads to and on the Site If there is any deviation, and such deviations are accepted by the transport contractor, then such deviations shall be accepted by the Contractor.

Notwithstanding anything else contained in the contract all Access to the Site and Plant is subject to the applicable site safety, security and environmental requirements and Applicable Law (and the Contractor should comply with the same). The Employer will have the right to limit Access or expel any Person off the Site in case of them not fulfilling the Emergency plan of the Site, the Emergency plan of the Plant Facility.

18.3 Employer's Permits

Contractor, on behalf of the Employer, shall obtain and maintain all Permits and any Permits required by Applicable Law to be obtained in the name of the Employer in order to (i) perform Employer's obligations under the contract and (ii) enable Contractor to lawfully access the Site at the point of entry to the Site and the Plant].

19. SITE REGULATIONS

Employer shall (directly or through a Subcontractor, advisor or agent) provide the Site Regulations and revisions thereof from time to time, and shall require the Other Subcontractors and their respective agents and employees to, (i) comply with the Site Regulations; and (ii) take all necessary precautions (as required by Applicable Law or

otherwise) for the health and safety of all Persons (including Contractor's personnel) at the Site.

20. CERTAIN NOTIFICATIONS BY EMPLOYER

20.1 Employer shall, upon obtaining actual knowledge thereof, promptly give the Contractor, as soon as practicable, notice of:

20.1.1. any events or facts or observations that the Employer believes has determined that would:

(i) have a material adverse effect on the operation of any of the Plant or the performance of the Contractor's obligations under the contract; or

(ii) to cause an immediate threat to the safe operation of the Project (or any Plant therein) and/or the safety of Persons; provided that, in the case of this current Sub-Clause, the Employer shall provide as soon as possible verbal notice of such event, fact or observation to the other;

20.1.2. any (a) violation of Applicable Laws, including environmental Laws or the terms of any Permit, by Contractor or any Other Subcontractor or (ii) any notices of Liens (or claims of Liens) or investigations by Governmental Authorities related to the Project.

20.2 Failure to furnish notice pursuant to Certain Notifications by Employer shall not affect the Contractor's obligations to perform its obligations. Contractor.

21. EMPLOYER 'S OWNERSHIP OF ENERGY, EQUIPMENT, SPARES AND PROJECT BENEFITS

21.1 The Contractor acknowledges that ownership of the Energy or any benefits arising out of the operation of the Plant remains at all times, and in all circumstances with the Employer at all times and the Contractor has no legal or equitable title to or interest in the Energy or other benefit.

21.2 The ownership of all item supplied by the Contractor, including under Additional Services shall be transferred to the Employer at the end of the term of the contract:

(i) such items becoming a permanent part of the Plant against the mutually agreed payment by both the parties

21.3 The ownership of any item (not including Energy or benefits arising out of the operation of the Plant) supplied by the Contractor as part of the Services shall be transferred to the Employer upon such items becoming a permanent part of the Plant.

21.4 The Contractor agrees that any benefits, including any carbon credits, renewable energy certificates or similar royalty or credit that may arise as a result of having the Project undertaken belong to the Employer and the Contractor shall provide all reasonable assistance requested by the Employer in order to obtain such rights and benefits.

22. PRICE AND PAYMENT

22.1 Total Annual O&M Cost

Commencing on the Commencement Date and for the remainder of the Term, Employer shall, in consideration of the Contractor providing the Services and its prior receipt of an invoice with respect thereto, pay in accordance with Invoices and Payment to Contractor an annual O&M cost in INR in equal quarterly instalments at the end of every quarter for each year till 10 (Ten) years in the amounts set forth in and payable in accordance with ~~Price Schedule No 5/SOR-5 [Schedule of Rates]~~ of the bidding documents for the plant facilities.

Following is the yearly breakup of the Total O&M price in line with the Price ~~Schedule No 5/SOR-5:~~

PRICE SCHEDUELES AS SPECIFIED ELSE WHERE

SCHEDULE OF RATES [SOR-5] [OPERATION AND MAI									
S No	Description of Item	Year	PRICES (INR)						
			Currency	Yearly O&M Price in INR (Excluding GST)		Total O&M Price (INR) (Excluding GST) in figures	Total value of Applicable GST in absolute figures [GST to be calculated on absolute O&M Price	% (Percentage) of Goods & Service Tax (GST) considered	Total O&M Price including GST
				Solar PV - Part -A	BESS - Part-B				
1	2	3	4	5	6	7=5+6	8	9	10=7+8

OPERATION & MAINTENANCE									
1	Operation and Maintenance of the Plant Facility **for FIRST YEAR**	1		**0.00**	**0.00**	**0.00**	**0.00**		**0.00**
2	Operation and Maintenance of the Plant Facility **for SECOND YEAR**	2		**0.00**	**0.00**	**0.00**	**0.00**		**0.00**
3	Operation and Maintenance of the Plant Facility **for THIRD YEAR**	3		**0.00**	**0.00**	**0.00**	**0.00**		**0.00**
4	Operation and Maintenance of the Plant Facility **for FOURTH YEAR**	4		**0.00**	**0.00**	**0.00**	**0.00**		**0.00**
5	Operation and Maintenance of the Plant Facility **for FIFTH YEAR**	5		**0.00**	**0.00**	**0.00**	**0.00**		**0.00**
6	Operation and Maintenance of the Plant Facility **for SIXTH YEAR**	6		**0.00**	**0.00**	**0.00**	**0.00**		**0.00**
7	Operation and Maintenance of the Plant Facility **for SEVENTH YEAR**	7		**0.00**	**0.00**	**0.00**	**0.00**		**0.00**
8	Operation and Maintenance of the Plant Facility **for EIGHTH YEAR**	8		**0.00**	**0.00**	**0.00**	**0.00**		**0.00**
9	Operation and Maintenance of the Plant Facility **for NINETH YEAR**	9		**0.00**	**0.00**	**0.00**	**0.00**		**0.00**
10	Operation and Maintenance of	10		**0.00**		**0.00**	**0.00**		**0.00**

	the Plant Facility **for TENTH YEAR**								
	TOTAL NPV OF O&M FOR 10 YEARS (1+2+3+4+5+6+7+8+9+10)					**0.00**	**0.00**		**0.00**

Against the successful Operation and Maintenance of the entire Plant Facility (Solar & BESS) payment will be released on quarterly basis at the end of every quarter for each year till 10 (Ten) years.

The O&M of the plant will commence from the date of Operational Acceptance of the plants.

(i) Year 1 : OM -1
(ii) Year 2 : OM -2
(iii) Year 3 : OM -3
(iv) Year 4 : OM -4
(v) Year 5 : OM -5
(vi) Year 6 : OM -6
(vii) Year 7 : OM -7
(viii) Year 8 : OM -8
(ix) Year 9 : OM -9
(x) Year 10 : OM -10

The Contractor acknowledges that the Total Annual O&M cost forms the sole and exclusive consideration and reimbursement due to the Contractor for the performance of the services included under the Services and Spare Parts and that the Contractor shall not be entitled to any additional amount for their performance, for whatever reason, including, amount others due to increased costs, changes in applicable GST, customs or duties (including, without limitation those set forth in GST, Taxation and Import Duties below), and except as may be specifically provided in the contract.

Payment of amounts due to the Contractor:

Amount shall not be considered as due and payable and the period for the payment of any Price stipulated under the contract shall not commence until the Contractor

has duly fulfilled and delivered all obligations and deliverables required from the Contractor until the date of submission of the invoice for the payment to the Employer with relation to such invoice and/or within the period for which the Price included in the invoice are due.

23. INVOICES AND PAYMENT

REFER PAYMENT TERMS SPECIFIED ELSEWHERE

23.1 Contractor shall submit Goods & Service Tax (GST) compliant invoices to Employer for the amounts due under Total Annual O&M cost above and for any other amounts that may be due under the contract.

23.2 The Total Annual O&M Cost shall be invoiced by the Contractor quarterly against the completion of concerned quarter and each invoice may be submitted by Contractor no later than the day after the completion of the quarterly period in question and, subject to the terms of the contract, shall be paid by the Employer no later thirty (30) days from the date of submission of the invoice along with all other requisite documents (If so required). The Employer shall make payments by wire transfer to the bank account designated from time to time and owned by Contractor. The payment of any invoice shall be subject to the Contractor submitting to the Employer the Monthly Performance Reports.

23.3 Additional Services may, for purposes of this Invoices and Payment, be invoiced upon full and proper completion of each individual task and shall, subject to the terms of the contract be paid by the Employer within thirty (30) days from the date of submission of the invoice along with all other requisite documents (If so required).

23.4 In the event that the Employer fails to make any payment on its respective due date, the Employer shall pay to the Contractor interest on amount of such delayed payment at the rate as applicable for 46 days term deposit scheme as established by State Bank of India for Local currency payment and London Inter Bank Offered Rate (LIBOR) for Foreign currency payment, shall become payable as from the end of the 15 days period on certified amount due, but not paid, at the end of such period.

23.5 To the extent permitted by Applicable Laws, if the amount of an invoice is disputed by the Employer, the Employer shall be entitled to withhold payment of the disputed amount for the next invoice (or part thereof), until the dispute is resolved between the Parties under Law Dispute Resolution or otherwise. The Employer shall pay at the applicable time the undisputed amount of such invoice including any undisputed portion of the invoice item in dispute. Further, the Employer shall be entitled to

withhold payment of any amount due to the Contractor, if, at the time, the Contractor is in breach of one or more of its material obligations in terms of the contract.

23.5.1. Subject to the provisions on the contract, the Contractor warrants that it has, and will be deemed to have, done everything that would be expected of a prudent, competent and experienced Contractor and in accordance with Good Solar/BESS Industry Practices in:

(i) assessing all risks which it is assuming under the Contract; and

(ii) ensuring that the **O&M Price** contain allowances to protect it against any of these risks eventuating,

and that it will not make a claim for an increase in the **O&M Price** if any of those risks eventuate.

23.5.2. Except for Liens arising out of a failure of the Employer to make any payment when due hereunder to Contractor or any other Person providing labour or services to the Project under Contract to the Employer, the Contractor acknowledges and agrees that it shall not file, claim or register any Liens and shall use its best efforts to prevent any Liens from being filed, claimed or registered by any Subcontractor or by any employee, or agent of the Contractor or Subcontractor, against the Services, Additional Services, the Plant as a whole or any part thereof, or any real or other property of the Employer, for any works done or any Services and/or Additional Services rendered under the Contract or any subcontract let by the Contractor and shall procure that all subcontracts contain undertakings to the like effect.

23.5.3. The Contractor shall indemnify the Employer against any loss, damage, cost or expense (including legal fees) of the Employer arising out of or in connection with any Lien being filed, claimed or registered as referred to Invoices and Payment.

23.5.4. The delay or failure of a party to pay any amounts due hereunder, or the withholding of any amounts which are claimed by a party to be due, shall not release the other Party from any of its obligations or liabilities under the contract.

24. SCADA, EMS & BMS

Contractor shall be required from time to time to update the SCADA, EMS and BMS software, as required for the ongoing adequate operation of the Plant Facility. Such updates shall also be provided to the Employer at no additional costs.

25. INSURANCE

25.1 Contractor ‘s insurance

The Contractor, at his own cost and expense, shall take out and maintain in full force and effect and shall cause its Subcontractors to take out and maintain in full force and effect, throughout the Term of the Contract and any extensions thereof, the following insurance policies from reputable insurers and shall provide the Employer with copies of the corresponding insurance certificates:

a) Covering physical loss or damage to the all plant facilities at the Site, with an extended maintenance coverage for the Contractor’s liability in respect of any loss or damage for the entire term of the contract.
b) Workers compensation insurance, as required by the Applicable Law and Contracts made with employees.

c) Group Medical Claim, Group Term Policy & Group Personal Accident Insurances covering the financial consequences cause by damage and loss arising from sickness, disease, injury or death of any person employed by the Contractor in respect of the services performed Automobile Public Liability insurance, as required by the Applicable Laws, for all vehicles and automotive equipment owned hired, rented, leased and non-owned by the Contractor and used in the performance of the Services

d) Comprehensive General third-party liability insurance including product and contractual liability covering the financial consequences of the liability arising out loss or damage caused to third parties or to the employer as consequence of the performance of the services.

e) All other insurance like – transit insurance (Marine/ Cargo/ others as applicable), Construction All Risk, Erection All Risk, workmen compensation, fire, third party liability, insurance against Insurance against theft, fire, act of God, Contractor’s Equipments, machinery breakdown policy, business interruption insurance, Property damage Insurance & Environmental risk insurance as required during the O&M period of the Plant shall be in the contractor’s scope & shall borne by the Contractor.

The Service Provides shall ensure that under the aforementioned insurance policies, each of the insured has the ability to claim thereunder for a minimum period of three (3) months from the date of expiry of the insurance policies for any claims that arose prior to the expiry date.

The Employer shall be named as co-insured under all insurance policies taken out by the Contractor, except for the Third-Party Liability and Workers' Compensation Insurances, and the Contractor's Subcontractors shall be named as co-insureds under all insurance policies taken out by the Contractor, except for the Cargo, Workers' Compensation. All insurer's rights of subrogation against such co-insureds for losses or claims arising out of the performance of the Contract shall be waived under such policies.

25.2 Contractor's Insurance for the Plant Facility

The Contractor shall take out and maintain an insurance policy, seamlessly with CAR policy taken earlier during construction phase, preferably from same insurance company for the plant facility during the entire term of the contract

In the event of any incident or damage or loss that would be reasonably expected to result in an insurance claim, the Contractor shall:

a) Notify without delay to the Employer
b) Prepare and conduct all and any claims made under the policies effected by it, and all monies payable by any insurers shall be paid to the Contractor take all reasonable measures to mitigate the loss, its effects and to protect salvage.
c) Collaborate with Employer and the insurer and provide them with all information and documents they may request.
d) Arrange immediate reinstatement of the damage to the employer's satisfaction, without waiting for the settlement for the corresponding insurance claim.
e) Claim in pursuant to the contract to the insurance agencies, if the claim is accepted or rejected or not accepted or partly accepted by the insurance agency then it will not limit the contractor obligation in any case and also if any losses on account of this shall be in the scope of contractor.

25.3 General Insurance Requirements

25.3.1 The Contractor shall, provide copies of the corresponding insurance certificates mentioned above.

25.3.2 If the Contractor fails to effect or maintain any insurance policy required hereunder, or fails to produce copy of the corresponding insurance certificates, the Employer may (but as no obligation), without prejudice to any other right or remedy available to it under the contract, procure the insurance for the relevant coverage and/or pay the premiums due. Such payments shall be recoverable and deducted from the payments to be made to the Contractor by the Employer under the Contract. In the event if Contractor does not pay the premium, then the Employer may pay the premium however in such case the obligations of Contractor to undertake the coverage shall

continue as envisaged, irrespective of premium being paid by Employer. The Premium if paid by the Employer shall be recovered from the Annual O&M Fees payable by the Employer to the Contractor.

25.3.3 The Contractor shall comply with the conditions stipulated in each of the insurance policies to be affected under the Contract and shall not make any alteration to the terms of any policy subscribed by it so it deviates from the requirements herein.

25.3.4 The Contractor must promptly notify to the Employer any notification received from an insurance company regarding any actual alteration to one of their policies.

25.3.5 On occurrence of any loss covered by an insurance policy contemplated under *Insurance*, the Contractor shall, as soon as reasonably possible, notify to insurance companies for the policy subscribed by it. The Contractor shall also take any appropriate measure to mitigate the effects to the loss to the maximum extent possible. The Contractor shall assist any assessment mandated by the insurance companies.

25.3.6 The required coverages referred to and set forth in this Article 33 (*Insurance*) shall in no way affect or limit the Contractor's liability with respect to its obligations under the Contract.

25.4 The Contractor shall also arrange suitable insurance to cover following during the O&M Period:

a) **Machinery Breakdown**: Electrical & or machinery breakdown of any machinery or other equipment resulting in costly repairs or even replacement of the solar panel.

b) **Business Interruption**: Cover for period of operational downtime i.e., covering the cash flow of the solar business as a result of an insured peril, for example fire or storm damage, machinery breakdown or equipment failure.

c) **Property Damage**: The insurance should cover material damage due to external causes such as fire, theft, vandalism, sabotage, hail damage, snow load, lightning strike, overload, operational mistakes, clumsiness, negligence & theft.

d) **Employers Liability**: Provides cover against the risk of accident from usual workplace risks such as working at height & manual handling during construction & O&M period..

e) **Environmental Risk Insurance**: Environmental damage coverage indemnifies solar system owners of the risk of either environmental damage done by their development or pre-existing damage on the development site.

ANNEXURE 1:

Scope of Work for Operation and Maintenance

i) The Contractor shall prepare the initial Annual Operating Plan for the Plant Facility and shall also indicate the proposed resources (manpower, material & machinery) that would be deployed for O&M.

ii) The Contractor shall be responsible for the smooth day-to-day operation of the Plant Facility.

iii) The Contractor shall provide necessary routine and preventive maintenance schedules of the plant for the Employer's approval and shall carry out all routine and preventive maintenance accordingly.

iv) The Contractor shall perform periodic overhauls and preventive maintenance required for the Plant in accordance with the recommendations of equipment manufacturers and as per the O&M manuals.

v) Contractor shall perform all break down maintenance and other maintenance in the Plant Facility. The Contractor shall be responsible for achieving the performance guarantee of the plant as indicated in the contract.

vi) The Contractor shall operate and maintain fire protection system and safety equipment for the plant.

vii) The Contractor shall do maintenance of Electricity system including overhead lines in the Plant Facility area up to the Point of Common Coupling (PCC) to the grid at the site. Necessary co-ordination shall be made by the Contractor with CSPDCL/SLDC and other agencies as may be required during the Operation and Maintenance term for smooth operation of the plant.

viii) Contractor shall work in coordination with the Employer or any Employer's designated party to optimize the Plant production.

ix) The Contractor shall provide required spare plant Equipment, Spare Parts, tools and tackles, consumables required for comprehensive operation and maintenance of the plant facility. The Contractor shall make arrangement to procure required spare parts, or equipment/s as required, overhauling of parts, tools and equipment, required to operate and maintain the Plant in accordance with the recommendations of individual original equipment

manufacturer at his own cost. Cost of imported Equipment & spare parts, if any, shall be included in the O&M quoted cost. The List of Consumables, Spare Parts, tools and equipment shall be finalised in consultation with the Employer or Employer's representative. List of recommended spare parts shall be submitted by the Contractor at the beginning of services, however the complete recommended spares will be in the scope of contractor only. In case any equipment or spares is not listed in the mandatory spares list but is required vitally for the operation of the plant, then the same shall be procured and provided by the contractor without any additional cost.

x) It is the responsibility of the Service Provide to store the materials in appropriate stock yard or container at the site so as to ensure timely availability of the materials.

xi) The Contractor shall employ only such personnel who are adequately qualified and experienced for operating and maintaining such power generating sets. The Contractor shall ensure that such personnel are on duty at the plant at all times, 24 (twenty-four) hours a day and 7 (seven) days a week commencing from the Date of Operational acceptance.

xii) Contractor shall carry out all day-to-day operation and maintenance for the Plant Facility as set forth herein. Contractor shall perform the Work and supply all required spare parts in a prudent and efficient manner and in accordance with manufacturers and systems designers' specifications, the Annual Operating Plan for the Plant and all operation and maintenance manuals, all Indian applicable laws including environmental protection, pollution, sanitary, labour act, factory act, employment and safety laws, ("Government Rules") and Prudent Utility Practice.The contractor shall adhere to all labour laws which are applicable and as specified in the Design, supply and installation contract (DSI contract) document.

xiii) Contractor shall arrange necessary security staff for watch and ward of the Plant Facility round the clock at his own cost, the details of which shall be furnished along with the bid.

xiv) Contractor shall be responsible for:

- Maximizing plant capacity utilization,
- Reducing plant downtime,

- Optimizing the useful life of the equipment of the power plant.

xv) The Contractor shall maintain all accounting records regarding the facility in accordance with the generally acceptable accounting principles under the Laws of India.

xvi) The Contractor shall maintain accurate and up-to-date operating logs, records and monthly reports regarding operation and maintenance of the Plant facility (Such records shall be distinctly recorded for Solar PV Plant and BESS Plant, in order to have clear data for assessment of any individual component of the Plant Facility) which shall include details of power output, other operating data, repairs performed and status of equipment. All such records to be maintained for a minimum of 60 (sixty) months after the creation of such record or data and for any additional length of time required by regulatory agencies with jurisdiction over the Parties. Upon expiry of term, the Contractor shall hand over all such records to EMPLOYER. However, EMPLOYER shall have access to all such records at any time. Generation and O&M reports should be made available to EMPLOYER on daily and monthly basis in required formats as well as the Quarterly and Annual Performance Reports shall be provided. Contractor shall provide communications as well as daily, weekly, monthly, quarterly and annual reports to the employer in the desired format as per the Contract with the Employer or Employer's Engineer.

xvii) The Contractor shall develop and implement plans and procedures including those for fire fighting, maintenance planning, procuring and inventory control of stores and spares, plan to meet emergencies, plant safety and security; and such other facilities and systems as may be necessary to commence Contractor's ongoing responsibilities.

xviii) The Contractor shall provide copies of all necessary documents including the following :

- Operation and maintenance manuals shall be prepared and approval shall be accorded from Employer within three months from the date of Operational acceptance.

- Failure Analysis/history/trouble shooting details of all the Equipment

- Identification of Equipment needing preventive maintenance

- List of Vendors indicating name and addresses during operation and maintenance with credentials
- root cause analysis report for any major failure.
- Record of consumables / spare parts

xix) The Contractor shall be responsible for conveying following details to the Employer on daily basis as well as on monthly basis (by the end of 5th day of each month) by fax/ e-mail giving the detail of plant performance during previous month.

- Power generated at all Solar PV Plant, Utilisation of BESS
- Power fed to the grid
- Internal power loss and internal consumption
- Power consumption for captive use (if any)
- Reactive power consumption
- Downtime of Plant Facilities including Solar PV Plant, BESS and other infrastructure of the Plant facility.

xx) The Contractor shall be responsible for liasioning with statutory authorities and local authorities in order to ensure smooth operation of the Power Plant.

xxi) Contractor shall provide constant remote surveillance to the Plant Facility

xxii) Contractor shall provide updates and revisions to Reference Documents, as and when applicable.

xxiii) Shall implement software updates to control and monitoring systems including EMS/SCADA/BESS in order to meet the plant facility operating requirement in consonance with the grid operations and in compliance with the grid codes as applicable during the operation.

xxiv) Duly and timely provide the Employer (or parties designated by the Employer) with all notifications required under the Contract including in particular such notifications set forth in Certain Notifications by Contractor;

xxv) Contractor shall provide access to the Employer to all data for the Plant Facility from the EMS including the SCADA system.

xxvi) Contractor shall at all times allow and provide Employer all necessary information for the operation of EMS including the SCADA system (with no notification or approval of access being required unless specifically and otherwise agreed to by the Parties) full, free, unconditional, safe and complete access to the EMS including the SCADA system. Contractor shall monitor and operate the Plant in accordance with the contract and shall ensure smooth operation of the plant.

xxvii) Provide the training to the Employer's personnel in relation to the operation of the complete plant facility. Training shall be provided to the employer within 190 days before end the contract.

xxviii) Contractor shall provide the insurances prescribed in insurance. The Contractor shall, with [prior intimation of 5 Business Days] at regular business hours, allow persons duly authorized by the Employer including but not limited to the officials of the insurance company of the Employer, to inspect the Project and provide to such personnel, access to all information which is necessary for their inspection, and is reasonably requested by the Employer. All representatives of the Employer shall strictly adhere to the Applicable Laws and the Health, Safety and Environmental (HSE) practices of the Contractor as provided in the Reference Documents;

xxix) Contractor shall provide for the watch and ward of the Plant at all times during the Term. The watch and ward deployment plan shall take care of comprehensive Project level security and the Contractor shall take necessary steps to prevent sabotage, theft, vandalism and malicious damage of the assets comprising the Plant, and shall also coordinate and liaison with law enforcement authorities. The Contractor shall take all possible measures to keep the plant operational and secure.

xxx) Contractor shall Coordinate with CSPDCL, Discom, SLDC and other related entities/departments/local Panchayats as required for proper operation of the Plant Facilities. Also coordinate with relevant agencies for monthly Joint Meter Readings, meter testing, and any other requirements such as any audit or inspection by the government agencies or authorities, financiers, any designated third-party agency etc. for the Project operations.

xxxi) Contractor shall be responsible for appointing a Qualified Coordinating Agency at the Pooling Substation Level and shall be responsible for carrying out the forecasting and scheduling of the energy generation from the plant facility (In accordance with the Deviation Settlement Mechanism Regulations of the Chhattisgarh Electricity Regulatory Commission). Scheduling given by the Contractor is such that no penalty is levied on the Employer due to any deviation of actual generation from scheduling beyond the allowed limit. If any penalty is imposed on the Employer due to such deviations beyond allowed limit the same shall be passed on to the Contractor and the recovery of the same will be done from the O&M Price payable to the Contractor.

xxxii) The operation and maintenance of BESS shall be done in coordination with the use cases as defined in the Technical Specifications under Annexure A of the Bid Document. In case any modification or any other requirement from the grid operator, then the same shall be discussed with Employer or Employer representative, and any such modification shall be done by the Contractor only on after Employer's approval.

xxxiii) Contractor will be required to maintain the BESS rating (In MW as well as MWh) as specified in the Technical Specifications (Annexure A, requirement of Bid Document) during the entire O&M period by means of replacement or augmentation of the Battery.

xxxiv) Water requirement for module cleaning arrangement and the cost for the same shall be borne by Contractor. The Contractor shall arrange for water on it's own, by ensuring ESIA norms.

xxxv) Contractor shall be responsible to comply with all applicable National and International Standards as well as local statutory provisions related to Environmental Protection Regulations, Health and Safety requirement and also follow the Environmental and Social Management Plan (ESMP) for the Project as developed under the Environmental and Social Impact Assessment Study.

xxxvi) Contractor will be responsible for coordinating with the OEMs for securing warrantee conditions and services from OEMs as per the warrantee of each equipment, as well also for the Project insurance claims.

xxxvii) Contractor shall carry out the performance monitoring for the Plant Facility (Solar and BESS) on continuous basis and in case of any deviation,

the Contractor shall perform the due diligence appropriately to find out the actual root cause of such deviation. Any test or inspection required such as thermal imaging, IV characteristics test etc. to analyse such deviation will be the responsibility of the Contractor. Thereafter the corrective action required to mitigate such deviation shall be undertaken by the Contractor without any additional cost.

xxxviii) Contractor shall be responsible for maintenance of all each and every civil infrastructures parts like Building, cable trench, fencing, drain, plumbing system fire-fighting system, CCTV system, security arrangement, road, earthing, any foundations, anti-weeding, clearing bushes in the solar field etc., as per the direction of employer's Engineering In-charge.

ANNEXURE 2

Functional Guarantees

1. Annual CUF Guarantee

A. In consideration for the payment of the O&M Price , from the Commencement Date until the end of the Term, the Contractor grants to the Employer the CUF Guarantee on the terms and conditions set forth in the contract.

B. The Contractor guarantees the annual CUF committed herein over the O&M Period ("**Annual CUF Guarantee**") from the date of Operational Acceptance. In the event the CUF is less than the Guaranteed CUF, the Contractor shall immediately, upon demand, indemnify the Employer, as liquidated damages and not as penalty, amounts equivalent to remuneration of the equivalent Energy, subject to a maximum of hundred (100%) percent of the Total Annual O&M Price.

C. The Procedure for measurement and verification of the CUF Guarantee is as per Annexure-C: Performance Guarantee Test procedure, defined under the Annexure A (Employers' Requirement) of the bid document.

D. The Procedure for measurement and verification of the BESS Availability shall be as per relevant section (Battery energy Storage System: System Rating Verification) of Annexure-F: Plant Documentation, Commissioning and Test Procedure, defined under the Annexure A (Employers' Requirement) of the bid document

E. Liquidated Damages for Shortfall in Annual CUF for Solar PV Plant

(i) If the Contractor fails to achieve guaranteed annual CUF, then the Contractor shall pay compensation to the Employer an amount equal to the difference in units (kWh) derived from guaranteed CUF and achieved CUF multiplied by Rs.4 per unit (kWh).

(ii) If the Contractor fails to achieve the annual guaranteed CUF at the end of 10th year, then the Contractor shall pay compensation to the Employer an amount equal to the Net Present Value (NPV) of the revenue loss for 10th to 25th year calculated as below.

(a) % CUF drop i.e. [(Guaranteed CUF of 10th year – Actual CUF of 10th year) / Guaranteed CUF of 10th year]*100 in the 10th year shall be considered as the representative CUF drop for each subsequent year starting from 11th to 25th year.

(b) Estimated revenue loss @ Rs.4 per unit (kWh) for each subsequent year will be calculated as % CUF drop in the 10th year (as per (a) above) multiplied by the respective year's estimated generation.

(c) The Net Present Value (NPV) of the revenue loss for 10th to 25th year with discount factor of 8.61% will be considered as the LD payable by the Contractor.

F. In case the Project fails to generate any power continuously for 1 month any time during the O&M period, apart from the force majeure and grid outages as certified by competent authority from STU/ CTU, it shall be considered as "an event of default". In the case of default the entire Contract Performance Security will be forfeited.

G. Penalty during O&M period against breakdown of other Infrastructure of Plant Facilites that don 't affect the generation of power directly, such as but not limited to, civil infrastructure, water supply system/network, other Infrastructure developed by the Contractor as a Scope of Work for the Project (Section-VII: Scope of Works & Technical Specifications) shall be penalised @ Rs.1000/day, for non-compliance with PM Schedule (Initiation/Completion of Scheduled maintenance Activity as agreed under this Contract) beyond 48 hours. Cumulative value of such penalty shall be limited to 50% of yearly O&M cost. Cumulative value of such penalty shall be limited to 50% of yearly O&M cost.

For the purpose of this Clause, the PM shall be inclusive of, but not limited to, the following PM activities:

Item	**Scope of Maintenance Activity**	**Periodicity**
Environmental/Corrosive Protective Coatings	White-washing/Application/Re-application of Distemper, Epoxy coatings	Once in every 2 years under the O&M Contract period, in consultation with the Owner
Roads and Access paths	Repair and maintenance of all roads – Access, Internal and Periphery roads, walkways as well as fences, gates, cable-	Once every year prior to Monsoon season, in Consultation with

	trenches and outdoor equipment platforms.	the Owner
Water Supply Network	Repair and Maintenance of Water Supply Network including piping network, valves, pumps etc.	Once Every Year in Consultation with the Owner.
Periphery Lighting	Repair and maintenance of Peripheral Lighting including replacement of non-functional lighting fixtures, Junction Boxes, Conduits etc.	Once every Six Months
Rodent Entry Points	Application/re-application of Anti-rodent protection measures like PUF filling, sealant etc. at Checker/Gland Plates, Cable Entry Points (in PCU/SMU, Switchgear Panels, Buildings, Enclosures)	Once every Six Months
All bolted/tightened structures	Tightening/fastening of bolts that are exposed to winds/vibrations like MMS members/foundation bolts	Once every Year before onset of Windy season, in consultation with the Owner.
Enclosures of Equipment requiring Temperature and Dust Controlled environment for Normal Operation	Application/re-application of insulation/Dust-Filters/Temperature-control equipment at Enclosures/Buildings housing BESS, PCU, Switchgear	Once every Year, consultation with the Owner.
Entire Plant Facility	Oversight management of the hazardous/toxic materials including its handling and disposal as per Government of	Once every Year, in consultation with the Owner.

	India Rules and environmental and safety assessments by a qualified Specialist	

Note : *The Contractor shall ensure intimation and submission of requisite Reports to the owner at least 15 days prior to initiation of maintenance action for the activity.*

H. For breakdown of generation related infrastructure, the generation loss estimated based on the outage equipment's weightage (Wi) multiplied by estimated total energy output in the outage period beyond 48 hours, in the event of no breakdown (E_{est}) multiplied by Rs. 4/kWh will be levied. E_{est} for the period shall be calculated from the guaranteed CUF (i.e. Guaranteed CUF* outage period beyond 48 hours). Cumulative value of such penalty shall be limited to 50% of yearly O&M cost. The Equipment weightage (Wi) shall be calculated as below:

$$Wi = \frac{\text{Equipment Rating (in MW)}}{\text{Plant AC Capacity (MW)}}$$

I. The Penalty specified on account of delays, as specified in Liquidated Damages and Penalty specified on account of deviations in Functional Guarantees as above shall be assessed independent of each other. Above mentioned Penalties specified under this clause of SCC are independent of each other.

2. BESS Availability

A. The Contractor shall maintain all BESS equipment to ensure Annual Equipment Availability not less than 99%. Equipment Availability includes the availability of Batteries, Battery Management System (BMS), Power Conversion System (PCS), Energy Management System (EMS) as well as the power evacuation system for BESS up to interface with the solar PV arrays.

B. BESS Equipment Availability is the percentage of hours that the BESS is available during the year. The availability guarantee shall begin upon facility commissioning till the end of O&M period. BESS annual equipment availability shall be calculated as follows.

Equipment Availability =

$$\left[1 - \left(\frac{\sum \text{Accountable BESS Outage duration in hours} \times We}{8760}\right)\right] \times 100$$

Where:

- W_e, Weightage is $\frac{Outage\ Capacity}{Rated\ Capacity}$, where Outage and Rated Capacity shall be in Energy terms i.e. MWh. Rated Capacity in a given year shall correspond to the daily throughput capacity guarantee for the beginning of the year.

C. Accountable BESS outages are outages caused or necessitated by the BESS equipment that result in reduced capacity or loss of essential function of the BESS. These outages may be initiated by failure of components, loss of battery capacity, operation of protective devices, alarms, or manual action. Such outages include both forced outages due to equipment problems and scheduled outages for BESS maintenance.

D. Accountable BESS outage duration is the elapsed time of accountable BESS outages from the instant the BESS experiences reduced capacity or is out of service to the instant it is returned to service or full capacity. If the BESS experiences reduced capacity but is determined by the Employer to be available for service even if the Employer elects not to immediately return the equipment to full capacity, such time will be discounted from the outage duration.

E. The Procurement specific nameplate ratings shall be as defined in Technical Specifications under Annexure A: (Employer's Requirement). The BESS shall be considered to be under an accountable outage if any of those ratings cannot be met. The BESS shall also be considered to be under an accountable outage if a scheduled (or required) charge cycle cannot be completed.

F. The data required for assessment of the availability of the BESS shall be collected through the Plant's integrated SCADA system.

G. Grid outage hours shall be subtracted from total no. of hours in the year.

H. If the Plane of Array Radiation is less than 2kWh/m2 on a day, the day (i.e. 24 hours) shall be excluded.

I. Liquidated Damages for Shorfall in Equipment Availability

If the annual equipment availability for BESS is less than 99% during any year, then Contractor shall compensate the Employer an amount calculated as per the following formula.

$$COM = \left(\frac{99 - EA}{EA}\right) \times C \times E$$

where,

COM is Compensation payable to the Employer in rupees

EA is Annual BESS Equipment Availability

C is ₹8/kWh

E is the intended energy output from BESS in kWh during the respective year in 99% availability condition after considering any degradation.

Recovery of Compensation

The above compensations shall be deducted from CPS submitted by the developer.

Scheduling and Forecasting:

1. The Contractor shall be responsible for appointing a Qualified Coordinating Agency if required by concerned authorities at the Pooling Substation Level for scheduling and forecasting activity. Also the contractorshall be responsible for carrying out the forecasting and scheduling of the energy generation from the plant facility (In accordance with the Deviation Settlement Mechanism Regulations of the Chhattisgarh Electricity Regulatory Commission). Scheduling given by the Contractors is such that no penalty is levied on the Employer due to any deviation of actual generation from scheduling beyond the allowed limit. If any penalty is imposed on the Employer due to such deviations beyond allowed limit the same shall be recovered from the CPS given by the contractor.

Annexure V

SPECIAL TECHNICAL CONDITIONS

ANNEXURE A.3
SPECIAL TECHNICAL CONDITIONS

1. Based on preliminary site survey, Soil strata at top is composed of poorly graded sandy gravel followed by rocky strata. Presence of rock outcrops is also observed in some of the land patches. The Contractor is advised to inspect the site and study the nature of soil, topography and other conditions to decide the extent of scope of area grading, ground compaction, and foundation system to be provided before submission of the Bid. The Employer shall not be responsible for any variations in soil characteristics and other conditions, between those observed during preliminary site visit and detailed investigations to be carried out by the Contractor during contract execution and there shall be no compensation what so ever in the contract price on this account.
2. Topographical survey for the project site has been conducted by the employer and contour map prepared on its basis has been attached with this Annexure. This has been provided only for reference and general information of the Bidder. No warranty is expressed or implied that such information, given in good faith, will present the exact picture of the whole of the project site. The Bidder shall be responsible for any inference drawn from the attached details and is advised to inspect the site before submission of the Bid. The Employer shall not be responsible for any variations in site topography, if observed during detailed topographical survey to be carried out by the Contractor during contract execution and there shall be no compensation what so ever in the contract price on this account.
3. The Contractor is advised to ascertain the availability of good quality ground water at site for construction, drinking and module cleaning purpose. In case of non-availability of ground water source, the contractor shall explore the option of supply of water through water tankers. In case the water quality is not suitable for drinking or module cleaning purpose, the Contractor shall install suitable water treatment facilities.
4. **Power Conditioning Units (TS Part B Clause 4)**

   Power Conditioning Unit shall be outdoor type, installed on plinth comprising of RCC framed structure with foundations, columns and beams up to plinth level (FFL), with a suitable metal canopy on top.
5. **HT Switchgear (TS Part B Clause 6)**

   HT Switchgear shall be outdoor type, installed on plinth comprising of RCC framed structure with foundations, columns and beams up to plinth level (FFL), with a suitable metal canopy on top.
6. **Power Transformer (TS Part B, Clause 16)**

   The Power Transformer shall be designed for suitable duty cycle considering at least 4 hours of operation at 110% of full (rated) load.
7. The Design Parameters for all structural works are provided below:
   a. The basic wind speed ‘Vb’ = 39 m/sec (Moderate Damage Risk Wind zone B).

b. Seismic zone – II.
c. Design hourly rainfall intensity for storm water drainage – 80 mm/hr.
d. The average annual rainfall at project site is 1275 mm.

8. Plant fencing for each plot shall be of Chain Link Type as per the drawing provided in this section. The total perimeter of the fencing is approx. 22 km.
9. Main Entry gate for each plot shall be as per the drawing provided in this section.
10. MCR shall be RCC Type Building sand shall conform to the provisions as specified in Technical Specifications
11. SCADA Room shall be pre-engineered structures and shall conform to the provisions as specified in Technical Specifications.
12. All UG cables shall be laid in brick masonry trench (max. depth 450mm) to be covered with precast concrete covers.
13. Site Office for SECI (during construction) shall be as per specifications of Portable Cabin defined under Clause 16.2.4 for MCR.
14. Pyranometers (for measurement of GHI and albedo) and temperature sensors (for measurement of PV Module Temperatures) shall be installed at 2 locations to account for spatial variability over the project. The locations shall be finalised in consultation with the Owner at the time of detailed engineering. The data shall be averaged for the purpose of calculation of PR.
15. The BESS shall be distributed into at least 2 sub-systems (defined in terms of the Power Rating, Energy Capacity and point of interconnection with the PV arrays) with the objective of increasing system robustness.
16. For Plant internal lighting along internal roads, Solar LED type Garden/Landscape stake lights (Color Temperature 5700 K) shall be installed along with Solar Panels and rechargeable and replaceable battery units with minimum 8 hours of discharge.
17. **Part B: Electrical System, Clause 22 CCTV Camera:** CCTV Camera network covering complete perimeter of Plant Area is not required. However, shall include Main Entry, Control Rooms: Covering Entry/Exit and Equipment Rooms, Switchyard and BESS installation area.
18. **Part C: Civil, Mechanical and Plumbing Works, Clause 6: Roads:** Peripheral road along inside of the boundary fence/ wall of land patch is not required. However sufficient space may be left with cleared and flat surface.
19. Guest House shall be RCC Type Building as per the specifications in ANNEXURE A.2 - The Plan of the Guest House shall be as per the drawing in this section. The location shall be finalised in consultation with the Owner.
20. Security cabins shall be provided in every patch as per specifications provided in ANNEXURE A.2.

21. The Plant Equipment Maintenance Schedule shall include Spare Power and Inverter Duty Transformers.

ANNEXURES TO ANNEXURE A: Employer's Requirements

Annexure – A

Pre-dispatch Inspection Protocol for Crystalline PV Modules by Employer or Employer Deputed Agency

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Pre-dispatch inspection procedure

1. Objective:

The objective of this document is to establish General inspection protocol with objectivity for verification of Quality Parameters of Solar Modules by the customer (or its authorised inspection agency) prior to dispatch. The decision rules and procedure specified herein seek to uphold quality standards based on industry best practices and technical specifications laid out in tender documents as well as to control risks associated with item procurement.

2. Standards and Codes:

1. Sampling for determining Acceptance Quality Level (AQL) shall follow ISO 2859-1: 1999.
2. IEC TS 60904-1-2:2019 - Photovoltaic devices - Part 1-2: Measurement of current-voltage characteristics of bifacial photovoltaic (PV) devices

3. Definitions:

1. Lot: All products/items manufactured in one batch.
   Notwithstanding the aforementioned definition, the customer or authorized inspection agency can lay down alternate/additional criteria for determining a lot.
2. Major Defect: A defect that reduces the usability or causes the product to fail to fulfil its nominal characteristic function.
3. Minor Defect: A defect that does not reduce the usability of the product, but does not meet the quality standard.

4. Inspection Schedule:

Customer representative shall propose the schedule for Pre-despatch Inspection of Finished Goods to the Customer well in advance, and in no case less than 3 working days prior to commencement of Inspection at a location within India and 7 days in case of a foreign country.

5. Scope of Inspection:

Supplier representative will accompany the Inspector while doing the inspection which shall typically consist of 2 steps for clearance of each Lot:

BOM verification: To be conducted prior to the commencement of production.

The details of materials used will be verified from the ERP/Manufacturing data and corroborated with the Construction Data Form (CDF). This shall include verification of following:

Item	Method of Verification
Shelf life of the following BOM items: • EVA • PV Module Back sheet • Sealant and potting material (Silicone)	Verify the expiry date/shelf life and storage conditions *The PV Module manufacturer shall submit all required information to prove that materials being used are within their shelf life.*

Note: Supplier shall provide the necessary documents for approval of BOM as per IEC standards and tender Technical Specifications.

Witness Tests:

Manufacturer shall assist the Inspecting agency to witness following checks, the details of which are provided elsewhere in this document:

I. Flash test- As per sampling Plan

For Bifacial Modules, Measurement of current-voltage characteristics shall be done as per IEC TS 60904-1-2:2019 - Photovoltaic devices - Part 1-2:

II. Visual Inspection- As per sampling Plan

III. EL Inspection-As per Sampling Plan

IV. Electrical Characteristics (Other than Flash Test)- As per Sampling Plan

Note: The Supplier shall furnish soft and hard copy of the Production Quality Plan prior to commencement of the Inspection.

6. Sampling Process:

a. Supplier shall provide the list of modules in a lot ready for despatch, along with flash test data (Measured Electrical Data, P_{max}) prior to commencement of Inspection tests. **Note**: Smallest lot size for Inspection: 20% of the capacity as per the PO.

b. Supplier will arrange to move the PV Modules from FG to Inspection area.

c. Same samples shall be used for all Witness Tests stated at 5.2 above.

d. Inspector shall commence Inspection process by randomly selecting samples from the list of serial nos. (pallet-wise) provided by Supplier as per ISO 2859: Single Sampling Plan for Normal Inspection, General Inspection plan level-II. However, the

Inspector shall reserve the right to switch to tightened or reduced level of Inspection as per the lot quality.

7. Decision Rules for Acceptance/Rejection

Following is a summary of Decision Rules for Acceptance/Rejection of a given Sample in a lot offered for Inspection:

Table 1: AQL Levels

Defect Type	AQL (%)
Major (Ma)	2.5
Minor (Mi)	4

Table 2: Inspection Levels

Inspection steps	Inspection item	Inspection level
1	Flash Test	General inspection level I
2	Visual	General inspection level I
3	EL	General inspection level I
4	EC (Other than Flash Test)	10 Nos. per lot

8. Inspection Process

a. Electrical Inspection – Flash Tests

For Electrical inspection following preparation will be done:

- Module Temp Stabilisation: Modules will be kept in controlled environmental condition till it reaches 25 ±2ºC
- Calibration of Sun-simulator: Sun-simulator will be calibrated as per Calibration Reference. Reference should calibrated against Calibration Reference tested from reputed testing lab TUV / Fraunhofer etc. Testing of modules will be done at STC condition, AM=1.5

Note:

(i) All modules selected for sampling inspection will be re-tested in the sun-simulator. A P_{max} retest (repeatability test) variation of ± 2 % on actual flash P_{max} value will be acceptable.

(ii) The Supplier shall provide a valid calibration certificate of the apparatus used.

b. Visual Inspection:

- Customer representative will verify the module visual characteristics as per the Visual Acceptance norms.
- The Visual Inspection shall be carried out in a well-lit room. It shall be the responsibility of the Supplier to ensure adequate brightness in the room.

c. Electroluminescence (EL) Inspection:

- The EL image shall have sufficient resolution for analysis of defects.
- Hi-pot test shall be done as per IEC procedure. The Supplier shall provide a valid calibration certificate of the apparatus used.

9. Re-inspection and review

In case of minor non-conformities like cleaning issues, label mismatch, etc. which can be easily reworked, Supplier shall rework/replace the modules and offer them for re-inspection to Inspector.

10. Inspection Summary:

Once the inspection is completed Customer Representative will compile his Inspection Summary Report and share with Supplier and give necessary recommendation on despatch depending upon the audit findings based on the observations made. This report shall be provided within same day of inspection (Format Attached).

11. Disclaimer:

Inspection by SECI/ Employer does not absolve the responsibility of the Supplier/vendor to ensure quality during production of the material and its transport to site. Any damages during transport/ handling shall be replaced before erection at site as directed by Engineer-in-charge without any extra cost to the purchaser.

Sampling Plan

(Sampling Plan as Per ISO 2859) -1

Table 1 - Sample size code letters (see 10.1 and 10.2)

Lot size		Special inspection levels				General inspection levels		
		S-1	S-2	S-3	S-4	I	II	III
2 to	8	A	A	A	A	A	A	B
9 to	15	A	A	A	A	A	B	C
16 to	25	A	A	B	B	B	C	D
26 to	50	A	B	B	C	C	D	E
51 to	90	B	B	C	C	C	E	F
91 to	150	B	B	C	D	D	F	G
151 to	280	B	C	D	E	E	G	H
281 to	500	B	C	D	E	F	H	J
501 to	1 200	C	C	E	F	G	J	K
1 201 to	3 200	C	D	E	G	H	K	L
3 201 to	10 000	C	D	F	G	J	L	M
10 001 to	35 000	C	D	F	H	K	M	N
35 001 to	150 000	D	E	G	J	L	N	P
150 001 to	500 000	D	E	G	J	M	P	Q
500 001 and over		D	E	H	K	N	Q	R

(Sampling Plan as Per ISO 2859) – 2 – Normal, Tightened and Reduced)

Table 2-A — Single sampling plans for normal inspection (Master table)

Sample size code letter	Sample size	Acceptance quality limit, AQL, in percent nonconforming items and nonconformities per 100 items (normal inspection)																									
		0,010	0,015	0,025	0,040	0,065	0,10	0,15	0,25	0,40	0,65	1,0	1,5	2,5	4,0	6,5	10	15	25	40	65	100	150	250	400	650	1 000
		Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re
A	2	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↓	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	30 31
B	3	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	30 31	44 45
C	5	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	30 31	44 45	↑
D	8	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	30 31	44 45	↑	↑
E	13	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	30 31	44 45	↑	↑	↑
F	20	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	↑	↑	↑	↑	↑	↑
G	32	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	↑	↑	↑	↑	↑	↑	↑
H	50	↓	↓	↓	↓	↓	↓	↓	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	↑	↑	↑	↑	↑	↑	↑	↑
J	80	↓	↓	↓	↓	↓	↓	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	↑	↑	↑	↑	↑	↑	↑	↑	↑
K	125	↓	↓	↓	↓	↓	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
L	200	↓	↓	↓	↓	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
M	315	↓	↓	↓	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
N	500	↓	↓	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
P	800	↓	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
Q	1 250	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
R	2 000	↑	↑	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑

⇩ = Use the first sampling plan below the arrow. If sample size equals, or exceeds, lot size, carry out 100 % inspection.

⇧ = Use the first sampling plan above the arrow.

Ac = Acceptance number

Re = Rejection number

Table 2-B — Single sampling plans for tightened inspection (Master table)

Sample size code letter	Sample size	Acceptance quality limit, AQL, in percent nonconforming items and nonconformities per 100 items (tightened inspection)																										
		0,010	0,015	0,025	0,040	0,065	0,10	0,15	0,25	0,40	0,65	1,0	1,5	2,5	4,0	6,5	10	15	25	40	65	100	150	250	400	650	1 000
		Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re
A	2	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	0 1	⇩	⇩	1 2	2 3	3 4	5 6	8 9	12 13	18 19	27 28
B	3	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	0 1	⇩	⇩	1 2	2 3	3 4	5 6	8 9	12 13	18 19	27 28	41 42
C	5	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	0 1	⇩	⇩	1 2	2 3	3 4	5 6	8 9	12 13	18 19	27 28	41 42	⇧
D	8	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	0 1	⇩	⇩	1 2	2 3	3 4	5 6	8 9	12 13	18 19	27 28	41 42	⇧	
E	13	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	0 1	⇩	⇩	1 2	2 3	3 4	5 6	8 9	12 13	18 19	27 28	41 42	⇧		
F	20	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	0 1	⇩	⇩	1 2	2 3	3 4	5 6	8 9	12 13	18 19	⇧	⇧	⇧	⇧		
G	32	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	0 1	⇩	⇩	1 2	2 3	3 4	5 6	8 9	12 13	18 19	⇧						
H	50	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	0 1	⇩	⇩	1 2	2 3	3 4	5 6	8 9	12 13	18 19	⇧							
J	80	⇩	⇩	⇩	⇩	⇩	⇩	⇩	0 1	⇩	⇩	1 2	2 3	3 4	5 6	8 9	12 13	18 19	⇧								
K	125	⇩	⇩	⇩	⇩	⇩	⇩	0 1	⇩	⇩	1 2	2 3	3 4	5 6	8 9	12 13	18 19	⇧									
L	200	⇩	⇩	⇩	⇩	⇩	0 1	⇩	⇩	1 2	2 3	3 4	5 6	8 9	12 13	18 19	⇧										
M	315	⇩	⇩	⇩	⇩	0 1	⇩	⇩	1 2	2 3	3 4	5 6	8 9	12 13	18 19	⇧											
N	500	⇩	⇩	⇩	0 1	⇩	⇩	1 2	2 3	3 4	5 6	8 9	12 13	18 19	⇧												
P	800	⇩	⇩	0 1	⇩	⇩	1 2	2 3	3 4	5 6	8 9	12 13	18 19	⇧													
Q	1 250	⇩	0 1	⇩	⇩	1 2	2 3	3 4	5 6	8 9	12 13	18 19	⇧														
R	2 000	0 1	⇧	⇩	1 2	2 3	3 4	5 6	8 9	12 13	18 19	⇧															
S	3 150			1 2																							

⇩ = Use the first sampling plan below the arrow. If sample size equals, or exceeds, lot size, carry out 100 % inspection.

⇧ = Use the first sampling plan above the arrow.

Ac = Acceptance number

Re = Rejection number

Table 2-C — Single sampling plans for reduced inspection (Master table)

Sample size code letter	Sample size	Acceptance quality limit, AQL, in percent nonconforming items and nonconformities per 100 items (reduced inspection)																										
		0,010	0,015	0,025	0,040	0,065	0,10	0,15	0,25	0,40	0,65	1,0	1,5	2,5	4,0	6,5	10	15	25	40	65	100	150	250	400	650	1 000
		Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re
A	2	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇧	0 1	⇩	⇩	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	30 31
B	2	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	0 1	⇧	⇩	⇩	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	30 31
C	2	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	0 1	⇧	⇩	⇩	1 2	2 3	3 4	5 6	6 7	8 9	10 11	14 15	21 22	⇧
D	3	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	0 1	⇧	⇩	⇩	1 2	2 3	3 4	5 6	6 7	8 9	10 11	14 15	21 22	⇧	⇩
E	5	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	0 1	⇧	⇩	⇩	1 2	2 3	3 4	5 6	6 7	8 9	10 11	14 15	21 22	⇧	⇩	⇩
F	8	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	0 1	⇧	⇩	⇩	1 2	2 3	3 4	5 6	6 7	8 9	10 11	⇧	⇧	⇧	⇩	⇩	⇩
G	13	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	0 1	⇧	⇩	⇩	1 2	2 3	3 4	5 6	6 7	8 9	10 11	⇧	⇩	⇩	⇩	⇩	⇩	⇩
H	20	⇩	⇩	⇩	⇩	⇩	⇩	⇩	0 1	⇧	⇩	⇩	1 2	2 3	3 4	5 6	6 7	8 9	10 11	⇧	⇩	⇩	⇩	⇩	⇩	⇩	⇩
J	32	⇩	⇩	⇩	⇩	⇩	⇩	0 1	⇧	⇩	⇩	1 2	2 3	3 4	5 6	6 7	8 9	10 11	⇧	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩
K	50	⇩	⇩	⇩	⇩	⇩	0 1	⇧	⇩	⇩	1 2	2 3	3 4	5 6	6 7	8 9	10 11	⇧	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩
L	80	⇩	⇩	⇩	⇩	0 1	⇧	⇩	⇩	1 2	2 3	3 4	5 6	6 7	8 9	10 11	⇧	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩
M	125	⇩	⇩	⇩	0 1	⇧	⇩	⇩	1 2	2 3	3 4	5 6	6 7	8 9	10 11	⇧	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩
N	200	⇩	⇩	0 1	⇧	⇩	⇩	1 2	2 3	3 4	5 6	6 7	8 9	10 11	⇧	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩
P	315	⇩	0 1	⇧	⇩	⇩	1 2	2 3	3 4	5 6	6 7	8 9	10 11	⇧	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩
Q	500	0 1	⇧	⇧	⇩	1 2	2 3	3 4	5 6	6 7	8 9	10 11	⇧	⇧	⇧	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩
R	800	⇧	⇧	⇧	1 2	2 3	3 4	5 6	6 7	8 9	10 11	⇧	⇧	⇧	⇧	⇧	⇧	⇧	⇧	⇧	⇧	⇧	⇧	⇧	⇧	⇧	⇧

⇩ = Use the first sampling plan below the arrow. If sample size equals, or exceeds, lot size, carry out 100 % inspection.

⇧ = Use the first sampling plan above the arrow.

Ac = Acceptance number

Re = Rejection number

Customer inspection Report

CUSTOMER INSPECTION REPORT			
Ref. No. & Date:			
Client:	**PMC**: SECI	**EPC Contractor**: PO Ref. No.:	
Place of Inspection:	**Date of inspection:**	**Lot Size**	**Sample Quantity**
Problem Quantity: **Detail:** **Inspection Result (OK/Not OK):**			
Visual Inspection **Problem Quantity:** **Detail:**			
Flash Test **Problem Quantity:** **Detail:**			
EL Inspection: **Problem Quantity:** **Detail:**			
EC Inspection (Hipot,DC Continuity,IR): **Problem Quantity:** **Detail:**			
Any Other Criteria/Remarks:			
Is the shipment qualified to be released? ☐ ☐ **Yes** **No**			
From Client	From EPC Contractor	Solar Energy Corporation of India Limited	

Enclosed: Test Details, Flash Test Report, EL test (images- soft copy), EC Test Report

Disclaimer: *This Inspection by SECI/ Employer does not absolve the responsibility of the vendor to ensure quality during production of the material and its transport to site. Any damages during transport/ handling shall be replaced before erection at site as directed by Engineer-in-charge without any extra cost to the purchaser.*

Details:

Lot :				**Date**
S.No.	**Defect**	**Module Id**	**Type (Ma/Mi)**	**Details**
1				
2				
….				

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	**Sr.No.**	**Activity & Operation**	**Instruments**	**Class of Check**	**Type of Check**	**Quantum of Check**	**Reference Documents & Acceptance Standard**	**Format of Record**	**D*** (Records identified with (√) shall be issentially included by EPC vender in QA documentation)	**Cheking Agency**			**Remarks**
2								SR - Site Register SECI-SPV-QA-F-XXX SECI-SPV-QA-T-XXX (XXX - Inspection record form No. or Test report format no.)		**M'fr/ Supplier or Sub-Contractor**	**EPC Contractor**	**SECI or Owner**	
3	**1**	**General Requirements**											
4	a	Availability of requisite test set-up and equipment in good working condition with valid calibration at site well before commencement of concerned activity	As required/ agreed	Critical	Physical	Once prior to start of work & Monthly there after	Tech. Specs, Construction Drawings	SR	√		**x**	**x**	**Min. list of equipment** - CTM, Set of Seives for CA & FA, Elcometer (digital), Micrometer, Multimeter, Meggar, Torque Wrench, Moulds for casting of concrete/ mortar test samples, Curing tank of adequate size, SS measuring tape - 50m, Theodolite, leveling staff and associated equipment etc. for day to day work with proper storrage racks. The equipment shall be in adequate no. matching the site progress requirements. Functioning of laboratory equipment in proper working condition to be verified on monthly basis
5	b	Submission of QA & QC manpower deployment schedule based on agreed L-2 network	As required/ agreed	Critical	Verification	Before start of work	Tech. Specs, Construction Drawings	SR	√		**x**	**x**	
6	c	Availability of QA & QC manpower deployment based on agreed deployment schedule, Periodic review for augmentation as per actual progress	As required/ agreed	Critical	Physical	Once prior to start of work & Monthly there after	Tech. Specs, Construction Drawings	SR	√		**x**	**x**	
7	d	Submission of schedule/ programme of tests and inspection of civil works (survey, excavation, concreting, backfilling, brickwork, finishing works, roads, drains etc.) to be done monthly and quarterly based on agreed schedule	As required/ agreed	Critical	Physical	Once prior to start of work & Monthly/ Quarterly there after	Tech. Specs, Construction Drawings	SR	√	**x**	**x**	**x**	
8	e	Submission of actual work programme min. 3 days (72 hours) in advance to facilitate planning for quality checks as per approved QP	As required/ agreed	Critical	Physical	48 hours before start of actual work	Master programme/ schedule	SR	√	**x**	**x**	**x**	
9	f	Stacking and storage of construction materials and components at site	IS: 4062	Critical	Physical	Random	Tech. Specs, Construction Drawings & IS: 4062	SR	√	**x**	**x**	**x**	
11	**2**	**Surveying (Execution phase)**											
12	a	Availability of Calibrated Instruments, qualified & experieced staff at site	As required/ agreed	Critical	Physical	100%	Tech. Specs, Construction Drawings, Agreed deployment schedule	Calibration Report	√	x	x	x	
13	b	Ensure correct Boundary Layout and Latitude-Longitude Coordinates,True North	construction Drawings	Critical	Measurement	100%	Tech. Specs, Construction Drawings	SR	√	x	x	x	
14	c	GL (ground level), FGL (finished ground level) and Plinth Level, Check PBM(permanent bench mark) with Total Station/ Theodolite and after conformation carryout Peg marking	As required/ agreed	Critical	Measurement	100%	Construction Drawings	SR	√	x	x	x	
16	**3**	**Materials**											
17	A	*Cement*											
18	i	Fineness	As per IS: 4031	Critical	Review of MTC/ Physical	One test at Lab to corelate with MTC	IS:456,IS:269,IS:8112, IS:12269,IS:1489, Tech. Specs	Manufacturers Test Certificate (MTC's) and Laboratory Test results	√	**x**	**x**	**x**	Each consignment/ lot of cement shall be duly correlated with MTC If cement stored is more than 60 days in godown the same shall be re-tested for conformation with MTC
19	ii	Compressive Strength											
20	iii	Initial & final setting time											
21	iv	Chemical composition of Cement											
22	B	*Coarse Aggregates (CA)*											

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	**Sr.No.**	**Activity & Operation**	**Instruments**	**Class of Check**	**Type of Check**	**Quantum of Check**	**Reference Documents & Acceptance Standard**	**Format of Record**	**D*** (Records identified with (√) shall be issentially included by EPC vender in QA documentation)	**Cheking Agency**			**Remarks**
2								SR - Site Register SECI-SPV-QA-F-XXX SECI-SPV-QA-T-XXX (XXX - Inspection record form No. or Test report format no.)		**M'fr/ Supplier or Sub-Contractor**	**EPC Contractor**	**SECI or Owner**	
23	i	Determination of Particle size (Sieve Analysis), Flakiness index, Elongation index	As per IS: 2386	Major	Visual	Once per 100 cum or part thereof (During monsoon moisture content to be checked every day)	IS:383,IS:2386, Tech. Specs	Lab Test results	√	x	x	x	Water content of concrete to be corrected as per results of moisture content
24	ii	Moisture content											
25	iii	Crushing Value, Impact value, Abrasion value		Critical		One test at Lab for each source/ on every change of source			√	x	x	x	These tests shall be carried out while establishing design mix. In case of change of source the design mix shall be re-validated for new source
26	iv	Specific Gravity, water absorption											
27	v	Bulk Density											
28	vi	Soundness											
29	vii	Presence of deleterious materials											
30	C	*Fine Aggregate (FA)*											
31	i	Gradation/Determination of Particle size (Sieve Analysis)	Balance, Oven etc. As per IS: 2386, 383	Major	Visual	Gradation - Once per 1000 cum or part there of Mosture content - Every day	IS:383,IS:2386,IS:456 , Tech. Specs	Lab Test results	√	x	x	x	Water content of concrete to be corrected as per results of moisture content
32		Moisture Content											
33	ii	Specific Gravity and density (for design mix concretes only)	As per IS: 2386, 383	Major	Visual	One test at Lab for each source/ on every change of source							
34	iii	Water absorption (for design mix concretes only)											
35	iv	Presence of deleterious materials											
36	D	*Concrete Admixture*											
37	i	Type of admixture			Review of MTC		IS: 9103, Approved design mix		√	x	x	x	Admixture shall be of brand and type as per approved design mix.
38	ii	Physical & Chemical properties			Review of MTC		IS: 9103, Manufacturer's Brochure						Each lot/ batch of admixurture shall acompany the Manufacturer's Brochure and shall be correlated with MTC
39	iii	Suitability											
40	E	*Bricks*											
41	i	Dimensional Tolerance, shape			Measurement/ Physical	As per relevant IS code/ one sample for 30,000 nos. or part there of	IS: 1077, IS: 13757, IS: 12894, Tech. Specs, Construction Drawings	Lab Test results	√	x	x	x	Efflorescence shall be checked at each source
42	ii	Compressive Strength											
43	iii	Water Absorption											
44	iv	Efflorescence			Visual								
45	E	*Water*											
46	i	Cleanliness - Test for ascertaining limit of solids		Major		One per 3 months for each source	IS:456,IS:3025 (part 18), Tech. Specs, Construction Drawings specification	Lab Test reports	√	x	x	x	Water to be used for concrete shall be of potable quality and shall meet requirements specifed in IS: 456
47	ii	Chemical Tests to ascertain the suitability for construction purposes - pH Value, Sulphate & Chloride content					IS:456,IS:3025 (part 22, 23), Tech. Specs, Construction Drawings	Lab Test reports	√	x	x	x	
48	F	*Reinforcement Steel*											
49	i	Identification & Size		Major	Visual	Each batch of delivery	IS:432,IS:1786,IS:1852, Tech Specs	SR	√	x	x	x	Reinforcement steel shall be stored properly at site to avoid rusting
50	ii	Freedom from cracks, surface flaws, lamination				Random in each shift			√	x	x	x	
51	iii	Tensile Test		Critical	Review of MTC	Each batch of delivery	IS:432,IS:1566,IS:1786, Tech Specs	Manufacturers Test Certificate (MTC's)	√	x	x	x	
52	iv	Yield stress/proof stress											
53	v	Percentage Elongation							√	x	x	x	
54	vi	Bend/Rebend Test											
55	vii	Reverse Bend Test for HDS wire					IS:432, Tec. Specs		√	x	x	x	
57	**3**	**Structural Steel Work {Example: Chequered plate cover, Panel supports, Rungs, Cat lader, Inserts, Fencing gate (MS) etc.}**											
58	i	Strutural Steel (Raw material)-Chemical Properties, Ultimate Tensile Strength(UTS), Yield Strength (YS), Percentage Elongation, Bend test		Critical	Review of MTC	For each batch of each section	IS: 2062, IS: 8500, Tech. Specs, Construction Drawings	Manufacturers Test Certificate (MTC's)	√	x	x	x	MTC to be correlated
59	ii	Dimensional Check - Secition dimensions, thickness		Critical	Measurement	10% of total quanity at Random			√	x	x	x	For Fencing gate - dimensional check 100%

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2								SR - Site Register SECI-SPV-QA-F-XXX SECI-SPV-QA-T-XXX (XXX - Inspection record form No. or Test report format no.)		**M'fr/ Supplier or Sub-Contractor**	**EPC Contractor**	**SECI or Owner**	
60	iii	Visual checks for damages, rusting, pitting, scaling etc.		Major	Visual	100%	IS: 822, Tech. Specs, Construction Drawings, MTC, relevant BIS standards for painting	Manufacturers Test Certificate (MTC's)/ SR	√	x	x	x	
61	iv	Visual checks for welding defects, painting (surface preparation, primer coat, and Finishing coat - make and shade of paint, DFT) as applicable.		Major	Visual/ Measurement/ Review of MTC	10% of total quanity at Random			√	x	x	x	MTC to be correlated
62	v	Acceptance ofStructural steel works		Major	Physical/ Acceptance	Random	Tech. Specs, Construction Drawings	SR	√	x	x	x	
64	**4**	**Foundation System**											
65	**A**	**Bored Cast in-situ Concrete Piling (for MMS support)**											
66	**a**	**Execution**											
67	i	Ensuring correctness of layout		Critical	Physical	100%	Tech. Specs, Construction Drawings	SR	√	x	x	x	
68	ii	Checking of pile making as per drawing	Total Station	Major	Vsual								
69	iii	Checking of Centre line of Pile Group	Total Station	Critical	Physical			IS 2911, Tech Specs, Construction Drawings	√	x	x	x	1. During boring of pile, record SPT/ core recovery to ensure socketing length in the hard strata equivalent in terms of pile diameter in hard rock zone as per tech Specs and approved construction drawings. 2. In case of collapse of pile bore during drilling temporary MS lining shall be used. 3. Lines and levels to be checked 4. Each bore shall be cleaned of any loose materail by pressure jet washing/ cleaning by air jet 5.The column section shall pe placed and held in position in true vertical alignment using template/ tripod till initial setting of concrete 6. Concrete garde - as per Construction Drawing
70	iv	Check Pile Location	Total Station										
71	v	GL, Pile depth, diameter and alignment	As required		Measurement								
72	vi	Cleaning/ flushing of pile bore	As required	Major	Visual								
73	vii	Insertion & positioning of Column post in the bore hole (in case of embeded col. Leg) Placement of reinforcement and foundation bolts with template (inacse of fixing of col. with base plate & foundation bolt assembly)	As required	Critical	Visual/ Measurement								
74	viii	Acceptance of Pile casting - Shape, reinforcement or col. leg embedment (as aplicable), concreting, compacting with use of needle vibrator etc.	As required/ Agreed	Major	Visual								
75	ix	Grouting u/s of base plate	As required/ Agreed	Critical	Visual	100%	Tech. Specs & Construction drawings	SR	√	x	x	x	The type, grade and thickness of grout shall be as per approved drawing
76	**b**	**Testing**											
77	i	Initial pile load test - Compression (Vertical), Lateral (Horizontal), & Pull out (Tension)	Calibrated dial gauges, jack of required capacity, datum bars etc.	Critical	Physical	100% for 3 no. for each type of test or as specified in Tech Specs, Approved test pile layout	IS 2911, Tech Specs, Construction Drawings	Test Report	√	x	x	x	1. The R/F details shall be as per approved drawing for test plie (if applicable), 2. The test load shall be up to 2.5 times of required pile capacity in case of Compression and Lateral load and 2 times in case of Pull out test as per IS: 2911 (Pt. 4), 3. The location shall be as per approved pile test programme/ layout drawing 4. The test shall be carried out as per approved methodology 5. Test report along with test records shall be submitted in standard format as per IS:2911
78	ii	Routine pile tests - Pull out and Lateral		Critical	Physical	100% for 0.5% of total no. of working piles for each type of test	IS 2911, Tech Specs, Construction Drawings	Test Report					1. The piles for routine tests shall be selected at Random to represent total no. of job piles insalled 2. The test load for vertical and pull out shall be 1.5 times the required pile capacity 3. The test shall be carried out as per approved methodology. 4. The Test report along with test records shall be submitted in standard format as per IS:2971 (Pt. 4)

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80	**B**	**Cable Trench/ Building & Equipment Foundations**											
81	**a**	Before Excavation											
82	i	Ensuring correctness of layout		Critical	Physical	100%	Tech. Specs, Construction Drawings	SR	√	x	x	x	
83	ii	Checking of trench marking & alignment		Major	Visual		Tech Specs, Construction Drawings						
84	**b**	Excavation											
85	i	Dimensional conformity including diagonal check		Ctitical	Visual / Measurement	100%	IS:3764, Tech Specs, Construction Drawings	SR	√	x	x	x	
86	ii	Excavated earth kept away from edges		Minor	Visual	Random		SR	√	x	x	x	
87	**c**	Acceptance of Trench/ Foundation casting - Shape, reinforcement, shuttering, concreting, etc.		Minor	Physical	100%	Tech. Specs, Construction Drawings	SR	√	x	x	x	
89	**5**	**Foundation Bolts / Inserts/ Concrete embedments**											
90	i	Visual check of mechanical damage and galvanising painting if applicable on inserts			Visual / Measurement	100%	As per Tech Specs, Construction Drawings	SR	√	x	x	x	
91	ii	Bolt and assecories, inserts - Dimensions (total & threaded length & dia of bolt, size & thk of embedment and lugs etc.), Nos											
92	iii	Verticality, alignment, levels, pitch distance, embeded and projected length of bolt											
93	iii	Use of template for Alignment and Level checking											
94	iv	Acceptance of foundation bolt assembly / inserts in postion											
96	**6**	**Formwork**											
97	i	Materials & Accessories	As agreed/ required	Major	Visual	Once before start of work	IS :456 , Other relevant BIS Standard, Tech. Specs, Construction Drawings	SR	√	x	x	x	
98	ii	Soundness of staging, shuttering and scaffolding including application of mould oil/ release agent	As agreed/ required	Major	Visual	Once before start of work	Manufacturer's specs, IS :3096, IS:4014, IS: 4990, Tech. Specs, Construction Drawings	SR	√	x	x	x	
99	iii	Dimensional Check, alignment & levels as per drawing and tolerences		Major	Visual/ Measurement	100%	Tech. Specs, Construction Drawings	SR	√	x	x	x	
100	iv	Proper sealing of joints, Acceptance of formwork before concreting		Major	Physical/ Visual	Before start of concreting	As per provisions, tolerences, Tech. Specs, Construction drawings		√	x	x	x	
102	**7**	**Placement of Reienforcement Steel**											
103	i	Check whether Bar bending schedule (BBS) with necessary lap, spacers & chairs is available before start of cutting & bending of bars	As agreed/ required	Major	Visual/ physical	Random in each shift at each work site	Tech. Specs, Construction Drawings, IS: 2502	SR	√	x	x	x	
104	ii	Check whether cutting and bending of bars is as per BBS and placement conforms construction drawings			Visual/ measurement								
105	iii	Check whether all joints and crossing of bars are tied properly with right gauge and annealed wire			Visual								

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2								SR - Site Register SECI-SPV-QA-F-XXX SECI-SPV-QA-T-XXX (XXX - Inspection record form No. or Test report format no.)		**M'fr/ Supplier or Sub-Contractor**	**EPC Contractor**	**SECI or Owner**	
106	iv	Check for proper cover,spacing of bars, spacers & chairs after the reinforcement cage has been put inside the foundation			Visual								
107	v	Check whether lapping of bars are tied properly with right gauge and annealed wire			Visual								
109	**8**	**Concrete**											
110	i	Availability of approved Design Mix (for all specified grades)		Critical	Physical	For each specified grade of concrete	IS :456, Tech Specs, Construction Drawings	Approved mix design	√		x	x	The concrete shall be as per approved design mix and the materials (cement, coarse and fine aggregate shall be from the same source considered during mix trials. The mix design shall be verified and approved in case of change of source of any of the matearials
111	ii	Minimum cement content (as applicable in MMS piling and foundation/ below ground works)		Critical	Physical	For piling and foundation works	IS: 456, Tech. specs, Construction drawings	SR	√		x	x	The minimum cement content shall correspond to exposure conditions and/ or, suplphate contents in ground water/ soil
112	iii	Trial mixes to ascertain the workability and cube strength	As per recommended mix design from specialist agency	Critical	Physical/ Testing	One for each mix proportion	Tech. Specs, IS: 456	Lab Test Reports	√	x	x	x	Necessary correction for moisture content and water absoption according to mix design recommendations may be carried out during trial mix
113	iv	Mixing of concrete- check for quanities of cement, CA, FA and water used, Concrete shall be homogenous	Mixing shall be done in a approved mixer/ batching plant (conforming to IS: 4926/ 4925)	Major	Physical	Mixer/ Batcher to be calibrated at the time of starting and subsequently once in tree months	IS: 4925, IS: 4926	Calibration Report/ Certificate	√	x	x	x	Review of calibration chart/ Certificate as per IS: 4926 Qty. of materials including cement consumptionshall be available through on line printer
114	v	Handling & trasportation	As required	Major	Physical	100%	As per approved/ agreed construction methodology	SR		x	x	x	Concrete shall be placed within 30 minutes of its removal from mixer
115	vi	Placement of concrete	As required	Major	Visual/ Physical	100%			√	x	x	x	
116	vii	Compacting	As required	Major	Physical	At Random			√	x	x	x	
117	viii	Curing	As required	major	Physical	At Random	IS: 456	SR		x	x	x	
119	**9**	**Concrete Testing & Acceptance**											
120	i	Workability - Slump Test		Critical	Physical	At the time of concrete pouring at site every 2 hrs	IS:456, IS:516,IS:1199, Tech Specs, Construction Drawings	Test Results / SR	√	x	x	x	
121	ii	Crushing strength - (Works test cubes)		Critical	Physical	Testing	IS:456, IS:516,IS:1199, Tech Specs, Construction Drawings	Test Results/ SR	√	x	x	x	**MMS Pile** - 6 cubes (3 for 7 day test & 3 for 28 day strength) per sample for each 5 cum or part there off **Building work and Equipment/ Misc foundations etc.** - 6 cubes (3 for 7 day test & 3 for 28 day strength) per sample for each 25 cum or part there off
122	iii	Acceptance of concrete work - Dimensional check (dimensions, levels etc), placement of bolts, inserts, pockets, pitch distance for bolts etc.	As required & dimensional tolerences	Major	Visual/ Measurement	100%		Joint Protocol between Civil Conractor, EPC Vendor and SECI/ Owner where applicable/ SR	√	x	x	x	
124	**10**	**Acceptance of Hardened Concrete**											
125	i	Dimensional check (dimensions, levels etc), workmanship, finsishing after removal of shuttering	As required & dimensional tolerences	Major	Visual/ Measurement	At Random			√	x	x	x	

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2								SR - Site Register SECI-SPV-QA-F-XXX SECI-SPV-QA-T-XXX (XXX - Inspection record form No. or Test report format no.)		**M'fr/ Supplier or Sub-Contractor**	**EPC Contractor**	**SECI or Owner**	
126	ii	Water tightness test for liquid retaining structures/ tanks	As required	Critical	Physical/ Testing	100%	IS: 3370 (Pt.4), Tech Specs, Construction Drawings	SR/ Test Records	√	x	x	x	Water tightness test shall be performed for Under ground (UG) water tank, Septic tank
128	**11**	**Excavation & filling in foundations, trenches, plinth & grading works**											
129		**Excavation**											
130		Nature, Type of soil/ rock before and during excavation		Major	Visual	Random in each shift	Tech. Specs., Construction Drawings	SR		x	x	x	
131		Initial GL before start of excavation		Major	Measurement	100%		SR	√	x	x	x	
132		Final shape/ size & dimensions of excavation		Major	Measurement	100%		SR	√	x	x	x	
133		Final excavation levels		Major	Measurement	100%		SR	√	x	x	x	
134		Side slope of final excavation		Major	Measurement	Random in each shift		SR		x	x	x	
135	**12**	**Fill / Backfill**											
136	i	Suitability of borrowed earth for filling (if applicable) - Grain size analysis, Atterberg limits, Free swell index, Organic matter		Major	Physical	One in every 2000 cum or part there of for each type and source of fill material subject to min. 2 samples	IS: 2720 (Pt. IV), IS: 2720 (Pt. XI), Tech Specs, Construction Drawings	Lab Test Results/ SR	√	x	x	x	The parameter should not be worse than the parameter of the existing soil in plant area
137	ii	Optimum moisture content (OMC), Max. dry density (MDD) before fill		Critical	Visual	At Random	IS: 2720 (Pt. I), IS: 2720 (Pt.VII), Tech Specs, Construction Drawings	Lab Test Results/ SR	√	x	x	x	
138	iii	Layer thickness, Compaction procedure		Major	Visual	At Random	Approved Methodology, Tech. Specs, Construction Drawings	SR	√	x	x	x	The layer thickness, Type & Capacity of roller, No. of passes shall be as per approved methodology, Construction Drawing, Tech. Specs
139	iv	Degree of compaction - 1. Dry density by proctor needle penetration 2. Earth filling - In-situ Dry density (core cutter or sand replacement method) or Sand Filling - In-situ Relative density (Density Index)		Critical	Physical	(i) For foundation fill/ backfill - One for every 10 foundations at Random for each compacted layer (ii) For area grading/ filling - one every 1000 sqm area for each compacted layer	IS: 2720 (Pt. XXIX), IS: 2720 (Pt. XXVIII), IS: 2720 (Pt. XIV), Tech Specs, Construction Drawings	Test Results/ SR	√	x	x	x	
141	**13**	**Brick masonry work**											
142	i	Soaking of Bricks before use		Major	Physical	100%	IS: 2250	SR		x	x	x	
143	ii	Grading of sand, Mortar mix / proportion, Compressive strength, Consistency		Major	Physical/ Test	At Random	IS: 2250, IS: 2116, Tech Specs, Construction Drawings / As per Design Specification	Lab Test Results/ SR		x	x	x	The sand grading shall conform to IS: 2116
144	iii	Workmanship, Verticality (Plumb) / Alignment		Major	Physical/ Measurement	100%	IS: 2212, IS: 1905, Tech Specs, Construction Drawings	SR	√	x	x	x	
145	iv	Check for Bond/closers, joints		Major	Visual	At Random	IS: 2250	SR		x	x	x	
146	v	Curing		Major	Visual	100%	IS: 2250 / As perTech. Specification	SR		x	x	x	
148	**12**	**Cement Plaster**											

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2								SR - Site Register SECI-SPV-QA-F-XXX SECI-SPV-QA-T-XXX (XXX - Inspection record form No. or Test report format no.)		M'fr/ Supplier or Sub-Contractor	EPC Contractor	SECI or Owner	
149	i	Quality & Grading of sand, Check for mix proportion, wetting the surface etc		Major	Physical	At Random	IS: 2116, IS: 2386 (Pt. I & II), IS: 1542, Tech Specs	Lab Test Results/ SR		x	x	x	Sand to be used shall be free from deleteriousmaterials, Grading shall conform to Table-I of IS: 2116
150	ii	Plaster & grooves - Thickness, Evenness & Finishing, Trueness os palstering system		Major	Visual/ Measurement	At Random in each shift	Tech Specifications, Construction Drawings	SR	√	x	x	x	Trueness - Deviation not more than 4mm when checked with straight edge of 2m length
151	iii	Hacking, Raking of joints, Cleaning the surface, Removing all loose particles, Wetting the surface etc		Major	Visual	At Random in each shift	IS 1661, Tech Specs	SR		x	x	x	
152	iv	Curing		Minor	Physical	100%	IS 1661, Tech Specs	SR		x	x	x	
154	14	**Painting System - Plastered Masonry & Concrete surface**											
155	i	Materials & accessories - Approval for Paint, Color shade and Brand- Dry distemper, Oil Bound Distemeper, Acrylic Emulsion, Chemical resistant, Oil resistant Paint, Weather proof acrylic exterior paint, water proof cement paint etc.	As approved by SECI/ Owner	Critical	Review of MTC	Each batch of delivery	Tech Specs, Construction Drawings	MTC/ SR	√	x	x	x	MTC shall be correlated with the material received
156	ii	Surface preparation	As required	Minor	Physical	Random in each shift	IS: 2935 (Pt.1), Tech Specs, Construction Drawings	SR	x	x	x	x	
157	iii	Number of coats	As required	Major	Physical	Random in each shift	Tech Specs, Construction Drawings	SR	x	x	x	x	
158	iv	Application and Acceptance of painted surface	As required	Major	Physical	Each surface at Random							
160	15	**Floor finishes & Alied works**											
161	i	Preperation of Sub-grade			Physical	At Random for each building	Tech. Specs, Construction Drawings	SR	√	x	x	x	
162	ii	Plinth filling in layers (stone agrregates/ rubble with interstices filled with sand), ramming & compaction			Physical	At Random for each building	IS: 2720, Tech. Specs, Construction Drawings		√	x	x	x	Quality Checks as aplicable to Fill/ Back fill
163	iii	Check providing shuttering, reinforcement (if applicable)			Physical	At Random for each building	Tech. Specs, Construcion Drawings			x	x	x	Quality Checks as aplicable to Shuttering/ Reinforcement placement
164	iv	Checking the Panel size (as applicable)			Physical	At Random for each building	IS: 5491, Tech. Specs, Construcion Drawings			x	x	x	The concrete shall be cast in alternate panels in chess board fashion, panel size as specified in Construction Drawing or 25 sqm
165	v	Availability of Design mix (if applicable)			Visual	At Random for each building	Tech. Specs, Construcion Drawings	Mix Design Report/ SR		x	x	x	
166	vi	Clearance for concreting (as applicable)			Physical	100%	Tech. Specs, Construction Drawings	Joint Protocol between Civil Contractor, Eqpt. Supplier/ EPC Vendor & SECI/ Owner SR		x	x	x	
167	viii	Performing concreting ensuring Grade/Mix Proportions, Compaction, Thickness and Finish			Physical	At Random per shift	IS; 456, Tech. Specs, Construction Drawings	SR	√	x	x	x	Quality Checks as aplicabel to Concrete Work
168	viii	Curing			Visual	100%	IS: 456, Tech. Specs	SR		x	x	x	Minimum up to 10 days from date of casting
169	ix	Testing of Concrete Cubes for Flooring			Physical	One sample for every 20 Cum of concreting or part thereof for each days concreting (one sample consists of min 3 test cubes for 28 days strength)	IS:456, IS:516,IS:1199 and Design specification	Lab Test Reports					
170	x	Tiled flooring/ dado											

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171	a	Material - Glazed ceramic Tiles, Vitrified Ceramic Tiles, Mosaic Tailes, Acid alkali Tiles, Heavy duty cement concrete tiles	As agreed/ required	Critical	Review of MTC & Test Reports	Each lot of material received	IS:13755, IS:1237, IS:8042, Tech Specs, Construction Drawings	MTC/ SR	√	x	x	x	MTC shall be correlated for all the parameters specified in Tech. Specs, BIS Standard
172	b	Finishing & Acceptance		Major	Physical	100%	IS: 1443, Tech Specs, Construction Drawings						
173	xi	IPS with or without IRONITE (as aplicable)		Major	Physical	At Random per shift	IS: 5491, Tech. Specs, Construction Drawings	SR	√	x	x	x	
174	xi	Fixing of Panel Dividers for finishing course (3 mm Thk Glass/ 2mm Thk Aluminium strip) (if applicable)		Major	Physical	At Random per shift	Tech Specs, Construction Drawings	SR	√	x	x	x	
175	xii	Anti abrasion/ anti wearing epoxy coating (if aplicable)											
176	a	Material	As agreed/ required	Critical	Approved Make and Type	Each lot of material received	Tech Specs, Construction Drawings, Manufacturer's Brochure/ Recommendations	manufacturer's Brochure/ SR	√	x	x	x	Material specifications to be correlated with Manufacturer's Brochure
177	b	Finishing & Acceptance		Major	Physical	100%	Tech Specs, Construction Drawings	SR	√	x	x	x	
178	xiv	Kota stone flooring and skirting (as aplicable)											
179	a	Material	Quality, Texture, Thickness, Colour fro approved source	Major	Physical	Each batch of delivery	Tech Specs, Construction Drawings	SR	√	x	x	x	
180	b	Finishing & Acceptance		Major	Physical	100%	Tech Specs, Cosntruction Drawings	SR	√	x	x	x	
181	xv	Acid/ Alkali resistant tile flooring/ dado											
182	a	Material -Tiles, Mortar, Sealing, Fillers etc.	Thickness, Quality,	Critical	Approved source, Review of MTC/ Test Report	Each batch of delivery	Tech Specs, Construction Drawings	SR	√	x	x	x	The acid alkali resistant tile flooring nd dado shall be provided in battery room as per approved Arch finishing details
183	b	Finishing & Acceptance	Workmanship	Major	Physical	100%	Tech Specs, Construction Drawings	SR	√	x	x	x	
184	xvi	Interlocking Blocks											
185	a	Materials	Size/ Shape, colour shade, Grade of Concrete	Critical	Approved source, Review of MTC/ Test Report	Each batch of delivery	BS: 6717, Tech Specs, Construction Drawings	SR	√	x	x	x	
186	b	Final finishing & Acceptance	As agreed/ required	Major	Physical	100%	BS: 7533 (Pt.3), Tech Specs, Construction Drawings	SR	√	x	x	x	
188	**16**	**Damp Proof Course**											
189	i	Material - Hot bitumen & water proofing materials etc.	As agreed/ required	Critical	Review of MTC	Each batch of delivery	IS: 702, Tech. Specs, Cosntruction Drawings	SR	√	x	x	x	
190	ii	Acceptance of Damp Proof Course - Thickness, Grade of PCC, Application of Bitumen layer etc.	As agreed/ required	Major		100%	Tech Specs, Construction Drawings	SR	√	x	x	x	
192	**17**	**Grouting of pockets/ underside of base plate**											
193	i	Material	As required/ Agreed	Critical	Review of MTC/ Physical	Each batch of delivery	Tech. specs, Construction Drawings, Manufacturerr's catelogue	SR	√	x	x	x	In case of ready mixed grout MTC to be correlated with Manufacturerr's catelogue
194	ii	Type of Mix	Anti shrink cement grout/ Ready mixed - Fluid mix, stiff mix as required	Major	Physical	At Random prr shift of grout application	Tech. specs, Construction Drawings	SR	√	x	x	x	In case of cement grout anti shrink compound shall be added as per provisions of relevant IS/ Cosntruction Drawing
195	iii	Mixing, placement, application	As required	Major	Visual	At Random prr shift of grout application	Tech. Specs, Construction Drawings	SR	√	x	x	x	
196	iv	Crushing Strength - Test cubes	As required	Major	Physical/ Testing	3 cubes for entire grouting work	IS: 4031 (Pt.6), Tech Specs, Construction Drawings	SR/ Lab Test Report	√	x	x	x	

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197	v	Acceptance of Grouting	Thickness, Finished level etc.	Major	Physical	!00% of 20 % of grout work at Random	Tech. Specs, Construction Drawings	SR	√	x	x	x	
199	**18**	**Precast Concrete**											
200	**a**	**Bought Out Units (Precast boundary wall units - Slab Panels, Column etc., Trench Covers , Manhole Covers, Paver Blocks etc.)**											
201	i	Crushing strength	As required	Critical	Review of MTC/ Test Reports	100% for Each batch of delivery	IS: 456, IS:516, IS: 1199, Tech Specs, Construction Drawings	MTC	√	x	x	x	Sampling as per IS: 456, Vendor record review
202	ii	Workmanship, dimentions, R/F	As require/ agreed	Major	Review of MTC/ Physical	Each batch of delivery at Random	Tech Specs, Construction Drawings	MTC/ SR	√	x	x	x	Vendor record review, Physical check at Random
203	**b**	**Cast at site (if applicable)**											
204	i	Crushing strength - Test Cubes	As required	Critical	Testing		IS: 456, IS:516, IS: 1199, Tech Specs, Construction Drawings	SR	√	x	x	x	1 sample of 6 cubes (3 for 7 days strength, 3 for 28 days strength) for each 5 cum of concrete with minimum 1 sample per shift of concrete work
205	ii	Workmanship, dimentions, R/F	As required/ agreed	Major	Physical	At Random	Tech Specs, Construction Drawings	SR		x	x	x	
206	**c**	**Acceptance of pre-cast concrete units**											
207	i	Bought Out Units - Check for any breakage, damage during handing & trasport, erection at site (levels) etc.	As required/ Agreed	Major	Visual	At Random	Tech Specs, Construction Drawings	SR	√	x	x	x	
208	ii	Cast at site (if applicable) - Check for curing, damage during handling, erection at site (level) etc.	As required/ Agreed	Major	Visual	100% of 10% at Random	Tech Specs, Construction Drawings	SR	√	x	x	x	
210	**19**	**Joints In concrete**											
211	i	Joint Material - Bitumen inpregnataed fiber board, PVC water stop, Sealing compound - Bitumastic/ polysulphide, Hydrophilic strip, Expanded polysterene (thermocol) board etc.	As per manufacturer's standards	Critical	Review of MTC	Each batch of delivery	Tech. Specs, Construction Drawings, IS: 1838, IS:1834, IS:2200	MTC	√	x	x	x	
212	ii	Acceptance of installation	As agreed/ required	Major	Physical	Each installation at Random	Tech. Specs and Construction Drawings	SR	√	x	x	x	
214	**20**	**Underdeck Insulation Works**											
215	i	Insulation material - Mineral/ Glass wool, galvanized wire neting, Aluminium foil, fasteners etc.	As agreed/ required	Critical	Review of MTC/ Test Reports	Each lot received at site	Tech. Specs and Construction Drawings	MTC/ Test Reports/ SR	√	x	x	x	All tests as per Tech. Specifications
216	ii	Acceptance of installation	As agreed/ required	Major	Physical	Each installation	Tech. Specs and Construction Drawings	SR	√	x	x	x	
218	**21**	**False Ceiling**											
219	i	Materials - Gypsum board/ Tiles, Particle board tiles, Al tiles/ Strips, GI hangers, AL/ GI Tee support, AL/ GI Edge angle, Fasteners etc.	As agreed/ required	Critical	Visual/ Physical, Review of MTC	Each lot received at site	IS:2095, IS:8183, Tech. Specs and Construction Drawings	MTC/ SR	√	x	x	x	Compare MTC with Tech. Specifications and requirements
220	ii	Acceptance of Installation	As agreed/ required	Major	Visual/ Physical	Random	Tech. Specs and Construction Drawings	SR		x	x	x	
222	**22**	**Doors, Windows, Ventilators, Glass/ Glazing and Grill**											

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223	i	Door Frame (Hollow steel metal, Aluminium, Wooden etc. including fittings such as hold fasts etc.)	As agreed/ required	Critical	Visual, Physical, Reviewof MTC/ Test Reports	Each lot received at site	Tech. Specs and Construction Drawings	MTC/ Lab Test Reports/ SR	√	x	x	x	
224	**a**	**Steel Doors**											
225	i	Materials (MS sheet & Stiffeners, fasteners,hinges, jambs, lock strike plate, hydraulic door closer, fittings and fixtures etc)	As agreed/ required	Critical	Visual/ Physical/ Review of MTC, Test Report	Each lot received at site	IS:2062, Tech. Specs and Construction Drawings	MTC/ Lab Test Report/ SR	√	x	x	x	Review of MTC/ Test Report
226	ii	Finishing & Acceptance - Surface preperation for painting, primer & finishing coat, DFT	As agreed/ required	Major	Visual/ Physical	Random	Tech. Specs and Construction Drawings	SR	√	x	x	x	
227	**b**	**Flush Doors**											
228	i	Shutters, Teak beading	As agreed/ required	Critical	Review of MTC/ Test Report	Each lot received at site	IS:2202, Tech. Specs and Cosnstruction Drawings	MTC/ Lab Test Report/ SR	√	x	x	x	
229	ii	Acceptance	As agreed/ required	Major	Visual/ Physical	Random	Tech. Specs and Construction Drawings	SR		x	x	x	
230	**c**	**Aluminium doors and Partition works**											
231	i	Materials- Aluminium sections (average thickness, alkali resistant, anodisation, power coating and colour shade etc.), fittings and fixtures. floor spring, hydraulic door closer, hinges, etc.	As agreed/ required	Critical	Visual/ Physical/ Review of Test Report	Each lot received at site	IS:1948, IS;1949, IS:733, IS:1285, IS:1868, IS:11857, Tech. Specs and Construction Drawings	SR/ Lab Test Reports	√	x	x	x	Review of Test Report For anodization check as per Tech. Specs and Construction Drawings Power coating, colour shade as applicable as per Tech. Specs and Construction Drawings
232	ii	Finishing & Acceptance - fabrication & erection, fitting etc..	As agreed/ required	Major	Visual/ Physical	Random	Tech. Specs and Construction Drawings	SR		x	x	x	
233	**d**	**Grill**											
234	i	Materials - Aluminium, MS, Anodization in case of aluminium	As agreed/ required	Critical	Visual/Physical/ Review of Test Report	Each lot received at site	Tech. Specs and Construction Drawings	SR/ Lab Test Reports	√	x	x	x	Review of Test Reports
235	ii	Finishing & Acceptance - erection, fitting, painting in case of MS grill etc.	As agreed/ required	Major	Visual/ Physical	Random	Tech. Specs and Construction Drawings	SR		x	x	x	
236	**e**	**Rolling Shutters**											
237	i	Surface finish, Thickness of plate, mechanically operated	As agreed/ required	Critical	Visual/ Physical/ review of MTC	Random for each lot of delivery	IS:8248, Tech. Specs & Construction Drawings	SR	√	x	x	x	
238	ii	Finishing and Acceptance -Painting , DFT	As agreed/ required	Major	Visual/ Physical	Random	Tech. Specs and Construction Drawings	SR		x	x	x	
239	**f**	**Glass and Glazing**											
240	i	Material - Clear float glass, wired glass, tinted glass, ground glass, figured glass, thickness	As agreed/ required	Major	Review of MTC/ test reports	For each lot received at site	IS: 14900, IS:1081, IS: 3548, IS:5437 Tech Specs and Construction Drawings	SR	√	x	x	x	
241	ii	Installation, finishing and acceptance	As agreed/ required	Major	Visual/ Physical	Random	Tech Specs and Construction Drawings	SR	√	x	x	x	
243	**23**	**Precast Concrete Boundary Wall**											
244		Acceptance of boundary wall- Finising, Alignment Dimensions etc.	As agreed/ required	Major	Physical		Tech Specs and Construction Drawings	SR		x	x	x	For inspection of precast concrte units -refer S.No. 18
246	**24**	**Roof Water Proofing**											
247	i	Methodology for the application of water proofing system	As required	Critical	Review	for each type of treatment	Tech Specs and Const. Drawings						
248	**a**	Materials											

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249	i	Polyurethene based coating, polyester scrim cloth, extruded HD dimpled polyurethene	As agreed / required	Critical	Review of MTC/ test reports	For each lot received at site	ASTM C-836, ASTM C898 and Tech Specs /Const. Drawings	MTC/ SR	√				
250	**b**	Roof											
251	i	Graded under bed - Slope/ Level	As agreed / required	Major	Physical	100%	Tech Specs and Construction Drawings	SR		**x**	**x**	**x**	
252	ii	Elastomaric coatings -Primer coat, Finishing coat	As agreed / required	Major	Review of MTC/ test reports	Each lot of delivery	Tech Specs and Construction Drawings	MTC/ Test Reports/ SR	√	**x**	**x**	**x**	
253	iii	Wearing Course - PCC-Grade, chicken wire mesh, elastomeric sealant	As agreed / required	Major	Visual/ Review of MTC	Each lot of delivery of material/ Review of Test Report	Tech Specs and Construction Drawings	MTC/ Test Reports SR	√	**x**	**x**	**x**	2 samples of 3 no. of test cube each shall be taken for PPC work for testing of crushing strength of concrete mix, Review of MTC for Chicken wire mesh, waterproof sealant
254	c	Acceptance of Water proofing treatment	As agreed/ required	Major	Visual/ Physical	100%	Tech Specs and Construction Drawings	SR		**x**	**x**	**x**	
256	**25**	**Water Supply and Sanitary Installations**											
257	**a**	**Water Supply Fittings and Fixtures**											
258	i	Materials - GI/ MS/ C-PVC/ uPVC/PPR/HDPE pipes and fittings	As agreed / required	Critical	Review of MTC/ test reports	Each lot of delivery as per Specifications	IS:1239, IS:4736, IS:4985, IS:6745, IS: 4984, IS:2633, IS:2629, IS:15778, IS:15801, Tech Specs and Construction Drawings	MTC/ SR	√	**x**	**x**	**x**	
259	ii	Disinfection - Before use	As agreed / required	Major	Physical	Each installation	IS:2065, Tech specs and construction Drawings	SR		**x**	**x**	**x**	
260	iii	Hydraulic test - Before use/ Leakage	As agreed / required	Critical	Physical	Each installation	Tech Specs and Construction Drawings	SR		**x**	**x**	**x**	
261	iv	Acceptance & Working	As agreed / required	Major	Physical	Random	Tech Specs and Construction Drawings	SR		**x**	**x**	**x**	
262	**b**	**Sand Cast Iron/ Cast iron Pipes**											
263	i	Material - SCI / CI pipes and fittings / joints	As agreed / required	Critical	Review of MTC/ test reports	Each lot of delivery (as applicable)	IS: 1729, IS:1536, IS:1538, Tech Specs and Construction Drawings	MTC/ SR	√	**x**	**x**	**x**	
264	ii	Acceptance and leakage	As agreed / required	Major	Physical	Random	Tech Specs and Construction Drawings	SR		**x**	**x**	**x**	
265	**c**	**HDPE Pipes for Sewerage**											
266	i	Material- HDPE pipes and fittings/ joints	As agreed/ required	Critical	Review of MTC/ test reports	Each lot of delivery (as applicable)	IS:14333, Tech. Specs	MTC/SR	√	**x**	**x**	**x**	
267	ii	Acceptance & leakage	As agreed / required	Major	Physical	Random	Tech Specs and Const. Drawings	SR		**x**	**x**	**x**	
268	**d**	**HDPE Pipes for Rain water Downcommer**											
269	i	HDPE pipes and fittings/ joints	As agreed/ required	Critical	Review of MTC/ test reports		IS:4984, Tech. Specs	MTC/SR	√	**x**	**x**	**x**	
270	ii	Acceptance & leakage	As agreed / required	Major	Physical	Random	Tech Specs and Const. Drawings	SR		**x**	**x**	**x**	
271	**e**	**Sanitary fitting and fixtures**											
272	i	Sanitory items and fixtures i.e. water closets, urinals, wash basins, sinks, mirrors, shelves, towel rail, soap containers, geyser, water cooler, etc, water supply / sanitation pipes, manhole cover and frames etc	As agreed / required	Major	Review of MTC/ Test reports	Each lot of delivery as per Specifications	Tech Specs and Const. Drawings	MTC/Test Reports/ SR	√	**x**	**x**	**x**	

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273	ii	Acceptance of installations of all sanitory items and fixtures	As agreed / required	Major	Acceptance	100%	Tech Specs and Const. Drawings	SR		x	x	x	
274	f	**RCC Pipes**											
275	i	Material - RCC pipes	As agreed / required	Major	Review of MTC/ test reports	Each lot of delivery as per Specifications	IS: 458, Tech Specs and Const. Drawings	MTC/Test Reports/ SR	√	x	x	x	
276	ii	Acceptance and leakage	As agreed / required	Major	Physical	Random	Tech Specs and Const. Drawings	SR		x	x	x	
277	g	**Water Storage Tank**											
278	i	Over head / loft type	As agreed / required	Critical	Physical, review of MTC/ test reports	Each lot of delivery as per Specifications	IS:12701, Tech Specs and Const. Drawings	MTC/Test Reports/ SR	√	x	x	x	
279	ii	Aceptance and leakage	As agreed / required	Major	Acceptance	Random	IS:12701, Tech Specs and Const. Drawings	SR		x	x	x	
281	26	**Special Items (Switch Yard)**											
282	a	**Earthing Mat (Grounding System)**											
283	i	Earthing mat	As agreed / required	Critical	Physical, review of MTC/ test reports	Each lot of delivery as per Specifications	As per relevant IS and Tech. Specs / Manufacturer's, IS 3043	SR/MTC	√	x	x	x	
284	ii	Weld sizes & length	Visual/Tape	Major	Visual/ Measurement	100%	Tech Specs and Const. Drawings	SR		x	x	x	Low hydrogen electrode as per approval shall be used.
285	iii	D P test	DP test Kit	Critical	Physical	10% at random	Tech Specs and Const. Drawings	TR	√	x	x	x	
286	iv	Earth test	Earthing test kit	Critical	Physical	100%	IS:3043, Tech Specs and Const. Drawings, Relevant IS 3043	SR/ Test Report	√	x	x	x	
287	b	**Anti Weed Treatment**											
288	i	Anti-weed treatment materials	As agreed / required	Critical	Physical, review of MTC	Each batch of delivery	Tech Specs and Const. Drawings	SR/ MTC	√	x	x	x	
289	ii	Execution of treatment	As agreed / required	Major	Physical	Random check for each treatment	Tech Specs and Const. Drawings	SR		x	x	x	
291	27	**Road Work**											
292	a	**Construction of Sub-Grade and earthen/hard soulders**											
293	i	Standard proctor Test	As per IS: 2720	Critical	Physical	One in every 2000 cum for each type and source of fill materials	As per Tech Specs and Const. Drawings,Section 900 of MORTH specification, IS 2720 (Pt.VII)	SR	√	x	x	x	In cutting or existing levelled ground - quantum of check shall be one per 1000 SQM
294	ii	Moisture content of fill before compaction	As per IS: 2720	Major	Physical	One in every 2000 cum for each type and source of fill materials	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification, IS 2720 (Pt.II)	SR		x	x	x	In cutting or existing levelled ground - quantum of check shall be one per 1000 SQM
295	iii	Dry density by core cutter method ---- OR---- Dry density in place by sand displacement method	As per IS: 2720	Critical	Physical	One in every 500 SQM area for each compacted layer.	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification, IS 2720 (Pt. XXIX)/ IS 2720 (Pt. XXVIII)	SR	√	x	x	x	Both for embankment and cut formation quantum of check - One in every 1000 SQM area for each compacted layer.
296	iv	Lines, grade and cross section	As required / agreed	Major	Physical	One in every 500 SQM area	As per Tech Specs and Const. Drawings	SR	√	x	x	x	Template, straight edge

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297	**b**	**Water Bound Macadam (Non-Bituminous) for base course and sub-base course**											
298	i	Aggregate Impact value	Agrregate Impact value Test Apparatus	Critical	Physical	One test per 200 cum of Test aggregate	As perTech Specs and Const. Drawings, Section 900 of MORTH specification	SR	√	x	x	x	
299	ii	Grading	Set of IS Sieves	Major	Physical	One test per 100 cum of aggregate	As perTech Specs and Const. Drawings, Section 900 of MORTH specification	SR		x	x	x	
300	iii	Flakiness index and elongation index	Flakiness test gauge	Major	Physical	One test per 200cun of agregate	As perTech Specs and Const. Drawings, Section 900 of MORTH specification	SR		x	x	x	
301	iv	Atterberg Limits of binding material	Atterberg limits determination	Critical	Physical	One test per 25 cum of binding material	As perTech Specs and Const. Drawings, Section 900 of MORTH specification	SR	√	x	x	x	
302	v	Atterberg Limits of portion of agreggate passing 425 micron sieve	Atterberg limits determination	Critical	Physical	One test per 100cum of aggregate	As perTech Specs and Const. Drawings, Section 900 of MORTH specification	SR	√	x	x	x	
303	vi	Camber, surface, slope	As required / agreed	Major	Physical	One in every 500 SQM area	As per Tech Specs and Const. Drawings	SR	√	x	x	x	Template, straight edge
304	**c**	**Bituminous Macadam for base and binder course**											
305	i	Quality of binder	Penetrometre with St. needle	Critical	Physical	No. of samples per Lot & tests as per IS:73, IS:217, IS:8887 as applicable	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification, IS 73	SR	√	x	x	x	
306	ii	Aggregate Impact Value / Los angeles abrasion value	Aggregate Impact ValueTest apparatus	Major	Physical	Once per source	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR	√	x	x	x	
307	iii	Flakiness Index and elongation index of aggregates	Flakiness test gauge	Major	Physical	One test per 50 cum of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR		x	x	x	
308	iv	Stripping value of aggregate (Immersion tray test)	As required / agreed	Major	Physical	Initialy one set of 3 representative specimen per source, and on every change of source.	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR		x	x	x	
309	v	Water sensitivity of mix	As required / agreed	Critical	Physical	Initialy one set of 3 representative specimen per source, and on every change of source.	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR	√	x	x	x	
310	vi	Grading of aggregates	Set of Sieves	Major	Physical	Two test per day per plant both on individual constituents and mixed aggregate from dryer	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR		x	x	x	
311	vii	Water absorption of aggregate	As required / agreed	Major		Initially one set of 3 representative specimen per source, and on every change of source.	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR		x	x	x	

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312	viii	Soundness (Magnesium and Sodium Sulphate)	As required as per IS:2386	Critical	Physical	Once per source by each method and on every change of source	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR	√	x	x	x	
313	ix	Percentage of fractured faces	As required / agreed	Major	Physical	When gravel is used one test per 50cum of aggregates	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR		x	x	x	
314	x	Binder content and aggregate grading	Bitumen extractor	Critical	Physical	Periodic, subject to a min of two tests per day per plant	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR	√	x	x	x	
315	xi	Control of Temperature of binder and aggregate for mixing and of the mix at the time of laying and rolling	Thermometer	Major	Physical	At regular close intervals	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR		x	x	x	
316	xii	Rate of spread of mixed materials	As required / agreed	Major	Physical	Regular control through checks of layer thickness	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR		x	x	x	
317	xii	Density of compacted Layer	As required / agreed	Critical	Physical	One test per 250 sqm of area	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR	√	x	x	x	
318	**c**	**Bituminous Surfacing - Open graded premix carpet and Seal coat**											
319	i	Quality of binder	Penetrometre with St. needle	Critical	Physical	No. of samples per Lot & tests as per IS:73, IS:217, IS:8887 as applicable	IS 73,Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR	√	x	x	x	
320	ii	Aggregate Impact Value / Los angeles abrasion value	Aggregate Impact ValueTest apparatus	Major	Physical	One test per 50 cum of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR	√	x	x	x	
321	iii	Flakiness Index and elongation indexof aggregates	Flakiness test gauge	Major	Physical	One test per 50 cum of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR		x	x	x	
322	iv	Stripping value of aggregate (Immersion tray test)	As required / agreed	Major	Physical	Initialy one set of 3 representative specimen per source, and on every change of source.	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR	√	x	x	x	
323	v	Water absorption test		Critical	Physical	Initialy one set of 3 representative specimen per source, and on every change of source.	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR	√	x	x	x	
324	vi	Water sensitivity of mix	As required / agreed	Critical	Physical	Initialy one set of 3 representative specimen per source, and on every change of source.	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR	√	x	x	x	
325	vii	Grading of aggregates	Set of Sieves	Major	Physical	One test per 25 cum of aggregates	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR	√	x	x	x	

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326	viii	Soundness (Magnesium and Sodium Sulphate)	As required as per IS:2386	Critical	Physical	Once per source by each method and on every change of source	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR	√	x	x	x	
327	ix	Polished stone value	As required as per BS:812(Part 114)	Major	Physical	As required	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR		x	x	x	
328	x	Temperature of binder at application	Thermometer	Major	Physical	At regular close intervals	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR		x	x	x	
329	xi	Binder content	Bitumen extractor	Critical	Physical	One test per 500 cum& not less than two tests per day	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR	√	x	x	x	
330	xii	Rate of spread of materials	As required / agreed	Major	Physical	One test per 500 cum and not less than 2 tests per day	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR		x	x	x	
331	xiii	Percentage of fractured faces	Bitumen extractor	Critical	Physical	When gravel is used one test per 50cum of aggregates	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR	√	x	x	x	
332	**d**	**Tack Coat/ Prime coat/ fog coat**											
333	i	Quality of binder	Penetrometre with Standard needle	Critical	Physical	No. of samples per Lot & tests as per IS:73, IS:217, IS:8887 as applicable	IS 73,Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR	√	x	x	x	
334	ii	Temperature of binder at application	Thermometer	Major	Physical	At regular close intervals	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR		x	x	x	
335	iii	Rate of spread of binder	As required / agreed	Major	Physical	One test per 500 cum and not less than 2 tests per day	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR		x	x	x	
336	**e**	**Alignment, Level, Surface regularity and rectification**											
337	i	Horizontal alignment, Surface levels and Surface regularity	As required / agreed	Major	Physical	At Random	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR	√	x	x	x	
338	ii	Rectification	As required / agreed	Major	Physical	Each rectification	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR		x	x	x	
340	**28**	**Geotechnical Investigations**											
341	i	Deployment of approved Geotechnical Investigation Agency - Equipments, Manpower etc	As required / agreed	Critical	Physical	Once before commencement of work	As per technical specifications and relevant IS Codes	SR	√	x	x	x	
342	ii	Execution of Geotechnical Investigation - locations, type etc as per scheme	As required / agreed	Major	Physical	Each Location	As per technical specifications and relevant IS Codes	SR		x	x	x	
343	iii	Collection of disturbed and undisturbed samples , their packing and storage	As required / agreed	Major	Physical	each sampling	As per technical specifications and relevant IS Codes	SR		x	x	x	
344	iv	Conducting filed tests as per investigation scheme- such as, SPT/ERT/SCPT/PLT/PMT etc	As required / agreed	Major	Physical	each field test	As per technical specifications and relevant IS Codes	SR		x	x	x	

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345	v	Submittion of Field Borelogs in approved format	As required / agreed	Major	Review	Within 24 hours after completion of each BH	As per technical specifications and relevant IS Codes	SR		x	x	x	
346	vi	Submittion of laboratory test schedule and selection of samples for laboratory testing	As required / agreed	Critical	Review and acceptance	as per consultation with engineer during dispatch of samples to approved laboratory	As per technical specifications and relevant IS Codes	SR	√	x	x	x	
347	vii	Submission of Final Geotechnical investigation report along with recommendations	As required / agreed	Critical	Physical	After completion of investigation work and review of draft reports	As per technical specifications and relevant IS Codes	SR		x	x	x	
349	**29**	**Topographical Survey Works**											
350	i	Deployment of approved Topographical Surveying Agency - Equipments, Manpower etc	As required / agreed	Critical	Physical	Once before commencement of work	As per technical specifications and relevant IS Codes	SR	√	x	x	x	
351	ii	Transfer of Permanent Bench mark to site from known location	As required / agreed	Major	Physical	Before commencement of work	As per technical specifications and relevant IS Codes	SR		x	x	x	
352	iii	Establishment of boundary pillers and survey grid, Temporary bench Marks, Measurement & recording spot levels	As required / agreed	Major	Physical		As per technical specifications and relevant IS Codes	SR		x	x	x	
353	iv	Recording features like trees, roads, transmission lines, lake, nala, river, temple, house, culverts etc. with coordinate locations	As required / agreed	Major	Physical		As per technical specifications and relevant IS Codes	SR		x	x	x	
354	vi	Submission of final Counter map showing all topographical features, record of spot levels	As required / agreed	Critical	Physical	After completion of investigation work and review of draft reports	As per technical specifications and relevant IS Codes	SR	√	x	x	x	
356	**30**	**Internal Switchyard - Site Leveling & Grading**											
357	i	Leveling Switchyard area	As required / agreed	Major	Visual / Physical	100%	As perTech. Specification and Approved Drawing	SR		x	x	x	
358	ii	Grading of 20/40mm stone / Gravel Spreading in sitchyard area	As required / agreed	Major	Physical	100%	As per Tech. Specification & Approved Drawing	SR		x	x	x	
360	**31**	**Plant Boundary Fencing (if applicable) & Gate (Also refer S.No. 3 for Steel works as applicable)**											
361	i	Fence posts (Intermediate, Stay & Corner Posts etc.) - Section size, Length, Galvanization - Grade/ Thickness, Tensile strength etc.	As agreed/ Required	Critical	Physical/ Measurement/ Review of MTC	Each lot received at site Random	IS:226; IS:2721; IS:278; IS:480; IS:4826 , Tech. Specs & Construction Drawings	MTC/ SR	√	x	x	x	For Structural steel checks refer S.No. 3
362	ii	Barbed wire - Dia. of line wire and barb wire, Grade of galvanization etc, Tensile strength etc.	As agreed/ Required	Critical	Physical/ Measurement/ Review of MTC				√	x	x	x	
363	iii	Tie wire - Diameter, Galvanization- Grade, tensile strength etc.	As agreed/ Required	Critical	Physical/ Measurement/				√	x	x	x	
364	iv	Blade barbed/ Concertina Wire - Thickness/ Diameter, galvanization, Diameter of concertina coil, Tensile strength etc.	As agreed/ Required	Critical	Physical/ Measurement/ Review of MTC				√	x	x	x	

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365	v	Fence Fabric- Mesh size, Wire Diameter, Galvanization-Grade, Selvage, Knuckling, Tensile strength etc.	As agreed/ Required	Critical	Physical/ Measurement/ Review of MTC				√	x	x	x	
366	vi	MS Gate - Caster weels, ball & bearings, Fixtures & fasteners etc.	As agreed/ Required	Major	Visual	100%	Tech. Specs & Construction Drawings	SR		x	x	x	
367	vi	Acceptance of Boundary Fence and gate	As agreed/ Required	Major	Physical	100%	Tech. Specs & Construction Drawings	SR		x	x	x	
369	**32**	**Tranformer Yard Fencing & Gate (Also refer S.No. 3 for Steel Works as applicable)**											
370	i	Fence posts (Intermediate, Stay & Corner Posts), Concertina Wire Support Angles - Section size, Length, Galvanization, Tensile strength etc.	As agreed/ Required	Critical	Physical/ Measurement/ Review of MTC	Each lot received at site Random	IS-226; IS 2721; IS-4948 , IS:480; IS:4826 Tech. Specification and Approved Drawing	MTC/ SR	√	x	x	x	For structural steel checks refer S.No. 3
371	ii	Tie wire (as aplicable) - Diameter, Galvanization, Tensile strength etc.	As agreed/ Required	Critical	Physical/ Measurement/ Review of MTC				√	x	x	x	
372	iii	Fence Fabric (chain link/ welded wire as aplicable)- Mesh size, Wire Diameter, Galvanization, Selvage, Knuckling, Tensile strength etc.	As agreed/ Required	Critical	Physical/ Measurement/ Review of MTC				√	x	x	x	
373	iv	MS Gate - Fixtures and fasteners	As agreed/ Required	Major	Visual	100%	Tech Specs andAproved Drawings	SR		x	x	x	
374	v	Acceptance of Fence & Gate	As agreed/ Required	Major	Physical	100%	Tech Specs and Approved Drawings	SR		x	x	x	
376	**33**	**Installation of Pre Engineered Building (PEB) - Security Cabin**											
377	**a**	**Receipt**											
378	i	Receipt of materials and Checking as per packing list	As agreed/ Required	Major	Visual	100%	As per Approved Drawings & Method Statement, Relevant BIS standards	SR	√	x	x	x	
379	iii	Dimensional Check	As agreed/ Required	Major	Measurement	100%			√	x	x	x	
380	iv	Visual checks for damages, rusting, pitting etc.	As agreed/ Required	Major	Visual	100%				x	x	x	
381	v	Visual checks for defects, primer coating and painting/galvanising as applicable.	As agreed/ Required	Major	Visual	100%				x	x	x	
382	vi	Nut/Bolt/Washers Checks	As agreed/ Required	Major	Visual	100%				x	x	x	
383	**b**	**Pre-Installation**											
384	i	Check that the work area is ready and safe to start installation	As agreed/ Required	Major	Visual / Dimension					x	x	x	
385	ii	Check readiness of Foundations	As agreed/ Required	Major		100%				x	x	x	
386	**c**	**Installation (as aplicable)**											
387	i	Readyness of concrete platform, foundations for installation- Size, Location, Level etc.	As agreed/ Required	Major	Visual					x	x	x	
388	ii	Check PUF side walls/ roof are installed properly	As agreed/ Required	Major	Physical					x	x	x	
389	iii	Check tightening of all Nut/Washers/Bolts	As agreed/ Required	Major	Physical					x	x	x	
391	**34**	**Structural Work for Module Mounting Structure (MMS)**					Tech. Specification, Approved Drawing & Method Statement						
437	a	**Manufacturing**											

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438		**Strucural Steel (Raw Material)** Hot rolled & cold formed sections - Angle, Channel, Z-section, Box section, Plate, rod & bar											
439	i	Ultimate Tensile Strength (UTS), Yield Strength (YS), Percentage Elongation, Bend Test, Chemical Composition, Section dimensions	As agreed/ Required	Critical	Chemical composition, Mechanical, Measurement	1 Sample per 50 MT or part thereoff/ for every heat no.	IS 2062, IS 513, IS 811, IS 1079, IS 808, IS 1852, IS 1730 -Part I	MTC	√				Raw material to be procured from reputed manufacturers - like SAIL, RINL, JSPL, JSW, TISCO, ISSAR
440	ii	Visual Examination - Cracks, Scaling, Rust, Pitting, Lamination etc.	As agreed/ Required	Major	Visual	10% IS 2500, Level II, AQL 1.5	IS 2062, IS 513, IS 811, IS 1079, IS 808, IS 1852, IS 1730-Part I	SR	√	x	x	x	Material shall be free from surface defects like cracks, lamination,roughness, imperfect edges, rust, pitting & other harmful defects. Removal of minor surface defects as per IS;2062 is acceptable. Witness for 10% sample. Record review for every material
441		**Boughtout Items (Hardware - Nuts, Bolts and Washers - plain, spring)**											
442	i	Mechanical & Chemical Properties	As agreed/ Required	Critical	Chemical composition, Mechanical	1 sample per 5 MT or part thereoff	IS 1327 (Part 17) eq./ ASTM standard	MTC/ Lab test Report	√	x	x	x	
443	ii	Dimensional check (Dia., Thickness, Total stem length & Threaded length etc.)	As agreed/ Required	Major	Measurement	IS 1327 (part 17) eq 10 pieces per lot per member type	IS 6639, IS 2016,IS 6610 & IS 3063 / ASTM standard	Vendor Records	√	x	x	x	Witness for sample. Record review for every material
444	iii	Galvanizing - Mass per Sqm, Thickness (DFT)	As agreed/ Required Alcometer	Major	Visual, Measurement	IS 1327 (part 17) eq 10 pieces per lot per member type	For Hot dip galvanizing should be maintained 43 microns (min) and average 54 microns as per IS 1367 (part XIII) eq.	Vendor Records	√	x	x	x	Record review Random sample inspection/ measurement
445	b	**In Process Inspection**											
446		**Structural Item Fabrication**											
447	i	Straightening	As agreed/ Required	Major	Visual	100%	0.2% of total length	Vendor Records	√	x	x	x	Record review
448	ii	Cropping (Cutting)	As agreed/ Required	Major	Visual	100%	Approved drawing	Vendor Records	√	x	x	x	Record review
449	iii	Identification/ Marking	As agreed/ Required	Major	Visual	100%	Approved drawing Marking Shall be done with the help of permanent paint marker using stencil as per Drawing	Vendor Records	√	x	x	x	Record review Random sample inspection
450	iv	Punching/ Drilling of Holes	As agreed/ Required	Critical	Measurement	1 piece per 25 pieces	IS 802/ Approved drawing	Vendor Records	√	x	x	x	Record review
451		Edge Security							√	x	x	x	
452	v	Overall Length	As agreed/ Required	Major	Measurement	1 piece per 25 pieces	IS 802/ Approved drawing	Vendor Records	√	x	x	x	Record review Random sample measureemnt
453	vi	Bending	As agreed/ Required	Critical	Measurement	100%	IS 801, 811/ Approved drawing	Vendor Records	√	x	x	x	
454		Cross Section Dimensions							√	x	x	x	Record review
455	vii	Welding	As agreed/ Required	Major	Visual	100%	Approved Welding Procedure & Welder Qualification	Vendor Records	√	x	x	x	Record review Random sample ispection
456	viii	Visual Examination - Black spots, Porosity, Spatter, Rust bleed points, Weld dimensions	As agreed/ Required	major	Visual	100%	Tech. Specification, Approved Drawing	Vendor Records	√	x	x	x	Record review Raddom sample inspection (The fabricated material shall be free from
457	ix	DP Test (as necessary)	As agreed/ Required	Major	Chemical	Shift wise/ random	As and when required	Vendor Records	√	x	x	x	
458	x	Final Inspection of Fabricated Parts - Cross section dimensions, Thickness (before galvanization)	As agreed/ Required	Critical		10 % in lot size of 100 nos.	IS- 802, IS 807, IS 811 and relevant applicable eq. standards , approved drawings, Tech spec	Vendor Records	√	x	x	x	
459		**Galvanizing**											
460	i	Zinc - Ingot, Molten metal in galvanizing bath	As agreed/ Required	Critical	Chemical	1 sample from each batch of ingot supply	IS 2629	MTC Lab test report	√	x	x	x	Purity of Zn 98.5%, MTC to be correlated. Molten metal in the galvanizing bath ≥ 98.5 % by mass of zinc.
461		**Pre Galvanizing**											

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462	i	Degreasing	Acid base cold degreaser	Major	Chemical	One sample daily	Sp. Gravity 1.1 to 1.2, ph Value 2 to 3	Vendor Records	√	x	x	x	Record review
463	ii	Pickling - Acid & Iron content	Lab test	Major	Chemical	One sample daily	Acid Content-Concentration 18% to 4% min, Sp. Gravity 1 to 1.3 Iron Content -120g/litre (max)	Vendor Records	√	x	x	x	Record review
464	iii	Rinsing	pH meter	Major	Chemical	One sample daily	Rinsing water ph value 5 to 7	Vendor Records	√	x	x	x	Record review
465	iv	Pre-fluxing in ZnCl solution - Specific gravity, pH	pH meter	Major	Measurement	One sample daily	Sp Gr - 1.10 to 1.26 pH - 3 to 5	Vendor Records	√	x	x	x	Record review
466	v	Pre-heating	Pyrometer	Major	Measurement	One sample daily	Above 50^0 C	Vendor Records	√	x	x	x	Record review
467	vi	Dipping - Zinc bath temperature, Imersion & withdrawl time	Continuous recording & verification by Pyrometer	Major	Measurement	Hourly check	Zn bath temp - 440^0 C to 460^0 C Article to be immersed till reaction	Vendor Records	√	x	x	x	Record review
468	vii	Quenching	Plain water	Minor			Bath in plain water for cooling & Cleaning. Temp. Below 65°	Vendor Records	√	x	x	x	Record review
469	viii	Di-chromating	Di-chromate solution	Major	Chemical	One sample daily	strength of the solution to be maintained as 0.7 to 1% of sodium dichromate, temperature of solution should be less than 65°	Vendor Records	√	x	x	x	Record review
470		**Post Galvanizing**											
471	i	Surface Defects/Finish - Dross, Pimples, Black marks, Ash deposition	As agreed/ Required	Major	Visual	100%	IS 2633	Vendor Records	√	x	x	x	Record review Random samples to be inspected during
472	ii	Thickness of Zinc Coating	Alcometer	Critical	Measurement	3 samples per dip	As Per IS 4759 , 6745 , Minimum 80micron or as per spec.	Vendor Records	√	x	x	x	Record review Random samples to be measured during factory visit by Owner/PMC
473	iii	Mass of Zinc Coating		Critical	Chemical	1 sample per shift	As Per IS 6745	Vendor Records	√	x	x	x	Record review
474	iv	Uniformity of Zinc Coating (Preece Test)		Major	Chemical	1 sample per shift	No red stains after 4 dippings	Vendor Records	√	x	x	x	Record review/ Sample test if deemed necessary
475	v	Adhesion of Zinc Coating (Pivote Hammer Test/ Knife Test)		Major	Physical	1 sample per hour	No Removal or lifting in areas between hammer impression/coating should not peel off. As per IS 2629	Vendor Records	√	x	x	x	Record review Random samples to be inspected during factory visit by Owner/PMC. Sample test if deemed necessary
476		**Proto Assembly**											
477	i	Proto Assembly check - Fitment, Dimensions, Alignment, Overall Stability	Prototype of one mounting table with	Critical	Physical/ Measureemnt	100%	Cut lengths of all members, Fitment (dia. of holes, end security, c/c distance between holes etc. shall be checked for correctness wrt permissible tolerence through in postion ispection of assembled proto), Fasteners (bolts, nuts and washers), Cleats, Gussete plates shall be as per Approved drawing/ specifications. The proto assembly shall be checked for overall stability for design verification of various conenctions and col. support system.	IR	√	x	x	x	The general quality of fabrication and galvanization of members, straightness of members, overall stability of prototype etc. shall be checked for design verification. Any suggestions for design changes etc. shall be properly recorded in the inspection report for implimentation in mass production of MMS members
478		**Marking/ Packaging**											
479	i	Marking	As agreed/ Required	Major	Visual	100%	Aprroved drawing/ marking scheme	IR	√	x	x	x	Record review Random sample shall be checked during facroty visit by Vendor and SECI/ Owner representative

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1	**Sr.No.**	**Activity & Operation**	**Instruments**	**Class of Check**	**Type of Check**	**Quantum of Check**	**Reference Documents & Acceptance Standard**	**Format of Record**	**D*** (Records identified with (√) shall be issentially included by EPC vender in QA documentation)	**Cheking Agency**			**Remarks**
2								SR - Site Register SECI-SPV-QA-F-XXX SECI-SPV-QA-T-XXX (XXX - Inspection record form No. or Test report format no.)		**M'fr/ Supplier or Sub-Contractor**	**EPC Contractor**	**SECI or Owner**	
480	ii	Packaging, Storing, Bundling, Handling	As agreed/ Required	Major	Visual	100%	As per IS-802. Packing of Column. Bracing, Rafters and Purlins shall be done by strapping. Packing of smaller items by wires or in gunny bags/ or as per approved procedure	IR	√	x	x	x	Separate packaging for different type of members like Col, Purlin, Rafter, Front/ rear/ diagonal bracings, fasteners, cleats etc. Small members shall be bundled with wire. Damage to galvanization and form (shape) of the member during handling and trasporting shall be controlled
481		**Site Installation**								x	x	x	
482	i	Receipt of materials and Checking as per packing list	As agreed/ Required	Critical	Visual	Random	Tech. Specification, Approved Drawing & Method Statement.		√	x	x	x	
483	ii	Fabricated members - Dimensional Check	As agreed/ Required	Major	Visual	100%				x	x	x	
484	iii	Visual checks for defects/damages, rusting, pitting, galvanising etc.	As agreed/ Required	Major	Visual	Random				x	x	x	
485	iv	Nut/Bolt/Washers	As agreed/ Required	Major	Measurement	100%				x	x	x	
486	v	Mounting of structures & Accessories - Coordinates, Levels, Fitment, Alignment etc.	As agreed/ Required	Critical	Visual /Measurement	100%			√	x	x	x	
487	vi	Torque Checking - Daily calibration check, Bolt installation	As agreed/ Required	Major	Measurement	100%				x	x	x	
489	**35**	**Module Mouting - Pre Installation Check**			Visual	100%							
490	i	Check for site physical layout as per drawing / Design Specification		Major	Physical	100%				x	x	x	
491	ii	Check for Structure, Mounting readiness		Major	Physical					x	x	x	
493	**36**	**String Combiner Boxes (SCB) - Mouting - Pre Installation Check**											
494	i	Check for foundation readyness - location & coordinates, dimensions & levels, foundation bolts etc.		Major	Physical	100%				x	x	x	
496	**37**	**Inverter Panel**					Design Specification, Drawings, Manufacturer Manual Method Statement	SR					
497		**Pre Installation**											
498	i	Check for site physical layout as per drawing.		Major	Visual	100%			√	x	x	x	
499	ii	Ensure that no fouling with civil/structural		Major	Physical	Random				x	x	x	
500	iii	Check for Foundation readiness and level of foundation.		Major	Physical	100%				x	x	x	
502	**38**	**Burried Cables**					Design Specification, Drawings, Manufacturer Catalogue Method Statement (SW-SEPC-MS-CAB-006)						
503	i	Cable Trench - Dimensions, alignment		Critical	Physical	100%	Design Specification, Drawings, Manufacturer Catalogue Method Statement	SR		x	x	x	
504	ii	Sand filling before cable laying, sand filling after cable laying, placing of precast concrete slabs/ bricks, backfilling with soil		Major	Visual	100%				x	x	x	
586													
587													
588													
589													
590													
591													

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	**Sr.No.**	**Activity & Operation**	**Instruments**	**Class of Check**	**Type of Check**	**Quantum of Check**	**Reference Documents & Acceptance Standard**	**Format of Record**	**D*** (Records identified with (√) shall be issentially included by EPC vender in QA documentation)	**Cheking Agency**			**Remarks**
2								SR - Site Register SECI-SPV-QA-F-XXX SECI-SPV-QA-T-XXX (XXX - Inspection record form No. or Test report format no.)		**M'fr/ Supplier or Sub-Contractor**	**EPC Contractor**	**SECI or Owner**	
592			**LEGEND**: D * Records, indentified with "Tick" (√) shall be essentially included by supplier in QA documentation.							**DOC. NO**.: SECI - XXX - XXX -XXX - FQP & MQP - 001		**REV**: 0	
593			**Legend to be used:**										
594			**Class # : A** = Critical, **B**=Major, **C**=Minor										
595			**Format of Record #** : **SR**=Site Register, **TR**=Lab Test Report, **IR**=Inspection Report, **MTC**=Manufacturer's Test Certificate										
596			All **MTC'**s shall be correlated with batch of material supply, Tech specs and drawings										
597			**Category 'A'** - Sub-contractor/ sub-vendor, EPC Vendor, SECI/ Owner										
598			**Category 'B'** - Sub-Contractor/ Sub-Vendor, EPC Vendor, SECI										
599			**Category 'C'** - Sub-Contractor/ Sub-Vendor										
600										**Reviewed By**	**Approved By**		**Approval Seal**
601			This document shall be read in conjunction with Tech. Specifications and Drawings										

Annexure – C

PG Test Procedure

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1 INTRODUCTION

This document lays down the procedures and requirements for conducting Functional Guarantee tests including scope of the tests, procedures for the tests, reporting formats and process for determining test results in accordance with the Tender Specifications, applicable standards and industry best practices.

2 FUNCTIONAL GUARANTEE TESTS FOR SOLAR PV PLANT

Functional Guarantee for Solar PV Plant shall comprise of following Guarantees:

(1) Performance Ratio Guarantee test for operational acceptance.

(2) BESS Performance Assessment as per Annexure G.

2.1 PERFORMANCE RATIO GUARANTEE TEST

A Performance Ratio Guarantee test shall be commenced within 60 days of the commissioning of Plant Facilities to demonstrate that the plant has achieved the Guaranteed Performance Ratio in line with requirements under ANNEXURE A of the bidding document. This will be one of the pre-conditions for the Plant Operational Acceptance. Performance Ratio (PR) test period would be continuous measurement of 30 consecutive days. The test shall be conducted in accordance with the IEC-61724 as per the methodology described in Technical Specifications under ANNEXURE A of the bidding document. The procedure of PR test is described further in Section 2.4. The report shall contain all the measured energy and Met data values, calculations, results and conclusions.

2.1.1 Performance Ratio

The Performance Ratio (PR) of the PV Plant is calculated as follows (according to IEC 61724 Ed.2).

$$PR = \frac{E_{out}}{\sum_k \left(\frac{(C_k \times P_o) \times (G_{i,k} \times \tau_k)}{G_{i,ref}} \right)}$$

where

PR Temperature Corrected Performance Ratio

E_{out} Cumulative AC energy measured at the Plant End (ABT meter) over the duration of reporting period (kWh)

τ_k Duration of the kth recording interval, i.e. (1/60) hour

$\sum_k$ Summation over all recording intervals in the reporting period, (1/4) hour

C_k Power rating temperature adjustment factor and can be calculated as below

$Ck = 1 + \gamma \times (T_{avg\_mod,k} - T_{ref})$

γ Temperature coefficient of power with negative sign ($°C^{-1}$)

$T_{avg\_mod,k}$ Average PV Module temperature measured at the commencement of time interval 'τ_k' (°C)

T_{ref} PV Module temperature at which P_o is determined, i.e. 25°C

P_o Installed nominal peak power of PV modules, i.e. Nameplate rating at STC (kW_p)

$G_{i,k}$ Average irradiance measured at the Plane of Array (POA) at the commencement of time interval τ_k (kW/m^2) (average of all Pyranometres in various sites)

$G_{i,ref}$ Irradiance value at which P_o is determined, i.e. 1 kW/m^2

2.1.2 **General Requirement**

- The Functional Guarantee shall comprise of a set of visual/mechanical/Electrical checks followed by a Performance Ratio (PR) test of the Plant Facilities.
- The PR test shall be carried out for a period of 30 consecutive days at site by the Contractor in presence of the Employer/ Employer's Representative/ Owner's Engineer.
- These tests shall be binding on both the parties to the contract to determine compliance of the equipment with the guaranteed performance parameters.
- The test will consist of guaranteeing the correct operation of the Plant Facilities, by way of the performance ratio based on the reading of the energy produced and delivered to the grid (ABT meter) and the Plane of Array incident solar radiation.
- PR is calculated as per the formula given in Clause no. 2.1 and recorded as per the format provided at ***Annexure 1***.
- The filled-in format shall be signed by both the parties (EPC Contractor and SECI) and each party will keep one copy for record. **The same will be recorded for 30 consecutive days.**
- The Functional Guarantee condition for the purpose of Provisional Acceptance of the Plant Facilities shall be considered to have been met if the guaranteed Performance Ratio (PR) is achieved on a daily basis for 30 *consecutive days** as per Clause 2.1.5 of this document.
- During this PR test, equipment failure/interruption of any kind, except for SCADA communication failures, will not be accountable. In case of a breakdown, the test may be resumed once the complete system is rectified and working properly.

  ***** Interruptions due to communication breakdown only may be exempted based on specific approval to the effect that generation is not affected and equipment failure (Refer Clause 2.1.5) is not attributable. In such case, the test shall be extended for affected no. of days (up to 5 days)

2.2 PRE-PR TEST

2.2.1 The EPC Contractor shall perform start-up tests after completion of Commissioning and Test Procedure as per Annexure F: Plant Documentation, Commissioning and Test Procedure and recording of punch points.

2.2.2 Functional Guarantee Test shall commence immediately after all issues arising from the functional/ start-up test have been rectified.

Note:

(a) All measurement(s) procedure should be carried out taking proper safety precaution.

(b) Also it should be ensured that to avoid any loose connection at the terminal points for which measurement procedure is conducted.

(c) Ensure proper functioning (e.g. Multimeters shall be calibrated) of all measuring instruments before conducting above measurement procedure.

(d) The above test procedure shall be conducted in presence of site in-charge.

2.3 PR TEST PROCEDURE

The date of commencement of the PR Test shall be communicated in advance and agreed upon by both parties i.e. SECI and EPC Contractor. Any consecutive 30 days period (excluding interruptions that last entire day on account of grid outage or as per hindrance record maintained at site only) for the purpose of conducting PR test shall be mutually discussed and agreed between SECI and EPC Contractor. It shall comprise of the following procedures.

2.3.1 Pre-test Procedure

(1) Before the commencement of Performance Ratio (PR) test, the plant shall have achieved visual/mechanical/Electrical completion as per Clause 2.2 above and SCADA system and WMS shall be fully commissioned and functional.

(2) Trial Run: The PG Test for Plant Facilities shall commence with a trial run for 7 consecutive days. The EPC Contractor shall provide the data in requisite formats (specified elsewhere in the document) to SECI. SECI shall vet the data for any discrepancies and systemic errors and revert within 3 working days. Post the trial run period, the 30 days PR test will commence after communication from SECI in this regard.

(3) Pyranometer Tilt Angle & Cleanness: The pyranometers & Tilt Angle shall be verified before the test commences and **then visually inspected at regular intervals for cleanliness during the tests**.

(4) The average POA radiation of all the Pyranometers ($G_{i,k}$) shall be considered for the calculation of PR. The average of module temperatures recorded by all the temperature sensors shall be used for calculation of PR. The Pyranometers and Temperature sensors

used for the purpose of the PR Test shall have valid calibration certificates.

2.3.2 Following the completion of the pre-test procedures, Performance Ratio Test of plant shall commence in accordance with the procedures, conditions and requirements provided in the next section.

2.3.3 General Procedure for the PR Test

The PR Test Procedure shall include the following components:

(1) Data Collection: PV Power Plant test related parameters are collected in one-minute and 15 intervals for the 30 (Thirty) days (consecutive) reference period. The data shall consist of the following at a minimum:

- Irradiance at Collector's (i.e. PV Module) POA; (Source: SCADA, Temporal Resolution: 1 minute) Average values form all the sites will be considered
- Other Met Data received from installed WMS; (Source: SCADA, Temporal Resolution: 1 minute)
- Energy generated at Plant (kWh) (Source: Plant TVM Meter from SCADA, Temporal Resolution: 1 minute)
- Energy injected into grid (kWh) (Source: Plant End ABT Meter, Temporal Resolution: 15 minute)
- PV Module Temperature recorded from the temperature Sensors (^{o}C) (Source: SCADA, Temporal Resolution: 1 minute)

(2) **Data Filtering:** The data shall be filtered so that the data set is free of nuisance data points and bad data that exhibit a high degree of error (such as errors caused by faulty instrumentation). The EPC Contractor shall document data which is to be eliminated along with reasons. The following criteria shall be excluded from the dataset used for this test:

- **Nuisance or bad data** – Nuisance data points or bad data that clearly exhibit a high degree of error including required meteorological measurement equipment that is identified as being out of calibration or requiring adjustment. A 15-minute time-block shall be *explicitly* flagged through a flag parameter on account of this factor after recording reasons thereof (**Note**: no filtration shall be done at site level). The same shall be corroborated/verified by SECI.
- Time blocks with insufficient (less than equal to 10) 1-minute records.
- **Grid Interruptions** – Time periods (in 15-minute time blocks) of the grid interruptions at the utility substation, recorded manually jointly by EPC Contractor and SECI representatives shall be eliminated. Grid outage period, if any, shall be verified from SCADA.
- Any Force majeure conditions

- **Radiation Criteria –** Radiation on Plane of Array (POA) less than 200 W/m^2
- Shutdown explicitly demanded by the Owner/DISCOM/STU.
- As per the hindrance record maintained at site.

Note: Minimum 24 Nos of 15-minute time blocks shall be considered to account the day for PR measurement. Otherwise the PR test shall be extended to another day.

2.3.4 **Determination of PR Test**

Daily PR shall be calculated as the average of the PR calculated for valid 15-minute time blocks (Refer Clause 2.3.3) for the 30-day duration. If the ABT Meter data is not available on daily basis, PR shall be calculated based on the MFM data and shared for record. However, at the end of the PR test period, the daily PR shall be re-calculated with the ABT Meter data for sign-off.

If the If the EPC Contractor is not able to demonstrate guaranteed PR during this period, two more chances shall be given to demonstrate the same after incorporation of suitable corrective measures. In case the contractor fails to achieve guaranteed PR even after the two more chances, further action shall be taken as per the provisions of contract.

The test shall be repeated for 30 days in case of any outage of following equipment (as applicable) for more than 7 days.

- Power Transformer/Inverter Duty Transformer
- Power Conditioning Unit
- HT Switchgear Panel
- SCADA and data logger combined
- Tilted pyranometer
- Other WMS sensors.

2.3.5 **Raw Data Formats and Reports**

The EPC Contractor shall submit to SECI the raw data from the Plant SCADA on daily basis in the following format.

Temporal Resolution: 1 Minute

Date & Time dd/mm/yyyy hh:mm:ss format	Wind Speed (m/s)	Module Temp. (°C)	Ambient Temp. (°C)	Horizontal Irradiance (W/m²)	POA Irradiance (W/m²)	POA Radiation (kWh/m²)	Humidity (%)	Wind Direction (°)	Generation (kWh) (Source: TVM)

Temporal Resolution: 15 Minute (Every 15th Min record from the 1 Min Data)

Date & Time Dd/mm/yyyy hh:mm:ss	Wind Speed (m/s)	Module Temp. (° C)	Ambient Temp. (° C)	Horizontal Irradiance (W/m²)	POA Irradiance (W/m²)	POA Radiation (kWh/m²)	Humidity (%)	Wind Direction (°)	Generation (kWh) (Source:	Explicit Removal Flag*	Remarks

format									TVM)	(0 or1)	

* Explicit Removal Flag: 0 indicates time block considered; 1 indicates time block not considered.

PR Test Report shall be generated from the Raw Data (Sample Report provided in the Annexure) after data filtering as per criteria laid out in (2). The Report shall contain the signature of both representatives (SECI/Employer & EPC Contractor).

Note: In case of multiple pyranomters/temperature sensors, the radiation and temperature data for the purpose of calculation of PR shall be derived from the average values from tilted pyranometer /temperature sensors.

2.4 CAPACITY UTILIZATION FACTOR (CUF)

Capacity Utilization Factor for Solar Plant shall be calculated as per the following formula.

$$\mathbf{CUF} = \frac{\mathbf{E_{ac}}}{\mathbf{8760 \times P_{ac} \times (1 - DF \times (N - 1))} \mathbf{x}\, \boldsymbol{RCF}}$$

where,

Eac is the number of units recorded in the plant end ABT meter excluding auxiliary consumption, kWh

8760 refers to the number of hours in non-leap year. It shall be replaced by 8784 hours during leap year

Pac is the plant AC capacity, kW

DF is module degradation factor, 0.55% per year

N is the number of years of operation after operational acceptance of the plant

RCF is the Radiation Correction Factor: RCF = $\frac{Measured\ Irradiation}{Reference\ Irradiation}$,

where Reference Irradiation = 1828 kWh/m^2 and Measured Irraditation (GHI_{mes}) shall be recorded from the Pyranometer installed in horizontal plane at the site location. The radiation data of the Pyranometer shall be compared with the Reference Irradiation mentioned above. The radiation data from the Plant Pyranometer shall be used for computation of CUF, except in case of any discrepancy (i.e. more than ± 10% variation from the Reference Radiation, GHI_{ref}), in which case the radiation data from the nearest available Solar Radiation Resource Assessment (SRRA) station data will be used for computation of CUF. Missing data (GHI_{mes}) from the Plant Pyranometer shall be substituted by average of GHI measured for the same period in the past three (3) days. The plant Pyranometer has to be under CCTV coverage.

CUF shall be calculated on annual basis from the date of operational acceptance of the plant till the

end of O&M period. Module degradation factor will not be considered for first year CUF calculation. It is the Contactor's responsibility to envisage and install extra DC capacity to accommodate any degradation during first year. Module degradation factor, as per above will be considered from second year of operation.

Grid outage hours shall be subtracted from total number of hours in a year. The Contractor shall submit grid outage certification from competent authority of STU/DISCOM.

Reports

Sample Report for PR Test

PR Guarantee Test Report

Day 20-Nov-2016 Criteria >200

No. of Timeblocks considered 36 /42 Tot Gen 53694

Plant PR for the day ABI 80.68%

Remarks: [to be recorded, if any]

Liquidated Damages for Shortfall in PR

For every 0.01 shortfall in PR below the committed PR value, a penalty of 1% of the total Contract Value (i.e., total sum of all the Supply, Service and absolute value of O & M Contract) shall be levied. In case the Contract Performance Security has already been encashed on account of any default/delays, the penalty amount will be recovered from any due payments to the contractor. In case the Plant PR Shortfall is more than 0.05 than the specified PR value, then the total plant will be accepted on as-is basis & the total Contract Performance. Security submitted by the contractor will be forfeited & payments linked to operational acceptance will not be made.

Annexure – F

Procedure for Plant Testing, Commissioning and Documentation

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1 INTRODUCTION

This document lays down the procedures, requirements and templates for conducting commissioning tests and inspection of the Plant Facilities after installation and for subsequent re-inspection, maintenance or modifications in accordance with the Tender Specifications, IEC 62446 standard (Part 1: Grid connected systems – Documentation, commissioning tests and inspection)- and industry best practices.

2 CODES AND STANDARDS

The Testing and Commissioning Procedures shall, in general, comply with the following standards:

1. IEC 62446 standard (Part 1: Grid connected systems – Documentation, commissioning tests and inspection).
2. IEC 60364-6:2016 - Low voltage electrical installations - Part 6: Verification.
3. IEC 61829:2015: Photovoltaic (PV) array - On-site measurement of current-voltage characteristics.
4. IEC 60904-4:2019 Photovoltaic devices - Part 4: Reference solar devices - Procedures for establishing calibration traceability
5. IEC TS 60904-1-2:2019 - Photovoltaic devices - Part 1-2: Measurement of current-voltage characteristics of bifacial photovoltaic (PV) devices
6. IEC 62305-3– Protection against lightning - Part 3: Physical damage to structures and life hazard
7. IS/IEC 61557 : Part 2 : 2007 - Electrical safety in low voltage distribution systems up to 1000 V ac and 1500 V dc - Equipment for testing, measuring or monitoring of protective measures: Part 2 insulation resistance

3 COMMISSIONING

3.1 GENERAL

3.1.1 Objective

The Commissioning Procedure defined in this document aims to:

- Verify that the power plant is structurally and electrically safe
- Verify that the power plant is structurally and electrically robust to operate for the specified lifetime of a project

- Verify that the power plant operates as designed and its performance is as expected

3.1.2 General Requirements before Starting the Commissioning Process

- The modules shall be stabilized (sufficiently exposed after 200 kWh/m² reaching the PV plane)
- The tests shall be conducted under stable weather conditions
- The process shall be witnessed by the Owner or their duly appointed representative.
- Soiling losses shall not be accounted for in the assessment of Results. Therefore, adequate Module cleaning exercise shall be undertaken prior to commencement of Commissioning process.

- The following equipment shall be used during the commissioning process (Refer Annexure A.2:Technical Specifications for testing instruments):
  - Earth resistance tester
  - IV curve tracer
  - Insulation tester
  - Digital multimeter
  - Clamp meter
  - Infrared camera
  - Digital lux meter
  - Electroluminescence camera, power supply and accessories
- All testing equipment shall possess valid calibration certificate issued from approved laboratories.

4 Cold Commissioning

4.1 DC COMMISSIONING

4.1.1 Visual Inspection

The visual inspection shall be conducted on 5% of the system split in subareas equally distributed in the field. Unless otherwise specified, Approved Cat I Drawings shall be referred for correctness/verification. At least following aspects shall be verified visually on the DC side:

- Sizing of the DC fuses for running conditions, for the maximum voltage and the maximum current.

- Sizing of the string cables including overcurrent protection considering the current carrying capacity under operating conditions
- Cables protected against mechanical damage
- Functionality of the main DC switch
- Fixation of the modules to the mounting structure
- Termination of the cables to the inverter
- Where the PV system includes functional earthing of one of the DC conductors, the functional earth connection shall be specified and installed to the requirements of IEC 62548.
- Laying and installation of cables
- Fixation of the grounding electrodes
- Grounding of all conductive parts and connected to the equipotential bonding system of the PV plant
- The torque values in the mounting structure, combiner boxes, bars and joints shall match the manufacturer specifications
- Where protective earthing and/or equipotential bonding conductors are installed, they shall be parallel to and bundled with the DC cables
- Electrical circuits and devices shall be labelled.
- The PV modules shall be in a good condition (no visible serial defects such as yellowing, delamination, scratches, etc.).
- Functioning of fire protection equipment.

Acceptance criteria

Each deviation from industrial best practices, norms, standards and good workmanship shall be documented in a punch list. All items shall be categorized as "critical", "important" or "minor".

4.1.2 Pre-Energizing Tests

4.1.2.1 Measuring instruments and monitoring equipment and methods shall be chosen in accordance with the relevant parts of IEC 61557 and IEC 61010. The following tests shall be carried out on the DC circuit forming the PV array in accordance with a Sampling Plan:

- Electrical Continuity test: This test shall be performed on the earthing and/or

equipotential bonding conductors, in the PV array field. Connection of such conductors to earthing pit shall also be verified .

- Polarity test: Polarity of DC cables shall be verified. After verifying the correctness of polarity, marking on cable shall be checked for correctness

  Note: Polarity test shall be performed before closing the switches or string overcurrent protective devices are inserted

- Combiner box test: The purpose of this test is to ensure all strings are connected correctly to the combiner box. The test procedure is as follows and shall be performed before any string fuses / connectors are inserted for the first time:

i) Select a volt meter with voltage range at least twice the maximum system voltage.

ii) Insert all negative fuses / connectors so strings share a common negative bus.

iii) Do not insert any positive fuses / connectors.

iv) Measure the open circuit voltage of the first string, positive to negative, and ensure it is an expected value.

v) Leave one lead on the positive pole of the first string tested, and put the other lead on the positive pole of the next string. Because the two strings share a common negative reference, the voltage measured should be near-zero, with an acceptable tolerance range of ±15 V.

vi) Continue measurements on subsequent strings, using the first positive circuit as the meter common connection.

vii) A reverse polarity condition will be very evident if it exists – the measured voltage will be twice the system voltage.

- String open circuit voltage test, V_{oc} (under stable weather conditions): The purpose of this test is check the modules connection in string as per the design. The V_{oc} of PV string should be measured using suitable measuring device before closing any switch or string overcurrent protective devices, where fitted.

  The measured string V_{oc} will be assessed to ensure it matches the expected value (typically within 5 %) in one of the following ways:

  a) Compare with the expected value derived from the module datasheet or from a detailed PV model that takes into account the type and number of modules and the module cell temperature.

  b) Measure V_{oc} on a single module, then use this value to calculate the expected value

for the string.

c) For systems with multiple identical strings, voltages between strings can be compared.

- String circuit current test, Isc (under stable weather conditions): The purpose of this test to check the correctness of system, operational characteristic and PV array wiring. These tests are not to be taken as a measure of module / array performance. The test procedure will be as follows:

i) Ensure that all switching devices and disconnecting means are open and that all PV strings are isolated from each other.

ii) Create a temporary short circuit into string under test by using any of the following method:

(a) use of a test instrument with a short circuit current measurement function (e.g. a specialized PV tester);

(b) a short circuit cable temporarily connected into a load break switching device already present in the string circuit;

(c) use of a "short circuit switch test box" – a load break rated device that can be temporarily introduced into the circuit to create a switched short circuit.

iii) Measure the short circuit current (Isc) using a suitably rated measuring instrument.

iv) After taking the reading, interrupt the short circuit using a suitable load break switching device and check the zero value of current before changing any other connections.

v) Compare the measure value of Isc with the expected value. For systems with multiple identical strings, measurements of currents in individual strings shall be compared. These values should be the same (typically within 5 % of the average string current).

Note: An I-V curve test can be performed as an alternative to this test (see 4.3).

- Functional tests: The following functional tests shall be performed:

i) Switchgear and other control apparatus shall be tested to ensure correct operation and that they are properly mounted and connected.

ii) All inverters forming part of the PV system shall be tested to ensure correct operation. The test procedure should be as defined by the inverter manufacturer.

Functional tests that require the AC supply to be present (e.g. inverter tests) shall only be performed once the AC side of the system has been tested.

- Insulation resistance of the DC circuits: Test procedure to conduct this test will be as

follows:

i) Before commencing the test adopt the following safety measure to avoid any potential shock hazard

(a) Isolate the testing area.

(b) Do not touch any metallic surface, module backsheet or the module terminals when performing the insulation test.

(c) Appropriate personal protective clothing / equipment should be worn for the duration of the test.

ii) Isolate the PV array from the inverter (typically at the array switch disconnector)

iii) Disconnect any piece of equipment that could have impact on the insulation measurement (i.e. overvoltage protection) in the junction or combiner boxes.

iv) The insulation resistance test device shall be connected between earth and the array cable(s) or combiner bus bar. Connections can be made between earth and array negative followed by a test between earth and array positive or between earth and short circuited array positive and negative.

v) Follow the IR test device instructions to ensure the test voltage and readings in megaohms. When the system voltage (Voc at STC X 1.25) is higher than 500V, the test voltage shall be 1,000V and the minimum insulation resistance 1 MΩ.

vi) Ensure the system is de-energized before removing test cables or touching any conductive parts.

4.1.2.2 Sampling Plan:

At least 2 strings from 2 SMUs shall be randomly chosen by the Owner connected to each Inverter.

Acceptance criteria

The DC commissioning will be passed when the aforementioned verifications are successfully passed in 100% of the sample according to the IEC 62446: 2016 – 5 and IEC 62446:2016 – 6.

4.2 AC COMMISSIONING

4.2.1 Visual Inspection

The visual inspection shall be conducted on 5% of the system. In general, the requirements

specified in the IEC 60364-6 -6.4.2 apply. At least following aspects shall be verified visually on the AC side:

4.2.1.1 General requirements

- Protective requirements against electric shock
- Protection against fire and heat
- Choice, setting, selectivity and coordination of protective and monitoring devices
- Sizing of cables regarding voltage drop and ampacity as per approved Drawings.
- Sizing of protective and monitoring devices as per approved Drawings
- The circuit breakers are correctly located
- Selection, location and installation of suitable isolating, overvoltage protective devices and switching
- The equipment and protective measures are appropriate for the external influences and mechanical stresses
- The diagrams, warning notices or similar information attached to the wall inside the inverter housing or the control room
- Proper fixation of the cables to the collector bars in the AC combiner box
- Proper labelling of all electrical circuits and devices including the neutral conductor and protective conductor as well as correct connection of single pole devices to the phase conductors
- Adequacy of termination and connection of cables and conductors
- The warning labels and technical documentation physically displayed
- Selection and installation of earthing arrangements, protective conductors and their connections
- The existence and correct use of protective conductors and protective equipotential bonding conductors (PEB)
- Measures against electromagnetic disturbances implemented
- Easy access to the operational devices for maintenance
- Any exposed conductive parts connected to the earthing system
- The RCD type has been selected according to the requirements of the IEC 62548
- The isolation means of the inverter on the AC side are functional and correctly sized
- The fire protection requirements according to the approved design shall be given

4.2.1.2 Requirements for the inverter

- Installation as per manufacturer's instructions and compliance with IEC 62548
- Inverters properly fastened to the ground
- Inverter properly earthed
- Inverter incoming/outgoing cables properly isolated, labelled and connected
- The connections for phase sequence L1, L2, L3 and N in the correct order
- All cable terminations properly done
- Nameplate data. The minimum requirements for the production of a name plate are –
    - name and origin of the manufacturer; –
    - model or type name;
    - serial number;
    - electrical parameters: Vdcmax, Vmppmin, Vmppmax, Idcmax, Pac,r, Vac,r, f r , Iacmax;
    - degree of protection;
    - overvoltage category;
    - safety class.
- The displays - check / readout show plausible results
- The filters are clean and properly maintained
- The cooling outputs of the inverters are free from obstruction
- The DC circuit breaker is functional
- The DC insulation monitoring correctly installed
- The fuses at the DC entrance correctly sized
- The location of the inverter(s) in the field matches the approved design
- Protection against self-loosening of clamps and screws
- The string inverter anchored to the mounting structure
- The mechanical assembly is robust
- The inverters are fixed to non-flammable mechanical elements

Acceptance criteria

Each deviation from industrial best practices, norms, standards and good workmanship shall be documented in a punch list. The punch list shall represent a maximum budget of 1% of the construction price and all items shall be categorized as "critical", "important" or "minor".

4.2.2 Pre-Energizing Tests

Measuring instruments and monitoring equipment and methods shall be chosen in accordance with the relevant parts of IEC 61557 and IEC 61010. The following tests shall be carried out on the AC circuit forming the PV array:

- Continuity of conductors. The requirements in IEC 60364-6:2016 – 6.4.3.2 apply
- Insulation resistance of the electrical installation. The requirements in IEC 60364-6:2016 – 6.4.3.3 apply
- Insulation resistance testing to confirm the effectiveness of protection by SELV, PELV or electrical separation. The requirements in IEC 60364-6:2016 – 6.4.3.4 apply
- Insulation resistance/impedance of floors and walls. The requirements in IEC 60364-6:2016 - 6.4.3.5 apply
- Polarity test. The requirements in IEC 60364-6:2016 - 6.4.3.6 apply
- Testing to confirm effectiveness of automatic disconnection of supply. The requirements of the IEC 60364-6:2016 – 6.4.3.7 apply
- Testing to confirm the effectiveness of additional protection. The requirements of the IEC 60364-6:2016 – 6.4.3.8 apply.
- Test of phase sequence. The requirements of the IEC 60364-6:2016 – 6.4.3.9 apply
- Functional tests. The requirements of the IEC 60364-6:2016 – 6.4.3.10 apply
- Voltage drop. The requirements of the IEC 60364-6:2016 – 6.4.3.11 apply

Acceptance criteria

The AC commissioning will be passed when the aforementioned verifications are successfully passed in 100% of the sample according to the IEC 62446: 2016 – 5 and IEC 60364 – 6.

4.2.3 Additional Pre-Energizing Tests

All of the below tests shall be conducted in accordance with the supplier's installation/commissioning manuals.

4.2.3.1 Distribution boards and combiner boxes

Site testing on distribution boards shall include:

- Mechanical functional test of all components including mechanical interlocks
- Electrical functional test of all control and protection wiring against the approved

switchgear schematics

- Power frequency overvoltage test (flash test) on the switchgear including circuit-breakers in the test circuit
- Low resistance ductor test on the switchgear including circuit-breakers in the test circuit
- Visual inspection
- Verification of earthing

4.2.3.2 Inverters

Site testing on inverters shall include:

- Full test procedure as defined by the inverter manufacturer
- A full mechanical functional test of all components including mechanical interlocks
- Verification that the inverter operational parameters have been programmed to local regulations
- Electrical functional test of all control and protection wiring against the approved switchgear schematics as per approved MQP/FQP
- Insulation resistance test and earth residual current monitoring test
- Anti-islanding functionality
- High Voltage overvoltage test
- SCADA and metering calibration & functionality test

4.2.3.3 HT Switchgear

Site testing on outdoor circuit-breakers shall include:

- Functional check of all wiring, interlocks, auxiliaries and pressure devices
- Timing test and travel curve
- Visual inspection

4.2.3.4 LV/MV transformers

Transformer commissioning shall include:

- Visual inspection, alignment, earthing and labeling
- Functional check of all wiring against the approved transformer schematics
- Testing and calibration of all transformer protection and monitoring devices
- Insulation resistance test
- Functional test of off-circuit/on Circuit tap changer and check of the continuity of all windings

4.2.3.5 Substation/Power Transformers

- Ratio measurement on all tap changer settings
- Winding resistance measurement on highest, lowest and nominal tap settings
- Insulation resistance between all windings, and each winding to earth
- Insulation resistance core-to-earth
- Oil sample tests: breakdown strength, moisture content, and dissolved-gas content
- Transformer differential protection scheme testing

Acceptance criteria

The test results shall be aligned with the manufacturer specifications stated in the installation manual.

4.3 IV CURVE TESTING

The requirements of the IEC 62446-1:2016 – 7.2 apply. Following normative references shall be considered while performing the IV curve test:

- IEC 61829:2015 Photovoltaic (PV) array - On-site measurement of current-voltage characteristics
- IEC 60891:2009 Photovoltaic devices - Procedures for temperature and irradiance corrections to measured I-V characteristics

2 % of the module strings shall be measured. If $\Delta P_{stringN}$>5%, all the modules within that string shall be I-V characterized. Modules with ΔP_N>5% shall be replaced. If more than 5% of the measured strings of the first sample show ΔP_N>5%, another 2% shall be inspected. If more than 5% of the measured strings in the second sample show ΔP_N>5%, another 5% shall be inspected. If more than 5% of the measured strings in the third sample show ΔP_N>5%, another 10% shall be inspected. If more than 5% of the measured strings in the fourth sample show ΔP_N>5%, another 10% shall be inspected. The reference power value is the flash list value minus the light induced degradation (LID) value in the datasheet/module warranty.

Acceptance criteria

The power determination analysis will be passed when less than 5% of the modules measured in the last sample show ΔP_N<5%.

5 Hot Commissioning

5.1 INFRARED INSPECTION

Following normative references apply:

- PV array infrared camera inspection procedure (IEC 62446-1:2016 - 7.3) and IEC 62446-3 TS Ed.1.0 - Photovoltaic (PV) systems - Requirements for testing, documentation and maintenance - Part 3: Outdoor infrared thermography of photovoltaic modules and plants (draft)
- The infrared inspection shall be applied both to the PV modules and the BOS components

The inspection sample will depend on the project size and shall be agreed with the OWNER. The following values serve as an orientation:

- Large scale ground mounted PV plants
    - PV modules: 100%
    - Inverters: 100%
    - Combiner boxes: 100%

Acceptance criteria

The following conditions shall be met simultaneously:

- 0.2% or less of the inspected modules show thermal gradients at the cell level of T > 10 K
- 0.2% or less of the inspected modules show thermal gradients at the junction box level of T > 10 K
- 0.2% or less of the inspected modules show inactive cell strings
- No PID is detected
- All module strings are connected and producing
- All inverters are connected and producing

5.2 INVERTER AVAILABILITY TEST

5.2.1 Calculation of the Operation Time

It shall be calculated on inverter level. The operation time starts as soon as the inverter switches on. Therefore only the logged irradiation values during the operation time of the inverter shall be considered. Irradiation values logged before or after the inverter running time shall be disregarded.

5.2.2 Calculation of the Downtime

The downtime relevant for the availability calculation is any time in which a part or a subpart of the system is not operational. The outage periods shall be considered again on inverter level. Only complete outages shall be taken into consideration. System black-out periods due to following reasons shall not flow into the calculation (i.e. excluded events):

- A failure in the distribution grid or the transformer substation, making it impossible to transmit the generated power
- Solar radiation below the level needed to obtain the minimum operating voltage to start the inverter operation
- Causes of Force Majeure.
- Occurrences of anomalies in the power supply system (frequency differences or voltage surges) that trigger the protective systems of the plant or the limit settings of the inverter

Any forced disconnection shall be documented and recorded.

Acceptance criteria

The system availability shall be at least 99% during the testing period.

5.3 SINGLE AXIS TRACKER AVAILABILITY TEST (IF APPLICABLE)

The tracker availability test shall be carried out in parallel to the inverter availability test and shall have the same duration. During the test, all trackers shall follow the sun according to the angles established in the tracking mechanism. A loss of availability shall be considered when the angle of inclination of one or more trackers deviates by more than 2° from the theoretical angle. The angles of inclination of each tracker shall be recorded with a resolution of 1min via the SCADA system.

Acceptance criteria

The tilt angle of each tracker shall lie within a ±2° range during 99.5% of the operational time.

5.4 SCADA AND WEATHER STATION RELIABILITY

5.4.1 Visual Inspection

- Installation of the communication system architecture diagram according to the

specifications

- Functional Tests conducted during FAT for Pre-Dispatch Inspection shall be repeated.
- SCADA shall be linked to all protection relays, disturbance recorders and other substation equipment using the communications protocol
- Visual check on the assembly of all joints and on the as-installed condition of all components, including:
    - The irradiation sensor is not shaded and is installed at the correct tilt angle and under CCTV coverage.
    - Ambient temperature and module temperature sensor are installed properly (Reference IEC 61724)
    - Mechanical anchorage of the sensors is robust
- Complete calibration certificates of all the instruments shall be provided

Acceptance criteria

Each deviation from industrial best practices, norms, standards and good workmanship shall be documented in a punch list. The punch list shall represent a maximum budget of 1% of the construction price and all items shall be categorized as "critical", "important" or "minor".

6 Battery Energy Storage System

6.1 VISUAL INSPECTION

Before energizing the BESS, following visual checks shall be made to check the required design compliance:

- Installation of protective cover for live, hot and cold parts, and the adequate distance from the person;
- Installation of fence, wall, locking system of doors and access panels, and notice boards
- Installation of ventilation system;
- Installation of firefighting system;
- Installation of lightning protections devices.
- Wiring
    - All wiring shall be continuous and without splices.

- Wiring that may be exposed to mechanical damage are placed in conduit or armoured.
- Wires have permanent and durable identifying labels or markings on both ends.
- Control and instrumentation wiring shall be separated from power and high-voltage wiring by use of separate compartments or enclosures or by use of separate wireways and appropriate barrier strips.
- BESS and PCS control and instrumentation system wiring shall be bundled, laced, and otherwise laid in an orderly manner.
- Cable systems do not block access to equipment by personnel. There are no exposed current-carrying or voltage-bearing parts.

6.2 CONTINUITY TEST

Continuity of power, control and auxiliary circuit in the system shall be verified through visual inspection, continuity tester and insulation resistance test.

Phase sequence and terminal marking shall also be verified with drawing and design documents.

6.3 EARTHING TEST

Following element to be check according to the design and applicable standards:

- Proper connection of the earthing busbar to the local earthing busbar;
- Individual earthing connection of main equipment to the earthing busbar;
- Connection of earthing cables to structures via proper connectors to prevent corrosion from dissimilar metals.

6.4 INSULATION TEST

For low-voltage EES systems, the insulation resistance test and withstand voltage test shall be performed according to IEC 60364-6.

For EES systems exceeding 1 kV AC or 1,5 kV DC, the withstand voltage test shall be performed according to IEC 61936-1.

6.5 FUNCTIONAL TEST

6.5.1 Start and stop test

Check start and stop operation of BESS system with the startup/shutdown command manually and automatically.

6.5.2 Alarms Functional Test

Alarms initiation from the BESS in case of following conditions:

- Emergency trip switch.

- Loss of the low-voltage AC or utility grid voltage.
- An AC circuit breaker trip (either side of transformer).
- Door interlock: Initiate shutdown when the door is opened (with appropriate provision for maintenance work). Interlocks shall be self-resetting.
- Smoke/fire alarm.
- Control logic trouble.
- A DC ground fault (simulated).
- Remote disable (no reset required).
- grid system faults (balanced and unbalanced; line-to-ground, line-to-line, and three-phase).
- Abnormal voltage
- Islanding condition.
- Protection or control scheme failures, including the following:
  - Failure of local interconnection protection system
  - Failure of critical breaker trip coil or interrupting device
  - Loss of DC supply

6.5.3 Load tripping test

Check the interlock of BESS with the main

6.5.4 Operating cycle test

Check for any abnormalities such as rise in temperature, noise level and vibration in ESS system during rated input and output power operation.

6.5.5 Storage Settings

Verification of settings/control points and provision for modification of various set points and fixed operation/control settings associated with the various control functions.

Operator Controls:

- Trip/reset for the BESS AC circuit breaker or contactor.
- Trip/reset for DC circuit breaker(s)/contactor(s).
- PCS on/off.
- Reset cut-out selector switch to disable remote or local reset signals.
- A selector switch to manually set the operating state (that is, the shutdown, disconnect, or operate state) and to have the control system set the operating state automatically.
- A selector switch to manually set the operating mode and to have the control system set the operating mode automatically.

6.5.6 Communication test

Verified that measuring, alarm, fault indication, message and control and monitoring system operations are correct transmitted and received by the SCADA system.

6.6 SYSTEM RATING VERIFICATION

BESS rating including rated power, energy available at rated power, and the performance of the BESS associated with different performance metrics mentioned herein taken at the beginning of life shall be based on a set of ambient operating conditions specified by the BESS Original Equipment Manufacturer (OEM) for the Project site. The Contractor shall also provide an indication of how the performance of the BESS with respect to the metrics is expected to change over time, to account for time and use of the system, and report the same periodically.

An energy capacity test shall be performed at the time of Commissioning, in accordance with procedure mentioned below and is intended to be used to determine the dispatchable energy capacity of the BESS at the time of commencement of Operation. In conducting the energy capacity test, the Contractor shall provide a detailed and documented charging procedure within the specifications of the BESS. The energy capacity tests conducted on the BESS shall be documented to allow for tracking performance degradation.

Available/Dispatchable/Throughput energy shall be tested in accordance with the following procedure under the standard testing conditions specified in IEC 62933-2-1 (Cl. 5.1.3):

Measurement:

System shall be charged to the full available energy level. Subsequently, the BESS (appropriate modular sub-unit thereof) shall be discharged and charged at rated power between the lower and upper SOC* limit (as recommended by the OEM for current application). Power during charge and discharge shall be recorded at regular intervals of time documented by the OEM to provide a statistically valid resolution. The associated energy input (Ei), including all BESS functional, parasitic and auxiliary consumption and energy output (Eo) of the BESS shall be calculated from the recorded power. Discharged energy should be recorded as per the readings in the ABT Meter(s) at the point of interconnection of the BESS with the Solar PV array,

** SOC recorded, shall be as reported by the Battery Management System.*

The above process shall be repeated multiple times, with minimum rest period between charging and discharging, if so recommended, so as to record data for a specified no. of cycles (n). The reference performance test value for stored energy shall be calculated as the mean of the values of Eo and Ei as measured for discharge and charge respectively.

The procedure shall be repeated (one cycle each) with power levels at 75%, 50%, and 25% of rated power and documented.

Criterion: BESS stored Energy capacity shall be at least total energy dispatchable as specified in the Section V: Technical Specifications at rated Power at the time of commissioning.

2. Round-trip energy efficiency (RtE, η) shall be determined as a function of the charge and discharge power and calculated using the following formula:

$$\eta_p = \frac{\sum Eo}{\sum Ei}$$

where,

∑Ei is the sum of Energy input to the BESS over n cycles

∑Eo is the sum of Energy output from the BESS over n cycles η_p is the Round Trip Efficiency at charge/discharge Power, P (expressed as a percentage of rated power)

Eo and Ei shall be determined as per point 1. above.

Criterion: η_p, as determined through the process described above shall be >80% at the time of commissioning.

Note: The tests are intended to be carried out over a continuous period. The value of n shall be at least 3 for 100% rated Power and 1 for 25%, 50% and 75% of rated power as per procedure laid down in Annexure B.

3. BESS Response time: shall be measured as the sum of the following two entities: 1-> The time elapsed between the instant when a command to change set point from rest to discharge is sent to the BESS (T_0) and the instant when the BESS starts responding to the discharge command signal (T_1), the BESS being in active standby state and 50% SOC at T_0 i.e., T_1- T_0

2-> Time elapsed in seconds between the instant the ESS output transitions from no discharge i.e. 0% (T_1) to discharge and the instant it attains rated power capacity(T_2) (or from no charge (T_1) to charge state and the instant it attains rated charge rate(T_2)) i.e. T_{2-} T_1

$$\mathbf{RT} = (T_{2-} T_1) + (T_{1-} T_0) = \mathbf{T_{2-} T_0}$$

Where T_0 , T_1 and T_2 are timestamps:

T_0 :	Instant when a command to change set point is received at BE boundary (to be identified in advance);
Data Format:	dd/mm/yyyy hh:mm:ss.00
T_1 :	Instant when the BESS starts responding to the Command signal;
Format:	dd/mm/yyyy hh:mm:ss.00
T_2 :	Instant when the BESS attains 100% of full discharge rate wl discharging or full charge rate;
Format:	dd/mm/yyyy hh:mm:ss.00

Annexure VI
FUNCTIONAL GUARANTEES AND ASSOCIATED LIQUIDATED DAMAGES

Appendix 8. Functional Guarantees

1. General

This Appendix sets out

(a) the functional guarantees referred to in GCC Clause 28 (Functional Guarantees) and ANNEXURE 2 - Functional Guarantees of Annexure C – Operation and Maintenance of the RFB

(b) the preconditions to the validity of the functional guarantees, either in production and/or consumption, set forth below

(c) the minimum level of the functional guarantees

(d) the formula for calculation of liquidated damages for failure to attain the functional guarantees.

(e) Annexure C (PG Test Procedure) of Annexure – A, Employer's Requirements.

2. Preconditions

The Contractor gives the functional guarantees (specified herein) for the facilities, subject to the following preconditions being fully satisfied: NA

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3. Functional Guarantees

Subject to compliance with the foregoing preconditions, the Contractor guarantees as follows:

- Performance Ratio (PR) for Operational Acceptance : 82%
- Capacity Utilization Factor (CUF) 36.5%
- BESS Availability 99 %

1. Performance Ratio Guarantee

Annexure C (PG Test Procedure) of Annexure – A, Employer's Requirements shall be referred.

2. Annual CUF Guarantee

A. In consideration for the payment of the O&M Price , from the Commencement Date until the end of the Term, the Contractor grants to the Employer the CUF Guarantee on the terms and conditions set forth in the contract.

B. The Contractor guarantees the annual CUF committed herein over the O&M Period ("**Annual CUF Guarantee**") from the date of Operational Acceptance. In the event the CUF is less than the Guaranteed CUF, the Contractor shall immediately, upon demand, indemnify the Employer, as liquidated damages and not as penalty, amounts equivalent to remuneration of the equivalent Energy, subject to a maximum of hundred (100%) percent of the Total Annual O&M Price.

C. The Procedure for measurement and verification of the CUF Guarantee is as per Annexure-C: Performance Guarantee Test procedure, defined under the Annexure A (Employers' Requirement) of the bid document.

D. The Procedure for measurement and verification of the BESS Availability shall be as per relevant section (Battery energy Storage System: System Rating Verification) of Annexure-F: Plant Documentation, Commissioning and Test Procedure, Section VII defined under the Annexure A (Employers' Requirement) of the bid document

E. Liquidated Damages for Shortfall in Annual CUF for Solar PV Plant

(i) If the Contractor fails to achieve guaranteed annual CUF, then the Contractor shall pay compensation to the Employer an amount equal to the difference in units (kWh) derived from guaranteed CUF and achieved CUF multiplied by Rs.4 per unit (kWh).

(ii) If the Contractor fails to achieve the annual guaranteed CUF at the end of 10th year, then the Contractor shall pay compensation to the Employer an amount equal to the Net Present Value (NPV) of the revenue loss for 10th to 25th year calculated as below.

(a) % CUF drop i.e. [(Guaranteed CUF of 10th year – Actual CUF of 10th year) / Guaranteed CUF of 10th year]*100 in the 10th year shall be considered as the representative CUF drop for each subsequent year starting from 11th to 25th year.

(b) Estimated revenue loss @ Rs.4 per unit (kWh) for each subsequent year will be calculated as % CUF drop in the 10th year (as per (a) above) multiplied by the respective year's estimated generation.

(c) The Net Present Value (NPV) of the revenue loss for 10th to 25th year with discount factor of 8.61% will be considered as the LD payable by the Contractor.

F. In case the Project fails to generate any power continuously for 1 month any time during the O&M period, apart from the force majeure and grid outages as certified by competent authority from STU/ CTU, it shall be considered as "an event of default". In the case of default, the entire Contract Performance Security will be forfeited.

G. Penalty during O&M period against breakdown of other Infrastructure of Plant Facilities that don 't affect the generation of power directly, such as but not limited to, civil infrastructure, water supply system/network, other Infrastructure developed by the Contractor as a Scope of Work for the Project (Section-VII: Scope of Works & Technical Specifications) shall be penalised @ Rs.1000/day, for non-compliance with PM Schedule (Initiation/Completion of Scheduled maintenance Activity as agreed under this Contract) beyond 48 hours. Cumulative value of such liquidated damages shall be limited

to 50% of yearly O&M cost. Cumulative value of such liquidated damages shall be limited to 50% of yearly O&M cost.

For the purpose of this Clause, the PM shall be inclusive of, but not limited to, the following PM activities:

Item	**Scope of Maintenance Activity**	**Periodicity**
Environmental/Corrosive Protective Coatings	White-washing/Application/Re-application of Distemper, Epoxy coatings	Once in every 2 years under the O&M Contract period, in consultation with the Owner
Roads and Access paths	Repair and maintenance of all roads – Access, Internal and Periphery roads, walkways as well as fences, gates, cable-trenches and outdoor equipment platforms.	Once every year prior to Monsoon season, in Consultation with the Owner
Water Supply Network	Repair and Maintenance of Water Supply Network including piping network, valves, pumps etc.	Once Every Year in Consultation with the Owner.
Periphery Lighting	Repair and maintenance of Peripheral Lighting including replacement of non-functional lighting fixtures, Junction Boxes, Conduits etc.	Once every Six Months
Rodent Entry Points	Application/re-application of Anti-rodent protection measures	Once every Six Months

	like PUF filling, sealant etc. at Checker/Gland Plates, Cable Entry Points (in PCU/SMU, Switchgear Panels, Buildings, Enclosures)	
All bolted/tightened structures	Tightening/fastening of bolts that are exposed to winds/vibrations like MMS members/foundation bolts	Once every Year before onset of Windy season, in consultation with the Owner.
Enclosures of Equipment requiring Temperature and Dust Controlled environment for Normal Operation	Application/re-application of insulation/Dust-Filters/Temperature-control equipment at Enclosures/Buildings housing BESS, PCU, Switchgear	Once every Year, consultation with the Owner.
Entire Plant Facility	Oversight management of the hazardous/toxic materials including its handling and disposal as per Government of India Rules and environmental and safety assessments by a qualified Specialist	Once every Year, in consultation with the Owner.

Note : *The Contractor shall ensure intimation and submission of requisite Reports to the owner at least 15 days prior to initiation of maintenance action for the activity.*

H. For breakdown of generation related infrastructure, the generation loss estimated based on the outage equipment's weightage (Wi) multiplied by estimated total energy output in the outage period beyond 48 hours, in the event of no breakdown (E_{est}) multiplied by

Rs. 4/kWh will be levied. E_{est} for the period shall be calculated from the guaranteed CUF (i.e. Guaranteed CUF* outage period beyond 48 hours). Cumulative value of such liquidated damages shall be limited to 50% of yearly O&M cost. The Equipment weightage (Wi) shall be calculated as below:

$$Wi = \frac{\text{Equipment Rating (in MW)}}{\text{Plant AC Capacity (MW)}}$$

I. The Penalty specified on account of delays, as specified in Liquidated Damages and Penalty specified on account of deviations in Functional Guarantees as above shall be assessed independent of each other. Above mentioned Penalties specified under this clause of SCC are independent of each other.

3. **BESS Availability**

A. The Contractor shall maintain all BESS equipment to ensure Annual Equipment Availability not less than 99%. Equipment Availability includes the availability of Batteries, Battery Management System (BMS), Power Conversion System (PCS), Energy Management System (EMS) as well as the power evacuation system for BESS up to interface with the solar PV arrays.

B. BESS Equipment Availability is the percentage of hours that the BESS is available during the year. The availability guarantee shall begin upon facility commissioning till the end of O&M period. BESS annual equipment availability shall be calculated as follows.

Equipment Availability =

$$\left[1 - \left(\frac{\sum Accountable\ BESS\ Outage\ duration\ in\ hours\ x\ We}{8760}\right)\right] \times 100$$

Where:

- W_e, Weightage is $\frac{Outage\ Capacity}{Rated\ Capacity}$, where Outage and Rated Capacity shall be in Energy terms i.e. MWh. Rated Capacity in a given year shall correspond to the daily throughput capacity guarantee for the beginning of the year.

C. Accountable BESS outages are outages caused or necessitated by the BESS equipment that result in reduced capacity or loss of essential function of the BESS. These outages may be initiated by failure of components, loss of battery capacity, operation of protective devices, alarms, or manual action. Such outages include both forced outages due to equipment problems and scheduled outages for BESS maintenance.

D. Accountable BESS outage duration is the elapsed time of accountable BESS outages from the instant the BESS experiences reduced capacity or is out of service to the instant it is returned to service or full capacity. If the BESS experiences reduced capacity but is determined by the Employer to be available for service even if the Employer elects not to immediately return the equipment to full capacity, such time will be discounted from the outage duration.

E. The Procurement specific nameplate ratings shall be as defined in Technical Specifications under Annexure A: (Employer's Requirement). The BESS shall be considered to be under an accountable outage if any of those ratings cannot be met. The BESS shall also be considered to be under an accountable outage if a scheduled (or required) charge cycle cannot be completed.

F. The data required for assessment of the availability of the BESS shall be collected through the Plant's integrated SCADA system.

G. Grid outage hours shall be subtracted from total no. of hours in the year.

H. If the Plane of Array Radiation is less than 2kWh/m2 on a day, the day (i.e. 24 hours) shall be excluded.

I. Liquidated Damages for Shortfall in Equipment Availability

If the annual equipment availability for BESS is less than 99% during any year, then Contractor shall compensate the Employer an amount calculated as per the following formula.

$$COM = \left(\frac{99 - EA}{EA}\right) \times C \times E$$

where,

COM is Compensation payable to the Employer in rupees

EA is Annual BESS Equipment Availability

C is ₹8/kWh

E is the intended energy output from BESS in kWh during the respective year in 99% availability condition after considering any degradation.

Recovery of Compensation

The above compensations shall be deducted from CPS submitted by the developer.

Scheduling and Forecasting:

The Contractor shall be responsible for appointing a Qualified Coordinating Agency if required by concerned authorities at the Pooling Substation Level for scheduling and forecasting activity. Also, the contractor shall be responsible for carrying out the forecasting and scheduling of the energy generation from the plant facility (In accordance with the Deviation Settlement Mechanism Regulations of the Chhattisgarh Electricity Regulatory Commission). Scheduling given by the Contractors is such that no penalty is levied on the Employer due to any deviation of actual generation from scheduling beyond the allowed limit. If any penalty is imposed on the Employer due to such deviations beyond allowed limit the same shall be recovered from the CPS given by the contractor.

Annexure VI
FUNCTIONAL GUARANTEES AND ASSOCIATED LIQUIDATED DAMAGES

Appendix 8. Functional Guarantees

1. General

This Appendix sets out

(a) the functional guarantees referred to in GCC Clause 28 (Functional Guarantees) and ANNEXURE 2 - Functional Guarantees of Annexure C – Operation and Maintenance of the RFB

(b) the preconditions to the validity of the functional guarantees, either in production and/or consumption, set forth below

(c) the minimum level of the functional guarantees

(d) the formula for calculation of liquidated damages for failure to attain the functional guarantees.

(e) Annexure C (PG Test Procedure) of Annexure – A, Employer's Requirements.

2. Preconditions

The Contractor gives the functional guarantees (specified herein) for the facilities, subject to the following preconditions being fully satisfied: NA

---

3. Functional Guarantees

Subject to compliance with the foregoing preconditions, the Contractor guarantees as follows:

- Performance Ratio (PR) for Operational Acceptance : 82%
- Capacity Utilization Factor (CUF) 36.5%
- BESS Availability 99 %

1. Performance Ratio Guarantee

Annexure C (PG Test Procedure) of Annexure – A, Employer's Requirements shall be referred.

2. Annual CUF Guarantee

A. In consideration for the payment of the O&M Price , from the Commencement Date until the end of the Term, the Contractor grants to the Employer the CUF Guarantee on the terms and conditions set forth in the contract.

B. The Contractor guarantees the annual CUF committed herein over the O&M Period ("**Annual CUF Guarantee**") from the date of Operational Acceptance. In the event the CUF is less than the Guaranteed CUF, the Contractor shall immediately, upon demand, indemnify the Employer, as liquidated damages and not as penalty, amounts equivalent to remuneration of the equivalent Energy, subject to a maximum of hundred (100%) percent of the Total Annual O&M Price.

C. The Procedure for measurement and verification of the CUF Guarantee is as per Annexure-C: Performance Guarantee Test procedure, defined under the Annexure A (Employers' Requirement) of the bid document.

D. The Procedure for measurement and verification of the BESS Availability shall be as per relevant section (Battery energy Storage System: System Rating Verification) of Annexure-F: Plant Documentation, Commissioning and Test Procedure, Section VII defined under the Annexure A (Employers' Requirement) of the bid document

E. Liquidated Damages for Shortfall in Annual CUF for Solar PV Plant

(i) If the Contractor fails to achieve guaranteed annual CUF, then the Contractor shall pay compensation to the Employer an amount equal to the difference in units (kWh) derived from guaranteed CUF and achieved CUF multiplied by Rs.4 per unit (kWh).

(ii) If the Contractor fails to achieve the annual guaranteed CUF at the end of 10th year, then the Contractor shall pay compensation to the Employer an amount equal to the Net Present Value (NPV) of the revenue loss for 10th to 25th year calculated as below.

(a) % CUF drop i.e. [(Guaranteed CUF of 10th year – Actual CUF of 10th year) / Guaranteed CUF of 10th year]*100 in the 10th year shall be considered as the representative CUF drop for each subsequent year starting from 11th to 25th year.

(b) Estimated revenue loss @ Rs.4 per unit (kWh) for each subsequent year will be calculated as % CUF drop in the 10th year (as per (a) above) multiplied by the respective year's estimated generation.

(c) The Net Present Value (NPV) of the revenue loss for 10th to 25th year with discount factor of 8.61% will be considered as the LD payable by the Contractor.

F. In case the Project fails to generate any power continuously for 1 month any time during the O&M period, apart from the force majeure and grid outages as certified by competent authority from STU/ CTU, it shall be considered as "an event of default". In the case of default, the entire Contract Performance Security will be forfeited.

G. Penalty during O&M period against breakdown of other Infrastructure of Plant Facilities that don 't affect the generation of power directly, such as but not limited to, civil infrastructure, water supply system/network, other Infrastructure developed by the Contractor as a Scope of Work for the Project (Section-VII: Scope of Works & Technical Specifications) shall be penalised @ Rs.1000/day, for non-compliance with PM Schedule (Initiation/Completion of Scheduled maintenance Activity as agreed under this Contract) beyond 48 hours. Cumulative value of such liquidated damages shall be limited

to 50% of yearly O&M cost. Cumulative value of such liquidated damages shall be limited to 50% of yearly O&M cost.

For the purpose of this Clause, the PM shall be inclusive of, but not limited to, the following PM activities:

Item	**Scope of Maintenance Activity**	**Periodicity**
Environmental/Corrosive Protective Coatings	White-washing/Application/Re-application of Distemper, Epoxy coatings	Once in every 2 years under the O&M Contract period, in consultation with the Owner
Roads and Access paths	Repair and maintenance of all roads – Access, Internal and Periphery roads, walkways as well as fences, gates, cable-trenches and outdoor equipment platforms.	Once every year prior to Monsoon season, in Consultation with the Owner
Water Supply Network	Repair and Maintenance of Water Supply Network including piping network, valves, pumps etc.	Once Every Year in Consultation with the Owner.
Periphery Lighting	Repair and maintenance of Peripheral Lighting including replacement of non-functional lighting fixtures, Junction Boxes, Conduits etc.	Once every Six Months
Rodent Entry Points	Application/re-application of Anti-rodent protection measures	Once every Six Months

	like PUF filling, sealant etc. at Checker/Gland Plates, Cable Entry Points (in PCU/SMU, Switchgear Panels, Buildings, Enclosures)	
All bolted/tightened structures	Tightening/fastening of bolts that are exposed to winds/vibrations like MMS members/foundation bolts	Once every Year before onset of Windy season, in consultation with the Owner.
Enclosures of Equipment requiring Temperature and Dust Controlled environment for Normal Operation	Application/re-application of insulation/Dust-Filters/Temperature-control equipment at Enclosures/Buildings housing BESS, PCU, Switchgear	Once every Year, consultation with the Owner.
Entire Plant Facility	Oversight management of the hazardous/toxic materials including its handling and disposal as per Government of India Rules and environmental and safety assessments by a qualified Specialist	Once every Year, in consultation with the Owner.

Note : *The Contractor shall ensure intimation and submission of requisite Reports to the owner at least 15 days prior to initiation of maintenance action for the activity.*

H. For breakdown of generation related infrastructure, the generation loss estimated based on the outage equipment's weightage (Wi) multiplied by estimated total energy output in the outage period beyond 48 hours, in the event of no breakdown (E_{est}) multiplied by

Rs. 4/kWh will be levied. E_{est} for the period shall be calculated from the guaranteed CUF (i.e. Guaranteed CUF* outage period beyond 48 hours). Cumulative value of such liquidated damages shall be limited to 50% of yearly O&M cost. The Equipment weightage (Wi) shall be calculated as below:

$$Wi = \frac{\text{Equipment Rating (in MW)}}{\text{Plant AC Capacity (MW)}}$$

I. The Penalty specified on account of delays, as specified in Liquidated Damages and Penalty specified on account of deviations in Functional Guarantees as above shall be assessed independent of each other. Above mentioned Penalties specified under this clause of SCC are independent of each other.

3. **BESS Availability**

A. The Contractor shall maintain all BESS equipment to ensure Annual Equipment Availability not less than 99%. Equipment Availability includes the availability of Batteries, Battery Management System (BMS), Power Conversion System (PCS), Energy Management System (EMS) as well as the power evacuation system for BESS up to interface with the solar PV arrays.

B. BESS Equipment Availability is the percentage of hours that the BESS is available during the year. The availability guarantee shall begin upon facility commissioning till the end of O&M period. BESS annual equipment availability shall be calculated as follows.

Equipment Availability =

$$\left[1 - \left(\frac{\sum Accountable\ BESS\ Outage\ duration\ in\ hours\ x\ We}{8760}\right)\right] \times 100$$

Where:

- W_e, Weightage is $\frac{Outage\ Capacity}{Rated\ Capacity}$, where Outage and Rated Capacity shall be in Energy terms i.e. MWh. Rated Capacity in a given year shall correspond to the daily throughput capacity guarantee for the beginning of the year.

C. Accountable BESS outages are outages caused or necessitated by the BESS equipment that result in reduced capacity or loss of essential function of the BESS. These outages may be initiated by failure of components, loss of battery capacity, operation of protective devices, alarms, or manual action. Such outages include both forced outages due to equipment problems and scheduled outages for BESS maintenance.

D. Accountable BESS outage duration is the elapsed time of accountable BESS outages from the instant the BESS experiences reduced capacity or is out of service to the instant it is returned to service or full capacity. If the BESS experiences reduced capacity but is determined by the Employer to be available for service even if the Employer elects not to immediately return the equipment to full capacity, such time will be discounted from the outage duration.

E. The Procurement specific nameplate ratings shall be as defined in Technical Specifications under Annexure A: (Employer's Requirement). The BESS shall be considered to be under an accountable outage if any of those ratings cannot be met. The BESS shall also be considered to be under an accountable outage if a scheduled (or required) charge cycle cannot be completed.

F. The data required for assessment of the availability of the BESS shall be collected through the Plant's integrated SCADA system.

G. Grid outage hours shall be subtracted from total no. of hours in the year.

H. If the Plane of Array Radiation is less than 2kWh/m2 on a day, the day (i.e. 24 hours) shall be excluded.

I. Liquidated Damages for Shortfall in Equipment Availability

If the annual equipment availability for BESS is less than 99% during any year, then Contractor shall compensate the Employer an amount calculated as per the following formula.

$$COM = \left(\frac{99 - EA}{EA}\right) \times C \times E$$

where,

COM is Compensation payable to the Employer in rupees

EA is Annual BESS Equipment Availability

C is ₹8/kWh

E is the intended energy output from BESS in kWh during the respective year in 99% availability condition after considering any degradation.

Recovery of Compensation

The above compensations shall be deducted from CPS submitted by the developer.

Scheduling and Forecasting:

The Contractor shall be responsible for appointing a Qualified Coordinating Agency if required by concerned authorities at the Pooling Substation Level for scheduling and forecasting activity. Also, the contractor shall be responsible for carrying out the forecasting and scheduling of the energy generation from the plant facility (In accordance with the Deviation Settlement Mechanism Regulations of the Chhattisgarh Electricity Regulatory Commission). Scheduling given by the Contractors is such that no penalty is levied on the Employer due to any deviation of actual generation from scheduling beyond the allowed limit. If any penalty is imposed on the Employer due to such deviations beyond allowed limit the same shall be recovered from the CPS given by the contractor.

Solar Energy Corporation of India Limited
(A Government of India Enterprise)
CIN: U40106DL2011GOI225263

D - 3, 1st Floor, Wing - A, Prius Platinum, District Centre,
Saket, New Delhi - 110 017
Tel: 011 - 71989200, Fax: 011 - 71989243
E mail: contracts@seci.co.in

Request for Bids

For

Design, Engineering, Supply, Construction, Erection, Testing & Commissioning of 100 MW (AC) Solar PV Project (200MWp DC capacity) along with 50MW/150 MWh Battery Energy Storage System having 10 years Plant O&M

At

District Rajnandgaon, Chhattisgarh, India

Tender No. SECI/C&P/RfB/2020/CG/100/150

Dated: 11/09/2020

PROCUREMENT DOCUMENT

Request for Bids

Plant
Design, Supply, and Installation

International Competitive Procurement

(Two-Envelope Bidding Process with e-Procurement)

(Without Prequalification)

Bidding Document Summary

Specific Procurement Notice - Request for Bids (RFB)

The template attached is the Specific Procurement Notice for Request for Bids for a two-envelope e-Procurement Bidding process without prequalification.

Bidding Document: Request for Bids - Plant (Design, Supply and Installation)

(Two-Envelope Bidding Process with e-Procurement without Prequalification)

PART 1 – BIDDING PROCEDURES

Section I - Instructions to Bidders (ITB)

This Section provides relevant information to help Bidders prepare their Bids. It is based on a two-envelope e-Procurement Bidding process when prequalification has not taken place. Information is also provided on the submission, opening, and evaluation of Bids and on the award of Contracts. **Section I contains provisions that are to be used without modification.**

Section II - Bid Data Sheet (BDS)

This Section consists of provisions that are specific to each procurement and that supplement the information or requirements included in Section I, Instructions to Bidders.

Section III - Evaluation and Qualification Criteria

This Section specifies the criteria to determine the Most Advantageous Bid.

Section IV - Bidding Forms

This Section includes the forms to be completed and submitted by the Bidder as part of its Bid.

Section V - Eligible Countries

This Section contains information regarding eligible countries.

Section VI - Fraud and Corruption -

This section includes the Fraud and Corruption provisions which apply to this Bidding process.

PART 2 – EMPLOYER'S REQUIREMENTS

Section VII - Employer's Requirements

This Section contains the Specification, the Drawings, and supplementary information that describe the Plant and Installation Services to be procured.

PART 3 – CONDITIONS OF CONTRACT AND CONTRACT FORMS

Section VIII - General Conditions of Contract (GCC)

This Section contains the general clauses to be applied in all contracts. **The text of the clauses in this Section shall not be modified.**

Section IX - Particular Conditions of Contract (PCC)

This Section contains the Particular Conditions of Contract (PCC). The contents of this Section modify or supplement the General Conditions and shall be prepared by the Employer.

Section X - Contract Forms

This Section contains the Letter of Acceptance, Contract Agreement and other relevant forms.

Specific Procurement Notice

Request for Bids
Plant
Design, Supply and Installation

E-Procurement Notice
(Two-Envelope e-Procurement Bidding Process without Prequalification)

Employer: Solar Energy Corporation of India Limited (SECI), New Delhi

Project: Innovation in Solar Power and Hybrid Technologies Project

Contract title: Design, Engineering, Supply, Construction, Erection, Testing & Commissioning of 100 MW (AC) Solar PV Project (200MWp DC capacity) along with 50MW/150 MWh Battery Energy Storage System having 10 years plant O&M at Rajnandgaon, Chhattisgarh, India

Country: India

Project No.: P160379

RFB No: SECI/C&P/RfB/2020/CG/100/150

Issued on: 11/09/2020

1. Solar Energy Corporation of India Limited (SECI) has applied for financing from the World Bank toward the cost of the Project of Innovation in Solar Power and Hybrid Technologies and intends to apply part of the proceeds toward payments under the Contract for the Design, Engineering, Supply, Construction, Erection, Testing & Commissioning of 100 MW (AC) Solar PV Project (200MWp DC capacity) along with 50MW/150 MWh Battery Energy Storage System having 10 years plant O&M at Rajnandgaon, Chhattisgarh, India under International competitive bidding.

2. SECI now invites online Bids from eligible Bidders for Design, Engineering, Supply, Construction, Erection, Testing & Commissioning of 100 MW (AC) Solar PV Project (200MWp DC capacity) along with 50MW/150 MWh Battery Energy Storage System having 10 years plant O&M at Rajnandgaon, Chhattisgarh, India under International competitive bidding. Bidders are advised to note the clauses on eligibility (Section I Clause 4) and minimum qualification criteria (Section III – Evaluation and Qualification Criteria), to qualify for the award of the contract.

3. Bidding will be conducted through international competitive procurement using a Request for Bids (RFB) as specified in the World Bank's "Procurement Regulations for IPF Borrowers- Procurement in Investment Projects Financing", July 2016 revised November 2017 and August 2018 ("Procurement Regulations"), and is open to all eligible Bidders as defined in the Procurement Regulations.

4. The Bidding document in English is available online at ISN-ETS portal https://www.bharat-electronictender.com from **11/09/2020 to 27/10/2020** free of cost. Bidders will be required to register in the website, which is also free of cost. The bidders would be responsible for ensuring that any addenda available on the website is also downloaded and incorporated.

5. For submission of the bids, the bidder is required to have Digital Signature Certificate (DSC) from one of the authorized Certifying Authorities, authorized by Government of India for issuing DSC. Bidders can see the list of licensed CA's from the link (www.cca.gov.in). Aspiring bidders who have not obtained the user ID and password for participating in e-procurement in this Project, may obtain the same from the website: https://www.bharat-electronictender.com. (Bidders are required to refer the M/s Electronic Tender.com India Pvt Ltd (ETI) website). A non-refundable fee of **INR 5400/- (Indian Rupees Fifty-Four hundred only) or USD 72 (Seventy-Two US Dollars only) (**Inclusive of GST/Taxes) or equivalent amount in a freely convertible, is required to be paid. The method of payment will be Demand Draft / Banker's Cheque or through online payment gateway (As mentioned in the Electronic Tender.com India Pvt Ltd (ETI) website). Payment documents are to be submitted subsequently as per the procedure described in paragraph 8 below.

6. Bids must be submitted online https://www.bharat-electronictender.com on or before **27/10/2020 upto 1400 Hours**. Any bid or modifications to bid (including discount) received outside e-procurement system will not be considered. The electronic bidding system would not allow any late submission of bids. The "TECHNICAL PART" of the Bids will be publicly opened online in the presence of the Bidders' designated representatives and anyone who chooses to attend at the address below on **27/10//2020 from 1430 Hours.** The "Financial Part" of the Bids shall remain unopened in the e-procurement system until the second public Bid opening for the financial part. Since e-Reverse Auction (e-RA) applies to this procurement, the Financial Parts will not be opened in public, and will be opened in the presence of a Probity Auditor appointed by the Employer.

7. All Bids must be accompanied by a Bid Security of the **7 Cr (Indian Rupees Seven Crores only) or USD 0.9 M (US Dollars zero point Nine Million only)** as specified for the contract in case of a Bid Security. The Bid Security documents are to be submitted subsequently as per the procedure described in paragraph 8 below.

8. The bidders are required to submit (a) original payment documents towards the cost of registration on e-procurement website (if not previously registered); and **(b) original bid security in approved form(c) Written confirmation authorizing the signatory of the Bid to commit the Bidder, in accordance with ITB 21.3/Power of Attorney & copy of Board Resolution for such authorization (d) In case of a bid submitted by a JV, JV**

agreement or Letter of Intent to form the JV in accordance with ITB 4.1' to Manager (C&P), Solar Energy Corporation of India Limited, D3, Wing A, Ist Floor, Prius Platinum Building, Saket District Centre, Saket, New Delhi 110017 before the Bid submission deadline, either by registered post/speed post/ courier or by hand, failing which such bids will be declared non-responsive and will not be opened.

9. A pre-bid meeting at office/site or through Video Conferencing (VC) will be held on **29/09/2020 at 1100 Hours.** at the office of SECI to clarify the issues and to answer questions on any matter that may be raised at that stage as stated in ITB Clause 7.4 of 'Instructions to Bidders' of the bidding document. Bidders are advised to download the bidding document prior to the pre-bid meeting in order for bidders to have a good understanding of the scope of the requirements under this contract for discussion and clarification at the pre-bid meeting.

10. Other details can be seen in the bidding documents. The Employer shall not be held liable for any delays due to system failure beyond its control. Even though the system will attempt to notify the bidders of any bid updates, the Employer shall not be liable for any information not received by the bidder. It is the bidders' responsibility to verify the website for the latest information related to this bid.

11. Attention is drawn to the Procurement Regulations requiring the Borrower to disclose information on the successful bidder's beneficial ownership, as part of the Contract Award Notice, using the Beneficial Ownership Disclosure Form as included in the bidding document.

12. The address (es) referred to above is (are):

Solar Energy Corporation of India Limited
D3, Wing A, Ist Floor, Prius Platinum Building,
Saket District Centre, Saket, New Delhi 110017

Kind Attn.: Mr Sandeep Kumar, Sr Manager (C&P)

Telephone Nos.: - 0091-(0)11-71980290/256
E mail: sandeeprana@seci.co.in

Standard Procurement Document

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PART 1 – Bidding Procedures

Section I - Instructions to Bidders

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Section I - Instructions to Bidders

A. General

1. Scope of Bid

1.1 In connection with the Specific Procurement Notice - Request for Bids (RFB), specified in the Bid Data Sheet (BDS), the Employer, as specified **in the BDS**, issues this bidding document for the Design, Supply and Installation of Plant as specified in Section VII, Employer's Requirements. The name, identification and number of lots (contracts) of this RFB are specified **in the BDS.**

1.2 Throughout this bidding document:

(a) the term "in writing" means communicated in written form (e.g. by mail, e-mail, fax, including if specified **in the BDS,** distributed or received through the electronic-procurement system used by the Employer) with proof of receipt;

(b) if the context so requires, "singular" means "plural" and vice versa;

(c) "Day" means calendar day, unless otherwise specified as "Business Day." A Business Day is any day that is an official working day of the Borrower. It excludes the Borrower's official public holidays.

(d) **"ES"** means environmental and social (including Sexual Exploitation and Abuse (SEA), and Sexual Harassment (SH));

(e) **"Sexual Exploitation and Abuse" "(SEA)"** means the following:

Sexual Exploitation is defined as any actual or attempted abuse of position of vulnerability, differential power or trust, for sexual purposes, including, but not limited to, profiting monetarily, socially or politically from the sexual exploitation of another.

Sexual Abuse is defined as the actual or threatened physical intrusion of a sexual nature, whether by force or under unequal or coercive conditions.

(f) **"Sexual Harassment" "(SH)"** is defined as unwelcome sexual advances, requests for sexual favors, and other

verbal or physical conduct of a sexual nature by the Contractor's Personnel with other Contractor's or Employer's Personnel.

(g) **"Contractor's Personnel"** is as defined in GCC Sub-Clause 1; and

(h) **"Employer's Personnel"** is as defined in GCC Sub-Clause 1.

(i) A non-exhaustive list of (i) behaviors which constitute SEA and (ii) behaviors which constitute SH is attached to the Code of Conduct form in Section IV.

2. Source of Funds

2.1 The Borrower or Recipient (hereinafter called "Borrower") indicated **in the BDS** has applied for or received financing (hereinafter called "funds") from the World Bank (hereinafter called "the Bank") in an amount specified **in BDS**, toward the project named **in BDS**. The Borrower intends to apply a portion of the funds to eligible payments under the contract(s) for which this bidding document is issued.

2.2 Payment by the Bank will be made only at the request of the Borrower and upon approval by the Bank in accordance with the terms and conditions of the Loan (or other financing) Agreement. The Loan (or other financing) Agreement prohibits a withdrawal from the loan account for the purpose of any payment to persons or entities, or for any import of goods, equipment, plant, or materials, if such payment or import is prohibited by a decision of the United Nations Security Council taken under Chapter VII of the Charter of the United Nations. No party other than the Borrower shall derive any rights from the Loan (or other financing) Agreement or have any claim to the proceeds of the Loan (or other financing).

3. Fraud and Corruption

3.1 The Bank requires compliance with the Bank's Anti-Corruption Guidelines and its prevailing sanctions policies and procedures as set forth in the WBG's Sanctions Framework, as set forth in Section VI.

3.2 In further pursuance of this policy, bidders shall permit and shall cause their agents (where declared or not), subcontractors, subconsultants, service providers, suppliers, and personnel, to permit the Bank to inspect all accounts, records and other documents relating to any initial selection process, prequalification process, bid submission, proposal submission and contract performance (in the case of award), and to have them audited by auditors appointed by the Bank.

4. Eligible Bidders

4.1 A Bidder may be a firm that is a private entity, a state-owned enterprise or institution subject to ITB 4.6, or any combination of such entities in the form of a joint venture (JV) under an existing agreement or with the intent to enter into such an agreement supported by a letter of intent. In the case of a joint venture, all members shall be jointly and severally liable for the execution of the entire Contract in accordance with the Contract terms. The JV shall nominate a Representative who shall have the authority to conduct all business for and on behalf of any and all the members of the JV during the Bidding process and, in the event the JV is awarded the Contract, during contract execution. Unless specified **in the BDS**, there is no limit on the number of members in a JV.

4.2 A Bidder shall not have a conflict of interest. Any Bidder found to have a conflict of interest shall be disqualified. A Bidder may be considered to have a conflict of interest for the purpose of this Bidding process, if the Bidder:

(a) directly or indirectly controls, is controlled by or is under common control with another Bidder; or

(b) receives or has received any direct or indirect subsidy from another Bidder; or

(c) has the same legal representative as another Bidder; or

(d) has a relationship with another Bidder, directly or through common third parties, that puts it in a position to influence the Bid of another Bidder, or influence the decisions of the Employer regarding this Bidding process; or

(e) or any of its affiliates participated as a consultant in the preparation of the design or technical specifications of the Plant and Installation Services that are the subject of the Bid; or

(f) or any of its affiliates has been hired (or is proposed to be hired) by the Employer or Borrower as Project Manager for the Contract implementation; or

(g) would be providing goods, works, or non-consulting services resulting from or directly related to consulting services for the preparation or implementation of the project specified in the BDS ITB 2.1 that it provided or were provided by any affiliate that directly or indirectly controls, is controlled by, or is under common control with that firm; or

(h) has a close business or family relationship with a professional staff of the Borrower (or of the project implementing agency, or of a recipient of a part of the loan) who: (i) are directly or indirectly involved in the preparation of the bidding document or specifications of the Contract, and/or the Bid evaluation process of such Contract; or (ii) would be involved in the implementation or supervision of such contract unless the conflict stemming from such relationship has been resolved in a manner acceptable to the Bank throughout the Bidding process and execution of the Contract.

4.3 A firm that is a Bidder (either individually or as a JV member) shall not participate as a Bidder or as JV member in more than one Bid except for permitted alternative Bids. Such participation shall result in the disqualification of all Bids in which the firm is involved. However, this does not limit the participation of a Bidder as subcontractor in another Bid or of a firm as a subcontractor in more than one Bid.

4.4 A Bidder may have the nationality of any country, subject to the restrictions pursuant to ITB 4.8. A Bidder shall be deemed to have the nationality of a country if the Bidder is constituted, incorporated or registered in and operates in conformity with the provisions of the laws of that country, as evidenced by its articles of incorporation (or equivalent documents of constitution or association) and its registration documents, as the case may be. This criterion also shall apply to the determination of the nationality of proposed subcontractors or subconsultants for any part of the Contract including related Services.

4.5 A Bidder that has been sanctioned by the Bank, pursuant to the Bank's Anti-Corruption Guidelines, in accordance with its prevailing sanctions policies and procedures as set forth in the WBG's Sanctions Framework as described in Section VI paragraph 2.2 d., shall be ineligible to be prequalified for, initially selected for, bid for, propose for, or be awarded a Bank-financed contract or benefit from a Bank-financed contract, financially or otherwise, during such period of time as the Bank shall have determined. The list of debarred firms and individuals is available at the electronic address specified in the BDS.

4.6 Bidders that are state-owned enterprises or institutions in the Employer's Country may be eligible to compete and be awarded a Contract(s) only if they can establish, in a manner acceptable to the Bank, that they (i) are legally and financially autonomous

(ii) operate under commercial law, and (iii) are not under supervision of the Employer.

4.7 A Bidder shall not be under suspension from Bidding by the Employer as the result of the operation of a Bid-Securing Declaration or Proposal-Securing Declaration.

4.8 Firms and individuals may be ineligible if so indicated in Section V and (a)as a matter of law or official regulations, the Borrower's country prohibits commercial relations with that country, provided that the Bank is satisfied that such exclusion does not preclude effective competition for the supply of goods or the contracting of works or services required; or (b)by an act of compliance with a decision of the United Nations Security Council taken under Chapter VII of the Charter of the United Nations, the Borrower's country prohibits any import of goods or contracting of works or services from that country, or any payments to any country, person, or entity in that country. Where the procurement is implemented across jurisdictional boundaries (and more than one country is a Borrower, and is involved in the procurement), then exclusion of a firm or individual on the basis of ITB 4.8 (a) above by any country may be applied to that procurement across other countries involved, if the Bank and the Borrowers involved in the procurement agree.

4.9 A Bidder shall provide such documentary evidence of eligibility satisfactory to the Employer, as the Employer shall reasonably request.

4.10 A firm that is under a sanction of debarment by the Borrower from being awarded a contract is eligible to participate in this procurement, unless the Bank, at the Borrower's request, is satisfied that the debarment; (a) relates to fraud or corruption, and (b) followed a judicial or administrative proceeding that afforded the firm adequate due process.

5. Eligible Plant and Installation Services

5.1 The Plant and Installation Services to be supplied under the Contract and financed by the Bank may have their origin in any country in accordance with Section V, Eligible Countries.

5.2 For purposes of ITB 5.1 above, "origin" means the place where the Plant, or component parts thereof are mined, grown, produced or manufactured, and from which the services are provided. Plant components are produced when, through manufacturing, processing, or substantial or major assembling of components, a commercially recognized product results that is substantially different in its basic characteristics or in purpose or utility from its components.

B. Contents of Bidding Document

6. Sections of Bidding Document

6.1 The bidding document consists of Parts 1, 2, and 3, which include all the sections indicated below, and should be read in conjunction with any Addenda issued in accordance with ITB 8.

PART 1. Bidding Procedures

- Section I - Instructions to Bidders (ITB)
- Section II - Bid Data Sheet (BDS)
- Section III - Evaluation and Qualification Criteria
- Section IV - Bidding Forms
- Section V - Eligible Countries
- Section VI - Fraud and Corruption

PART 2. Employer's Requirements

- Section VII -Employer's Requirements

PART 3. Conditions of Contract and Contract Forms

- Section VIII - General Conditions of Contract (GCC)
- Section IX -Particular Conditions of Contract (PCC)
- Section X -Contract Forms

6.2 The Specific Procurement Notice-Request for Bids (RFB) issued by the Employer is not part of the bidding document.

6.3 Unless obtained directly from the Employer, the Employer is not responsible for the completeness of the document, responses to requests for clarification, the Minutes of the pre-Bid meeting (if any), or Addenda to the bidding document in accordance with

ITB 8. In case of any contradiction, documents obtained directly from the Employer shall prevail.

6.4 The Bidder is expected to examine all instructions, forms, terms, and specifications in the bidding document and to furnish with its Bid all information or documentation as is required by the bidding document.

7. Clarification of Bidding Document, Site Visit, Pre-Bid Meeting

7.1 A Bidder requiring any clarification of the bidding document shall contact the Employer in writing at the Employer's address indicated **in the BDS** or raise his enquiries during the pre-Bid meeting if provided for in accordance with ITB 7.4. The Employer will respond in writing to any request for clarification, provided that such request is received prior to the deadline for submission of Bids within a period specified **in the BDS**. The Employer shall forward copies of its response to all Bidders who have acquired the bidding document in accordance with ITB 6.3, including a description of the inquiry but without identifying its source. If so specified **in the BDS**, the Employer shall also promptly publish its response at the web page identified **in the BDS**. Should the clarification result in changes to the essential elements of the bidding document, the Employer shall amend the bidding document following the procedure under ITB 8 and ITB 23.2.

7.2 The Bidder is advised to visit and examine the site where the Plant is to be installed and its surroundings and obtain for itself on its own responsibility all information that may be necessary for preparing the Bid and entering into a Contract for the provision of Plant and Installation Services. The costs of visiting the site shall be at the Bidder's own expense.

7.3 The Bidder and any of its personnel or agents will be granted permission by the Employer to enter upon its premises and lands for the purpose of such visit, but only upon the express condition that the Bidder, its personnel, and agents will release and indemnify the Employer and its personnel and agents from and against all liability in respect thereof, and will be responsible for death or personal injury, loss of or damage to property, and any other loss, damage, costs, and expenses incurred as a result of the inspection.

7.4 If so specified **in the BDS**, the Bidder's designated representative is invited to attend a pre-Bid meeting and/or a site visit. The purpose of the meeting will be to clarify issues and to answer questions on any matter that may be raised at that stage.

7.5 The Bidder is requested to submit any questions in writing, to reach the Employer not later than one week before the meeting.

7.6 Minutes of the pre-Bid meeting, including the text of the questions raised without identifying the source, and the responses given, together with any responses prepared after the meeting, will be transmitted promptly to all Bidders who have acquired the bidding document in accordance with ITB 6.3. If so specified **in the BDS,** the Employer shall also promptly publish the Minutes of the pre-Bid meeting at the web page identified **in the BDS**. Any modification to the bidding document that may become necessary as a result of the pre-Bid meeting shall be made by the Employer exclusively through the issue of an Addendum pursuant to ITB 8 and not through the minutes of the pre-Bid meeting. Nonattendance at the pre-Bid meeting will not be a cause for disqualification of a Bidder.

8. Amendment of Bidding Document

8.1 At any time prior to the deadline for submission of Bids, the Employer may amend the bidding document by issuing addenda.

8.2 Any addendum issued shall be part of the bidding document and shall be communicated in writing to all who have obtained the bidding document from the Employer in accordance with ITB 6.3. The Employer shall also promptly publish the addendum on the Employer's web page in accordance with ITB 7.1.

8.3 To give prospective Bidders reasonable time in which to take an addendum into account in preparing their Bids, the Employer may, at its discretion, extend the deadline for the submission of bids, pursuant to ITB 23.2.

C. Preparation of Bids

9. Cost of Bidding

9.1 The Bidder shall bear all costs associated with the preparation and submission of its Bid, and the Employer shall not be responsible or liable for those costs, regardless of the conduct or outcome of the Bidding process.

10. Language of Bid

10.1 The Bid, as well as all correspondence and documents relating to the Bid exchanged by the Bidder and the Employer, shall be written in the language specified **in the BDS**. Supporting documents and printed literature that are part of the Bid may be in another language provided they are accompanied by an accurate translation of the relevant passages in the language specified **in the BDS**, in which case, for purposes of interpretation of the Bid, such translation shall govern.

11. Documents Comprising the Bid

11.1 The Bid shall comprise the following:

(a) **Letter of Bid** prepared in accordance with ITB12.1;

(b) **Price Schedules** completed in accordance with ITB 12 and ITB 17;

(c) **Bid Security** or **Bid Securing Declaration,** in accordance with ITB 20;

(d) **Alternative Bid**, if permissible, in accordance with ITB 13;

(e) **Authorization**: written confirmation authorizing the signatory of the Bid to commit the Bidder, in accordance with ITB 21.3;

(f) **Eligibility of Plant and Installation Services:** documentary evidence established in accordance with ITB 14.1 that the Plant and Installation Services offered by the Bidder in its Bid or in any alternative Bid, if permitted, are eligible;

(g) **Bidder's Eligibility and Qualifications:** documentary evidence in accordance with ITB 15.1 establishing the Bidder's eligibility and qualifications to perform the Contract if its Bid is accepted;

(h) **Conformity:** documentary evidence in accordance to ITB 16 that the Plant and Installation Services offered by the Bidder conform to the bidding document;

(i) **Subcontractors**: list of subcontractors in accordance with ITB 16.2; and

(j) any other document required **in the BDS**.

11.2 In addition to the requirements under ITB 11.1, Bids submitted by a JV shall include a copy of the Joint Venture Agreement entered into by all members. Alternatively, a letter of intent to execute a Joint Venture Agreement in the event of a successful Bid shall be signed by all members and submitted with the Bid, together with a copy of the proposed Agreement.

11.3 The Bidder shall furnish in the Letter of Bid information on commissions and gratuities, if any, paid or to be paid to agents or any other party relating to this Bid

12. Letter of Bid and Price Schedules

12.1 The Letter of Bid and Price Schedules shall be prepared, using the relevant forms furnished in Section IV, Bidding Forms. The forms must be completed as instructed in each form without any alterations to the text, and no substitutes shall be accepted except as provided under ITB 21.3. All blank spaces shall be filled in with the information requested.

13. Alternative Bids

13.1 Unless otherwise specified **in the BDS**, alternative Bids shall not be considered.

13.2 When alternatives to the Time Schedule are explicitly invited, a statement to that effect will be included **in the BDS**, and the method of evaluating different time schedules will be described in Section III, Evaluation and Qualification Criteria.

13.3 Except as provided under ITB 13.4 below, Bidders wishing to offer technical alternatives to the Employer's requirements as described in the bidding document must also provide: (i) a price at which they are prepared to offer a Plant meeting the Employer's requirements; and (ii) all information necessary for a complete evaluation of the alternatives by the Employer, including drawings, design calculations, technical specifications, breakdown of prices, and proposed installation methodology and other relevant details. Only the technical alternatives, if any, of the Bidder with the Most Advantageous Bid conforming to the basic technical requirements shall be considered by the Employer.

13.4 When Bidders are invited **in the BDS** to submit alternative technical solutions for specified parts of the facilities, such parts will be identified **in the BDS**, as will the method for their evaluation, and described in Section VII, Employer's Requirements.

14. Documents Establishing the Eligibility of the Plant and Installation Services

14.1 To establish the eligibility of the Plant and Installation Services in accordance with ITB 5, Bidders shall complete the country of origin declarations in the Price Schedule Forms, included in Section IV, Bidding Forms.

15. Documents Establishing the Eligibility and Qualification

15.1 To establish its eligibility and qualifications to perform the Contract in accordance with Section III, Evaluation and Qualification Criteria, the Bidder shall provide the information requested in the corresponding information sheets included in Section IV, Bidding Forms.

s of the Bidder

16. Documents Establishing the Conformity of the Plant and Installation Services

16.1 The Bidder shall furnish the information stipulated in Section IV, Bidding Forms in sufficient detail to demonstrate substantial responsiveness of the Bidders' proposal to the work requirements and the completion time.

16.2 For major items of Plant and Installation Services as listed by the Employer in Section III, Evaluation and Qualification Criteria, which the Bidder intends to purchase or subcontract, the Bidder shall give details of the name and nationality of the proposed Subcontractors, including manufacturers, for each of those items. In addition, the Bidder shall include in its Bid information establishing compliance with the requirements specified by the Employer for these items. Quoted rates and prices will be deemed to apply to whichever Subcontractor is appointed, and no adjustment of the rates and prices will be permitted.

16.3 The Bidder shall be responsible for ensuring that any Subcontractor proposed complies with the requirements of ITB 4, and that any Plant, or services to be provided by the Subcontractor comply with the requirements of ITB 5 and ITB 16.1.

17. Bid Prices and Discounts

17.1 Unless otherwise specified **in the BDS**, Bidders shall quote for the entire Plant and Installation Services on a "single responsibility" basis. The total Bid price shall include all the Contractor's obligations mentioned in or to be reasonably inferred from the bidding document in respect of the design, manufacture, including procurement and subcontracting (if any), delivery, construction, installation and completion of the Plant. This includes all requirements under the Contractor's responsibilities for testing, pre-commissioning and commissioning of the Plant and, where so required by the bidding document, the acquisition of all permits, approvals and licenses, etc.; the operation, maintenance and training services and such other items and services as specified in the bidding document, all in accordance with the requirements of the General Conditions. Items against which no price is entered by the Bidder will not be paid for by the Employer when executed and shall be deemed to be covered by the prices for other items.

17.2 Bidders are required to quote the price for the commercial, contractual and technical obligations outlined in the bidding document.

17.3 Bidders shall give a breakdown of the prices in the manner and detail called for in the Price Schedules included in Section IV, Bidding Forms.

Depending on the scope of the Contract, the Price Schedules may comprise up to the six (6) schedules listed below. Separate numbered Schedules included in Section IV, Bidding Forms, from those numbered 1 to 4 below, shall be used for each of the elements of the Plant and Installation Services. The total amount from each Schedule corresponding to an element of the Plant and Installation Services shall be summarized in the schedule titled Grand Summary, (Schedule 5), giving the total Bid price(s) to be entered in the Letter of Bid. Bidders shall note that the plant and equipment included in Schedule Nos. 1 and 2 below exclude materials used for civil, building and other construction works. All such materials shall be included and priced under Schedule No. 4, Installation Services. The Schedules comprise:

Schedule No. 1: Plant (including Mandatory Spare Parts) Supplied from Abroad

Schedule No. 2: Plant (including Mandatory Spare Parts) Supplied from within the Employer's Country

Schedule No. 3: Design Services

Schedule No. 4: Installation Services

Schedule No. 5: Grand Summary (Schedule Nos.1 to 4)

Schedule No. 6: Recommended Spare Parts

17.5. In the Schedules, Bidders shall give the required details and a breakdown of their prices as follows:

(a) Plant to be supplied from abroad (Schedule No. 1):

The price of the Plant shall be quoted on CIP-named place of destination basis as specified **in the BDS**.

(b) Plant manufactured within the Employer's Country (Schedule No. 2):

(i) The price of the Plant shall be quoted on an EXW Incoterm basis (such as "ex-works," "ex-factory," "ex-warehouse" or "off-the-shelf," as applicable) including all customs duties, sales and other taxes already paid or payable on the components and raw

materials used in the manufacture or assembly of the Plant;;

(ii) Sales tax and all other taxes payable in the Employer's Country on the Plant if the contract is awarded to the Bidder;

(c) Design Services (Schedule No. 3);

(d) Installation Services shall be quoted separately (Schedule No. 4) and shall include rates or prices for local transportation to named place of final destination as specified **in the BDS**, insurance and other services incidental to delivery of the plant, all labor, contractor's equipment, temporary works, materials, consumables and all matters and things of whatsoever nature, including operations and maintenance services, the provision of operations and maintenance manuals, training, etc., where identified in the bidding document, as necessary for the proper execution of the installation and other services, including all taxes, duties, levies and charges payable in the Employer's Country as of twenty-eight (28) days prior to the deadline for submission of Bids;

(e) Recommended spare parts shall be quoted separately (Schedule 6) as specified in either subparagraph (a) or (b) above in accordance with the origin of the spare parts.

17.6 The terms EXW, CIP, and other similar terms shall be governed by the rules prescribed in the current edition of Incoterms, published by the International Chamber of Commerce, as specified **in the BDS.**

17.7 The prices shall be either fixed or adjustable as specified **in the BDS.**

17.8 In the case of **Fixed Price**, prices quoted by the Bidder shall be fixed during the Bidder's performance of the contract and not subject to variation on any account. A Bid submitted with an adjustable price quotation will be treated as non-responsive and rejected.

17.9 In the case of **Adjustable Price**, prices quoted by the Bidder shall be subject to adjustment during performance of the contract to reflect changes in the cost elements such as labor, material, transport and contractor's equipment in accordance with the procedures specified in the corresponding Appendix to the Contract Agreement. A Bid submitted with a fixed price quotation will not be rejected, but the price adjustment will be

treated as zero. Bidders are required to indicate the source of labor and material indices in the corresponding Form in Section IV, Bidding Forms.

17.10 If so indicated in ITB 1.1, Bids are being invited for individual lots (contracts) or for any combination of lots (packages). Bidders wishing to offer any price reduction (discount) for the award of more than one Contract shall specify in their Letter of Bid the price reductions applicable to each package, or alternatively, to individual Contracts within the package, and the manner in which the price reductions will apply.

17.11 Bidders wishing to offer any unconditional discount shall specify in their Letter of Bid the offered discounts and the manner in which price discounts will apply.

18. Currencies of Bid and Payment

18.1 The currency(ies) of the Bid and the currency(ies) of payments shall be the same. The Bidder shall quote in the currency of the Employer's country the portion of the Bid price that corresponds to expenditures incurred in the currency of the Employer's Country, unless otherwise specified **in the BDS**.

18.2 The Bidder may express the Bid price in any currency. If the Bidder wishes to be paid in a combination of amounts in different currencies, it may quote its price accordingly but shall use no more than three foreign currencies in addition to the currency of the Employer's Country.

19. Period of Validity of Bids

19.1 Bids shall remain valid until the date **specified in the BDS** or any extended date if amended by the Employer in accordance with ITB 8. A Bid that is not valid until the date specified in the BDS, or any extended date if amended by the Employer in accordance with ITB 8, shall be rejected by the Employer as nonresponsive.

19.2 In exceptional circumstances, prior to date of expiration of the Bid validity, the Employer may request Bidders to extend the period of validity of their Bids. The request and the responses shall be made in writing. If a Bid Security is requested in accordance with ITB 20, the Bidder granting the request shall also extend the Bid Security for twenty-eight (28) days beyond the deadline of the extended validity period. A Bidder may refuse the request without forfeiting its Bid Security. A Bidder granting the request shall not be required or permitted to modify its Bid, except as provided in ITB 19.3.

19.3 If the award is delayed by a period exceeding fifty-six (56) days beyond the expiry of the initial Bid validity specified in

accordance with ITB 19.1, the Contract price shall be determined as follows:

(a) in the case of **fixed price** contracts, the Contract price shall be the Bid price adjusted by the factor or factors specified **in the BDS**;

(b) in the case of **adjustable price** contracts, no adjustment shall be made; or

(c) in any case, Bid evaluation shall be based on the Bid price without taking into consideration the applicable correction from those indicated above.

20. Bid Security

20.1 The Bidder shall furnish as part of the Technical part of its Bid, either a Bid-Securing Declaration or a Bid Security as specified **in the BDS,** in original form and, in the case of a Bid Security, in the amount and currency specified **in the BDS**.

20.2 A Bid-Securing Declaration shall use the form included in Section IV Bidding Forms.

20.3 If a Bid Security is specified pursuant to ITB 20.1, the Bid security shall be a demand guarantee in any of the following forms at the Bidder's option:

(a) an unconditional guarantee issued by a bank or non-bank financial institution (such as an insurance, bonding or surety company);

(b) an irrevocable letter of credit;

(c) a cashier's or certified check; or

(d) another security indicated **in the BDS**,

from a reputable source from an eligible country. If an unconditional guarantee is issued by a non-bank financial institution located outside the Employer's Country the issuing non-bank financial institution shall have a correspondent financial institution located in the Employer's Country to make it enforceable unless the Employer has agreed in writing, prior to Bid submission, that a correspondent financial institution is not required. In the case of a bank guarantee, the Bid Security shall be submitted either using the Bid Security Form included in Section IV, Bidding Forms, or in another substantially similar format approved by the Employer prior to Bid submission. The Bid Security shall be valid for twenty-eight (28) days beyond the

original date of expiry of the Bid validity, or beyond any extended date if requested under ITB 19.2.

20.4 If a Bid Security or a Bid-Securing Declaration is specified pursuant to ITB 20.1, any Bid not accompanied by a substantially responsive Bid Security or Bid-Securing Declaration shall be rejected by the Employer as nonresponsive.

20.5 If a Bid Security is specified pursuant to ITB 20.1, the Bid Security of unsuccessful Bidders shall be returned as promptly as possible upon the successful Bidder's furnishing of the Performance Security pursuant to ITB 51.

20.6 The Bid Security of the successful Bidder shall be returned as promptly as possible once the successful Bidder has signed the Contract and furnished the required Performance Security.

20.7 The Bid Security may be forfeited:

(a) if a Bidder withdraws its Bid prior to the expiry date of the Bid validity specified by the Bidder on the Letter of Bid – Technical Part and repeated in the Letter of Bid - Financial Part or any extended date provided by the Bidder; or

(b) if the successful Bidder fails to:

(i) sign the Contract in accordance with ITB 50; or

(ii) furnish a Performance Security in accordance with ITB 51.

20.8 The Bid Security or the Bid-Securing Declaration of a JV shall be in the name of the JV that submits the Bid. If the JV has not been legally constituted into a legally enforceable JV at the time of bidding, the Bid Security or the Bid Securing Declaration shall be in the names of all future members as named in the letter of intent referred to in ITB 4.1 and ITB 11.5.

20.9 If a Bid Security is not required **in the BDS**: and

(a) if a Bidder withdraws its Bid prior to the expiry date of the Bid validity specified by the Bidder on the Letter of Bid – Technical Part and repeated in the Letter of Bid - Financial Part or any extended date provided by the Bidder; or

(b) if the successful Bidder fails to:

(i) sign the Contract in accordance with ITB 50; or

(ii) furnish a Performance Security in accordance with ITB 51;

the Borrower may**,** if provided for **in the BDS**, declare the Bidder disqualified to be awarded a contract by the Employer for a period of time as stated **in the BDS**.

21. Format and Signing of Bid

21.1 The Bidder shall prepare one original of the documents comprising the bid as described in ITB 11 and clearly mark it "Original." Alternative Bids, if permitted in accordance with ITB 13, shall be clearly marked "Alternative". In addition, the Bidder shall submit copies of the Bid, in the number specified **in the BDS** and clearly mark them "Copy." In the event of any discrepancy between the original and the copies, the original shall prevail.

21.2 Bidders shall mark as "CONFIDENTIAL" information in their Bids which is confidential to their business. This may include proprietary information, trade secrets or commercial or financially sensitive information.

21.3 The original and all copies of the Bid shall be typed or written in indelible ink and shall be signed by a person duly authorized to sign on behalf of the Bidder. This authorization shall consist of a written confirmation as specified **in the BDS** and shall be attached to the Bid. The name and position held by each person signing the authorization must be typed or printed below the signature. All pages of the Bid where entries or amendments have been made shall be signed or initialed by the person signing the Bid.

21.4 In the case that the Bidder is a JV, the Bid shall be signed by an authorized representative of the JV on behalf of the JV, and so as to be legally binding on all the members as evidenced by a power of attorney signed by their legally authorized representatives.

21.5 Any interlineations, erasures, or overwriting shall be valid only if they are signed or initialed by the person signing the Bid.

D. Online Submission and Opening of Bids

22. Submission, Sealing and Marking of Bids

22.1 The Bidder shall deliver the Bid in a single, sealed envelope (one (1) envelope process). Within the single envelope the Bidder shall place the following separate, sealed envelopes:

(a) in an envelope marked "ORIGINAL", all documents comprising the Bid, as described in ITB 11; and

(b) in an envelope marked "COPIES", all required copies of the Bid; and

(c) if alternative Bids are permitted in accordance with ITB 13, and if relevant:

(i) in an envelope marked "ORIGINAL–ALTERNATIVE BID" the alternative Bid; and

(ii) in the envelope marked "COPIES – ALTERNATIVE BID" all required copies of the alternative Bid.

22.2 The inner and outer envelopes shall:

(a) bear the name and address of the Bidder;

(b) be addressed to the Employer in accordance with ITB 23.1;

(c) bear the specific identification of this Bidding process indicated in accordance with ITB 1.1; and

(d) bear a warning not to open before the time and date for Bid opening.

22.3 If all envelopes are not sealed and marked as required, the Employer will assume no responsibility for the misplacement or premature opening of the Bid.

23. Deadline for Submission of Bids

23.1 Bids must be received by the Employer at the address and no later than the date and time indicated **in the BDS**. When so specified **in the BDS**, Bidders shall have the option of submitting their Bids electronically. Bidders submitting Bids electronically shall follow the electronic Bid submission procedures specified **in the BDS**.

23.2 The Employer may, at its discretion, extend the deadline for the submission of Bids by amending the bidding document in accordance with ITB 8, in which case all rights and obligations of the Employer and Bidders previously subject to the deadline shall thereafter be subject to the deadline as extended.

24. Late Bids

24.1 The Employer shall not consider any Bid that arrives after the deadline for submission of Bids, in accordance with ITB 23. Any Bid received by the Employer after the deadline for submission of Bids shall be declared late, rejected, and returned unopened to the Bidder.

25. Withdrawal, Substitution, and

25.1 A Bidder may withdraw, substitute, or modify its bid after it has been submitted by sending a written notice, duly signed by an authorized representative, and shall include a copy of the

Modification of Bids

authorization in accordance with ITB 21.3, (except that withdrawal notices do not require copies). The corresponding substitution or modification of the Bid must accompany the respective written notice. All notices must be:

(a) prepared and submitted in accordance with ITB 21 and ITB 22 (except that withdrawals notices do not require copies), and in addition, the respective envelopes shall be clearly marked "Withdrawal," "Substitution," "Modification"; and

(b) received by the Employer prior to the deadline prescribed for submission of Bids, in accordance with ITB 23.

25.2 Bids requested to be withdrawn in accordance with ITB 25.1 shall be returned unopened to the Bidders.

25.3 No Bid may be withdrawn, substituted, or modified in the interval between the deadline for submission of Bids and the date of expiry of the Bid validity specified by the Bidder on the Letter of Bid or any extended date thereof.

E. Public Opening of Technical Parts of Bids

26. Public Opening of Technical Parts of Bids

26.1 Except as in the cases specified in ITB 24 and ITB 25.2, the Employer shall publicly open and read out in accordance with ITB 26.5 all Bids received by the deadline at the date, time and place specified **in the BDS** in the presence of Bidders' designated representatives and anyone who choose to attend. Any specific electronic Bid opening procedures required if electronic Bidding is permitted in accordance with ITB 23.1, shall be as specified **in the BDS**.

26.2 First, the written notice of withdrawal in the envelopes marked "Withdrawal" shall be opened and read out and the envelope with the corresponding Bid shall not be opened, but returned to the Bidder. No bid withdrawal shall be permitted unless the corresponding withdrawal notice contains a valid authorization to request the withdrawal and is read out at Bid opening.

26.3 Next, envelopes marked "Substitution" shall be opened and read out and exchanged with the corresponding Bid being substituted, and the substituted Bid shall not be opened, but returned to the Bidder. No Bid substitution shall be permitted unless the corresponding substitution notice contains a valid authorization to request the substitution and is read out at Bid opening.

26.4 Next, envelopes marked "Modification" shall be opened and read out with the corresponding Bid. No Bid modification shall

be permitted unless the corresponding modification notice contains a valid authorization to request the modification and is read out at Bid opening.

26.5 Next, all remaining envelopes shall be opened one at a time, reading out: the name of the Bidder and the Bid Price(s), including any discounts and alternative Bids, and indicating whether there is a modification; the presence or absence of a Bid Security or Bid-Securing Declaration, if required; and any other details as the Employer may consider appropriate.

26.6 Only Bids, alternative Bids and discounts that are opened and read out at Bid opening shall be considered further. The Letter of Bid and the Price Schedules are to be initialed by representatives of the Employer attending Bid opening in the manner specified **in the BDS**.

26.7 The Employer shall neither discuss the merits of any Bid nor reject any Bid (except for late Bids, in accordance with ITB 24.1).

26.8 The Employer shall prepare a record of the Bid opening that shall include, as a minimum:

(a) the name of the Bidder and whether there is a withdrawal, substitution, or modification;

(b) the Bid Price, per lot if applicable, including any discounts;

(c) any alternative Bids; and

(d) the presence or absence of a Bid Security or a Bid-Securing Declaration.

26.9 The Bidders' representatives who are present shall be requested to sign the record. The omission of a Bidder's signature on the record shall not invalidate the contents and effect of the record. A copy of the record shall be distributed to all Bidders.

F. Evaluation of Bids – General Provisions

27. Confidentiality

27.1 Information relating to the evaluation of Bids and recommendation of contract award, shall not be disclosed to Bidders or any other persons not officially concerned with the Bidding process until information on Intention to Award the Contract is transmitted to all Bidders in accordance with ITB 46.

27.2 Any effort by a Bidder to influence the Employer in the evaluation of the bids or Contract award decisions may result in the rejection of its Bid.

27.3 Notwithstanding ITB 27.2, from the time of Bid opening to the time of Contract Award, if any Bidder wishes to contact the Employer on any matter related to the Bidding process, it should do so in writing.

28. Clarification of Bids

28.1 To assist in the examination, evaluation, and comparison of the Bids, and qualification of the Bidders, the Employer may, at its discretion, ask any Bidder for a clarification of its Bid. Any clarification submitted by a Bidder that is not in response to a request by the Employer shall not be considered. The Employer's request for clarification and the response shall be in writing. No change in the prices or substance of the Bid shall be sought, offered, or permitted, except to confirm the correction of arithmetic errors discovered by the Employer in the evaluation of the Bids, in accordance with ITB 36.

28.2 If a Bidder does not provide clarifications of its Bid by the date and time set in the Employer's request for clarification, its Bid may be rejected.

29. Deviations, Reservations, and Omissions

29.1 During the evaluation of Bids, the following definitions apply:

(a) "Deviation" is a departure from the requirements specified in the bidding document;

(b) "Reservation" is the setting of limiting conditions or withholding from complete acceptance of the requirements specified in the bidding document; and

(c) "Omission" is the failure to submit part or all of the information or documentation required in the bidding document.

30. Nonmaterial Nonconformities

30.1 Provided that a Bid is substantially responsive, the Employer may waive any nonconformity in the Bid that does not constitute a material deviation, reservation or omission.

30.2 Provided that a Bid is substantially responsive, the Employer may request that the Bidder submit the necessary information or documentation, within a reasonable period of time, to rectify nonmaterial nonconformities in the Bid related to documentation requirements. Requesting information or documentation on such nonconformities shall not be related to any aspect of the price of

the Bid. Failure of the Bidder to comply with the request may result in the rejection of its Bid.

30.3 Provided that a Bid is substantially responsive, the Employer shall rectify quantifiable nonmaterial nonconformities related to the Bid Price. To this effect, the Bid Price shall be adjusted, for comparison purposes only, to reflect the price of a missing or non-conforming item or component by adding the average price of the item or component quoted by substantially responsive Bidders. If the price of the item or component cannot be derived from the price of other substantially responsive Bids, the Employer shall use its best estimate.

G. Evaluation of Technical Parts of Bids

31. Evaluation of Technical Parts of Bids

31.1 The Employer shall use the criteria and methodologies listed in this ITB and Section III, Evaluation and Qualification criteria. No other evaluation criteria or methodologies shall be permitted.

31.2 **Technical Evaluation**. The Employer will carry out a detailed technical evaluation of the Bids not previously rejected to determine whether the technical aspects are in compliance with the bidding document. The Bid that does not meet minimum acceptable standards of completeness, consistency and detail, and the specified minimum (or maximum, as the case may be) requirements for specified functional guarantees, will be rejected for non-responsiveness. In order to reach its determination, the Employer will examine and compare the technical aspects of the Bids on the basis of the information supplied by the Bidders, taking into account the following:

(a) overall completeness and compliance with the Employer's Requirements; conformity of the Plant and Installation Services offered with specified performance criteria, including conformity with the specified minimum (or maximum, as the case may be) requirement corresponding to each functional guarantee, as indicated in the Specification and in Section III, Evaluation and Qualification Criteria; suitability of the Plant and Installation Services offered in relation to the environmental and climatic conditions prevailing at the site; and quality, function and operation of any process control concept included in the Bid;

(b) type, quantity and long-term availability of mandatory and recommended spare parts and maintenance services; and

(c) other relevant factors, if any, listed in Section III, Evaluation and Qualification Criteria.

31.3 Where alternative technical solutions have been allowed in accordance with ITB 13, and offered by the Bidder, the Employer will make a similar evaluation of the technical parts of the alternatives. Where alternatives have not been allowed but have been offered, they shall be ignored.

32. Determination of Responsiveness

32.1 The Employer's determination of a Bid's responsiveness is to be based on the contents of the Bid itself, as defined in ITB11.

32.2 A substantially responsive Bid is one that meets the requirements of the bidding document without material deviation, reservation, or omission. A material deviation, reservation, or omission is one that:

(a) if accepted, would:

(i) affect in any substantial way the scope, quality, or performance of the Plant and Installation Services specified in the Contract; or

(ii) limit in any substantial way, inconsistent with the bidding document, the Employer's rights or the Bidder's obligations under the proposed Contract; or

(b) if rectified, would unfairly affect the competitive position of other Bidders presenting substantially responsive Bids.

32.3 The Employer shall examine the technical aspects of the Bid in particular, to confirm that all requirements of Section VII, Employer's Requirements have been met without any material deviation, reservation, or omission.

32.4 If a Bid is not substantially responsive to the requirements of the bidding document, it shall be rejected by the Employer and may not subsequently be made responsive by correction of the material deviation, reservation, or omission.

33. Eligibility and Qualification of the Bidder

33.1 The Employer shall determine to its satisfaction whether the eligible Bidders that have submitted substantially responsive Bid - Technical Parts meet the qualifying criteria specified in Section III, Evaluation and Qualification Criteria.

33.2 The determination shall be based upon an examination of the documentary evidence of the Bidder's qualifications submitted by the Bidder, pursuant to ITB 15. The determination shall not take into consideration the qualifications of other firms such as the Bidder's subsidiaries, parent entities, affiliates, subcontractors (other than Specialized Subcontractors if

permitted in the bidding document), or any other firm different from the Bidder.

33.3 If a Bidder does not meet the qualifying criteria specified in Section III, Evaluation and Qualification Criteria, its Bid shall be rejected by the Employer and may not subsequently be made responsive by correction of the material deviation, reservation, or omission.

33.4 Only Bids that are both substantially responsive to the bidding document, and meet all Qualification Criteria shall have the Financial Parts of their Bids opened at the private opening.

H. Opening of Financial Parts of Bids

34. Opening of Financial Parts when e-Reverse Auction (e-RA) Applies

34.1 Following the completion of the evaluation of the Technical Parts of the Bids, and the Bank has issued its no objection (if applicable), the Employer shall notify in writing those Bidders whose Bids were considered non-responsive to the bidding document or failed to meet the Qualification Criteria, advising them of the following information:

(a) the grounds on which their Technical Part of Bid failed to meet the requirements of the bidding document;

(b) their Financial Part of Bid shall not be opened.

34.2 The Employer shall, simultaneously, notify in writing those Bidders whose Technical Part have been evaluated as substantially responsive to the bidding document and met all Qualifying Criteria, advising them of the following information:

(a) their Bid has been evaluated as substantially responsive to the bidding document and met the Qualification Criteria;

(b) their Financial Part of Bid will not be opened in public, and will be opened in the presence of a Probity Auditor appointed by the Employer, and that the announcement of the names of the Bidders whose Financial Parts will be opened and the total Bid prices will be deferred to the time that the Notification of Intention to Award the contract is issued.

(c) the Employer will notify all Bidders of the location, date and time of the opening of Financial Parts in the presence of Probity Assurance Advisor.

34.3 The Employer shall record the names of each Bidder, and the total Bid prices and any other details as the Employer may consider

appropriate. The Employer shall prepare a record of the opening of the Financial Part of Bids that shall include, as a minimum:

(a) the names of the Bidders whose Financial Part of Bids were opened;

(b) the Bid prices including any discounts; and

(c) the Probity Auditor's report of the opening of the Financial Part.

34.4 The Probity Auditor shall sign the record. The contents of the Financial Part of Bids and the record of the opening shall be kept in safe custody by the Employer and not disclosed to anyone until the time of the transmission of the Notification of Intention to Award the contract.

Only Financial Parts of Bids and discounts that are opened at the Bid opening of Financial Part of Bids shall be considered further for evaluation.

I. Evaluation of Financial Parts of Bids

35. Evaluation of Financial Parts

35.1 The Employer shall use the criteria and methodologies listed in this ITB and Section III, Evaluation and Qualification criteria. No other evaluation criteria or methodologies shall be permitted. By applying the criteria and methodologies the Employer shall determine the Most Advantageous Bid in accordance with ITB 43.

35.2 To evaluate the Financial Part, the Employer shall consider the following:

(a) the Bid price, excluding Provisional Sums and the provision, if any, for contingencies in the Price Schedules;
(b) price adjustment for correction of arithmetic errors in accordance with ITB 36;
(c) price adjustment due to discounts offered in accordance with ITB 17.11;
(d) price adjustment due to quantifiable nonmaterial nonconformities in accordance with ITB 30.3;
(e) converting the amount resulting from applying (a) to (c) above, if relevant, to a single currency in accordance with ITB 37; and
(f) the evaluation factors specified **in the BDS** and in Section III, Evaluation and Qualification Criteria.

35.3 If price adjustment is allowed in accordance with ITB 17.7, the estimated effect of the price adjustment provisions of the Conditions of Contract, applied over the period of execution of the Contract, shall not be taken into account in Bid evaluation.

35.4 If this bidding document allows Bidders to quote separate prices for different lots (contracts), and the award to a single Bidder of multiple lots (contracts), the methodology to determine the lowest evaluated cost of the lot (contract) combinations, including any discounts offered in the Letter of Bid – Financial Part, is specified in Section III, Evaluation and Qualification Criteria.

36. Correction of Arithmetical Errors

36.1 Provided that the Bid is substantially responsive, the Employer shall correct arithmetical errors on the following basis:

(a) where there are errors between the total of the amounts given under the column for the price breakdown and the amount given under the Total Price, the former shall prevail and the latter will be corrected accordingly;

(b) where there are errors between the total of the amounts of Schedule Nos. 1 to 4 and the amount given in Schedule No. 5 (Grand Summary), the former shall prevail and the latter will be corrected accordingly; and

(c) if there is a discrepancy between words and figures, the amount in words shall prevail, unless the amount expressed in words is related to an arithmetic error, in which case the amount in figures shall prevail subject to (a) and (b) above.

36.2 Bidders shall be requested to accept correction of arithmetical errors. Failure to accept the correction in accordance with ITB 36.1, shall result in the rejection of the Bid.

37. Conversion to Single Currency

37.1 For evaluation and comparison purposes, the currency(ies) of the Bid shall be converted into a single currency as specified **in the BDS.**

38. Margin of Preference

38.1 No margin of domestic preference shall apply.

39. Comparison of Financial Parts

39.1 The Employer shall compare the evaluated costs of all substantially responsive Bids established in accordance with ITB 35.2 to rank the Bids. Bidder with the lowest Evaluated Bid Value (EBV) shall be L-1, Bidder with Second lowest EBV shall

be L-2 & so on. The Most Advantageous Bid shall be selected after applying e-Reverse Auction (e-RA).

40. Abnormally Low Bids

40.1 An Abnormally Low Bid is one where the Bid price, in combination with other elements of the Bid, appears so low that it raises material concerns as to the capability of the Bidder to perform the Contract for the offered Bid Price.

40.2 In the event of identification of a potentially Abnormally Low Bid, the Employer shall seek written clarifications from the Bidder, including detailed price analyses of its Bid price in correlation to the subject matter of the contract, scope, proposed methodology, schedule, allocation of risks and responsibilities and any other requirements of the bidding document.

40.3 After evaluation of the price analyses, in the event that the Employer determines that the Bidder has failed to demonstrate its capability to deliver the contract for the offered tender price, the Employer shall reject the Bid.

41. Unbalanced or Front Loaded Bids

41.1 If the Bid that is evaluated as the lowest evaluated cost is, in the Employer's opinion, seriously unbalanced or front loaded the Employer may require the Bidder to provide written clarifications. Clarifications may include detailed price analyses to demonstrate the consistency of the Bid prices with the scope of works, proposed methodology, schedule and any other requirements of the bidding document.

41.2 After the evaluation of the information and detailed price analyses presented by the Bidder, the Employer may:

(a) accept the Bid; or

(b) if appropriate, require that the total amount of the Performance Security be increased, at the expense of the Bidder, to a level not exceeding twenty percent (20%) of the Contract Price; or

(c) reject the Bid.

42. e-Reverse Auction (e-RA)

42.1 After completion of evaluation of bids, if specified **in the BDS**, the Employer may invite those Bidders to participate in e-Reverse Auction (e-RA). The procedure for participation in e-RA will be specified **in the BDS**. e-RA is a final opportunity for Bidders to improve (reduce) their bid price without changing the specified business function and performance requirements. Bidders are not obliged to participate in e-RA, and if a Bidder does not participate in e-RA, its evaluated bid value (EBV)

before commencement of e-RA, shall also be considered as its final EBV at the end of e-RA.

43. Most Advantageous Bid

43.1 The Most Advantageous Bid is the Bid of the Bidder that meets the Qualification Criteria and whose Bid has been determined to be:

(a) substantially responsive to the bidding document; and

(b) the lowest evaluated cost.

43.2 The capabilities of the manufacturers and subcontractors proposed in its Bid to be used by the Bidder with the Most Advantageous Bid for identified major items of supply or services will also be evaluated for acceptability in accordance with Section III, Evaluation and Qualification Criteria. Their participation should be confirmed with a letter of intent between the parties, as needed. Should a manufacturer or subcontractor be determined to be unacceptable, the Bid will not be rejected, but the Bidder will be required to substitute an acceptable manufacturer or subcontractor without any change to the Bid price. Prior to signing the Contract, the corresponding Appendix to the Contract Agreement shall be completed, listing the approved manufacturers or subcontractors for each item concerned.

44. Employer's right to Accept Any Bid and to Reject Any or All Bids

44.1 The Employer reserves the right to accept or reject any Bid, and to annul the Bidding process and reject all Bids at any time prior to Contract Award, without thereby incurring any liability to Bidders. In case of annulment, all documents submitted and specifically, Bid securities shall be promptly returned to the Bidders.

45. Standstill Period

45.1 The Contract shall not be awarded earlier than the expiry of the Standstill Period. The Standstill Period shall be ten (10) Business Days unless extended in accordance with ITB 49. The Standstill Period commences the day after the date the Employer has transmitted to each Bidder the Notification of Intention to Award the Contract. Where only one Bid is submitted, or if this contract is in response to an emergency situation recognized by the Bank, the Standstill Period shall not apply.

46. Notification of Intention to Award

46.1 The Employer shall send to each Bidder the Notification of Intention to Award the Contract to the successful Bidder. The Notification of Intention to Award shall contain, at a minimum, the following information:

(a) the name and address of the Bidder submitting the successful Bid;

(b) the Contract price of the successful Bid;

(c) the names of all Bidders who submitted Bids, and their Bid prices as readout, and as evaluated;

(d) a statement of the reason(s) the Bid (of the unsuccessful Bidder to whom the notification is addressed) was unsuccessful, unless the price information in c) above already reveals the reason;

(e) the expiry date of the Standstill Period;

(f) instructions on how to request a debriefing and/or submit a complaint during the standstill period; and

(g) probity report prepared by Probity Auditor containing observations on financial bid opening and e-RA process.

46.2 The probity report shall be simultaneously published on the Employer's website with free access if available, and on the e-procurement system.

J. Award of Contract

47. Award Criteria

47.1 Subject to ITB 44, the Employer shall award the Contract to the successful Bidder. This is the Bidder whose Bid has been determined to be the Most Advantageous Bid as specified in ITB 43.1.

48. Notification of Award

48.1 Prior to the date of expiry of the bid validity, and upon expiry of the Standstill Period, specified in ITB 45.1 or any extension thereof, and upon satisfactorily addressing any complaint that has been filed within the Standstill Period, the Employer shall notify the successful Bidder, in writing, that its Bid has been accepted. The notification of award (hereinafter and in the Contract Forms called the "Letter of Acceptance") shall specify the sum that the Employer will pay the Contractor in consideration of the execution of the contract (hereinafter and in the Conditions of Contract and Contract Forms called "the Contract Price").

48.2 Within ten (10) Business Days after the date of transmission of the Letter of Acceptance, the Employer shall publish the

Contract Award Notice which shall contain, at a minimum, the following information:

(a) name and address of the Employer;

(b) name and reference number of the contract being awarded, and the selection method used;

(c) names of all Bidders that submitted Bids, and their Bid prices as read out at Bid opening, and as evaluated;

(d) names of all Bidders whose Bids were rejected either as nonresponsive or as not meeting qualification criteria, or were not evaluated, with the reasons therefor;

(e) the name of the successful Bidder, the final total contract price, the contract duration and a summary of its scope; and

(f) successful Bidder's Beneficial Ownership Disclosure Form, if specified in BDS ITB 50.1.

48.3 The Contract Award Notice shall be published on a National website (GoI website http://tenders.gov.in or GoI Central Public Procurement Portal https://eprocure.gov.in/cpppp/) or on the Employer's website with free access if available, or in at least one newspaper of national circulation in the Employer's Country, or in the official gazette, and on the e-procurement system. The Employer shall also publish the contract award notice in UNDB online.

48.4 Until a formal contract is prepared and executed, the Letter of Acceptance shall constitute a binding Contract

49. Debriefing by the Employer

49.1 On receipt of the Employer's Notification of Intention to Award referred to in ITB 46, an unsuccessful Bidder has three (3) Business Days to make a written request to the Employer for a debriefing. The Employer shall provide a debriefing to all unsuccessful Bidders whose request is received within this deadline.

49.2 Where a request for debriefing is received within the deadline, the Employer shall provide a debriefing within five (5) Business Days, unless the Employer decides, for justifiable reasons, to provide the debriefing outside this timeframe. In that case, the standstill period shall automatically be extended until five (5) Business Days after such debriefing is provided. If more than one debriefing is so delayed, the standstill period shall not end earlier than five (5) Business Days after the last debriefing takes

place. The Employer shall promptly inform, by the quickest means available, all Bidders of the extended standstill period.

49.3 Where a request for debriefing is received by the Employer later than the three (3)-Business Day deadline, the Employer should provide the debriefing as soon as practicable, and normally no later than fifteen (15) Business Days from the date of publication of Public Notice of Award of contract. Requests for debriefing received outside the three (3)-day deadline shall not lead to extension of the standstill period.

49.4 Debriefings of unsuccessful Bidders may be done in writing or verbally. The Bidder shall bear their own costs of attending such a debriefing meeting.

50. Signing of Contract

50.1 The Employer shall send to the successful Bidder the Letter of Acceptance including the Contract Agreement, and, if specified **in the BDS**, a request to submit the Beneficial Ownership Disclosure Form providing additional information on its beneficial ownership. The Beneficial Ownership Disclosure Form, if so requested, shall be submitted within eight (8) Business Days of receiving this request.

50.2 The successful Bidder shall sign, date and return to the Employer, the Contract Agreement within twenty-eight (28) days of its receipt.

50.3 Notwithstanding ITB 50.2 above, in case signing of the Contract Agreement is prevented by any export restrictions attributable to the Employer, to the country of the Employer, or to the use of the Plant and Installation Services to be supplied, where such export restrictions arise from trade regulations from a country supplying those Plant and Installation Services, the Bidder shall not be bound by its Bid, always provided, however, that the Bidder can demonstrate to the satisfaction of the Employer and of the Bank that signing of the Contact Agreement has not been prevented by any lack of diligence on the part of the Bidder in completing any formalities, including applying for permits, authorizations and licenses necessary for the export of the Plant and Installation Services under the terms of the Contract.

51. Performance Security

51.1 Within twenty-eight (28) days of the receipt of the Letter of Acceptance from the Employer, the successful Bidder shall furnish the Performance Security in accordance with the General Conditions GCC 13.3, subject to ITB 41, using for that purpose the Performance Security Form included in Section X, Contract Forms, or another form acceptable to the Employer. If the Performance Security furnished by the successful Bidder is in the form of a bond, it shall be issued by a bonding or insurance company that has been determined by the successful Bidder to

be acceptable to the Employer. A foreign institution providing a bond shall have a correspondent financial institution located in the Employer's Country, unless the Employer has agreed in writing that a correspondent financial institution is not required.

51.2 Failure of the successful Bidder to submit the above-mentioned Performance Security or sign the Contract shall constitute sufficient grounds for the annulment of the award and forfeiture of the Bid Security. In that event the Employer may award the Contract to the Bidder offering the next Most Advantageous Bid.

52. Procurement Related Complaint

52.1 The procedures for making a Procurement-related Complaint are as specified **in the BDS**.

Section II - Bid Data Sheet

The following specific data for the Facilities to be procured shall complement, supplement, or amend the provisions in the Instructions to Bidders (ITB) Whenever there is a conflict, the provisions herein shall prevail over those in ITB. E-procurement clauses included in the BDS are specific to the e-procurement system being used by the Borrower.

A. General	
ITB 1.1	The reference number of the Request for Bids (RFB) is: **SECI/C&P/RfB/2020/CG/100/150** The Employer & Owner is: **Solar Energy Corporation of India Limited (SECI), New Delhi, India** The name of the RFB is: **Design, Engineering, Supply, Construction, Erection, Testing & Commissioning of 100 MW (AC) Solar PV Project (200MWp DC capacity) along with 50MW/150 MWh Battery Energy Storage System having 10 years plant O&M at Rajnandgaon, Chhattisgarh, India** The bidders shall note that this is a composite contract covering the entire scope of services of the Plant facility above (In line with Section VII, Annexure A, Employers requirement) & any bid offering incomplete scope of services will be summarily rejected. No partial bids are allowed.
ITB 1.2 (a)	The Employer shall use the e-procurement system specified in BDS 7.1.
ITB 2.1	The Borrower is: **Solar Energy Corporation of India Limited (SECI), New Delhi, India** The amount of the financing is: **US$ 200 Million (World Bank & Clean Technology Fund managed by the World Bank)** The name of the Project is: **Innovation in Solar Power and Hybrid Technologies Project**

ITB 4.1	Maximum number of members in the Joint Venture (JV) shall be: 03 (Three) Add the following at the end of ITB Clause 4.1 (i) In case of a JV, the members of the JV are required to execute a JV agreement as per the "FORM OF UNDERTAKING BY THE JOINT VENTURE PARTNERS, FORM 2a" under bidding forms. Formation of JV Company (JVC) is not mandatory. (ii) There can be a maximum of 03 (Three) partners/members in a JV. (iii) In case of the award, the Performance Security, to be submitted by a JV shall be in the name of the JV that has been awarded the NOA/Contract Agreement. If the JV has not been legally constituted into a legally enforceable JV, the Performance Security shall be in the names of all the partners/members of the JV & not in the name of "only lead bidder". The Performance Security Bank Guarantee shall be executed in the names of all the partners/members of the JV. (iv) The joint venture agreement (in form - Details of Participation in the Joint Venture in Section IV) should indicate precisely the responsibility of all partners/members of JV in respect of planning, design, manufacturing, supply, installation, commissioning and training. All members of JV should have active participation in execution during the currency of the Contract. The composition or the constitution of the JV shall not be varied/modified subsequently without prior approval of the Employer/SECI. JV is also required to declare detailed scope of work to be executed by each partner/member of JV. (v) A Joint Venture (JV), may or may not be incorporated as a Registered Company. (vi) A Joint Venture (JV), if incorporated as a Registered Company, is required to submit Bid Security and Performance Security (In case of award) in the name of Joint Venture only. (vii) A JV is required to submit the JV Agreement by the JV Partners as per prescribed formats enclosed under Bidding Forms.
ITB 4.5	A list of debarred firms and individuals is available on the Bank's external website: http://www.worldbank.org/debarr.
B. Bidding Document	

ITB 7	Replace ITB 7.1, ITB 7.5 and ITB 7.6 with the following: "7.1 The electronic bidding system specified **in the BDS** provides for online clarifications. A Bidder requiring any clarification of the Bidding Document may notify the Employer online or raise its inquiries during the pre-Bid meeting if provided for in accordance with ITB 7.4. Clarifications requested through any other mode shall not be considered by the Employer. The Employer will respond to any request for clarification, provided that such request is received prior to the deadline for submission of bids within a period specified **in the BDS**. Description of clarification sought and the response of the Employer shall be uploaded for information of all Bidders without identifying the source of request for clarification. Should the clarification result in changes to the essential elements of the Bidding Document, the Employer shall amend the Bidding Document following the procedure under ITB 8 and ITB 23.2. It is the bidder's responsibility to check on the e-procurement system, for any addendum/ amendment/ corrigendum to the bidding document." "7.5 The Bidder is requested, to submit any questions only through the e-procurement portal, not later than one week before the meeting. Clarifications requested through any other mode shall not be considered by the Employer" "7.6 Minutes of the pre-Bid meeting, including the text of the questions raised without identifying the source, and the responses given, together with any responses prepared after the meeting, shall be uploaded on the e-procurement system for information of all Bidders. Any modification to the bidding document that may become necessary as a result of the pre-Bid meeting shall be made by the Employer exclusively through the issue of an Addendum following the procedure under ITB 8 and ITB 23.2, and not through the minutes of the pre-Bid meeting. Nonattendance at the pre-Bid meeting will not be a cause for disqualification of a Bidder."
ITB 7.1	**Electronic –Procurement System** The Employer shall use the following electronic-procurement system to manage this Bidding process: ETS Portal of M/s ElectronicTender.com (India) Pvt. Limited, New Delhi Web page: https://www.bharat-electronictender.com Requests for clarification should be received by the Employer no later than: 10 days prior to the deadline for submission of bids.
ITB 7.4	A Pre-Bid meeting shall take place at the following date, time and place: **Date: 29/09/2020** **Time: 1100 Hours** **Place: Solar Energy Corporation of India Limited,**

	D - 3, 1st Floor, Wing - A, Prius Platinum, District Centre, Saket, **New Delhi - 110 017, India Or at Rajnandgaon, Chhattisgarh.** **If required, The Pre-Bid meeting may also be conducted through Video Conferencing (VC).** A site visit shall be organized by the Employer at a suitable date based on the discussion of the Pre-Bid meeting.
ITB 8.1	Replace ITB 8.1 with the following: "8.1 At any time prior to the deadline for submission of bids, the Employer may amend the Bidding Document by issuing addenda. The addendum will appear on the e-procurement system under https://www.bharat-electronictender.com and email notification is also automatically sent to those bidders who have started working on this tender. In addition, any changes to bidding document, pre-bid clarifications, extension of deadline for the submission of bids, addendum and corrigendum to the tender shall be published online in the e-Procurement portal. The Employer shall not be liable for any information not received by the bidder. It is the bidders' responsibility to verify the website for the latest information related to this bid."
ITB 8.2	Replace ITB 8.2 with the following: "8.2. Any addendum thus issued shall be part of the Bidding Document and shall be deemed to have been communicated to all the bidders".
C. Preparation of Bids	
ITB 10.1	The language of the Bid is: **English.** All correspondence exchange shall be in **English.** Language for translation of supporting documents and printed literature is **English.**
ITB 11	Replace ITB 11 with the following: "11.1 The Bid shall comprise two Parts, namely the Technical Part and the Financial Part. These two Parts shall be submitted simultaneously. 11.2 The **Technical Part** shall contain the following: (a) **Letter of Bid - Technical Part** prepared in accordance with ITB12; (b) **Bid Security** or **Bid Securing Declaration,** in accordance with ITB 20; (c) **Alternative Bid - Technical Part**, if permissible, in accordance with ITB 13;

	(d) **Authorization**: written confirmation authorizing the signatory of the Bid to commit the Bidder, in accordance with ITB 21.3, and in accordance with ITB 21.4 in case of a JV; (e) **Eligibility of Plant and Installation Services:** documentary evidence established in accordance with ITB 14.1 that the Plant and Installation Services offered by the Bidder in its Bid or in any alternative Bid, if permitted, are eligible; (f) **Bidder's Eligibility and Qualifications:** documentary evidence in accordance with ITB 15.1 establishing the Bidder's eligibility and qualifications to perform the Contract if its Bid is accepted; (g) **Conformity:** in the technical proposal, documentary evidence in accordance to ITB 16 that the Plant and Installation Services offered by the Bidder conform to the bidding document; (h) **Subcontractors**: list of subcontractors in accordance with ITB 16.2; and (i) any other document required **in the BDS**. 11.3 **The Financial Part** shall contain the following: (a) **Letter of Bid – Financial Part:** prepared in accordance with ITB 12 and ITB 17; (b) **Price Schedules** completed online in accordance with ITB 12 and ITB 17; (c) **Alternative Bid - Financial Part:** if permissible in accordance with ITB 13; and (d) any other document required **in the BDS**. 11.4 The Technical Part shall not include any information related to the Bid price. Where material financial information related to the Bid price is contained in the Technical Part the Bid shall be declared non-responsive 11.5 In addition to the requirements under ITB 11.2, Bids submitted by a JV shall include a copy of the Joint Venture Agreement entered into by all members. Alternatively, a letter of intent to execute a Joint Venture Agreement in the event of a successful Bid shall be signed by all members and submitted with the Bid, together with a copy of the proposed Agreement. 11.6 The Bidder shall furnish in the Letter of Bid – Financial Part information on commissions and gratuities, if any, paid or to be paid to agents or any other party relating to this Bid".
ITB 11.2 (i)	The Bidder shall submit the following additional documents in its Bid: **(i) Code of Conduct for Contractor's Personnel (ES)**

	The Bidder shall submit its Code of Conduct that will apply to the Contractor's Personnel (as defined in GCC Sub- Clause 1) employed for the execution of Installation Services (defined in GCC Sub- Clause 1) at the Site (or other places in the country where the Site is located), to ensure compliance with the Contractor's Environmental and Social (ES) obligations under the Contract. The Bidder shall use for this purpose the Code of Conduct form provided in Section IV. No substantial modifications shall be made to this form, except that the Bidder may introduce additional requirements, including as necessary to take into account specific Contract issues/risks. **(j) Management Strategies and Implementation Plans (MSIP) to manage the (ES) risks** The Bidder shall submit Management Strategies and Implementation Plans (MSIPs) to manage the Environmental and Social (ES) risks as elaborated in Contractor's C-ESMP and Sexual Exploitation, and Abuse (SEA) prevention and response action plan.
ITB 11.3 (d)	The Bidder shall submit the following additional documents in its Bid: **Nil**
ITB 12	Replace ITB 12 with the following: "12.1 The Letter of Bid – Technical Part, Letter of Bid – Financial Part, and Price Schedules shall be prepared, using the relevant forms furnished in Section IV, Bidding Forms. The forms must be completed as instructed in each form without any alterations to the text, and no substitutes shall be accepted except as provided under ITB 21.3. All blank spaces shall be filled in with the information requested. 12.2 Entire Bid including the Letter of Bid – Technical Part, Letter of Bid – Financial Part, and filled-up Price Schedules shall be submitted online on e-procurement system specified in ITB 7.1. Details and process of online submission of the tender and relevant documents are given in the website mentioned above. Scanned copies of documents listed in ITB clauses 11 and 12.3 should also be uploaded on this website. 12.3 **Submission of Original Documents**: The bidders are required to separately submit (i) original bid security, in approved form, with the office specified **in the BDS**, before the Bid submission deadline, either by registered/speed post/courier or by hand, failing which such bids will be declared non-responsive and will not be opened. Hard copy of rest of the bid or any other document are not to be submitted. **Note for Bidders:** Bidders have to submit the bids on the e-procurement portal along with the relevant required documents. For this purpose, the bidders shall fill up online, the forms that are available for online filling on the e-procurement portal. The rest of the forms shall be download by the bidders and filled up. The filled-up pages shall then be scanned and uploaded

	on the e-procurement portal along with the scanned copies of the supporting documents. The Electronic Form of the bid for the Price Part/Second Envelope, as available on the M/s ElectronicTender.com (India) Pvt. Limited portal as a summary of the total Project price, is "Termed as ELECTRONIC FORM" Detailed Price Bid (in Excel version) comprising of various Price schedules/Schedule of Rates (SOR) is "Termed as MAIN BID". As part of the Electronic Encrypted functionality, the contents of both the 'Electronic Forms' and the 'Main-Bid' are securely encrypted using a Pass-Phrase created by the Bidder himself. Unlike a 'password', a Pass-Phrase can be a multi-word sentence with spaces between words (e.g. I love this World). A Pass-Phrase is easier to remember, and more difficult to break. It is mandatory that a separate Pass-Phrase be created for each Bid-Part. This method of bid-encryption does not have the security and data-integrity related vulnerabilities which are inherent in e-tendering systems which use Public-Key of the specified officer of a Buyer organization for bid-encryption. Bid-encryption in ETS is such that the Bids cannot be decrypted before the Public Online Tender Opening Event (TOE), even if there is connivance between the concerned tender-opening officers of the Buyer organization and the personnel of e-tendering service provider. CAUTION: All bidders must fill Electronic Form for each bid-part sincerely and carefully and avoid any discrepancy between information given in the Electronic Form™ and the corresponding Main-Bid. If any variation is noted between the price mentioned in the Electronic Form and the Main Bid (Excel Version), the price mentioned in the Main Bid shall prevail. In case of any discrepancy between the values mentioned in figures and in words, the value mentioned in words will prevail. The bidder shall make sure that the Pass-Phrase to decrypt the relevant Bid-Part is submitted into the 'Time Locked Electronic Key Box (EKB)' after the deadline of Bid Submission and before the commencement of the Online TOE of Technical Bid. The process of submission of this Pass-Phrase in the 'Time Locked Electronic Key Box' is done in a secure manner by first encrypting this Pass-Phrase with the designated keys provided by the Employer".
ITB 12.3	For submission of original documents, the Employer's address is: Attention: **Mr Sandeep Kumar, Manager (C&P)** Address: **Solar Energy Corporation of India Limited,** **D - 3, 1st Floor, Wing - A, Prius Platinum, District Centre, Saket,** **New Delhi - 110 017** **Country: INDIA**

ITB 13.1	Alternative Bids **shall not be** considered.
ITB 13.2	Alternatives to the Time Schedule **shall not be** permitted.
ITB 13.4	Alternative technical solutions shall be permitted for the following parts of the Plant and Installation Services. as further detailed in the Specification: **NA**
ITB 17	Replace ITB 17.1 to ITB 17.5 with the following: "17.1 Bidders shall quote for the following components or services on a single responsibility basis: Complete plant facility including Design, Engineering, Supply, Construction, Erection, Testing & Commissioning of 100 MW (AC) Solar PV Project (200MWp DC capacity) along with 50MW/150 MWh Battery Energy Storage System having 10 years plant O&M at Rajnandgaon, Chhattisgarh, India. The prices and discounts quoted by the Bidder in the Letter of Bid – Financial Part and in the Price Schedules shall conform to the requirements specified below. This includes all requirements under the Contractor's responsibilities for testing, pre-commissioning and commissioning of the plant and, where so required by the bidding document, the acquisition of all permits, approvals and licenses, etc.; the operation, maintenance and training services and such other items and services as specified in the bidding document, all in accordance with the requirements of the General Conditions. Items against which no price is entered by the Bidder will not be paid for by the Employer when executed and shall be deemed to be covered by the prices for other items. Corrections if any, in the bid can be carried out by editing the information before electronic submission on e-procurement portal. 17.2 Bidders are required to quote the price for the commercial, contractual and technical obligations outlined in the bidding document. 17.3 Bidders shall give a breakdown of the prices in the manner and detail called for in the Price Schedules included in Section IV, Bidding Forms. 17.4 The Price Schedules will comprise the schedules listed below. Separate numbered Schedules included in Section IV, Bidding Forms, as mentioned below, shall be used for each of the elements of the Plant and Installation Services. The total amount from each Schedule corresponding to an element of the Plant and Installation Services shall be summarized in the schedule titled Grand Summary, (Schedule 6), giving the total bid price(s) to be entered in the Letter of Bid. Schedule 1 Plant and Mandatory Spare Parts Supplied from Abroad.

	Schedule 2 Plant and Mandatory Spare Parts Supplied from Within the Employer's Country. Schedule 3 Design Services. Schedule 4 Installation and Other Services. Schedule 5 Operation & Maintenance Schedule 6 Grand Total Summary (Schedule Nos.1 to 5) Bidders shall note that the Plant and Equipment including mandatory Spares included in Schedule Nos. 1 and 2 above exclude materials used for civil, building and other construction works. Accordingly, all such works and materials shall be included and priced under Schedule No. 4, Installation & other Services. The bidder shall not carry out any modification or changes in any other cell. 17.5 In the Schedules, Bidders shall give the required details and a breakdown of their prices as follows: (a) Plant to be suppled from Aboard (Schedule No 1): (i) CIP Incoterm basis. (ii) Final destination: District Rajnandgaon, Chhattisgarh, India Bidder shall also be responsible and be liable for the payment of unloading, Custom clearances & Customs duty (i.e. Basic Customs duty, Cess, Safeguard Duty, GST etc.) on CIP component of the Goods to be supplied from abroad. (b) Plant manufactured within the Employer's Country (Schedule No. 2): (i) The price of the plant shall be quoted on an EXW Incoterm basis (such as "ex-works," "ex-factory," "ex-warehouse" or "off-the-shelf," as applicable); (ii) GST and all other taxes payable in the Employer's Country on the plant if the contract is awarded to the Bidder; (c) Design Services (Schedule No. 3); with applicable taxes. (d) Installation Services shall be quoted separately (Schedule No. 4) and shall include rates or prices for local transportation to named place of final destination as specified **in the BDS 17.5 (a) ii**, insurance and other services incidental to delivery of the plant, all labor, contractor's equipment, temporary works, materials, consumables and all matters and things of whatsoever nature, including operations and maintenance

	services, the provision of operations and maintenance manuals, training, etc., where identified in the bidding document, as necessary for the proper execution of the installation and other services, including all taxes, duties, levies and charges payable in the Employer's Country as of twenty-eight (28) days prior to the deadline for submission of Bids; (e) Comprehensive Operation & Maintenance (O&M) charges for total 10 years period shall be quoted in Schedule No 5/SOR 5."
	Add a new Sub-Clause 17.5.1 as below: "17.5.1 Bidders may like to ascertain availability of tax/duty exemption benefits available in India. They are solely responsible for obtaining such benefits which they have considered in their bid and in case of failure to receive such benefits for reasons whatsoever, the Employer will not compensate the bidder (contractor). The bidder shall furnish along with his bid a declaration to this effect in the Declaration Format provided in Section IV of the bidding documents. Where the bidder has quoted taking into account such benefits, it must give all information required for issue of certificates in terms of the Government of India's relevant Notifications as per the declaration format. In case the bidder has not provided the required information or has indicated to be furnished later on in the Declaration Format, the same shall be construed that the goods/plant and equipment for which certificate is required is Nil. To the extent the Employer determines the quantity indicated therein are reasonable keeping in view the quantities in bill of quantities, construction program and methodology, the certificates will be issued within 60 days of signing of the contract and no subsequent changes will be permitted. In case of materials pertaining to Variation items and quantities the certificate shall be issued only on request from the contractor when in need and duly certified by the Project Manager. No certificate will be issued for items where no quantity/capacity of equipment is indicated in the statement. If the bidder has considered the tax/duty exemption for materials/plant and equipment to be bought for the work, the bidder shall confirm and certify that the Employer will not be required to undertake any responsibilities of the Government of India Scheme or the said exemptions being available during the contract execution, except issuing the required certificate. The bids which do not conform to the above provisions or any condition by the bidder which makes the bid subject to availability of tax/duty exemption for materials/plant and equipment or compensation on withdrawal of any variations to the said exemptions will be treated as non-responsive and rejected.

	Any delay in procurement of the materials/plant and equipment as a result of the above shall not be a cause for granting any extension of time.”
	Add a new Sub-Clause 17.5.2 as below: **“17.5.2 Deemed Export Benefits”** Bidders may like to ascertain availability of deemed export or other benefits. They shall solely be responsible for obtaining such benefits, and in case of failure to receive such benefits for any reasons whatsoever; the Employer will not compensate the Bidder. The Bidder shall furnish along with their bid, a declaration to this effect. As per GST Act and subsequent rules and the Foreign Tarde Policy 2015-2020, supplies covered under the Project through International Competitive Bidding shall be treated as Deemed Export and therefore GST levied/paid in respect of supply of the goods regarded as Deemed Export, refund can be claimed for GST. Government of India has notified class of persons who will be entitled to claim refund of taxes paid on notified supplies of Goods or Services. Bidders who have considered Deemed Export benefit while submitting their bids, shall be responsible to claim refund of taxes from the Govt, for which employer shall furnish necessary details and undertaking that Employer shall not claim input tax credit on those supplies. As per notification, the Supplier is entitled to claim refund of GST, the same shall be their responsibility. Further, the necessary documents / certificates as may be required to claim refund shall be provided by the Employer to the Supplier. Where the Bidder has quoted taking into account such benefits, he must give all information required for issue of Project Authority/ Payment/Other certificates in terms of the Foreign Trade Policy or GST law/Notifications. In case, bidder has not indicated information such as import content or has indicated to be furnished later, the same shall be construed that the import content is Nil. The Project Authority/ Payment/Other Certificates will be issued on this basis of agreements reached before award of the contract in line with the information furnished. If the bidder has considered the deemed export benefits in its bid, the bidder shall confirm and certify that SECI will not be required to undertake any responsibilities of the deemed export scheme or the benefits available during contract execution except issuing the required certificates. **Custom Duty for Solar Photo Voltaic Power Generation Projects:** As per relevant Notifications of Govt. of India, the benefits of concessional rate of custom duty (applicable for Solar Photo Voltaic Power Generation Projects) may be available for the import of raw materials, components, subassemblies and Equipments, if any, required for manufacture of equipment/ plant/ spares to be supplied under the contract. Bidder may appraise itself of the relevant policies and quote accordingly. The Employer shall issue the requisite certificate as specified in the relevant policy of Govt.

	of India. However, if the certificate is required to be issued by any department/ministry of Government of India or State Government where the Project is located other than Employer, the Bidder shall itself be responsible for obtaining such certificate from the concerned department/ministry. In such a case, the Employer may issue recommendatory letter to the bidder. To enable the Employer to issue such certificate / recommendatory letter, the Bidder shall furnish the requisite data. In addition, the Bidder may also like to ascertain availability of Custom Duty benefits available for import of construction equipment, if any, as per the extant Customs Acts & Notifications of Govt. of India. Where the bidder has quoted taking into account the Custom Duty benefits available for import of Construction Equipment, he must give all information required for issue of relevant Certificate by Employer along with its bid. However, the bidders shall themselves be solely responsible for availing such benefits, which they have considered in their bid. In case of failure of the bidder to receive the benefits partly or fully from the Govt. of India and/or in case of delay in receipt of such benefits and/or withdrawal of such benefits by the Govt. of India, the Employer shall neither be responsible nor liable in this regard in any manner whatsoever. **Exemption of GST or any other taxes and duties (if applicable) on Items Manufactured for Grid Connected Solar Photo Voltaic Power Generation Projects** As per extant guidelines of Department of Revenue, Ministry of Finance, Govt. of India, the benefits of exemption of GST or any other taxes and duties (if applicable on items manufactured for grid connected Solar Photo Voltaic Power Generation Projects) may be available for the items to be supplied under the contract, Bidder may appraise itself of the relevant policies and quote accordingly. The Employer shall issue the requisite certificate (if required) as specified in the relevant policy of Govt. of India. However, if the certificate is required to be issued by any department/ ministry of Government of India or State Government where the Project is located other than Employer, the Bidder shall itself be responsible for obtaining such certificate from the concerned department/ministry. In such a case, the Employer may issue recommendatory letter to the bidder. The Bidder shall be solely responsible for obtaining the benefits of exemption on excise duty GST or any other taxes and duties (if applicable) on the items to be supplied under the contract from the Govt. of India. In case of failure of the bidder to receive the benefits partly or fully from Govt. of India or in case of delay in receipt of such benefits, the Employer shall neither be responsible nor liable in this regard in any manner whatsoever.
ITB 17.6	The Incoterms edition is: **2010**

ITB 17.7	The prices quoted by the Bidder **shall not be** subject to adjustment during the performance of the Contract.
ITB 18.1	The currencies of the bid shall be as follows: (a) Plant and Mandatory Spare Parts Supplied from Abroad (Schedule No. 1/SOR 1) & Plant and Mandatory Spare Parts Supplied from Within the Employer's Country (Schedule 2/SOR 2) under BDS ITB Sub-Clause 17.5 (a) and (b) shall be quoted entirely in the currency of any country. If the Bidder wishes to be paid in a combination of amounts in different currencies, it may quote its price accordingly, but use no more than three foreign currencies. (b) Design Services (Schedule 3/SOR 3) covered under BDS ITB Sub-Clause 17.5 (c) and Local/Inland transportation including In-transit insurance and loading till site, Installation, Erection, Testing and Commissioning including Performance Testing & Civil and allied works (Schedule 4/SOR 4) covered under BDS ITB Sub-Clause 17.5 (d) shall be quoted in Employer's local currency only (INR). However, Foreign Bidders, in addition to the Indian Rupee Component may also quote a portion in foreign currency to cover the expenditures towards expatriate personnel and imported equipment for the Services to be performed at site. A provision of which is given in the Schedule 3 & Schedule 4 (c) Operation & Maintenance (O&M) (Schedule 5/SOR 5) covered under BDS ITB Sub-Clause 17.5 (e) shall be quoted in the currency of the employer (INR).
ITB 19.1	The Bid shall be valid until**: 27.04.2021**
ITB 19.3 (a)	The bid price shall be adjusted by the following factor: 0.13% (zero-point one three percent) per week of the bid price for delay in award of contract.
ITB 20.1	A Bid Security shall be required. A Bid-Securing Declaration shall not be required. The amount and currency of the Bid Security shall be **7 Cr (Indian Rupees Seven Crores only) or USD 0.9 M (US Dollars Point Nine Million only)**
ITB 20.3(a)	Replace existing texts with "a bank guarantee as per BG format in Section IV".
ITB 20.3 (d)	Other types of acceptable securities: crossed bank draft/pay orders.
ITB 20.9	Deleted.

ITB 21	Replace ITB 21.1, ITB 21.3 and ITB 21.4 with the following: "21.1 The Bidder shall prepare the Bid as per details given in ITB 11 and ITB 22." "21.3 The Bid shall be signed by a person duly authorized to sign on behalf of the Bidder. This authorization shall consist of a written confirmation as specified **in the BDS** and shall be uploaded along with the Bid. The name and position held by each person signing the authorization must be typed or printed below the signature." "21.4 In case the Bidder is a JV, the Bid shall be signed by an authorized representative of the JV on behalf of the JV, and so as to be legally binding on all the members as evidenced by a power of attorney signed by their legally authorized representatives. Documents establishing authority to sign the bid on behalf of the JV shall be uploaded along with the bid."
ITB 21.3	The written confirmation of authorization to sign on behalf of the Bidder shall consist of: (a) Legally valid Power of Attorney is required to demonstrate the authority of the signatory to sign the Bid; and (b) In the case of Bids submitted by an existing or intended JV, the authorization shall be evidenced by a Power of Attorney signed by legally authorized signatories of all the members.
D. Online Submission and Opening of Bids	
ITB 22 Preparation of Bids	Replace ITB 22 with the following: "22.1 Bids, both Technical and Financial Parts, shall be submitted online on the e-procurement system specified in BDS 7.1. Detailed guidelines for viewing bids and submission of online bids are given on the website. The Request for Bids under this Project is published on this website. Any citizen or prospective bidder can logon to this website and view the Request for Bids and can view the details of works for which bids are invited. A prospective bidder can submit its bid online; however, the bidder is required to have enrolment/registration in the website, and should have valid Digital Signature Certificate (DSC) in the form of smart card/e-token obtained from any certifying agency authorised by the Government of India (for DSC of Class 3). The bidder should register in the website using the relevant option available. Then the Digital Signature registration has to be done with the e-token, after logging into the website. The bidder can then login the website through the secured login by entering the password of the e-token & the user id/ password chosen during registration. After getting the bid schedules, the Bidder should go through them carefully and submit the specified documents, along with the bid, otherwise the bid will be rejected." 22.2 The completed bid comprising of documents indicated in ITB 12, should be uploaded on the e-procurement portal along with scanned copies of requisite certificates as are mentioned in different sections in the bidding

	document and scanned copy of the bid security or bid securing declaration as the case may be. 22.3 All the documents are required to be signed digitally by the bidder. After electronic on-line bid submission, the system generates a unique bid identification number which is time stamped as per server time. This shall be treated as acknowledgement of bid submission. 22.4 Physical, e-mail, Telex, Cable or Facsimile bids will be rejected as non-responsive."
ITB 23	Replace ITB 23 with the following: "23.1 Bids, both Technical and Financial Parts, must be uploaded online no later than the date and time specified **in the BDS**. 23.2 The Employer may, at its discretion, extend the deadline for the submission of Bids by amending the bidding document in accordance with ITB 8, in which case all rights and obligations of the Employer and Bidders previously subject to the deadline shall thereafter be subject to the deadline as extended."
ITB 23	The deadline for online uploading Technical and Financial Parts of the Bids is: **Date: 27/10/2020 Time: 1400 Hours**
ITB 24	Replace ITB 24.1 with the following: "24.1 The electronic bidding system would not allow any late submission of bids after due date & time as per server time."
ITB 25	Replace ITB 25 with the following: "25.1 A Bidder may modify its bid by using appropriate option for bid modification on the e-procurement portal, before the deadline for submission of bids. For bid modification and consequential re-submission, the bidder is not required to withdraw the bid submitted earlier. The last modified bid submitted by the bidder within the bid submission time shall be considered as the bid. For this purpose, modification/withdrawal by other means will not be accepted. In online system of bid submission, the modification and consequential re-submission of bids is allowed any number of times. A bidder may withdraw its bid by using appropriate option for bid withdrawal, before the deadline for submission of bids, however, if the bid is withdrawn, re-submission of the bid is allowed within the bid submission deadline. 25.2 Bids requested to be withdrawn in accordance with ITB 25.1 shall not be opened. 25.3 No Bid may be withdrawn, substituted, or modified in the interval between the deadline for submission of Bids and the expiration of the period of Bid validity specified by the Bidder on the Letter of Bid – Technical Part and repeated in the Letter of Bid - Financial Part, or any extension thereof."
E. Public Opening of Technical Parts of Bids	

ITB 26. Public Opening of Technical Parts of Bids	Replace ITB 26 with the following: "26.1 The Employer shall publicly open Technical Parts of all Bids received by the deadline at the date, time and place specified **in the BDS**, in the presence of Bidders' designated representatives and anyone who choose to attend, and this could also be viewed by the bidders online. The Financial Parts of the bids shall remain unopened in the e-procurement system, until the subsequent private opening, following the evaluation of the Technical Parts of the Bids. In all cases, original documents submitted as specified in ITB 12.3 shall be first scrutinized, and Bids that do not comply with the provisions of ITB 12.3 will be declared non-responsive and will not be opened. Thereafter bidder's names, the presence or absence of a Bid Security or Bid Securing Declaration, if one was required, alternative bids – technical parts, if any, and such other details as the Employer may consider appropriate, will be notified online by the Employer at the time of bid opening of the Technical Part of the bids. In the event of the specified date of bid opening being declared a holiday for the Employer, the bids shall be opened at the same time and venue on the next working day 26.2 The electronic summary of the bid opening will be generated and uploaded online. The Employer will also prepare minutes of the Bid opening, including the information disclosed, and upload the same for viewing online. 26.3 Only Technical Parts of Bids, and Alternative Bids – Technical Parts if permitted in ITB 13, that are opened at Bid opening of the Technical Part of the Bids, shall be considered further for evaluation."
ITB 26.1	The online Bid opening of the Technical Part of the bids shall take place at: Solar Energy Corporation of India Limited, D - 3, 1st Floor, Wing - A, Prius Platinum, District Centre, Saket, New Delhi - 110 017 **Date: 27/10/2020** **Time: 1430 Hours**
I. Evaluation of Financial Parts of Bids	
ITB 35.2 (f)	The adjustments shall be determined using the following criteria, from amongst those set out in Section III, Evaluation and Qualification Criteria: (a) Deviation in Time for Completion: No**;** (b) Life cycle costs: the projected operating and maintenance costs during the life of the Facilities: Yes; (c) Functional Guarantees of the Facilities: Yes; (d) Work, services, facilities, etc., to be provided by the Employer: No.

ITB 37.1	The currency that shall be used for Bid evaluation and comparison purposes to convert (at the selling exchange rate) all Bid prices expressed in various currencies into a single currency is: Indian Rupees (INR) The source of exchange rate shall be: Reference Rate published by Financial Benchmark India Pvt. Ltd (FBIL) available at www.fbil.org.in. The date for the exchange rate shall be: Deadline for online submission of Bids as per ITB 23.1.
ITB 42.1	e-Reverse Auction (e-RA) applies. The procedure for e- RA will be: as described in Section III, Evaluation and Qualification Criteria.
J. Award of Contract	
ITB 50.1	The successful Bidder shall submit the Beneficial Ownership Disclosure Form.
ITB 50.2	At the end of ITB 50.2, add the following: "along with (a) the performance security in accordance with ITB Clause 51; and (b) if the successful bidder is a JV, the JV agreement duly signed by all the members, if it had submitted only a letter of intent to execute the JV agreement."
ITB 51.1	At the end of ITB 51.1, add the following: "The performance security of a Joint Venture shall be in the name of the Joint Venture specifying the names of all members."
ITB 52	The procedures for making a Procurement-related Complaint are detailed in the "Procurement Regulations for IPF Borrowers (Annex III)." If a Bidder wishes to make a Procurement-related Complaint, the Bidder should submit its complaint following these procedures, in writing (by the quickest means available, that is either by email or fax), to: Kind attention: Mr Sanjay Sharma, GM (C&P) Solar Energy Corporation of India Limited D3, Wing A, Ist Floor, Prius Platinum Building, Saket District Centre, Saket, New Delhi 110017 Telephone Nos.: - 0091-(0)11-71980290/256 E mail: contracts@seci.co.in Bidders may refer the "Complaint handling Procedure for Procurement" given at the following link on the Employer's website at www.seci.co.in.

	http://seci.co.in/other_page.php?page=documents_faq&mmid=5 In summary, a Procurement-related Complaint may challenge any of the following: 1. the terms of the Bidding Documents; and 2. the Employer's decision to award the contract.

Section III - Evaluation and Qualification Criteria

This Section contains all the criteria that the Employer shall use to evaluate Bids and qualify Bidders. No other factors, methods or criteria shall be used other than those specified in this bidding document.

The Bidder shall provide all the information requested in the forms included in Section IV, Bidding Forms.

In line with the two-envelope bidding process, this section includes Evaluation and Qualification Criteria:

(i) Technical Part; and

(ii) Financial Part

The Employer shall use the criteria and methodologies listed in this Section to evaluate Bids. By applying the criteria and methodologies, the Employer shall determine the Most Advantageous Bid. This is the Bid of the Bidder that meets the qualification criteria and whose Bid has been determined to be:

(a) substantially responsive to the bidding document; and

(b) the lowest Evaluated Bid Value.

Evaluation of Bids

1.1 Technical Evaluation:

The Employer will carry out a detailed technical evaluation of the Bids to determine whether the technical aspects are in compliance with the bidding document. The Bid that does not meet minimum acceptable standards of completeness, consistency and detail, and the specified minimum (or maximum, as the case may be) requirements for specified functional guarantees, will be rejected for non-responsiveness.

The bidders are required to meet following minimum functional requirements:

- Performance Ratio (PR) 82%
- Capacity Utilization Factor (CUF) 36.5%
- BESS Availability 99 %

These are further elaborated under Scope of Work.

Evaluation of the Bidder's Technical Proposal will include apart from others (i) an examination of the technical aspects of the Bid in particular to confirm that all requirements of Section VII, Annexure A, Employer's Requirements have been met without any material deviation, reservation, or omission; (ii) that the bid is technically complete and responsive in terms of ITB 31; and (iii) an assessment of the Bidder's experience and technical capacity in terms of ITB 33 for timely supply of plant and installation services and achievement of specified performance parameters etc.

Where alternative technical solutions have been allowed in accordance with ITB 13, and offered by the Bidder, the Employer will make a similar evaluation of the alternatives. Where alternatives have not been allowed but have been offered, they shall be ignored.

In addition to the criteria listed in ITB 31.2 (a) – (b) the following factors shall apply: **NA**

1.2 Economic Evaluation/Financial Evaluation:

A. **The evaluation of the price bids will be conducted in the below mentioned manner, which will be followed by e-Reverse Auction (e-RA), details of which are provided in the subsequent clauses:**

B. **Evaluated Bid Value (EBV)**

The Evaluated Bid Value (EBV) shall be calculated using the following method:

i. Design, Supply and Installation (DSI) Price i.e., Total sum of Schedule Nos 1,2,3 & 4 including:

- The price comprising of Plant and Mandatory Spare Parts Supplied from Abroad on CIP basis (i.e. excluding BCD+SWS, SGD/ADD or any other duty or taxes) as per Schedule No 1/SOR 1, Plus
- Ex Works basis Supply of Plant and Mandatory Spare Parts Supplied from Within the Employer's Country on EXW basis (i.e. excluding GST) as per Schedule No 2/SOR 2, Plus
- Design Services excluding GST/Taxation as per Schedule No 3/SOR 3, Plus
- Freight (Inland) & Transportation charges for delivery at site and Insurance of all Equipments and materials including mandatory spares and any other supplies specified in the Bidding Documents, providing all services i.e. unloading, storage, handling at site, Civil works, Erection, Installation, Testing and Commissioning, performance testing in respect of all the equipment's supplied and any other services specified in the Bidding Documents excluding Goods & Service Tax / Taxation as per the Technical Scope of Work for the Plant Facilities (Solar and BESS) as per Schedule No 4/SOR 4.

ii. NPV of O&M for total 10 years i.e., Schedule No 5/SOR 5 including

- Net Present Value (NPV) of O&M Price excluding GST/Taxation for the 10 years O&M period for the plant facilities to be calculated at a discounting rate as per Price Schedule No 5/SOR 5. Discounting Rate for NPV calculation considered is 9.36%

Evaluated Bid Value (EBV), as given under Schedule No 6/SOR 6 = sum of (i) and (ii)

above

Important Notes:

1. **Schedule No 1 :**

- **The price evaluation for Schedule 1 will be done based on the total CIP price mentioned under CELL NO H 32 excluding of any applicable taxes & duties. However, For the Purpose of Contract award, the total price mentioned under CELL No R 32 including CIP Price+BCD+SWS+SGD/ADD+GST will be considered from Schedule No 1.**

- **BCD+SWS & SGD/ADD being of reimbursement nature duties, Employer will reimburse the amount for BCD+SWS & SGD/ADD at actuals against the submission of documentary evidence only, with a MAXIMUM CEILING of BCD+SWS & SGD/ADD charges as mentioned by the Bidder in the Price Schedules No 1 at the time of bidding. Bidders are required to quote the applicable BCD+SWS & SGD/ADD with due diligence & appropriate financial prudence, as afterwards bidders will not be able to change or claim such taxes & duties already quoted during the bid. No BCD+SWS & SGD/ADD will be reimbursed to the contractor in the absence of documentary proofs.**

- **As BCD+SWS & SGD/ADD will be reimbursed by the employer, the GST will be applicable on the actual CIP price only. The payment of GST by the Employer shall only be at the CEILING of GST as mentioned by the Bidder in the Schedule No 1 at the time of bidding. Bidders are required to quote the applicable GST with due diligence & appropriate financial prudence, as afterwards bidders will not be able to change or claim the GST charges already quoted during the bid.**

2. **Schedule No 2 :**

- **The price evaluation for Schedule 2 will be done based on the total Ex Works (EXW) price mentioned under CELL NO G 30 excluding of applicable GST. However, For the Purpose of Contract award, the total price mentioned under CELL No J 30 including Total Ex Works Price (EXW) + GST will be considered from Schedule No 2.**

- **The payment of GST by the Employer shall only be at the CEILING of GST as mentioned by the Bidder in the Schedule No 2 at the time of bidding. Bidders are required to quote the applicable GST with due diligence & appropriate financial prudence, as afterwards bidders will not be able to change or claim the GST charges already quoted during the bid.**

3. **Schedule No 3 :**

- **The price evaluation for Schedule 3 will be done based on the total basic price mentioned under CELL NO J 17 excluding of applicable GST/Taxation. However, For the Purpose of Contract award, the total price mentioned under CELL No M 17 including Total basic price + GST/Taxation will be considered from Schedule No 3..**

- **The payment of GST/Taxation by the Employer shall only be at the CEILING of**

GST/Taxation as mentioned by the Bidder in the Schedule No 3 at the time of bidding. Bidders are required to quote the applicable GST/Taxation with due diligence & appropriate financial prudence, as afterwards bidders will not be able to change or claim the GST charges already quoted during the bid.

4. **Schedule No 4 :**

- **The price evaluation for Schedule 4 will be done based on the total basic price mentioned under CELL NO J 21 excluding of applicable GST/Taxation. However, For the Purpose of Contract award, the total price mentioned under CELL No M 21 including Total basic price + GST/Taxation will be considered from Schedule No 4.**

- **The payment of GST/Taxation by the Employer shall only be at the CEILING of GST/Taxation as mentioned by the Bidder in the Schedule No 4 at the time of bidding. Bidders are required to quote the applicable GST/Taxation with due diligence & appropriate financial prudence, as afterwards bidders will not be able to change or claim the GST charges already quoted during the bid.**

5. **Schedule No 5 :**

- **The price evaluation for Schedule 5 will be done based on the NPV of O&M price excluding GST mentioned under CELL NO M 25. However, For the Purpose of Contract award, the total price mentioned under CELL No K 25 including Total O&M price of 10 years + GST will be considered from Schedule No 5.**

- **The payment of GST by the Employer shall only be at the CEILING of GST as mentioned by the Bidder in the Schedule No 5 at the time of bidding. Bidders are required to quote the applicable GST/Taxation with due diligence & appropriate financial prudence, as afterwards bidders will not be able to change or claim the GST charges already quoted during the bid.**

6. **Bidders are required to fill the relevant portion/Parts/Line items/scope of the respective Price Schedules only. In case, any line item is left blank by the bidder, it will be deemed assumed by the Employer that such portion/Parts/line item/Scope has been considered by the bidder suitably somewhere else in the Price schedules.**

7. **In case the bidder doesn't want to mention any quantity/price in any particular line item, then he has to mandatorily put zero (0) against that particular line item.**

C. **Evaluation of Price Bids**

The following factors and methods will apply:

(a) Time Schedule: NA

(b) Life Cycle Costs: Yes

Since the operating and maintenance costs of the facilities being procured form a major part of the **life cycle cost** of the facilities, these costs will be evaluated according to the principles given hereafter, including the cost of spare parts for the initial period of operation stated below and based

on prices furnished by each Bidder in Price Schedule Nos. 1 and 2, as well as on past experience of the Employer or other employers similarly placed. Such costs shall be added to the Bid price for evaluation.

The operating and maintenance costs factors for calculation of the life cycle cost are:

(i) number of years for life cycle: 10 [Ten] years

(ii) operating costs [NA]

(iii) maintenance costs, including the cost of spare parts for the initial period of operation [As per Price Schedule 5], and

(iv) Discount rate: 9.36% [Nine point Three Six percent] to be used to discount to present value all annual future costs calculated under (ii) and (iii) above for the period specified in (i).

(c) Functional Guarantees of the Facilities – financial aspects:

As mentioned earlier, bidders are required to meet following minimum functional requirements:

- Performance Ratio (PR) 82%
- Capacity Utilization Factor (CUF) 36.5%
- BESS Availability 99 %

If bidders offer better functional guarantees in their bids, there will be no bonus applied during the financial evaluation.

(d) Works, services, facilities, etc., to be provided by the employer: NA

(e) Sustainable procurement: NA

(f) Alternative technical solutions for specified parts – financial aspects: NA

(g) Specific additional criteria: NA

Evaluated Bid Values (EBV) for all the Bidders shall be compared to determine the lowest Evaluated Bid Value (EBV) as given under Schedule No 6/SOR- 6 Format of Schedule of Rates & the lowest (L1) evaluated Bid as such, will be selected for the Notification of Award (NOA) subject to the successful bidder selected after e-RA (procedure is given in the subsequent clause). The mentioned Evaluated Bid Value will be exclusive of GST/Duties/Taxation and will be considered up to 2 decimal places only. The award shall be placed Inclusive of Duties/GST with taxation bifurcation separately indicated as submitted by the successful bidder in the SOR formats.

D. **Procedure for e-Reverse Auction (e-RA):**

I. The e-RA process shall be conducted on **https://www.bharat-electronictender.com**. This shall be carried out on the day as intimated by the employer to the eligible bidders.

II. After financial bid evaluation, all bidders whose technical & financial bids have been opened and found to be qualified shall be invited for participation in e-RA.

- At least one week prior to e-RA, an advance intimation regarding the date and time of the e-RA will be sent by email to all bidders whose technical & financial bids have been opened and found to be qualified. Further at least two hours before the schedule start time of e-RA, a system generated email for invitation for e-RA will be sent to all those bidders.

- Shortlisted bidders for e-RA will be able to login into above website 15 minutes before the start time of e-RA.

- At the start of e-RA process, the bid along with the list of short-listed bidders shall be displayed with their pseudo names as their first round bid along with the NPV value of O&M quotation per year submitted and calculated as per NPV approach explained above. The e-RA shall be on both the DSI price and NPV value of the O&M quoted by the bidder.

The minimum decrement step for e-RA is in the multiples of ***Rs. 5, 00,000/- (INR five lakhs only)*** in DSI price and NPV of O&M price i.e. each decrement shall be in multiples of Rs.5,00,000/- (INR Five Lakhs only). At the end of the e-RA, the final discount offered by the bidder, in the form of price reduction so offered on the DSI price and NPV value of O&M price, shall be applied proportionately to all of the SOR Line items of the Schedules Nos 1,2,3,4 & 5 price (DSI Price + NPV of O&M price) quoted by the bidder initially in the financial bid. Accordingly, the revised reduced price of all of the SOR line items (Schedules Nos 1,2,3,4 & 5) of the DSI price and NPV of O&M will be derived. This proportionate price reduction will be applicable on both the DSI price and NPV value of O&M price, on which the e-RA has been actually conducted.

- **While applying the price reduction obtained after e-RA, all the SOR line items of the Schedule Nos 1,2,3 & 4/ SOR 1,2,3 & 4 (DSI Price of Supply & Service) can be straight away reduced by applying the % reduction factor uniformly on all the line items of Schedule Nos 1,2,3 & 4/ SOR 1,2,3 & 4. Same way, the NPV value of each year line item of O&M value under Schedule No 5/SOR – 5, can also be straight away reduced by applying the % reduction factor uniformly on all the line items of Schedule No 5/SOR – 5. However, as the reduced line items so arrived will be the NPV values of each year O&M value, so for the purpose of award, absolute values of each year O&M price line item wise will then be back calculated by dividing the finally arrived (After applying % reduction factor post e-RA) yearly reduced NPV values by the respective year "Discounting Rate for NPV calculation" & thereby, the absolute value of O&M price will be calculated on yearly basis. The award will be placed on the absolute value of O&M price including GST only and not on NPV of O&M price. NPV values are considered for the purpose of price bids evaluation only.**

- L2, L3, L4 etc. Bidders will have option to apply their decrements suitably so as to beat the L1 price. However, at no stage, increase in DSI price and NPV of O&M price will be permissible.

- The initial e-RA period will be of one (01) hour with a provision of auto extension by eight minutes

from the scheduled/ extended closing time if any fresh bid is received in last eight minutes of e-RA period or extended e-RA period. If no valid bid is received during last eight minutes of e-RA period or extended e-RA period, then the e-RA process will get closed.

III. Following information will be displayed in the bidder's bidding window:

- First round DSI price and NPV of O&M price as their start price initially and thereafter last quoted DSI price and NPV of O&M Price

- The list of last quoted DSI price and NPV of O&M price (i.e. last Bid Value) of all bidders with their Pseudo Identities and their time of quote.

IV. Selection of Successful Bidders

Post e-RA, the bidders shall be selected in the ascending order with lowest quoted Evaluated Bid value excluding Duties/GST/Taxation (DSI price + NPV of O&M price) (being L1). The bidder with lowest Evaluated Bid value (EBV) at the end of e-RA will be considered L1.

In case of tie of evaluated bid price (i.e. the sum of their last quoted discounted DSI price and the NPV of O&M price) after e-RA among two or more bidders, they will be considered in the chronological order of their last bid (on e-RA platform) with preference to the bidder who has quoted his last bid earlier than others.

In the above case, if the time of quote also become exactly same among the bidders at a tie, then the ranking among these bidders shall be done as follow:

- The bidder who has quoted lowest Total Price in their Price BID before commencement of e-RA shall be considered as L-1.

- If there is also a tie among any of these bidders, then L-1 will be the bidder who has the highest average annual turnover as per the documents submitted as a part of their bid.

V. At the end of selection process, a Notification of Intention to Award will be issued to the successful bidder (L1).

E. Other Instructions

- For further instructions, the bidder should visit the homepage of the portal **https://www.bharat-electronictender** and go to the User-Guidance Centre.

- The help information provided through 'ETS User-Guidance Centre' is available in three categories:
  Users intending to Register / First-Time Users, Logged-in users of Buyer organizations, and Logged-in users of bidder organizations. Various links (including links for User Manuals) are

provided under each of the three categories.

- Important Note: It is strongly recommended that all authorized users of bidder organizations should thoroughly peruse the information provided under the relevant links and take appropriate action. This will prevent hiccups and minimize teething problems during the use of ETS.

1.3 Multiple Contracts (ITB 35.4): NA

2. Qualification

Factor	1 Eligibility					
Sub-Factor	Criteria					Documentation Required
	Requirement	Bidder				
		Single Entity	Joint Venture (existing or intended)			
			All members combined	Each Member	At least one Member	
1.1 Nationality	Nationality in accordance with ITB 4.4.	Must meet requirement	must meet requirement	Must meet requirement	N / A	Form ELI –1.1 and 1.2, with attachments
1.2 Conflict of Interest	No- conflicts of interests as described in ITB 4.2	Must meet requirement	must meet requirement	Must meet requirement	N / A	Letter of Bid
1.3 Bank Ineligibility	Not having been declared ineligible by the Bank as described in 4.5.	Must meet requirement	must meet requirement	Must meet requirement	N / A	Letter of Bid
1.4 State Owned Enterprise or Institution	Compliance with conditions of ITB 4.6	Must meet requirement	Must meet requirement	Must meet requirement	N / A	Form ELI –1.1 and 1.2, with attachments
1.5 Ineligibility based on a United Nations resolution or Borrower's country law	Not having been excluded as a result of the Borrower's country laws or official regulations, or by an act of compliance with UN Security Council resolution, in accordance with ITB 4.8 and Section V.	Must meet requirement	must meet requirement	Must meet requirement	N / A	Letter of Bid

Factor	2. Historical Contract Non-Performance					
Sub-Factor	Criteria					Documentation Required
	Requirement	Bidder				
		Single Entity	Joint Venture (existing or intended)			
			All members combined	Each member	At least one member	
2.1 History of non-performing contracts	Non-performance[1] of a contract did not occur within the last **05 (Five) years** prior to the deadline for application submission, based on all information on fully settled disputes or litigation. A fully settled dispute or litigation is one that has been resolved in accordance with the Dispute Resolution Mechanism under the respective contract, and where all appeal instances available to the Bidder have been exhausted.	Must meet requirement by itself or as member to past or existing JV	Must meet requirement	Must meet requirement[2]	N / A	Form CON - 2

[1] Nonperformance, as decided by the Employer, shall include all contracts where (a) nonperformance was not challenged by the contractor, including through referral to the dispute resolution mechanism under the respective contract, and (b) contracts that were so challenged but fully settled against the contractor. Nonperformance shall not include contracts where Employers decision was overruled by the dispute resolution mechanism. Nonperformance must be based on all information on fully settled disputes or litigation, i.e. dispute or litigation that has been resolved in accordance with the dispute resolution mechanism under the respective contract and where all appeal instances available to the Bidder have been exhausted.

[2] This requirement also applies to contracts executed by the Bidder as JV member.

Factor	2. Historical Contract Non-Performance					
Sub-Factor	Criteria					Documentation Required
	Requirement	Bidder				
		Single Entity	Joint Venture (existing or intended)			
			All members combined	Each member	At least one member	
2.2 Suspension	Not under suspension based on execution of a Bid Securing Declaration or Proposal Securing Declaration pursuant to ITB 4.7 and ITB 20.9	Must meet requirement	Must meet requirement	Must meet requirement	N / A	Letter of Bid
2.3 Pending Litigation	Bid's financial position and prospective long-term profitability still sound according to criteria established in 3.1 below and assuming that all pending litigation will be resolved against the Bidder	Must meet requirement	Must meet requirement	Must meet requirement	N / A	Form CON – 2
2.4 Litigation History	No consistent history of court/arbitral award decisions against the Bidder[3] since **1st January 2015**	Must meet requirement	Must meet requirement	Must meet requirement	N / A	Form CON – 2

[3] The Bidder shall provide accurate information on the related Letter of Bid about any litigation or arbitration resulting from contracts completed or ongoing under its execution over the last five years. A consistent history of awards against the Bidder or any member of a joint venture may result in failure of the Bid.

Factor	2. Historical Contract Non-Performance					
Sub-Factor	Criteria					Documentation Required
	Requirement	Bidder				
		Single Entity	Joint Venture (existing or intended)			
			All members combined	Each member	At least one member	
2.5 Declaration: Environmental and Social (ES) past performance	Declare any contract that has been suspended or terminated and/or performance security called by an employer for reasons of breach of environmental, or social (including Sexual Exploitation, and Abuse) contractual obligations in the past five years.[4]	Must make the declaration. Where there are Specialized Subcontractor/s, the Specialized Subcontractor/s must also make the declaration.	N/A	Each must make the declaration. Where there are Specialized Subcontractor/s, the Specialized Subcontractor/s must also make the declaration.	N/A	Form CON-3 ES Performance Declaration

[4] The Employer may use this information to seek further information or clarifications in carrying out its due diligence.

Factor	3 Financial Situation					
Sub-Factor	Criteria					Documentation Required
	Requirement	Bidder				
		Single Entity	Joint Venture (existing or intended)			
			All members combined	Each member	At least one member	
3.1 Financial Capabilities	Submission of audited balance sheets or if not required by the law of the Bidder's Country, other financial statements acceptable to the Employer, for the last **03 [Three] Financial years** to demonstrate the current soundness of the Bidders financial position and its prospective long-term profitability. **The Net Worth of the Bidder for the last financial year should be positive.** For Indian companies, The derivation of "Net Worth" of the Bidder shall be calculated as per Company Act 2013.	Must meet requirement	N / A	Must meet requirement	N / A	Form FIN – 3.1 with attachments
3.2 Average Annual Turnover	Minimum average annual turnover **of INR 345 Crores (Indian Rupees Three hundred & forty-five Crores**	Must meet requirement	Must meet requirement	Must meet **25 % (Twenty five percent)**	Must meet **50 % (Fifty) percent)** of	Form FIN –3.2

Factor	3 Financial Situation					
Sub-Factor	Criteria					Documentation Required
	Requirement	Bidder				
		Single Entity	Joint Venture (existing or intended)			
			All members combined	Each member	At least one member	
	only) or USD 46 M (US Dollars Forty-Six Million only), calculated as total certified payments received for contracts in progress or completed within the last **03 (Three) years** For Indian companies, other income (as per the Companies Act, 2013 including amendment/ clarifications), shall not be considered for arriving at annual turnover			of the requirement	the requirement (Such Member will be called as Lead Member/partner)	
3.3 Financial Resources	The Bidder must demonstrate access to, or availability of, financial resources such as liquid assets & lines of credit, other than any contractual advance payments to meet: (i) the following cash-flow requirement: **INR 144 Crores (Indian Rupees One hundred & forty-four Crores only) or USD 19 M (US Dollars Nineteen Million only)**	Must meet requirement	Must meet requirement	Must meet **25 % (Twenty five percent)** of the requirement	Must meet **50 % (Fifty) percent)** of the requirement (Such Member will be called as Lead Member/partner)	Form FIN –3.3

Factor	4 Experience					
Sub-Factor	Criteria					Documentation Required
	Requirement	Bidder				
		Single Entity	Joint Venture (existing or intended)			
			All members combined	Each member	At least one member	
4.1 General Experience	Experience in Renewable Energy under contracts in the role of contractor, subcontractor, or management contractor for at least the last 03 (Three) years starting Jan 1, 2015.	Must meet requirement	N /A	Must meet requirement	N /A	Form EXP-4.1

4.2(a) Specific Experience	**Bidders can participate through any one of the below mentioned qualifying routes. The Bidder shall be considered meeting Technical Eligibility criteria either from Route I or Route II**[5] **<u>Route I:</u>** Participation as contractor, joint venture member, management contractor, or subcontractor: (A) Must have experience in EPC execution of Ground mounted Solar Projects on Turnkey basis including Design, Supply (Supply of Modules & Inverters can be inclusive or exclusive in the bidder's scope in the past experience), Installation and Commissioning of Grid connected Solar PV Power Plant(s) of total cumulative Capacity not less than **<u>50 (Fifty) MW</u>** in last five years as on last date of bid submission. However, such Grid connected Solar PV Power Plant capacity must have been in satisfactory operation for at least six (06) months prior to the last date of bid submission.	Must meet requirement	Must meet requirements	N / A	Must meet **100 % (Hundred percent)** of the requirement (Such Member will be called as Lead Member/partner)	Form EXP 4.2(a)

[5] For contracts under which the Bidder participated as a joint venture member or sub-contractor, only the Bidder's share, by value, shall be considered to meet this requirement. In the case of JV, the value of contracts completed by its members shall not be aggregated to determine whether the requirement of the minimum value of a single contract has been met. Instead, each contract performed by each member shall satisfy the minimum value of a single contract as required for single entity. In determining whether the JV meets the requirement of total number of contracts, only the number of contracts completed by all members each of value equal or more than the minimum value required shall be aggregated.

	(B) The bidder must have experience in EPC execution of Ground mounted Solar Projects on Turnkey basis including Design, supply (Supply of Modules & Inverters can be inclusive or exclusive in the bidder's scope in the past experience), installation & commissioning of at least **02 (Two)** Grid connected Solar PV Power Plant Projects having an individual capacity of **10 (Ten) MW or above** in last five years from last date of bid submission. However, such Grid connected Solar PV Power Plant capacity must have been in satisfactory operation for at least six (06) months prior to the last date of bid submission					
Or						

	Route II: Participation as developer, including as a joint venture member of developer: (A) Must have experience in execution of Ground mounted Solar Projects as a Developer of Grid-connected Solar PV Power Plant(s) of cumulative Capacity not less than **50 (Fifty) MW** in last five years as on last date of bid submission. However, such Grid connected Solar PV Power Plant capacity must have been in satisfactory operation for at least six (06) months prior to the last date of bid submission. (B) The bidder must have experience in execution of Ground mounted Solar Projects as a Developer of at least **02 (Two)** Grid connected Solar PV Power Plant Projects having an individual capacity of **10 (Ten) MW** or above in last Five years from last date of bid submission. However, such Grid connected Solar PV Power Plant capacity must have been in satisfactory operation for at least six (06) months prior to the last date of bid submission	Must meet requirement	Must meet requirements	N / A	Must meet **100 % (Hundred percent)** of the requirement (Such Member will be called as Lead Member/ partner)	Form EXP-4.2(b)

4.2 (b)	For the contracts in 4.2 (a) above and/or any other contracts [substantially completed and under implementation] as prime contractor, joint venture member, or Subcontractor between 1st January 2016 and Application submission deadline, experience in managing ES risks and impacts in the following aspects: 1. Experience of managing 100 labours during the construction phase. (Documentary proof: Labour Licenses obtained for Project) 2. Implementation of Air/Water/Noise Pollution Control Measures and/or Debris/Scrap Removal measures undertaken at Project Site (Documentary proof: Work Order, Details of Measures taken)	Must meet requirements	Must meet requirements	N/A	N/A	Form EXP – 4.2 (b)

Note: With reference to clause No 4.2 (a):

1. The list of projects commissioned at least 6 months prior to the last date of Bid Submission, indicating whether the project is grid connected, along with a scanned copy of the Commissioning certificate and Work order / Contract / Agreement/LOI from the Client (or Owner) shall be submitted in support of Clause above.

2. The Performance Certificate must have been issued for a minimum duration of 06 (Six) months from the date of commissioning. The Performance Certificate/Joint meter reading (JMR) reports shall have been issued by any state/ central owned agencies or state power departments or authorized representative of Power offtaker (DISCOM/Private Power purchaser). EPC projects with solar PV module or Inverters supplied by developer/ owner as free issue item to EPC contractor shall also be considered eligible.

3. For participation as an EPC Bidder under Route I: In case the bidder is a subsidiary of a holding company, financial eligibility criteria referred to in the clause above, shall be of that subsidiary company only (i.e. excluding its holding company). A job executed by a Bidder for its own plant/ projects cannot be considered as experience for the purpose of meeting the Eligibility Conditions of the tender. Also, the jobs executed for Subsidiary/ Fellow subsidiary/ Holding company will not be considered as experience for the purpose of meeting Eligibility Conditions.

4. Considered Exchange Rate 1 USD = INR 75

Note: General:

The Employer may assess the capacity and capability of the bidder, to ascertain that the bidder can successfully execute the scope of work covered under the package within stipulated completion period. This assessment shall inter-alia include (i) document verification, (ii) details of works executed, works in hand, anticipated in future & the balance capacity available for the present scope of work, (iii) details of plant and machinery, testing facilities, design capabilities, manpower and financial resources, (iv) details of quality systems in place, (v) past experience and performance, (vi) customer feedback, (vii) banker's feedback etc.

Note: BESS Supplier/sub-Contractor:

Bidders are not required to propose the BESS Supplier/sub-Contractor along with the Bid. After the Contract is signed with winning Bidder, the winning Bidder will be required to finalize a BESS Supplier/sub-Contractor meeting following requirements and establish subcontracting agreement/work order with the BESS Supplier/sub-Contractor within 180 days from the effective date of the Contract Agreement. Further, any delay beyond 180 (One Hundred and Eighty) days in signing of the subcontracting agreement as mentioned above, shall attract @ 1.25% as liquidated damages per month on the total price of the BESS Plant (Supply) as mentioned under Schedule No 1/Schedule No 2, calculated on pro-rata basis accordingly.

The BESS Supplier/sub-Contractor must have the experience of having successfully completed Design, Engineering, Procurement, Construction, Installation, Testing and Commissioning of Grid Connected Battery Energy Storage System (BESS) of at least 03 (Three) Grid connected BESS Plants, each having an individual capacity of 5 MWh (Five Mega Watt Hour) or above in last Five years. Also, such BESS Plant capacity must have been in satisfactory operation for at least 12 (Twelve) months from the date of commissioning.

2.5 Personnel:

The Bidder must demonstrate that it will have the personnel for the key positions that meet the following requirements:

No.	Position	Minimum Qualifications required
1.	Project Manager	B.E./B.Tech Degree and 15 years of experience in Project Management
2.	Construction managers (3 No's)	B.E./B.Tech Degree and 5 years of experience in Construction Management
3.	Design Engineering Lead	B.E./B.Tech. Degree and minimum 8 years of experience in Solar PV Design Engineering
4.	Design Engineers – Civil and Electrical (3 Nos. Each)	B.E./B.Tech. Degree and minimum 5 years of experience in Solar PV Design Engineering
5.	Environment Expert	B.E./B. Tech or Equivalent with Specialization / additional qualification in Environment related field and minimum 10 years of total experience out of which minimum 5 years of relevant experience in similar works
6.	Sociologist	Master's degree in Social Work or equivalent. 10 Years experiences out of which minimum 5 years of experience in similar works. * He/she should have worked as a social expert for Infrastructure projects. Experience in environment / safety / Social Risk Assessment, resettlement and rehabilitation and Management plans related to similar project would be preferred.

The Bidder shall provide details of the proposed personnel and their experience records in the relevant Forms included in Section IV, Bidding Forms.

2.6 Equipment:

Not applicable

2.7 Subcontractors:

In the case of a Bidder who offers to supply and install major items of supply under the contract that the Bidder did not manufacture or otherwise produce, the Bidder shall provide the manufacturer's authorization, using the form provided in Section IV, showing that the Bidder has been duly authorized by the manufacturer or producer of the related plant and equipment or component to supply and install that item in the Employer's Country. The Bidder is responsible for ensuring that the manufacturer or producer complies with the requirements of ITB 4 and 5 and meets the minimum criteria listed above for that item.

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****The bidders are required to mention country of origin of the supply of items mentioned under SOR -1, wherever applicable. 155**

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Letter of Bid – Technical Part

INSTRUCTIONS TO BIDDERS: DELETE THIS BOX ONCE YOU HAVE COMPLETED THE DOCUMENT

The Bidder must prepare this Letter of Bid – Technical Part on stationery with its letterhead clearly showing the Bidder's complete name and business address.

Note: All italicized text is to help Bidders in preparing this form.

Date of this Bid submission: [*insert date (as day, month and year) of Bid submission*]

RFB No.: [*insert number of RFB process*]

Alternative No[6].: NA

To: **[*insert complete name of Employer*]**

We, the undersigned, hereby submit our Bid, in two parts, namely:

(a) the Technical Part, and

(b) the Financial Part

In submitting our Bid, we make the following declarations:

(a) **No reservations:** We have examined and have no reservations to the bidding document, including Addenda issued in accordance with ITB 8;

(b) **Eligibility**: We meet the eligibility requirements and have no conflict of interest in accordance with ITB 4;

(c) **Bid-Securing Declaration:** We have not been suspended nor declared ineligible by the Employer based on execution of a Bid Securing Declaration or Proposal-Securing Declaration in the Employer's Country in accordance with ITB 4.7;

(d) **Conformity:** We offer to provide design, supply and installation services in conformity with the bidding document of the following: [Design, Engineering, Supply, Construction, Erection, Testing & Commissioning of 100 MW (AC) Solar PV Project (200MWp DC capacity) along with 50MW/150 MWh Battery Energy Storage System having 10 years plant O&M at Rajnandgaon, Chhattisgarh, India under International competitive bidding];

(e) **Bid Validity:** Our Bid shall be valid until *[insert day, month and year in accordance with ITB 19.1]*, and it shall remain binding upon us and may be accepted at any time before the expiration of that period;

[6] Delete if not applicable

(f) **Performance Security:** If our Bid is accepted, we commit to obtain a Performance Security in accordance with the bidding document;

(g) **One Bid Per Bidder:** We are not submitting any other Bid(s) as an individual Bidder, and we are not participating in any other Bid(s) as a Joint Venture member, and meet the requirements of ITB 4.3, other than alternative Bids submitted in accordance with ITB 13;

(h) **Suspension and Debarment**: We, along with any of our subcontractors, suppliers, consultants, manufacturers, or service providers for any part of the contract, are not subject to, and not controlled by any entity or individual that is subject to, a temporary suspension or a debarment imposed by the World Bank Group or a debarment imposed by the World Bank Group in accordance with the Agreement for Mutual Enforcement of Debarment Decisions between the World Bank and other development banks. Further, we are not ineligible under the Employer's Country laws or official regulations or pursuant to a decision of the United Nations Security Council;

(i) **State-owned enterprise or institution**: [*select the appropriate option and delete the other*] [*We are not a state-owned enterprise or institution*] / [*We are a state-owned enterprise or institution but meet the requirements of ITB 4.6*][7];

(j) **Binding Contract**: We understand that this Bid, together with your written acceptance thereof included in your Letter of Acceptance, shall constitute a binding contract between us, until a formal contract is prepared and executed;

(k) **Not Bound to Accept:** We understand that you are not bound to accept the lowest evaluated cost Bid, the Most Advantageous Bid or any other Bid that you may receive; and

(l) **Fraud and Corruption:** We hereby certify that we have taken steps to ensure that no person acting for us or on our behalf engages in any type of Fraud and Corruption.

Name of the Bidder: [*insert complete name of the Bidder*]

Name of the person duly authorized to sign the Bid on behalf of the Bidder: [*insert complete name of person duly authorized to sign the Bid*]

Title of the person signing the Bid: [*insert complete title of the person signing the Bid*]

Signature of the person named above: [*insert signature of person whose name and capacity are shown above*]

Date signed [*insert date of signing*] **day of** [*insert month*], [*insert year*]

[7] Use one of the two options as appropriate

FORM

POWER OF ATTORNEY FOR BIDDER

(*To be stamped in accordance with Stamp Act, the Non-Judicial Stamp Paper of Appropriate Value should be in the name of the Bidder or equivalent to the rules applicable to international bidders as per their country***)**

Know all men by these presents, We ……. (name and address of the registered office of the Bidding Company as applicable) do hereby constitute, appoint and authorize Mr./Ms. ……. (name & residential address) who is presently employed with us and holding the position of …… as our true and lawful attorney, to do in our name and on our behalf, all such acts, deeds and things necessary in connection with or incidental to submission of our Bid for …… (insert details of Tender) in response to the Tender No …… dated …….. issued by Solar Energy Corporation of India Limited (SECI), New Delhi including signing and submission of the Bid and all other documents related to the Bid, including but not limited to undertakings, letters, certificates, acceptances, clarifications, guarantees or any other document which the SECI may require us to submit. The aforesaid Attorney is further authorized for making representations to the Solar Energy Corporation of India Limited, New Delhi and providing information/ responses to SECI, New Delhi representing us in all matters before SECI, New Delhi and generally dealing with SECI, New Delhi in all matters in connection with Bid till the completion of the bidding process as per the terms of the above mentioned Tender.

We hereby agree to ratify all acts, deeds and things done by our said attorney pursuant to this Power of Attorney and that all acts, deeds and things done by our aforesaid attorney shall be binding on us and shall always be deemed to have been done by us.

All the terms used herein but not defined shall have the meaning ascribed to such terms under the Tender.

Signed by the within named

…….. (Insert the name of the executant company)

through the hand of

Mr. ……

duly authorized by the Board to issue such Power of Attorney

Dated this …… day of ……
Accepted

……..
Signature of Attorney
(Name, designation and address of the Attorney)

Attested
……
(Signature of the executant)
(Name, designation and address of the executant)

……
Signature and stamp of Notary of the place of execution

Common seal of …… has been affixed in my/ our presence pursuant to Board of Director's Resolution dated……

WITNESS

7. **……..**
   (Signature)

   Name……

   Designation ……

7. **…….**
   (Signature)

   Name……

   Designation ……

Technical Proposal

- Site Organization
- Method Statement
- Mobilization Schedule
- Construction Schedule
- Plant
- Contractor's Equipment
- Personnel
- Proposed Subcontractors for Major Items of Plant and Installation Services
- ES Management Strategies and Implementation Plans
- Code of Conduct for Contractor's Personnel (ES)
- Others

Appendix to Technical Part

Site Organization

Appendix to Technical Part

Method Statement

Appendix to Technical Part

Mobilization Schedule

Appendix to Technical Part

Construction Schedule

Appendix to Technical Part

ES Management Strategies and Implementation Plans (ES-MSIP)

The Bidder shall submit comprehensive and concise Environmental and Social Management Strategies and Implementation Plans (ES-MSIP) as required by ITB 11.2 (j) of the Bid Data Sheet. These strategies and plans shall describe in detail the actions, materials, equipment, management processes etc. that will be implemented by the Contractor, and its subcontractors.

In developing these strategies and plans, the Bidder shall have regard to the ES provisions of the contract including those as may be more fully described in the Employer's Requirements in Section VII, Annexure A.

Code of Conduct for Contractor's Personnel (ES) Form

Note to the Bidder:

The minimum content of the Code of Conduct form as set out by the Employer shall not be substantially modified. However, the Bidder may add requirements as appropriate, including to take into account Contract-specific issues/risks.

The Bidder shall initial and submit the Code of Conduct form as part of its bid.

CODE OF CONDUCT FOR CONTRACTOR'S AND SUBCONTRACTOR's PERSONNEL

We are the Contractor, [*enter name of Contractor*]. We have signed a contract with [*enter name of Employer*] for [*enter description of the Facilities*]. The Plant for the Facilities will be installed at [*enter the Site]*. Our contract requires us to implement measures to address environmental and social risks, related to the Installation Services i.e. services ancillary to the supply of the Plant for the Facilities, such as inland transportation, site preparation works/ associated civil works, installation, testing, precommissioning, commissioning, operations and maintenance etc. as the case may require.

This Code of Conduct is part of our measures to deal with environmental and social risks related to the Installation Services.

All personnel that we utilize in the execution of the Contract, including staff, labor and other employees of us and of each Subcontractor, and any other personnel assisting us in the execution of the Contract, are referred to as Contractor's personnel.

This Code of Conduct identifies the behavior that we require from the Contractor's Personnel employed for the execution of Installation Services at the Site (or other places in the country where the Site is located).

Our workplace is an environment where unsafe, offensive, abusive or violent behavior will not be tolerated and where all persons should feel comfortable raising issues or concerns without fear of retaliation.

REQUIRED CONDUCT

Contractor's Personnel employed for the execution of Installation Services at the Site (or other places in the country where the Site is located) shall:

1. carry out his/her duties competently and diligently;
2. comply with this Code of Conduct and all applicable laws, regulations and other requirements, including requirements to protect the health, safety and well-being of other Contractor's and Subcontractor's personnel and any other person;

3. maintain a safe working environment including by:
    a. ensuring that workplaces, machinery, equipment and processes under each person's control are safe and without risk to health;
    b. wearing required personal protective equipment;
    c. using appropriate measures relating to chemical, physical and biological substances and agents; and
    d. following applicable emergency operating procedures.
4. report work situations that he/she believes are not safe or healthy and remove himself/herself from a work situation which he/she reasonably believes presents an imminent and serious danger to his/her life or health;
5. treat other people with respect, and not discriminate against specific groups such as women, people with disabilities, migrant workers or children;
6. not engage in any form of sexual harassment including unwelcome sexual advances, requests for sexual favors, and other verbal or physical conduct of a sexual nature with other Contractor's or Employer's Personnel;
7. not engage in Sexual Exploitation, which means any actual or attempted abuse of position of vulnerability, differential power or trust, for sexual purposes, including, but not limited to, profiting monetarily, socially or politically from the sexual exploitation of another;
8. not engage in in Sexual Abuse, which means the actual or threatened physical intrusion of a sexual nature, whether by force or under unequal or coercive conditions;
9. not engage in any form of sexual activity with individuals under the age of 18, except in case of pre-existing marriage;
10. complete relevant training courses that will be provided related to the environmental and social aspects of the Contract, including on health and safety matters, and Sexual Exploitation and Abuse, and Sexual Harassment (SH);
11. report violations of this Code of Conduct; and
12. not retaliate against any person who reports violations of this Code of Conduct, whether to us or the Employer, or who makes use of the grievance mechanism for Contractor's Personnel or the project's Grievance Redress Mechanism.

RAISING CONCERNS

If any person observes behavior that he/she believes may represent a violation of this Code of Conduct, or that otherwise concerns him/her, he/she should raise the issue promptly. This can be done in either of the following ways:

1. Contact [*enter name of the Contractor's Social Expert with relevant experience in handling sexual exploitation, sexual abuse and sexual harassment cases, or if such person is not required under the Contract, another individual designated by the Contractor to handle these matters*] in writing at this address [ ] or by telephone at [ ] or in person at [ ]; or

2. Call [ ] to reach the Contractor's hotline *(if any)* and leave a message.

The person's identity will be kept confidential, unless reporting of allegations is mandated by the country law. Anonymous complaints or allegations may also be submitted and will be given all due and appropriate consideration. We take seriously all reports of possible misconduct and will investigate and take appropriate action. We will provide warm referrals to service providers that may help support the person who experienced the alleged incident, as appropriate.

There will be no retaliation against any person who raises a concern in good faith about any behavior prohibited by this Code of Conduct. Such retaliation would be a violation of this Code of Conduct.

CONSEQUENCES OF VIOLATING THE CODE OF CONDUCT

Any violation of this Code of Conduct by the Contractor's Personnel may result in serious consequences, up to and including termination and possible referral to legal authorities.

FOR CONTRACTOR's PERSONNEL:

I have received a copy of this Code of Conduct written in a language that I comprehend. I understand that if I have any questions about this Code of Conduct, I can contact [*enter name of Contractor's contact person(s) with relevant experience*] requesting an explanation.

Name of Contractor's Personnel: [insert name] Signature: _____

Date: (day month year): _____

Countersignature of authorized representative of the Contractor:

Signature: _____

Date: (day month year): _____

ATTACHMENT 1: Behaviors constituting SEA and behaviors constituting SH

ATTACHMENT 1 TO THE CODE OF CONDUCT FORM

BEHAVIORS CONSTITUTING SEXUAL EXPLOITATION AND ABUSE (SEA) AND BEHAVIORS CONSTITUTING SEXUAL HARASSMENT (SH)

The following non-exhaustive list is intended to illustrate types of prohibited behaviors.

(1) **Examples of sexual exploitation and abuse** include, but are not limited to:

- A Contractor's Personnel tells a member of the community that he/she can get them jobs related to the work site (e.g. cooking and cleaning) in exchange for sex.
- A Contractor's Personnel that is connecting electricity input to households says that he can connect women headed households to the grid in exchange for sex.
- A Contractor's Personnel rapes, or otherwise sexually assaults a member of the community.
- A Contractor's Personnel denies a person access to the Site unless he/she performs a sexual favor.
- A Contractor's Personnel tells a person applying for employment under the Contract that he/she will only hire him/her if he/she has sex with him/her.

(2) **Examples of sexual harassment in a work context**

- A Contractor's Personnel comment on the appearance of another Installation Services Personnel (either positive or negative) and sexual desirability.
- When a Contractor's Personnel complains about comments made by another Contractor's Personnel on his/her appearance, the other Contractor's Personnel comment that he/she is "asking for it" because of how he/she dresses.
- Unwelcome touching of a Contractor's Personnel or Employer's Personnel by another Contractor's Personnel.
- A Contractor's Personnel tells another Contractor's Personnel that he/she will get him/her a salary raise, or promotion if he/she sends him/her naked photographs of himself/herself.

Appendix to Technical Part

Plant

Appendix to Technical Part:

Contractor's Equipment

Form EQU

The Bidder shall provide adequate information to demonstrate clearly that it has the capability to meet the requirements for the key Contractor's equipment listed in Section III, Evaluation and Qualification Criteria. A separate Form shall be prepared for each item of equipment listed, or for alternative equipment proposed by the Bidder.

Item of equipment		
Equipment information	Name of manufacturer	Model and power rating
	Capacity	Year of manufacture
Current status	Current location	
	Details of current commitments	
Source	Indicate source of the equipment ☐ Owned ☐ Rented ☐ Leased ☐ Specially manufactured	

Omit the following information for equipment owned by the Bidder.

Owner	Name of owner	
	Address of owner	
	Telephone	Contact name and title
	Fax	Telex
Agreements	Details of rental / lease / manufacture agreements specific to the project	

Appendix to Technical Part

Functional Guarantees

Form FUNC

The Bidder shall copy in the left column of the table below, the identification of each functional guarantee required in the Specification and stated by the Employer in para. 1.3 of Section III, Evaluation and Qualification Criteria, and in the right column, provide the corresponding value for each functional guarantee of the proposed plant and equipment.

The Required functional Guarantees are mentioned under Annexure the Section VII, Employer's requirement. Bidders are required to fill in those Functional Guarantee here & provide their acceptance accordingly for all such functional Guarantees.

Appendix to Technical Part:

Personnel

Form PER -1

Proposed Personnel

Bidders should provide the names of suitably qualified personnel to meet the specified requirements stated in Section III. The data on their experience should be supplied using the Form below for each candidate.

1.	**Title of position***
	Name
2.	**Title of position***
	Name
3.	**Title of position***
	Name
4.	**Title of position***
	Name

*As listed in Section III.

Appendix to Technical Part

Form PER-2

Resume of Proposed Personnel

Name of Bidder

Position		
Personnel information	**Name**	**Date of birth**
	Professional qualifications	
Present employment	**Name of employer**	
	Address of employer	
	Telephone	**Contact (manager / personnel officer)**
	Fax	**E-mail**
	Job title	**Years with present employer**

Summarize professional experience over the last 20 years, in reverse chronological order. Indicate particular technical and managerial experience relevant to the project.

From	To	Company / Project / Position / Relevant technical and management experience

Appendix to Technical Part

Proposed Subcontractors for Major Items of Plant and Installation Services

A list of major items of Plant and Installation Services is provided below.

The following Subcontractors and/or manufacturers are proposed for carrying out the item of the facilities indicated. **Bidders are free to propose more than one for each item**

Major Items of Plant and Installation Services	Proposed Subcontractors/Manufacturers	Nationality
1. BESS	**1.** **2.** **3.** **4.** **6.** **7.** **8.** **9.** **10.**	

Refer the TS for the qualifying requirements for such BESS subcontractors

Appendix to Technical Part

Others – Time Schedule

(to be used by Bidder when alternative Time for **Completion is invited in ITB 13.2)**

Not Applicable

Appendix to Technical Part

Bidders Qualification

To establish its qualifications to perform the contract in accordance with Section III, Evaluation and Qualification Criteria the Bidder shall provide the information requested in the corresponding Information Sheets included hereunder.

Appendix to Technical Part

Form ELI 1.1

Bidder Information Sheet

Date: _____

RFB No.: _____

Page _____ of _____ pages

7. Bidder's Legal Name
7. In case of JV, legal name of each party:
3. Bidder's actual or intended Country of Registration:
4. Bidder's Year of Registration:
5. Permanent Account Number (PAN) of the Bidder (Only for bidders of Employer's country)
6. GST No (Only for bidders of Employer's country)
7. Bidder's Legal Address in Country of Registration: (Address of Lead Partner/member in case of JV)
7. Bidder's Authorized Representative Information Name: Address: Telephone/Fax numbers: Email Address:

7. Attached are copies of original documents of

☐ Certificate of Incorporation & Article of Association & Memorandum of Association (or equivalent documents of constitution or association), and/or documents of registration of the legal entity named above, in accordance with ITB 4.4

☐ In case of JV, letter of intent to form JV or JV agreement, in accordance with ITB 4.1

☐ In case of state-owned enterprise or institution, in accordance with ITB 4.6, documents establishing:

- Legal and financial autonomy
- Operation under commercial law
- Establishing that the Bidder is not under the supervision of the Employer

10. Included are the organizational chart, a list of Board of Directors, and the beneficial ownership. *[If required under BDS ITB 50.1, the successful Bidder shall provide additional information on beneficial ownership, using the Beneficial Ownership Disclosure Form.]*

Appendix to Technical Part

Form ELI 1.2

Party to JV Information Sheet

Date: _____

RFB No.: _____

Page _____ of_ _____ pages

7. Bidder's Legal Name:
2. JV's Party legal name:
3. JV's Party Country of Registration:
7. JV's Party Year of Registration:
5. Permanent Account Number (PAN) of the Bidder (Only for bidders of Employer's country)
6. GST No (Only for bidders of Employer's country)
7. JV's Party Legal Address in Country of Registration: (For all JV members/Partners)
7. JV's Party Authorized Representative Information Name: Address: Telephone/Fax numbers: Email Address:
7. Attached are copies of original documents of ☐ Certificate of Incorporation & Article of Association & Memorandum of Association (or equivalent documents of constitution or association), and/or registration documents of the legal entity named above, in accordance with ITB 4.4. ☐ In case of a state-owned enterprise or institution, documents establishing legal and financial autonomy, operation in accordance with commercial law, and that they are not under the supervision of the Employer, in accordance with ITB 4.6. 10. Included are the organizational chart, a list of Board of Directors, and the beneficial ownership. *[If required under BDS ITB 50.1, the successful Bidder shall provide additional information on beneficial ownership for each JV member using the Beneficial Ownership Disclosure Form.]*

FORM 1

FORM OF POWER OF ATTORNEY FOR JOINT VENTURE

(On Non-judicial Stamp Paper of Appropriate value, if required as per laws of the country of the bidder, to be Purchased in the Name of Joint Venture or equivalent to rules applicable to international bidders as per their country)

KNOW ALL MEN BY THESE PRESENTS THAT WE, the Partners whose details are given hereunder ..... have formed a Joint Venture under the laws of .....(*)/intend to form a Joint Venture(*) [(*) delete whichever is not applicable] and having our Registered Office(s)/Head Office(s) at ..... (hereinafter called the 'Joint Venture' which expression shall unless repugnant to the context or meaning thereof, include its successors, administrators and assigns) acting through M/s ..... being the Partner in-charge do hereby constitute, nominate and appoint M/s..... a Company incorporated under the laws of .....……... and having its Registered/Head Office at ..... as our duly constituted lawful Attorney (hereinafter called "Attorney" or "Authorised Representative" or "Partner In-charge") to exercise all or any of the powers for and on behalf of the Joint Venture in regard to Specification No..... Package ..... the bids for which have been invited by Solar Energy Corporation of India (SECI) Limited., having its Registered Office at D – 3, 1st Floor, Wing – A, Prius Platinum Building, District Centre, Saket, New Delhi – 110017, India (hereinafter called the '**Employer**') to undertake the following acts:

7) To sign and submit proposal and participate in the aforesaid Bid Specification of the Employer on behalf of the "Joint Venture".

7) To negotiate with the Employer the terms and conditions for award of the Contract pursuant to the aforesaid Bid and to sign the Contract with the Employer for and on behalf of the "Joint Venture".

7) To do any other act or submit any document related to the above.

iv) To receive, accept and execute the Contract for and on behalf of the "Joint Venture".

For the above purpose, the person(s) authorized by the Partner In-charge shall be the person(s) authorized to act on behalf of the "Joint Venture" as per the Power of Attorney given to him/her/them by the Partner In-Charge,

It is clearly understood that all the partners of the joint venture shall be liable jointly and severally for the execution of the Contract in accordance with the Contract terms and the Partner In-charge (Lead Partner) shall ensure performance of the Contract(s) and if one or more Partner fail to perform their respective portions of the Contract(s), the same shall be deemed to be a default by all the Partners.

It is expressly understood that this Power of Attorney shall remain valid binding and irrevocable till completion of the Defect Liability Period in terms of the Contract.

The Joint Venture hereby agrees and undertakes to ratify and confirm all the whatsoever the said Attorney/Authorised Representatives/Partner in-charge quotes in the bid, negotiates and signs the Contract with the Employer and/or proposes to act on behalf of the Joint Venture by virtue of this Power of Attorney and the same shall bind the Joint Venture as if done by itself.

IN WITNESS THEREOF the Partners Constituting the Joint Venture as aforesaid have executed these presents on this ..... day of ……..... under the Common Seal(s) of their Companies.

For and on behalf of the
Partners of Joint Venture
.....
.....

The Common Seal of the above Partners of the Joint Venture:

The Common Seal has been affixed there unto in the presence of:

WITNESS

7. Signature.....

   Name .....….....

   Designation .....….....

   Occupation .....….....

7. Signature.....…

   Name .....….....

   Designation .....….....

   Occupation .....….....

FORM 2a

FORM OF UNDERTAKING BY THE JOINT VENTURE PARTNERS

(On Non-Judicial Stamp Paper of Appropriate Value, if required as per laws of the country of the bidder, to be Purchased in the Name of Joint Venture or equivalent to rules applicable to international bidders as per their country) THIS JOINT DEED OF UNDERTAKING executed on this……. Day of…….. Two Thousand and …….....by……. a company incorporated under the laws of …… and having its Registered Office at .....hereinafter called the "Party No.1" which expression shall include its successors, executors and permitted assigns) and M/s……a company incorporated under the laws of…… and having its Registered Office at…… (hereinafter called the "Party No.2" which expression shall include its successors, executors and permitted assigns) and M/s.. .. .. a Company incorporated under the laws of…….. and having its Registered Office at……. (hereinafter called the "Party No.3" which expression shall include its successors, executors and permitted assigns) for the purpose of making a bid and entering into a contract [hereinafter called the "Contract"_{in case of award)] against the Specification No……for _____ (Package) _____ associated with _____ of *Solar Energy Corporation of India (SECI) Limited., having its Registered Office at D – 3, 1st Floor, Wing – A, Prius Platinum Building, District Centre, Saket, New Delhi – 110017, India (hereinafter called the 'Employer').*

WHEREAS the Party No.1, Party No.2 and Party No.3 have entered into an Agreement dated .....

AND WHEREAS the Employer invited bids as per the above mentioned Specification for the design, manufacture, Supply of Equipment Materials stipulated in the bidding documents under _____ (Package) _____ associated with _____.

AND WHEREAS 'Qualification Requirement of the Bidder', Section on Evaluation and Qualification Criteria forming part of the bidding documents, inter-alia, stipulates that an Undertaking of two or more qualified partners, meeting the requirements of 'Qualification Requirement of the Bidder', Section on Evaluation and Qualification Criteria, as applicable may bid, provided, the Joint Venture fulfills all other requirements under Qualification Requirement of the Bidder', Section on Evaluation and Qualification Criteria and in such a case, the Letter of Bid (Bid Form) shall be signed by the Partner – In Charge so as to legally bind all the Partners of the Joint Venture, who will be jointly and severally liable to perform the Contract and all obligations hereunder.

The above clause further states that this Undertaking shall be attached to the bid and the Contract performance guarantee will be as per the format enclosed with the bidding document without any restrictions or liability for either party.

AND WHEREAS the bid is being submitted to the Employer vide proposal No……..dated…... by Party No.1 based on this Undertaking between all the parties; under these presents and the bid in accordance with the requirements of 'Qualification Requirement of the Bidder', Section on Evaluation and Qualification Criteria, has been signed by all the parties.

NOW THIS UNDERTAKING WITNESSETH AS UNDER:

In consideration of the above premises and agreements all the parties of this Deed of Undertaking do hereby declare and undertake:

7. In requirement of the award of the Contract by the Employer to the Joint Venture Partners, we, the Parties do hereby undertake that M/s…… the Party No.1, shall act as Lead Partner and further declare and confirm that we the parties to the Joint Venture shall jointly and severally be bound unto the Employer for the successful performance of the Contract and shall be fully responsible for the design, manufacture, Supply, and successful performance of the equipment in accordance with the Contract:

7. In case of any breach or default of the said Contract by any of the parties to the Joint Venture, the party(s) do hereby undertake to be fully responsible for the successful performance of the Contract and to carry out all the obligations and responsibilities under the Contract in accordance with the requirements of the Contract.

7. Further, if the Employer suffers any loss or damage on account of any breach in the Contract or any shortfall in the performance of the equipment in meeting the performances guaranteed as per the specification in terms of the Contract, the Party(s) of these presents undertake to promptly make good such loss or damages caused to the Employer, on its demand without any demur. It shall not be necessary or obligatory for the Employer to proceed against Lead Partner to these presents before proceeding against or dealing with the other Party(s), the Employer can proceed against any of the parties who shall be jointly and severally liable for the performance and all other liabilities/obligations under the Contract to the Employer.

7. The financial liability of the Parties of this Deed of Undertaking to the Employer, with respect to any of the claims rising out of the performance or non-performance of the obligations set forth in this Deed of Undertaking, read in conjunction with the relevant conditions of the Contract shall, however not be limited in any way so as to restrict or limit the liabilities or obligations of any of the Parties of this Deed of Undertaking.

7. It is expressly understood and agreed between the Parties to this Undertaking that the responsibilities and obligations of each of the Parties shall be suitably appended by the Parties along with undertaking in its bid. It is further undertaken by the parties that the above sharing of responsibilities and obligations shall not in any way be a limitation of joint and several responsibilities of the Parties under the Contract.

7. It is also understood that this Undertaking is provided for the purposes of undertaking joint and several liabilities of the partners to the Joint Venture for submission of the bid and performance of the Contract if awarded and that this Undertaking shall not be deemed to give rise to any additional liabilities or obligations, in any manner or any law, on any of the Parties to this Undertaking or on the Joint Venture, other than the express provisions of the Contract.

7. ***This Undertaking shall be construed and interpreted in accordance with the provisions of the Contract.***

7. ***In case of an award of a Contract, we the parties to this Deed of Undertaking do hereby agree that we shall be jointly and severally responsible for furnishing a Contract performance security from a bank in favour of the Employer in the currency/currencies of the Contract.***

7. It is further agreed that this Deed of Undertaking shall be irrevocable and shall form an integral part of the bid and shall continue to be enforceable till the Employer discharges the same or upon the completion of the Contract in accordance with its provisions, whichever is earlier. It shall be effective from the date first mentioned above for all purposes and intents.

IN WITNESS WHEREOF, the Parties to this Deed of Undertaking have through their authorized representatives executed these presents and affixed Common Seals of their companies, on the day, month and year first mentioned above.

Common Seal of …….
Has been affixed in my/ our
presence pursuant to Board of
Director's Resolution dated …….

Name ……..

Designation …….

Signature …….

For Lead Partner (Party No.-1)
For and on behalf of M/s
……..

(Signature of the authorized
representative)

WITNESS:

7. ……

II. ……

Common Seal of …….
Has been affixed in my/ our
presence pursuant to Board of
Director's Resolution dated …….

Name ……..

Designation …….

Signature …….

For Party No.-2
For and on behalf of M/s……..

(Signature of the authorized
representative)

WITNESS:

7. ……

II. ……

Common Seal of …….
Has been affixed in my/ our
presence pursuant to Board of
Director's Resolution dated …….

Name ……..

Designation …….

Signature …….

WITNESS:

7. ……

II. ……

For Party No.-3
For and on behalf of M/s.
……..

(Signature of the authorized
representative)

FORM 2b

FORM OF LETTER OF INTENT BY JV PARTNERS TO ENTER INTO JV AGREEMENT

THIS LETTER OF INTENT signed on this……. Day of…….. Two Thousand and …….....by……. a company incorporated under the laws of …… and having its Registered Office at .....(hereinafter called the "Party No.1" which expression shall include its successors, executors and permitted assigns) and M/s……a company incorporated under the laws of…… and having its Registered Office at…… (hereinafter called the "Party No.-2" which expression shall include its successors, executors and permitted assigns) and M/s.. .. .. a Company incorporated under the laws of…….. and having its Registered Office at……. (hereinafter called the "Party No.3" which expression shall include its successors, executors and permitted assigns) for the purpose of making a bid and entering into a contract [hereinafter called the "Contract" {in case of award)] against the Specification No……for _____ (Package) _____ associated with _____ of Solar Energy Corporation of India (SECI) Limited., having its Registered Office at D – 3, 1st Floor, Wing – A, Prius Platinum Building, District Centre, Saket, New Delhi – 110017, India (hereinafter called the '**Employer**')

WHEREAS the Party No.1, Party No.2 and Party No.3 intend to enter into a Joint Venture Agreement

AND WHEREAS the Employer invited bids as per the above mentioned Specification for the design, manufacture, Supply of Equipment Materials stipulated in the bidding documents under _____ (Package) _____ associated with _____.

AND WHEREAS 'Qualification Requirement of the Bidder', Section on Evaluation and Qualification Criteria forming part of the bidding documents, inter-alia, stipulates that two or more qualified partners, meeting the requirements of 'Qualification Requirement of the Bidder', Section-Evaluation and Qualification Criteria, as applicable may bid, provided, they submit a Letter of Intent to enter into Joint Venture Agreement and the Joint Venture Partners fulfill all other requirements under 'Qualification Requirement of the Bidder', Section on Evaluation and Qualification Criteria and in such a case, the Letter of Bid (Bid Form) shall be signed by all the proposed partners so as to legally bind all the Partners of the Joint Venture, who will be jointly and severally liable to perform the Contract by entering into Joint Venture Agreement as per proforma specified in this Section. Bidding Forms of the Bidding Documents which will be legally binding on all partners and all obligations hereunder.

The above clause further states that this Letter of Intent shall be attached to the bid and the Contract performance guarantee will be as per the format enclosed with the bidding document without any restrictions or liability for either party.

AND WHEREAS the bid is being submitted to the Employer vide proposal No……..dated…... by Party No.1 based on this Letter of Intent between all the parties; under these presents and the bid in accordance with the requirements of 'Qualification Requirement of the Bidder', Section on Evaluation and Qualification Criteria, has been signed by all the parties.

NOW THIS UNDERTAKING WITNESSETH AS UNDER:

In consideration of the above premises and agreements all the parties of this Letter of Intent do hereby declare and undertake:

7. In requirement of the award of the Contract by the Employer to the Joint Venture Partners, we, the Parties do hereby undertake that M/s…… the Party No.1, shall act as Lead Partner and further declare and confirm that we the parties to the Joint Venture shall jointly and severally be bound unto the Employer for the successful performance of the Contract and shall be fully responsible for the design, manufacture, Supply, and successful performance of the equipment in accordance with the Contract for which we shall enter into Joint Venture Agreement as per proforma specified in this Section IV. Bidding Forms of the Bidding Documents which will be legally binding on all partners:

7. If the Contract is awarded to Joint Venture then in case of any breach or default of the said Contract by any of the parties to the Joint Venture, the party(s) will be fully responsible for the successful performance of the Contract and to carry out all the obligations and responsibilities under the Contract in accordance with the requirements of the Contract.

7. Further, if the Employer suffers any loss or damage on account of any breach in the Contract or any shortfall in the performance of the equipment in meeting the performances guaranteed as per the specification in terms of the Contract, the Party(s) of these presents will promptly make good such loss or damages caused to the Employer, on its demand without any demur. It shall not be necessary or obligatory for the Employer to proceed against Lead Partner to these presents before proceeding against or dealing with the other Party(s), the Employer can proceed against any of the parties who shall be jointly and severally liable for the performance and all other liabilities/obligations under the Contract to the Employer.

7. The financial liability of the Parties of the Deed of Undertaking to the Employer in the event of award of Contract on the Joint Venture, with respect to any of the claims arising out of the performance or non-performance of the obligations set forth in the Deed of Undertaking, read in conjunction with the relevant conditions of the Contract shall, however not be limited in any way so as to restrict or limit the liabilities or obligations of any of the Parties of the Deed of Undertaking.

7. It is expressly understood and agreed between the Parties to this Letter of Intent that the responsibilities and obligations of each of the Parties shall be suitably appended by the Parties along with Letter of Intent in its bid). It is further undertaken by the parties that the above

sharing of responsibilities and obligations shall not in any way be a limitation of joint and several responsibilities of the Parties under the Contract in the event of award on Joint Venture.

7. It is also understood that this Letter of Intent is provided for the purposes of undertaking joint and several liabilities of the partners to the Joint Venture for submission of the bid and performance of the Contract if awarded and that this Letter of Intent shall not be deemed to give rise to any additional liabilities or obligations, in any manner or any law, on any of the Parties to this Letter of Intent or on the Joint Venture, other than the express provisions of the Contract.

7. ***This Letter of Intent shall be construed and interpreted in accordance with the provisions of the Contract.***

7. ***In case of an award of a Contract, we the parties to this Letter of Intent do hereby agree that we shall enter into Joint Venture Agreement as per proforma specified in this Section IV. Bidding Forms of the Bidding Documents which will be legally binding on all partners and we shall be jointly and severally responsible for furnishing a Contract performance security from a bank in favour of the Employer in the currency/currencies of the Contract.***

7. It is further agreed that this Letter of Intent shall be irrevocable and shall form an integral part of the bid. It shall be effective from the date first mentioned above for all purposes and intents.

IN WITNESS WHEREOF, the Parties to this Letter of Intent have through their authorized representatives executed these presents and affixed Common Seals of their companies, on the day, month and year first mentioned above.

Common Seal of …….	For Lead Partner (Party No.-1)
Has been affixed in my/ our	For and on behalf of M/s
presence pursuant to Board of	……..
Director's Resolution dated …….	
Name ……..	
Designation …….	
Signature …….	(Signature of the authorized

representative)

WITNESS:

7. ……

II. ……

Common Seal of …….
Has been affixed in my/ our
presence pursuant to Board of
Director's Resolution dated …….

For Party No.-2
For and on behalf of M/s……..

(Signature of the authorized
representative)

Name ……..

Designation …….

Signature …….

WITNESS:

7. ……

II. ……

Common Seal of …….
Has been affixed in my/ our
presence pursuant to Board of
Director's Resolution dated …….

For Party No.-3
For and on behalf of M/s.
……..

Name ……..

Designation …….

(Signature of the authorized

Signature ……. representative)

WITNESS:

7. ……

II. ……

Appendix to Technical Part

Details of Participation in the

Joint Venture (if applicable)

PARTICIPATION DETAILS	**FIRM 'A' (Lead Member)**	**FIRM 'B'**	**FIRM 'C'**
Financial	Average Annual Turnover: LIQUIDITY: NET WORTH:	Average Annual Turnover: LIQUIDITY: NET WORTH:	Average Annual Turnover: LIQUIDITY: NET WORTH:
Detailed Role of each Partner/member in the JV			
Planning			
Construction Equipment			
Key Personnel			
Execution of Work (Give details on contribution of each e.g. Plant, Installation Services etc.)			

The Joint Venture should indicate the details of participation as above.

Appendix to Technical Part
Form CON – 2
Historical Contract Non-Performance

Bidder's Legal Name: _____ Date: _____

JV Member Legal Name: _____ _____

RFB No.: _____

Page _____ of _____ pages

Non-Performed Contracts in accordance with Section III, Evaluation and Qualification Criteria			
☐ Contract non-performance did not occur since 1st January *[insert year]* specified in Section III, Evaluation and Qualification Criteria, Sub-Factor 2.1. ☐ Contract(s) not performed since 1st January *[insert year]* specified in Section III, Evaluation and Qualification Criteria, requirement 2.1			
Year	**Non-performed portion of contract**	**Contract Identification**	**Total Contract Amount (current value, currency, exchange rate and US$ equivalent)**
[insert year]	*[insert amount and percentage]*	Contract Identification: *[indicate complete contract name/ number, and any other identification]* Name of Employer: *[insert full name]* Address of Employer: *[insert street/city/country]* Reason(s) for nonperformance: *[indicate main reason(s)]*	*[insert amount]*
Pending Litigation, in accordance with Section III, Evaluation and Qualification Criteria			
☐ No pending litigation in accordance with Section III, Evaluation and Qualification Criteria, Sub-Factor 2.3. ☐ Pending litigation in accordance with Section III, Evaluation and Qualification Criteria, Sub-Factor 2.3 as indicated below.			

Year of dispute	Amount in dispute (currency)	Contract Identification	Total Contract Amount (currency), USD Equivalent (exchange rate)
		Contract Identification: _____ Name of Employer: _____ Address of Employer: _____ Matter in dispute: _____ Party who initiated the dispute: ____ Status of dispute: _____	
		Contract Identification: Name of Employer: Address of Employer: Matter in dispute: Party who initiated the dispute: Status of dispute:	

Litigation History in accordance with Section III, Evaluation and Qualification Criteria

☐ No Litigation History in accordance with Section III, Evaluation and Qualification Criteria, Sub-Factor 2.4.

☐ Litigation History in accordance with Section III, Evaluation and Qualification Criteria, Sub-Factor 2.4 as indicated below.

Year of award	Outcome as percentage of Net Worth	Contract Identification	Total Contract Amount (currency), USD Equivalent (exchange rate)

[insert year]	*[insert percentage]*	Contract Identification: [indicate complete contract name, number, and any other identification] Name of Employer: *[insert full name]* Address of Employer: *[insert street/city/country]* Matter in dispute: *[indicate main issues in dispute]* Party who initiated the dispute: *[indicate "Employer" or "Contractor"]* Reason(s) for Litigation and award decision *[indicate main reason(s)]*	*[insert amount]*

Form CON – 3
Environmental and Social Performance Declaration

[The following table shall be filled in for the Bidder, each member of a Joint Venture and each Specialized Subcontractor]

Bidder's Name: *[insert full name]*
Date: *[insert day, month, year]*
Joint Venture Member's or Specialized Subcontractor's Name: *[insert full name]*
RFB No. and title: *[insert RFB number and title]*
Page *[insert page number]* of *[insert total number]* pages

Environmental and Social Performance Declaration in accordance with Section III, Qualification Criteria, and Requirements			
– **No suspension or termination of contract**: An employer has not suspended or terminated a contract and/or called the performance security for a contract for reasons related to Environmental or Social (ES) performance since the date specified in Section III, Qualification Criteria, and Requirements, Sub-Factor 2.5. – **Declaration of suspension or termination of contract**: The following contract(s) has/have been suspended or terminated and/or Performance Security called by an employer(s) for reasons related to Environmental or Social (ES) performance since the date specified in Section III, Qualification Criteria, and Requirements, Sub-Factor 2.5. Details are described below:			
Year	**Suspended or terminated portion of contract**	**Contract Identification**	**Total Contract Amount (current value, currency, exchange rate and US$ equivalent)**
[insert year]	*[insert amount and percentage]*	Contract Identification: *[indicate complete contract name/ number, and any other identification]* Name of Employer: *[insert full name]* Address of Employer: *[insert street/city/country]* Reason(s) for suspension or termination: *[indicate main reason(s) e.g. gender-based violence; sexual exploitation or sexual abuse breaches]*	*[insert amount]*
[insert year]	*[insert amount and percentage]*	Contract Identification: *[indicate complete contract name/ number, and any other identification]* Name of Employer: *[insert full name]* Address of Employer: *[insert street/city/country]*	*[insert amount]*

		Reason(s) for suspension or termination: *[indicate main reason(s)]*	
...	...	*[list all applicable contracts]*	...
Performance Security called by an employer(s) for reasons related to ES performance			
Year	Contract Identification		Total Contract Amount (current value, currency, exchange rate and US$ equivalent)
[insert year]	Contract Identification: *[indicate complete contract name/ number, and any other identification]* Name of Employer: *[insert full name]* Address of Employer: *[insert street/city/country]* Reason(s) for calling of performance security: *[indicate main reason(s) e.g. for gender-based violence; sexual exploitation, or sexual abuse breaches]*		*[insert amount]*

Appendix to Technical Part

Form CCC

Current Contract Commitments / Works in Progress

Bidders and each member to a JV should provide information on their current commitments on all contracts that have been awarded, or for which a letter of intent or acceptance has been received, or for contracts approaching completion, but for which an unqualified, full completion certificate has yet to be issued.

Name of contract	Employer, contact address/tel/fax	Value of outstanding work (INR/USD Equivalent)	Estimated completion date	Average monthly invoicing over last six months (INR/USD Equivalent)
1.				
2.				
3.				
4.				
5.				
etc.				

Appendix to Technical Part

Form FIN – 3.1

Financial Situation

Historical Financial Performance

Bidder's Legal Name: _____ Date: _____

JV Member Legal Name: _____ RFB No.: _____

Page _____ of _____ pages

To be completed by the Bidder and, if JV, by each member

Financial information ***(INR/RESPECTIVE CURRENCY OF THE BIDDER'S BALANCE SHEET))***	**Historic information for previous 03 (Three) years** ***(INR/RESPECTIVE CURRENCY OF THE BIDDER'S BALANCE SHEET)***				
	Year 1 **(FY 2018-19)**	**Year 2** **(FY 2017-18)**	**Year 3** **(FY 2016-17)**	**Avg.**	
Information from Balance Sheet					
Total Assets (TA)					
Total Liabilities (TL)					
Net Worth (NW)					
Current Assets (CA)					
Current Liabilities (CL)					
Information from Income Statement					
Revenue from Operations I					
Profits Before Taxes (PBT)					

Attached are copies of financial statements (balance sheets, including all related notes, and income statements) for the years required above complying with the following conditions:

(a) **Must reflect the financial situation of the Bidder or member to a JV, and not sister or parent companies**

(b) **Historic financial statements must be audited by a certified public accountant/Chartered accountant**

(c) **Historic financial statements must be complete, including all notes to the financial statements**

(d) **Historic financial statements must correspond to accounting periods already completed and audited (no statements for partial periods shall be requested or accepted)**

Bidders may produce the Financial statements based on the Calendar Year in place of Financial Year, if applicable

Appendix to Technical Part

Form FIN – 3.2

Average Annual Turnover

Bidder's Legal Name: _____ Date: _____

JV Member Legal Name: _____ RFB No.: _____

Page _____ of _____ pages

Annual turnover*		
Year	***(RESPECTIVE CURRENCY OF THE BIDDER'S BALANCE SHEET)***	***INR /USD equivalent***
(FY 2018-19)	_____	_____
(FY 2017-18)	_____	_____
(FY 2016-17)	_____	_____
Average Annual Turnover	_____	_____

* **Annual Turnover** shall mean Revenue from Operations as incorporated in the profit & loss account excluding other income, e.g. sale of fixed assets. This must be the individual Company's turnover and not that of any group of Companies. A summarized sheet of average turnover certified by a practicing CA/Statutory Auditor should be compulsorily enclosed along with corresponding annual accounts. Bidders may produce the Financial statements based on the Calendar Year in place of Financial Year, if applicable

Appendix to Technical Part

Form FIN3.3

Financial Resources

Specify proposed sources of financing, such as liquid assets, unencumbered real assets, lines of credit, and other financial means, net of current commitments, available to meet the total cash flow demands of the subject contract or contracts as indicated in Section III, Evaluation and Qualification Criteria

Source of financing	Amount (INR/USD equivalent)
1.	
2.	
3.	
4.	

Appendix to Technical Part

Form EXP 4.1

Experience

General Experience

Bidder's Legal Name: _____ Date: _____

JV Member Legal Name: _____ RFB No.: _____

Page _____ of _____ pages

Starting Month / Year	Ending Month / Year	Years *	Contract Identification	Role of Bidder
_____	_____		Contract name: Brief Description of the Works performed by the Bidder: Amount of contract: _____ Actual Completion Value: _____ Name of Employer: Address:	_____
_____	_____		Contract name: Brief Description of the Works performed by the Bidder: Amount of contract: _____ Actual Completion Value: _____ Name of Employer: Address:	_____

Starting Month / Year	Ending Month / Year	Years *	Contract Identification	Role of Bidder
_____	_____		Contract name: Brief Description of the Works performed by the Bidder: Amount of contract: _____ Actual Completion Value: _____ Name of Employer: Address:	_____
_____	_____		Contract name: Brief Description of the Works performed by the Bidder: Amount of contract: _____ Actual Completion Value: _____ Name of Employer: Address:	_____
_____	_____		Contract name: Brief Description of the Works performed by the Bidder: Amount of contract: _____ Actual Completion Value: _____ Name of Employer: Address:	_____
_____	_____		Contract name: Brief Description of the Works performed by the Bidder: Amount of contract: _____ Actual Completion Value: _____ Name of Employer: Address:	_____

*List calendar year for years with contracts with at least nine (9) months activity per year starting with the earliest year

Appendix to Technical Part

Form EXP –4.2(a)

Specific Experience

Bidder's Legal Name: _____ Date: _____

JV Member Legal Name: _____ RFB No.: _____

Page _____ of _____ pages

Similar Contract Number: ___ of ___ required.	**Information**		
Contract Identification	_____		
Award date Completion date	_____ _____		
Role in Contract	☐ Contractor	☐ Management Contractor	☐Subcontractor
Total contract amount	_____ __		INR/USD Equivalent___ _____
If member in a JV or subcontractor, specify participation of total contract amount	_____%	_____	INR/USD Equivalent___ ____
Employer's Name:	_____		
Address: Telephone/fax number: E-mail:	_____ _____ _____ _____		

Appendix to Technical Part

Form EXP –4.2(a) (cont.)

Specific Experience (cont.)

Bidder's Legal Name: _____ Page _____ of _____ pages

JV Member Legal Name: _____

Similar Contract No. _[insert specific number] of [total number of contracts] ___ required	**Information**
Description of the similarity in accordance with Sub-Factor 4.2a) of Section III:	
Amount	_____
Physical size	_____
Complexity	_____
Methods/Technology	_____
Physical Production Rate	_____

Appendix to Technical Part

Form EXP –4.2(b)

Specific Experience in Managing ES aspects

Bidder's Legal Name: _____ Date: _____

JV Member Legal Name: _____ RFB No.: _____

Subcontractor's Legal Name: _____ Page _____ of _____ pages

1. Key Requirement no 1 in accordance with 4.2 (b): __ _____

Contract Identification				
Award date				
Completion date				
Role in Contract	Prime Contractor –	Member in JV –	Management Contractor –	Subcontractor –
Total Contract Amount			US$	
Details of relevant experience				

2. Key Requirement no 2 in accordance with 4.2 (b): _____
3. Key Requirement no 3 in accordance with 4.2 (b): _____

Appendix to Technical Part

Form of Bid Security - Bank Guarantee

[The bank shall fill in this Bank Guarantee Form in accordance with the instructions indicated.]

[Guarantor letterhead or SWIFT identifier code]

Beneficiary: *[Employer to insert its name and address]*

RFB No.:*[Employer to insert reference number for the Request for Bids]*

Alternative No.*: [Insert identification No if this is a Bid for an alternative]*

Date:*[Insert date of issue]*

BID GUARANTEE No.:*[Insert guarantee reference number]*

Guarantor: *[Insert name and address of place of issue, unless indicated in the letterhead]*

We have been informed that _____ *[insert name of the Bidder, which in the case of a joint venture shall be the name of the joint venture (whether legally constituted or prospective) or the names of all members thereof]*(hereinafter call“d "the Applic”nt") has submitted or will submit to the Beneficiary its Bid (hereinafter call“d "the ”id") for the execution of _____ under RFB No. _____

Furthermore, we understand that, according to the Beneficiary’s conditions, Bids must be supported by a Bid guarantee.

At the request of the Applicant, we, as Guarantor, hereby irrevocably undertake to pay the Beneficiary any sum or sums not exceeding in total an amount of _____ (_____)upon receipt by us of the Beneficiary’s complying demand, supported by the Beneficiary’s statement, whether in the demand itself or a separate signed document accompanying or identifying the demand, stating that either the Bidder:

(a) has withdrawn its Bid prior to the Bid validity expiry date set forth in the Bidder’s Letter(s) of Bid, or any extended date provided by the Bidder; or

(b) having been notified of the acceptance of its Bid by the Beneficiary prior to the expiry date of the Bid validity or any extension thereto provided by the Applicant, (i) has failed to execute the Contract Agreement, or (ii) has failed to furnish the Performance Security, in accordance with the Instructions to Bidders (“ITB”) of the Beneficiary’s bidding document.

This guarantee will expire: (a) if the Applicant is the successful Bidder, upon our receipt of copies of the contract agreement signed by the Applicant and the Performance Security issued to the Beneficiary in relation to such contract agreement; or (b) if the Applicant is not the successful Bidder, upon the earlier of (i) our receipt of a copy of the Beneficiary's notification to the Applicant of the results of the Bidding process; or (ii) twenty-eight days after the expiry date of the Bid validity.

Consequently, any demand for payment under this guarantee must be received by us at the office indicated above on or before that date.

This guarantee is subject to the Uniform Rules for Demand Guarantees (URDG) 2010 Revision, ICC Publication No. 758.

_____

[Signature(s)]

Note: All italicized text is for use in preparing this form and shall be deleted from the final product.

Appendix to Technical Part

Manufacturer's Authorization

(For Solar Modules)

Date: _____

RFB No.: _____

To: _____

WHEREAS

We _____, who are official manufacturers of_____, having factories at _____, do hereby authorize _____ to submit a Bid the purpose of which is to provide the following goods, manufactured by us _____, and to subsequently negotiate and sign the Contract.

We hereby extend our full guarantee and warranty in accordance with Clause 27 of the General Conditions, with respect to the goods offered by the above firm.

Signed: _____

Name: _____

Title: _____

Duly authorized to sign this Authorization on behalf of:

_____

Dated on _____ day of _____, _____

Appendix to Technical Part

Manufacturer's Authorization

(For BESS)

Date: _____

RFB No.: _____

To: _____

WHEREAS

We _____, who are official manufacturers of_____, having factories at _____, do hereby authorize _____ to submit a Bid the purpose of which is to provide the following goods, manufactured by us _____, and to subsequently negotiate and sign the Contract.

We hereby extend our full guarantee and warranty in accordance with Clause 27 of the General Conditions, with respect to the goods offered by the above firm.

Signed: _____

Name: _____

Title: _____

Duly authorized to sign this Authorization on behalf of:

_____

Dated on _____ day of _____, _____

Appendix to Technical Part

(Name of the Project)

(*Declaration regarding tax/ duty exemption for plant/equipment/construction equipment bought for the work)*[8]

(*Bidder's Name and Address*)

To: ……..

(*Name of the Employer & address*)

Dear Sir:

Re: [*Name of Work*]…….

RFB No…….

Certificate for Import/Procurement of Plant and Equipment/Construction Equipment

7. Government Order/Circular Number under which tax/duty Exemption is being sought: …1. We confirm that we are solely responsible for obtaining tax/ duty waivers which we have considered in our bid and in case of failure to receive such waivers for reasons whatsoever, the employer will not compensate us. We are furnishing below the information required by the Employer for issue of the necessary certificates in terms of the Government of India's relevant Notifications. The goods/construction equipment for which certificates are required are as under:

Items *(modify the list suitably for each specific work)**	Make/ Brand Name	Capacity [*where applicable*]	Quantity	Value	State whether it will be procured locally or imported [*if so from which country*]	Remarks regarding justification for the quantity and their usage in works.
Plant and Equipment						
[a] _____						
[b] _____						
[c] _____						

[8] This declaration refers to ITB 17.5.2 and shall be retained only if ITB 17.5.2 is retained. The format may be modified as per the latest instructions of Government of India.

Construction Equipment						

7. 4. We agree that no modification to the above list is permitted after bids are opened. We agree that the certificate will be issued only to the extent considered reasonable by the Employer for the work, based on the Employer's Requirements and the construction program and methodology as furnished by us along with the bid. We confirm that the above plant, equipment and construction equipment will be exclusively used for the construction of the above work and the construction equipment will not be sold or otherwise disposed of in any manner for a period of five years from the date of acquisition.

Date: _____ (*Signature*) _____

Place: _____ (*Printed Name*) _____

(*Designation*)_____

(*Common Seal*) _____

[***This certificate will be issued within 60 days of signing of contract and no subsequent changes will be permitted.***]

**** Modify the above to suit the requirements given in Government of India's Notifications as current of date of bidding.***

Letter of Bid – Financial Part

INSTRUCTIONS TO BIDDERS: DELETE THIS BOX ONCE YOU HAVE COMPLETED THE DOCUMENT

The Bidder must prepare this Letter of Bid – Financial Part on stationery with its letterhead clearly showing the Bidder's complete name and business address.

Note: All italicized text is to help Bidders in preparing this form.

Date of this Bid submission: [*insert date (as day, month and year) of Bid submission*]

RFB No.: [*insert number of RFB process*]

Alternative No.[9]: NA

To: **[*insert complete name of Employer*]**

We, the undersigned, hereby submit the second part of our Bid, the Bid Price and Price Schedules. This accompanies the Letter of B–d - Technical Part.

In submitting our Bid, we make the following additional declarations:

(a) **No reservations:** We have examined and have no reservations to the bidding document, including Addenda issued in accordance with ITB 8;

(b) **Eligibility**: We meet the eligibility requirements and have no conflict of interest in accordance with ITB 4;

(c) **Bid-Securing Declaration:** We have not been suspended nor declared ineligible by the Employer based on execution of a Bid Securing Declaration or Proposal-Securing Declaration in the Employer's Country in accordance with ITB 4.7;

(d) **Conformity:** We offer to provide design, supply and installation services in conformity with the bidding document of the following: [Design, Engineering, Supply, Construction, Erection, Testing & Commissioning of 100 MW (AC) Solar PV Project (200MWp DC capacity) along with 50MW/150 MWh Battery Energy Storage System having 10 years plant O&M at Rajnandgaon, Chhattisgarh, India under International competitive bidding];

(e) **Performance Security:** If our Bid is accepted, we commit to obtain a Performance Security in accordance with the bidding document;

[9] Delete if not applicable

(f) **One Bid Per Bidder:** We are not submitting any other Bid(s) as an individual Bidder, and we are not participating in any other Bid(s) as a Joint Venture member, and meet the requirements of ITB 4.3, other than alternative Bids submitted in accordance with ITB 13;

(g) **Suspension and Debarment**: We, along with any of our subcontractors, suppliers, consultants, manufacturers, or service providers for any part of the contract, are not subject to, and not controlled by any entity or individual that is subject to, a temporary suspension or a debarment imposed by the World Bank Group or a debarment imposed by the World Bank Group in accordance with the Agreement for Mutual Enforcement of Debarment Decisions between the World Bank and other development banks. Further, we are not ineligible under the Employer's Country laws or official regulations or pursuant to a decision of the United Nations Security Council;

(h) **State-owned enterprise or institution**: [*select the appropriate option and delete the other*] [*We are not a state-owned enterprise or institution*] / [*We are a state-owned enterprise or institution but meet the requirements of ITB 4.6*][10];

(i) **Binding Contract**: We understand that this Bid, together with your written acceptance thereof included in your Letter of Acceptance, shall constitute a binding contract between us, until a formal contract is prepared and executed;

(j) **Not Bound to Accept:** We understand that you are not bound to accept the lowest evaluated cost Bid, the Most Advantageous Bid or any other Bid that you may receive; and

(k) **Fraud and Corruption:** We hereby certify that we have taken steps to ensure that no person acting for us or on our behalf engages in any type of Fraud and Corruption.

(l) **Bid Validity:** Our Bid shall be valid until *[insert day, month and year in accordance with ITB 19.1]*, and it shall remain binding upon us and may be accepted at any time before the expiration of that period;

(m) **Bid Price:** The total price of our Bid, excluding any discounts offered in item (n) below is: *[]*

(n) **Discounts:** The discounts offered and the methodology for their application are:

(i) The discounts offered are: [*Specify in detail each discount offered.*]

[10] Use one of the two options as appropriate

(ii) The exact method of calculations to determine the net price after application of discounts is shown below: [*Specify in detail the method that shall be used to apply the discounts*];

(o) Commissions, gratuities and fees: We have paid, or will pay the following commissions, gratuities, or fees with respect to the Bidding process or execution of the Contract: *[insert complete name of each Recipient, its full address, the reason for which each commission or gratuity was paid and the amount and currency of each such commission or gratuity]*

Name of Recipient	Address	Reason	Amount

(If none has been paid or is to be paid, indicate "none.")

Name of the Bidder: *[*insert complete name of the Bidder*]

Name of the person duly authorized to sign the Bid on behalf of the Bidder: **[*insert complete name of person duly authorized to sign the Bid*]

Title of the person signing the Bid: [*insert complete title of the person signing the Bid*]

Signature of the person named above: [*insert signature of person whose name and capacity are shown above*]

Date signed [*insert date of signing*] **day of** [*insert month*], [*insert year*]

*: In the case of the Bid submitted by joint venture specify the name of the Joint Venture as Bidder

**: Person signing the Bid shall have the power of attorney given by the Bidder to be attached with the Bid

Appendix to Financial Part
Schedule of Rates,

Schedule No 1/Schedule of Rates (SOR) 1

Schedule No 2/Schedule of Rates (SOR) 2

Schedule No 3/Schedule of Rates (SOR) 3

Schedule No 4/Schedule of Rates (SOR) 4

Schedule No 5/Schedule of Rates (SOR) 5

Schedule No 6/Grand Total Summary

Are attached as a "Main Bid" as .xlsx Sheets to the bidding document.

Appendix to Financial Part

Country of Origin Declaration Form

Item	Description	Code	Country

Note: The bidders are required to mention country of origin of the supply of items mentioned under SOR -1, wherever applicable.

Appendix to Financial Part

Price Adjustment

Not Applicable

Section–V - Eligible Countries

Eligibility for the Provision of Goods, Works and Non Consulting Services in Bank-Financed Procurement

In reference to ITB 4.8 and 5.1, for the information of the Bidders, at the present time firms, goods and services from the following countries are excluded from this Bidding process:

Under ITB 4.8 (a) and 5.1: *"none"*

Under ITB 4.8 (b) and 5.1: *"none"*

Section –I - Fraud and Corruption

1. Purpose

1.1 The Bank's Anti-Corruption Guidelines and this annex apply with respect to procurement under Bank Investment Project Financing operations.

2. Requirements

2.1 The Bank requires that Borrowers (including beneficiaries of Bank financing); bidders (applicants/proposers), consultants, contractors and suppliers; any sub-contractors, sub-consultants, service providers or suppliers; any agents (whether declared or not); and any of their personnel, observe the highest standard of ethics during the procurement process, selection and contract execution of Bank-financed contracts, and refrain from Fraud and Corruption.

2.2 To this end, the Bank:

a. Defines, for the purposes of this provision, the terms set forth below as follows:

i. "corrupt practice" is the offering, giving, receiving, or soliciting, directly or indirectly, of anything of value to influence improperly the actions of another party;

ii. "fraudulent practice" is any act or omission, including misrepresentation, that knowingly or recklessly misleads, or attempts to mislead, a party to obtain financial or other benefit or to avoid an obligation;

iii. "collusive practice" is an arrangement between two or more parties designed to achieve an improper purpose, including to influence improperly the actions of another party;

iv. "coercive practice" is impairing or harming, or threatening to impair or harm, directly or indirectly, any party or the property of the party to influence improperly the actions of a party;

v. "obstructive practice" is:

(a) deliberately destroying, falsifying, altering, or concealing of evidence material to the investigation or making false statements to investigators in order to materially impede a Bank investigation into allegations of a corrupt, fraudulent, coercive, or collusive practice; and/or threatening, harassing, or intimidating any party to prevent it from disclosing its knowledge of matters relevant to the investigation or from pursuing the investigation; or

(b) acts intended to materially impede the exercise of the Bank's inspection and audit rights provided for under paragraph 2.2 e. below.

b. Rejects a proposal for award if the Bank determines that the firm or individual recommended for award, any of its personnel, or its agents, or its sub-consultants, sub-contractors, service providers, suppliers and/ or their employees, has, directly or indirectly, engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices in competing for the contract in question;

c. In addition to the legal remedies set out in the relevant Legal Agreement, may take other appropriate actions, including declaring misprocurement, if the Bank determines at any time that representatives of the Borrower or of a recipient of any part of the proceeds of the loan engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices during the procurement process, selection and/or execution of the contract in question, without the Borrower having taken timely and appropriate action satisfactory to the Bank to address such practices when they occur, including by failing to inform the Bank in a timely manner at the time they knew of the practices;

d. Pursuant to the Bank's Anti- Corruption Guidelines and in accordance with the Bank's prevailing sanctions policies and procedures, may sanction a firm or individual, either indefinitely or for a stated period of time, including by publicly declaring such firm or individual ineligible (i) to be awarded or otherwise benefit from a Bank-financed contract, financially or in any other manner;[1] (ii) to be a nominated[2] sub-contractor, consultant, manufacturer or supplier, or service provider of an otherwise eligible firm being awarded a Bank-financed contract; and (iii) to receive the proceeds of any loan made by the Bank or otherwise to participate further in the preparation or implementation of any Bank-financed project;

e. Requires that a clause be included in bidding/request for proposals documents and in contracts financed by a Bank loan, requiring (i) bidders (applicants/proposers), consultants, contractors, and suppliers, and their sub-contractors, sub-consultants, service providers, suppliers, agents personnel, permit the Bank to inspect[3] all accounts,

---

[1] For the avoidance of doubt, a sanctioned party's ineligibility to be awarded a contract shall include, without limitation, (i) applying for pre-qualification, expressing interest in a consultancy, and bidding, either directly or as a nominated sub-contractor, nominated consultant, nominated manufacturer or supplier, or nominated service provider, in respect of such contract, and (ii) entering into an addendum or amendment introducing a material modification to any existing contract.

[2] A nominated sub-contractor, nominated consultant, nominated manufacturer or supplier, or nominated service provider (different names are used depending on the particular bidding document) is one which has been: (i) included by the bidder in its pre-qualification application or bid because it brings specific and critical experience and know-how that allow the bidder to meet the qualification requirements for the particular bid; or (ii) appointed by the Borrower.

[3] Inspections in this context usually are investigative (i.e., forensic) in nature. They involve fact-finding activities undertaken by the Bank or persons appointed by the Bank to address specific matters related to investigations/audits, such as evaluating the veracity of an allegation of possible Fraud and Corruption, through the appropriate mechanisms. Such activity includes but is not limited to: accessing and examining a firm's or individual's financial records and information, and making copies thereof as relevant; accessing and examining any other documents, data and information (whether in hard copy or electronic format) deemed relevant for the investigation/audit, and making copies thereof as relevant; interviewing staff and other relevant individuals; performing physical inspections and site visits; and obtaining third party verification of information.

records and other documents relating to the procurement process, selection and/or contract execution, and to have them audited by auditors appointed by the Bank.

PART–2 - Employer's Requirements

Section V–I - Employer's Requirements

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Scope of Supply of Plant and Installation Services by the Contractor

Specification

Employer's requirement or Technical specifications (including Environmental and Social (ES) requirements) is attached as "Annexure A" to the Bidding Documents

Contractor's Representative and Key Personnel

[Note: Insert in the following table, the minimum key specialists required to execute the contract, taking into account the nature, scope, complexity and risks of the contract.

Where a Project SEA risks are assessed to be substantial or high, the Employer shall include Sexual Exploitation, Abuse and Harassment expert(s]

Contractor's Representative and Key Personnel

Item No.	Position/specialization	Relevant academic qualifications	Minimum years of relevant work experience
~~1~~	~~Contractor's Representative~~		
2.	*Project Manager]*	B.**E. B.Tech Degree**	**15 years of experience in Project Management**
	Construction manager (3 No's)	B.**E. B.Tech Degree**	**5 years of experience in Construction Management**
1.	Design Engineering Lead	B.E./B.Tech. Degree	minimum 8 years of experience in Solar PV Design Engineering
2.	Design Engineers – Civil and Electrical (3 Nos. Each)	B.E./B.Tech. Degree	Minimum 5 years of experience in Solar PV Design
5.	Environmental Expert*	B.E./B. Tech or Equivalent with Specialization / additional qualification in Environment related field	minimum 10 years of total experience out of which minimum 5 years of experience in similar works
6.	Sociologist*	Master's degree in Social Work or equivalent	minimum 10 years of total experience out of which minimum 5 years of experience in similar works

* He/she should have worked as a social expert for Infrastructure projects. Experience in environment / safety / Social Risk Assessment, resettlement and rehabilitation and Management plans related to similar project would be preferred.

Forms and Procedures

Form of Completion Certificate

Date: _____

Loan/Credit Nº: _____

RFB Nº: _____

_____ *[Name of Contract]*

To: _____ *[Name and address of Contractor]*

Dear Ladies and/or Gentlemen,

Pursuant to GCC Clause 24 (Completion of the Facilities) of the General Conditions of the Contract entered into between yourselves and the Employer dated _____, relating to the _____*[brief description of the Facilities],* we hereby notify you that the following part(s) of the Facilities was (were) complete on the date specified below, and that, in accordance with the terms of the Contract, the Employer hereby takes over the said part(s) of the Facilities, together with the responsibility for care and custody and the risk of loss thereof on the date mentioned below.

1. Description of the Facilities or part thereof: _____

2. Date of Completion: _____

However, you are required to complete the outstanding items listed in the attachment hereto as soon as practicable.

This letter does not relieve you of your obligation to complete the execution of the Facilities in accordance with the Contract nor of your obligations during the Defect Liability Period.

Very truly yours,

_____

Title

(Project Manager)

Form of Operational Acceptance Certificate

Date: _____

Loan/Credit N°: _____

RFB N°: _____

_____*[Name of Contract]*

To: _____ *[Name and address of Contractor]*

Dear Ladies and/or Gentlemen,

Pursuant to GCC Sub-Clause 25.3 (Operational Acceptance) of the General Conditions of the Contract entered into between yourselves and the Employer dated _____, relating to the _____*[brief description of the Facilities]*, we hereby notify you that the Functional Guarantees of the following part(s) of the Facilities were satisfactorily attained on the date specified below.

1. Description of the Facilities or part thereof: _____
2. Date of Operational Acceptance: _____

This letter does not relieve you of your obligation to complete the execution of the Facilities in accordance with the Contract nor of your obligations during the Defect Liability Period.

Very truly yours,

_____

Title

(Project Manager)

Change Order Procedure and Forms

Date: _____

Loan/Credit Nº: _____

RFB Nº: _____

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1. General
2. Change Order Log
3. References for Changes

ANNEXES

Annex 1 Request for Change Proposal
Annex 2 Estimate for Change Proposal
Annex 3 Acceptance of Estimate
Annex 4 Change Proposal
Annex 5 Change Order
Annex 6 Pending Agreement Change Order
Annex 7 Application for Change Proposal

Change Order Procedure

1. General

This section provides samples of procedures and forms for implementing changes in the Facilities during the performance of the Contract in accordance with GCC Clause 39 (Change in the Facilities) of the General Conditions of Contract.

2. Change Order Log

The Contractor shall keep an up-to-date Change Order Log to show the current status of Requests for Change and Changes authorized or pending, as Annex 8. Entries of the Changes in the Change Order Log shall be made to ensure that the log is up-to-date. The Contractor shall attach a copy of the current Change Order Log in the monthly progress report to be submitted to the Employer.

3. References for Changes

(1) Request for Change as referred to in GCC Clause 39 shall be serially numbered CR-X-nnn.

(2) Estimate for Change Proposal as referred to in GCC Clause 39 shall be serially numbered CN-X-nnn.

(3) Acceptance of Estimate as referred to in GCC Clause 39 shall be serially numbered CA-X-nnn.

(4) Change Proposal as referred to in GCC Clause 39 shall be serially numbered CP-X-nnn.

(5) Change Order as referred to in GCC Clause 39 shall be serially numbered CO-X-nnn.

Note: (a) Requests for Change issued from the Employer's Home Office and the Site representatives of the Employer shall have the following respective references:

Home Office	CR-H-nnn
Site	CR-S-nnn

(b) The above number "nnn" is the same for Request for Change, Estimate for Change Proposal, Acceptance of Estimate, Change Proposal and Change Order.

Annex 1. Request for Change Proposal

(Employer's Letterhead)

To: _____ Date: _____

Attention: _____

Contract Name: _____

Contract Number: _____

Dear Ladies and/or Gentlemen:

With reference to the captioned Contract, you are requested to prepare and submit a Change Proposal for the Change noted below in accordance with the following instructions within _____ days of the date of this letter_____.

1. Title of Change: _____
2. Change Request No. _____
3. Originator of Change: Employer: _____

   Contractor (by Application for Change Proposal No.) _____:
4. Brief Description of Change: _____
5. Facilities and/or Item No. of equipment related to the requested Change: _____
6. Reference drawings and/or technical documents for the request of Change:

   Drawing No./Document No. Description

7. Detailed conditions or special requirements on the requested Change: _____
8. General Terms and Conditions:
   (a) Please submit your estimate to us showing what effect the requested Change will have on the Contract Price.
   (b) Your estimate shall include your claim for the additional time, if any, for completion of the requested Change.
   (c) If you have any opinion negative to the adoption of the requested Change in connection with the conformability to the other provisions of the Contract or the

safety of the Plant or Facilities, please inform us of your opinion in your proposal of revised provisions.

(d) Any increase or decrease in the work of the Contractor relating to the services of its personnel shall be calculated.

(e) You shall not proceed with the execution of the work for the requested Change until we have accepted and confirmed the amount and nature in writing.

_____

(Employer's Name)

_____

(Signature)

_____

(Name of signatory)

_____

(Title of signatory)

Annex 2. Estimate for Change Proposal

(Contractor's Letterhead)

To: _____ Date: _____

Attention: _____

Contract Name: _____

Contract Number: _____

Dear Ladies and/or Gentlemen:

With reference to your Request for Change Proposal, we are pleased to notify you of the approximate cost of preparing the below-referenced Change Proposal in accordance with GCC Sub-Clause 39.2.1 of the General Conditions. We acknowledge that your agreement to the cost of preparing the Change Proposal, in accordance with GCC Sub-Clause 39.2.2, is required before estimating the cost for change work.

1. Title of Change: _____
2. Change Request No./Rev.: _____
3. Brief Description of Change: _____
4. Scheduled Impact of Change: _____
5. Cost for Preparation of Change Proposal: _____[14]

(a)	Engineering				(Amount)
	(i)	Engineer	_____ hrs x _____ rate/hr =		_____
	(ii)	Draftsperson	_____ hrs x _____ rate/hr =		_____
		Sub-total	_____ hrs		_____
		Total Engineering Cost			_____
(b)	Other Cost				_____
Total Cost (a) + (b)					_____

[14] Costs shall be in the currencies of the Contract.

_____

(Contractor's Name)

_____

(Signature)

_____

(Name of signatory)

_____

(Title of signatory)

Annex 3. Acceptance of Estimate

(Employer's Letterhead)

To: _____ Date: _____

Attention: _____

Contract Name: _____

Contract Number: _____

Dear Ladies and/or Gentlemen:

We hereby accept your Estimate for Change Proposal and agree that you should proceed with the preparation of the Change Proposal.

1. Title of Change: _____

2. Change Request No./Rev.: _____

3. Estimate for Change Proposal No./Rev.: _____

4. Acceptance of Estimate No./Rev.: _____

5. Brief Description of Change: _____

6. Other Terms and Conditions: In the event that we decide not to order the Change accepted, you shall be entitled to compensation for the cost of preparation of Change Proposal described in your Estimate for Change Proposal mentioned in para. 3 above in accordance with GCC Clause 39 of the General Conditions of Contract.

_____

(Employer's Name)

_____

(Signature)

_____

(Name and Title of signatory)

Annex 4. Change Proposal

(Contractor's Letterhead)

To: _____ Date: _____

Attention: _____

Contract Name: _____

Contract Number: _____

Dear Ladies and/or Gentlemen:

In response to your Request for Change Proposal No. _____, we hereby submit our proposal as follows:

1. Title of Change: _____
2. Change Proposal No./Rev.: _____
3. Originator of Change: Employer: [_____

   Contractor: _____
4. Brief Description of Change: _____
5. Reasons for Change: _____
6. Facilities and/or Item No. of Equipment related to the requested Change: _____
7. Reference drawings and/or technical documents for the requested Change:

   Drawing/Document No. Description
8. Estimate of increase/decrease to the Contract Price resulting from Change Proposal:[15]

   (Amount)

[15] Costs shall be in the currencies of the Contract.

(a) Direct material _____

(b) Major construction equipment _____

(c) Direct field labor (Total _____ hrs) _____

(d) Subcontracts _____

(e) Indirect material and labor _____

(f) Site supervision _____

(g) Head office technical staff salaries

Process engineer	_____ hrs @	_____ rate/hr	_____
Project engineer	_____ hrs @	_____ rate/hr	_____
Equipment engineer	_____ hrs @	_____ rate/hr	_____
Procurement	_____ hrs @	_____ rate/hr	_____
Draftsperson	_____ hrs @	_____ rate/hr	_____
Total	_____ hrs		_____

(h) Extraordinary costs (computer, travel, etc.) _____

(i) Fee for general administration, _____ % of Items _____

(j) Taxes and customs duties _____

Total lump sum cost of Change Proposal _____

(Sum of items (a) to (j))

Cost to prepare Estimate for Change Proposal _____

(Amount payable if Change is not accepted)

9. Additional time for Completion required due to Change Proposal

10. Effect on the Functional Guarantees

11. Effect on the other terms and conditions of the Contract

12. Validity of this Proposal: within *[Number]* days after receipt of this Proposal by the Employer

13. Other terms and conditions of this Change Proposal:

(a) You are requested to notify us of your acceptance, comments or rejection of this detailed Change Proposal within _____ days from your receipt of this Proposal.

(b) The amount of any increase and/or decrease shall be taken into account in the adjustment of the Contract Price.

(c) Contractor's cost for preparation of this Change Proposal:[2]

_____

(Contractor's Name)

_____

(Signature)

_____

(Name of signatory)

_____

(Title of signatory)

[2] Specify where necessary.

Annex 5. Change Order

(Employer's Letterhead)

To: _____ Date: _____

Attention: _____

Contract Name: _____

Contract Number: _____

Dear Ladies and/or Gentlemen:

We approve the Change Order for the work specified in the Change Proposal (No. _____), and agree to adjust the Contract Price, Time for Completion and/or other conditions of the Contract in accordance with GCC Clause 39 of the General Conditions of Contract.

1. Title of Change: _____
2. Change Request No./Rev.: _____
3. Change Order No./Rev.: _____
4. Originator of Change: Employer: _____

   Contractor: _____
5. Authorized Price:

   Ref. No.: _____ Date: _____

   Foreign currency portion _____ plus Local currency portion _____
6. Adjustment of Time for Completion

   None Increase _____ days Decrease _____ days
7. Other effects, if any

Authorized by: _____ Date: _____

(Employer)

Accepted by: _____ Date: _____

(Contractor)

Annex 6. Pending Agreement Change Order

(Employer's Letterhead)

To: _____ Date: _____

Attention:_____

Contract Name: _____

Contract Number: [_____

Dear Ladies and/or Gentlemen:

We instruct you to carry out the work in the Change Order detailed below in accordance with GCC Clause 39 of the General Conditions of Contract.

1. Title of Change: _____
2. Employer's Request for Change Proposal No./Rev.: _____dated: _____
3. Contractor's Change Proposal No./Rev.: _____ dated: _____
4. Brief Description of Change: _____
5. Facilities and/or Item No. of equipment related to the requested Change: _____
6. Reference Drawings and/or technical documents for the requested Change:

   Drawing/Document No. Description

7. Adjustment of Time for Completion:
8. Other change in the Contract terms:
9. Other terms and conditions:

_____

(Employer's Name)

_____

(Signature)

_____

(Name of signatory)

_____

(Title of signatory)

Annex 7. Application for Change Proposal

(Contractor's Letterhead)

To: _____ Date: _____

Attention: _____

Contract Name: _____

Contract Number: _____

Dear Ladies and/or Gentlemen:

We hereby propose that the below-mentioned work be treated as a Change in the Facilities.

1. Title of Change: _____

2. Application for Change Proposal No./Rev.: _____ dated: _____

3. Brief Description of Change: _____

4. Reasons for Change:

5. Order of Magnitude Estimation (in the currencies of the Contract):

6. Scheduled Impact of Change:

7. Effect on Functional Guarantees, if any:

8. Appendix:

_____

(Contractor's Name)

_____

(Signature)

_____

(Name of signatory)

_____

(Title of signatory)

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PART 3 – Conditions of Contract and Contract Forms

Section VIII - General Conditions of Contract

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General Conditions of Contract

A. Contract and Interpretation

1. Definitions

1.1 The following words and expressions shall have the meanings hereby assigned to them:

"Contract" means the Contract Agreement entered into between the Employer and the Contractor, together with the Contract Documents referred to therein; they shall constitute the Contract, and the term "the Contract" shall in all such documents be construed accordingly.

"Contract Documents" means the documents listed in Article 1.1 (Contract Documents) of the Contract Agreement (including any amendments thereto).

"GCC" means the General Conditions of Contract hereof.

"PCC" means the Particular Conditions of Contract.

"day" means calendar day.

"year" means 365 days.

"month" means calendar month.

"Party" means the Employer or the Contractor, as the context requires, and "Parties" means both of them.

"Employer" means the person **named as such in the PCC** and includes the legal successors or permitted assigns of the Employer.

"Project Manager" means the person appointed by the Employer in the manner provided in GCC Sub-Clause 17.1 (Project Manager) hereof and **named as such in the PCC** to perform the duties delegated by the Employer.

"Contractor" means the person(s) whose Bid to perform the Contract has been accepted by the Employer and is named as Contractor in the Contract Agreement, and includes the legal successors or permitted assigns of the Contractor.

"Contractor's Representative" means any person nominated by the Contractor and approved by the Employer in the manner provided in GCC Sub-Clause 17.2 (Contractor's Representative and Construction Manager) hereof to perform the duties delegated by the Contractor.

"Construction Manager" means the person appointed by the Contractor's Representative in the manner provided in GCC Sub-Clause 17.2.4.

"Subcontractor," including manufacturers, means any person to whom execution of any part of the Facilities, including preparation of any design or supply of any Plant, is sub-contracted directly or indirectly by the Contractor, and includes its legal successors or permitted assigns.

"Dispute Board" (DB) means the person or persons named as such in the PCC appointed by agreement between the Employer and the Contractor to make a decision with respect to any dispute or difference between the Employer and the Contractor referred to him or her by the Parties pursuant to GCC Sub-Clause 46.1 (Dispute Board) hereof.

"The Bank" means the financing institution **named in the PCC.**

"Contract Price" means the sum specified in Article 2.1 (Contract Price) of the Contract Agreement, subject to such additions and adjustments thereto or deductions therefrom, as may be made pursuant to the Contract.

"Facilities" means the Plant to be supplied and installed, as well as all the Installation Services to be carried out by the Contractor under the Contract.

"Plant" means permanent plant, equipment, machinery, apparatus, materials, articles and things of all kinds to be provided and incorporated in the Facilities by the Contractor under the Contract (including the spare parts to be supplied by the Contractor under GCC Sub-Clause 7.3 hereof), but does not include Contractor's Equipment.

"Installation Services" means all those services ancillary to the supply of the Plant for the Facilities, to be provided by the Contractor under the Contract, such as transportation and provision of marine or other similar insurance, inspection, expediting, site preparation works (including the provision and use of Contractor's Equipment and the supply of all construction materials required), installation, testing, precommissioning, commissioning, operations, maintenance, the provision of operations and maintenance manuals, training, etc… as the case may require.

"Contractor's Equipment" means all facilities, equipment, machinery, tools, apparatus, appliances or things of every kind required in or for installation, completion and maintenance of Facilities that are to be provided by the Contractor, but does not include Plant, or other things intended to form or forming part of the Facilities.

"Country of Origin" means the countries and territories eligible under the rules of the Bank as further **elaborated in the PCC.**

"Site" means the land and other places upon which the Facilities are to be installed, and such other land or places as may be specified in the Contract as forming part of the Site.

"Effective Date" means the date of fulfillment of all conditions stated in Article 3 (Effective Date) of the Contract Agreement, from which the Time for Completion shall be counted.

"Time for Completion" means the time within which Completion of the Facilities as a whole (or of a part of the Facilities where a separate Time for Completion of such part has been prescribed) is to be attained, as referred to in GCC Clause 8 and in accordance with the relevant provisions of the Contract.

"Completion" means that the Facilities (or a specific part thereof where specific parts are specified in the Contract) have been completed operationally and structurally and put in a tight and clean condition, that all work in respect of Precommissioning of the Facilities or such specific part thereof has been completed, and that the Facilities or specific part thereof are ready for Commissioning as provided in GCC Clause 24 (Completion) hereof.

"Precommissioning" means the testing, checking and other requirements specified in the Employer's Requirements that are to be carried out by the Contractor in preparation for Commissioning as provided in GCC Clause 24 (Completion) hereof.

"Commissioning" means operation of the Facilities or any part thereof by the Contractor following Completion, which operation is to be carried out by the Contractor as provided in GCC Sub-Clause 25.1 (Commissioning) hereof, for the purpose of carrying out Guarantee Test(s).

"Guarantee Test(s)" means the test(s) specified in the Employer's Requirements to be carried out to ascertain whether the Facilities or a specified part thereof is able to attain the Functional Guarantees specified in the Appendix to the Contract Agreement titled Functional Guarantees, in accordance with the provisions of GCC Sub-Clause 25.2 (Guarantee Test) hereof.

"Operational Acceptance" means the acceptance by the Employer of the Facilities (or any part of the Facilities where the Contract provides for acceptance of the Facilities in parts), which certifies the Contractor's fulfillment of the Contract in respect of Functional Guarantees of the Facilities (or the relevant part thereof) in accordance with the provisions

of GCC Clause 28 (Functional Guarantees) hereof and shall include deemed acceptance in accordance with GCC Clause 25 (Commissioning and Operational Acceptance) hereof.

"Defect Liability Period" means the period of validity of the warranties given by the Contractor commencing at Completion of the Facilities or a part thereof, during which the Contractor is responsible for defects with respect to the Facilities (or the relevant part thereof) as provided in GCC Clause 27 (Defect Liability) hereof.

"ES" means Environmental and Social (including Sexual Exploitation and Abuse (SEA), and Sexual Harassment (SH)).

"Sexual Exploitation and Abuse" "(SEA)" means the following:

Sexual Exploitation is defined as any actual or attempted abuse of position of vulnerability, differential power or trust, for sexual purposes, including, but not limited to, profiting monetarily, socially or politically from the sexual exploitation of another.

Sexual Abuse is defined as the actual or threatened physical intrusion of a sexual nature, whether by force or under unequal or coercive conditions.

"Sexual Harassment" "(SH)" is defined as unwelcome sexual advances, requests for sexual favors, and other verbal or physical conduct of a sexual nature by the Contractor's Personnel with other Contractor's Personnel or Employer's Personnel;

"Contractor's Personnel" means all personnel whom the Contractor utilizes in the execution of the Contract, including the staff, labor and other employees of the Contractor and each Subcontractor; and any other personnel assisting the Contractor in the execution of the Contract; and

"Employer's Personnel" means all staff, labor and other employees of the Project Manager and of the Employer engaged in fulfilling the Employer's obligations under the Contract; and any other personnel identified as Employer's Personnel, by a notice from the Employer to the Contractor.

2. Contract Documents

2.1 Subject to Article 1.2 (Order of Precedence) of the Contract Agreement, all documents forming part of the Contract (and all parts thereof) are intended to be correlative, complementary and mutually explanatory. The Contract shall be read as a whole.

3. Interpretation 3.1 In the Contract, except where the context requires otherwise:

(a) words indicating one gender include all genders;

(b) words indicating the singular also include the plural and words indicating the plural also include the singular;

(c) provisions including the word "agree," "agreed," or "agreement" require the agreement to be recorded in writing;

(d) the word "tender" is synonymous with "Bid," "tenderer," with "Bidder," and "tender documents" with "Bidding Document," and

(e) "written" or "in writing" means hand-written, type-written, printed or electronically made, and resulting in a permanent record.

The marginal words and other headings shall not be taken into consideration in the interpretation of these Conditions.

3.2 Incoterms

Unless inconsistent with any provision of the Contract, the meaning of any trade term and the rights and obligations of Parties thereunder shall be as prescribed by *Incoterms*.

Incoterms means international rules for interpreting trade terms published by the International Chamber of Commerce (latest edition), 38 Cours Albert 1er, 75008 Paris, France.

3.3 Entire Agreement

Subject to GCC Sub-Clause 16.4 hereof, the Contract constitutes the entire agreement between the Employer and Contractor with respect to the subject matter of Contract and supersedes all communications, negotiations and agreements (whether written or oral) of Parties with respect thereto made prior to the date of Contract.

3.4 Amendment

No amendment or other variation of the Contract shall be effective unless it is in writing, is dated, expressly refers to the Contract, and is signed by a duly authorized representative of each Party hereto.

3.5 Independent Contractor

The Contractor shall be an independent contractor performing the Contract. The Contract does not create any agency, partnership, joint venture or other joint relationship between the Parties hereto. Subject to the provisions of the Contract, the Contractor shall be solely responsible for the manner in which the Contract is performed. All employees, representatives or Subcontractors engaged by the Contractor in connection with the performance of the Contract shall be under the complete control of the Contractor and shall not be deemed to be employees of the Employer, and nothing contained in the Contract or in any subcontract awarded by the Contractor shall be construed to create any contractual relationship between any such employees, representatives or Subcontractors and the Employer.

3.6 Non-Waiver

3.6.1 Subject to GCC Sub-Clause 3.6.2 below, no relaxation, forbearance, delay or indulgence by either Party in enforcing any of the terms and conditions of the Contract or the granting of time by either Party to the other shall prejudice, affect or restrict the rights of that Party under the Contract, nor shall any waiver by either Party of any breach of Contract operate as waiver of any subsequent or continuing breach of Contract.

3.6.2 Any waiver of a Party's rights, powers or remedies under the Contract must be in writing, must be dated and signed by an authorized representative of the Party granting such waiver, and must specify the right and the extent to which it is being waived.

3.7 Severability

If any provision or condition of the Contract is prohibited or rendered invalid or unenforceable, such prohibition, invalidity or unenforceability shall not affect the validity or enforceability of any other provisions and conditions of the Contract.

3.8 Country of Origin

"Origin" means the place where the plant and component parts thereof are mined, grown, produced or manufactured, and from which the services are provided. Plant components are produced when, through manufacturing, processing, or substantial or major assembling of components, a commercially recognized product results that is substantially different in its basic characteristics or in purpose or utility from its components.

4. Communications

4.1 Wherever these Conditions provide for the giving or issuing of approvals, certificates, consents, determinations, notices, requests and discharges, these communications shall be:

(a) in writing and delivered against receipt; and

(b) delivered, sent or transmitted to the address for the recipient's communications as stated in the Contract Agreement.

When a certificate is issued to a Party, the certifier shall send a copy to the other Party. When a notice is issued to a Party, by the other Party or the Project Manager, a copy shall be sent to the Project Manager or the other Party, as the case may be.

5. Law and Language

5.1 The Contract shall be governed by and interpreted in accordance with laws of the country **specified in the PCC.**

5.2 The ruling language of the Contract shall be that **stated in the PCC.**

5.3 The language for communications shall be the ruling language unless otherwise **stated in the PCC.**

6. Fraud and Corruption

6.1 The Bank requires compliance with the Bank's Anti-Corruption Guidelines and its prevailing sanctions policies and procedures as set forth in the WBG's Sanctions Framework, as set forth in Appendix B to the GCC.

6.2 The Employer requires the Contractor to disclose any commissions or fees that may have been paid or are to be paid to agents or any other party with respect to the Bidding process or execution of the Contract. The information disclosed must include at least the name and address of the agent or other party, the amount and currency, and the purpose of the commission, gratuity or fee.

B. Subject Matter of Contract

7. Scope of Facilities

7.1 Unless otherwise expressly limited in the Employer's Requirements, the Contractor's obligations cover the provision of all Plant and the performance of all Installation Services required for the design, and the manufacture (including procurement, quality assurance, construction, installation, associated civil works, Precommissioning and delivery) of the Plant, and the installation, completion and commissioning of the Facilities in accordance with the plans, procedures, specifications, drawings, codes and any other documents as specified in the Section, Employer's Requirements. Such specifications include, but are not limited to, the provision of supervision and engineering services; the supply of labor, materials, equipment, spare parts (as specified in GCC Sub-Clause 7.3 below) and accessories; Contractor's Equipment; construction utilities and supplies; temporary materials, structures and facilities; transportation (including, without limitation, unloading and hauling to, from and at the Site); and storage, except for those supplies, works and services that will be provided or performed by the Employer, as set forth in the Appendix to the Contract Agreement titled Scope of Works and Supply by the Employer.

7.2 The Contractor shall, unless specifically excluded in the Contract, perform all such work and/or supply all such items and materials not specifically mentioned in the Contract but that can be reasonably inferred from the Contract as being required for attaining Completion of the Facilities as if such work and/or items and materials were expressly mentioned in the Contract.

7.3 In addition to the supply of Mandatory Spare Parts included in the Contract, the Contractor agrees to supply spare parts required for the operation and maintenance of the Facilities for the period **specified in the PCC** and the provisions, if any, **specified in the PCC.** However, the identity, specifications and quantities of such spare parts and the terms and conditions relating to the supply thereof are to be agreed between the Employer and the Contractor, and the price of such spare parts shall be that given in Price Schedule No. 6, which shall be added to the Contract Price. The price of such spare parts shall include the purchase price therefor and other costs and expenses (including the Contractor's fees) relating to the supply of spare parts.

8. Time for Commencement and Completion

8.1 The Contractor shall commence work on the Facilities within the period **specified in the PCC** and without prejudice to GCC Sub-Clause 9.9 and 26.2 hereof, the Contractor shall thereafter proceed with the Facilities in accordance with the time schedule specified in the Appendix to the Contract Agreement titled Time Schedule.

8.2 The Contractor shall attain Completion of the Facilities or of a part where a separate time for Completion of such part is specified in the Contract, within the time **stated in the PCC** or within such extended time to which the Contractor shall be entitled under GCC Clause 40 hereof.

9. Contractor's Responsibilities

9.1 The Contractor shall design, manufacture including associated purchases and/or subcontracting, install and complete the Facilities in accordance with the Contract. When completed, the Facilities should be fit for the purposes for which they are intended as defined in the Contract.

9.2 The Contractor confirms that it has entered into this Contract on the basis of a proper examination of the data relating to the Facilities including any data as to boring tests provided by the Employer, and on the basis of information that the Contractor could have obtained from a visual inspection of the Site if access thereto was available and of other data readily available to it relating to the Facilities as of the date twenty-eight (28) days prior to Bid submission. The Contractor acknowledges that any failure to acquaint itself with all such data and information shall not relieve its responsibility for properly estimating the difficulty or cost of successfully performing the Facilities.

9.3 The Contractor shall acquire and pay for all permits, approvals and/or licenses from all local, state or national government authorities or public service undertakings in the country where the Site is located which such authorities or undertakings require the Contractor to obtain in its name and which are necessary for the performance of the Contract, including, without limitation, visas for the Contractor's and Subcontractor's personnel and entry permits for all imported Contractor's Equipment. The Contractor shall acquire all other permits, approvals and/or licenses that are not the responsibility of the Employer under GCC Sub-Clause 10.3 hereof and that are necessary for the performance of the Contract.

9.4 The Contractor shall comply with all laws in force in the country where the Facilities are to be implemented. The laws will include all local, state, national or other laws that affect the performance of the

Contract and bind upon the Contractor. The Contractor shall indemnify and hold harmless the Employer from and against any and all liabilities, damages, claims, fines, penalties and expenses of whatever nature arising or resulting from the violation of such laws by the Contractor or its personnel, including the Subcontractors and their personnel, but without prejudice to GCC Sub-Clause 10.1 hereof.

9.5 Any Plant and Installation Services that will be incorporated in or be required for the Facilities and other supplies shall have their origin as specified under GCC Clause 1 (Country of Origin). Any subcontractors retained by the Contractor shall be from a country as specified in GCC Clause 1 (Country of Origin).

9.6 If the Contractor is a joint venture, or association (JV) of two or more persons, all such persons shall be jointly and severally bound to the Employer for the fulfillment of the provisions of the Contract, and shall designate one of such persons to act as a leader with authority to bind the JV. The composition or the constitution of the JV shall not be altered without the prior consent of the Employer.

9.7 Pursuant to paragraph 2.2 e. of Appendix B to the General Conditions the Contractor shall permit and shall cause its agents (where declared or not), subcontractors, subconsultants, service providers, suppliers, and personnel, to permit, the Bank and/or persons appointed by the Bank to inspect the site and/or the accounts, records and other documents relating to the procurement process, selection and/or contract execution, and to have such accounts, records and other documents audited by auditors appointed by the Bank. The Contractor's and its Subcontractors' and subconsultants' attention is drawn to Sub-Clause 6.1 (Fraud and Corruption) which provides, inter alia, that acts intended to materially impede the exercise of the Bank's inspection and audit rights constitute a prohibited practice subject to contract termination (as well as to a determination of ineligibility pursuant to the Bank's prevailing sanctions procedures).

9.8 The Contractor shall conform to the sustainable procurement contractual provisions, if and as specified **in the PCC**.

9.9 Contractor's Environmental and Social Management Plan (C-ESMP)

The Contractor shall not carry out mobilization to Site unless the Project Manager gives approval, an approval that shall not be unreasonably delayed, to the measures the Contractor proposes to address environmental and social risks and impacts including the code of conduct, in accordance with GCC Sub-Clause 22.4.

The Contractor shall submit, to the Project Manager for Review, any additional Management Strategies and Implementation Plans as are

necessary to manage the ES risks and impacts of the Facilities. These Management Strategies and Implementation Plans collectively comprise the Contractor's Environmental and Social Management Plan (C-ESMP).

The Contractor shall review the C-ESMP, periodically (but not less than every six (6) months), and update it as required to ensure that it contains measures appropriate to the Facilities. The updated C-ESMP shall be submitted to the Project Manager for its approval.

9.10 Training of Contractor's Personnel

The Contractor shall provide appropriate training to relevant Contractor's Personnel on ES aspects of the Contract, including appropriate sensitization on prohibition of SEA and health and safety training referred to in GCC Sub-Clause 22.2.7.

As stated in the Employer's Requirements or as instructed by the Project Manager, the Contractor shall also allow appropriate opportunities for the relevant Contractor's Personnel to be trained on ES aspects of the Contract by the Employer's personnel and/or other personnel assigned by the Employer.

The Contractor shall provide training on SEA and SH, including its prevention, to any of its personnel who has a role to supervise other Contractor's Personnel.

10. Employer's Responsibilities

10.1 All information and/or data to be supplied by the Employer as described in the Appendix to the Contract Agreement titled Scope of Works and Supply by the Employer, shall be deemed to be accurate, except when the Employer expressly states otherwise.

10.2 The Employer shall be responsible for acquiring and providing legal and physical possession of the Site and access thereto, and for providing possession of and access to all other areas reasonably required for the proper execution of the Contract, including all requisite rights of way, as specified in the Appendix to the Contract Agreement titled Scope of Works and Supply by the Employer. The Employer shall give full possession of and accord all rights of access thereto on or before the date(s) specified in that Appendix.

10.3 The Employer shall acquire and pay for all permits, approvals and/or licenses from all local, state or national government authorities or public service undertakings in the country where the Site is located which (a) such authorities or undertakings require the Employer to obtain in the Employer's name, (b) are necessary for the execution of the Contract, including those required for the performance by both the Contractor and the Employer of their respective obligations under the

Contract, and (c) are specified in the Appendix (Scope of Works and Supply by the Employer).

10.4 If requested by the Contractor, the Employer shall use its best endeavors to assist the Contractor in obtaining in a timely and expeditious manner all permits, approvals and/or licenses necessary for the execution of the Contract from all local, state or national government authorities or public service undertakings that such authorities or undertakings require the Contractor or Subcontractors or the personnel of the Contractor or Subcontractors, as the case may be, to obtain.

10.5 Unless otherwise specified in the Contract or agreed upon by the Employer and the Contractor, the Employer shall provide sufficient, properly qualified operating and maintenance personnel; shall supply and make available all raw materials, utilities, lubricants, chemicals, catalysts, other materials and facilities; and shall perform all work and services of whatsoever nature, including those required by the Contractor to properly carry out Precommissioning, Commissioning and Guarantee Tests, all in accordance with the provisions of the Appendix to the Contract Agreement titled Scope of Works and Supply by the Employer, at or before the time specified in the program furnished by the Contractor under GCC Sub-Clause 18.2 hereof and in the manner thereupon specified or as otherwise agreed upon by the Employer and the Contractor.

10.6 The Employer shall be responsible for the continued operation of the Facilities after Completion, in accordance with GCC Sub-Clause 24.8, and shall be responsible for facilitating the Guarantee Test(s) for the Facilities, in accordance with GCC Sub-Clause 25.2.

10.7 All costs and expenses involved in the performance of the obligations under this GCC Clause 10 shall be the responsibility of the Employer, save those to be incurred by the Contractor with respect to the performance of Guarantee Tests, in accordance with GCC Sub-Clause 25.2.

10.8 In the event that the Employer shall be in breach of any of his obligations under this Clause, the additional cost incurred by the Contractor in consequence thereof shall be determined by the Project Manager and added to the Contract Price.

C. Payment

11. Contract Price

11.1 The Contract Price shall be as specified in Article 2 (Contract Price and Terms of Payment) of the Contract Agreement.

11.2 Unless an adjustment clause is **provided for in the PCC,** the Contract Price shall be a firm lump sum not subject to any alteration, except in the event of a Change in the Facilities or as otherwise provided in the Contract.

11.3 Subject to GCC Sub-Clauses 9.2, 10.1 and 35 hereof, the Contractor shall be deemed to have satisfied itself as to the correctness and sufficiency of the Contract Price, which shall, except as otherwise provided for in the Contract, cover all its obligations under the Contract.

12. Terms of Payment

12.1 The Contract Price shall be paid as specified in Article 2 (Contract Price and Terms of Payment) of the Contract Agreement and in the Appendix to the Contract Agreement titled Terms and Procedures of Payment, which also outlines the procedures to be followed in making application for and processing payments.

12.2 No payment made by the Employer herein shall be deemed to constitute acceptance by the Employer of the Facilities or any part(s) thereof.

12.3 In the event that the Employer fails to make any payment by its respective due date or within the period set forth in the Contract, the Employer shall pay to the Contractor interest on the amount of such delayed payment at the rate(s) shown in the Appendix to the Contract Agreement titled Terms and Procedures of Payment, for the period of delay until payment has been made in full, whether before or after judgment or arbitrage award.

12.4 The currency or currencies in which payments are made to the Contractor under this Contract shall be specified in the Appendix to the Contract Agreement titled Terms and Procedures of Payment, subject to the general principle that payments will be made in the currency or currencies in which the Contract Price has been stated in the Contractor's Bid.

13. Securities

13.1 <u>Issuance of Securities</u>

The Contractor shall provide the securities specified below in favor of the Employer at the times, and in the amount, manner and form specified below.

13.2 Advance Payment Security

13.2.1 The Contractor shall, within twenty-eight (28) days of the notification of contract award, provide a security in an amount equal to the advance payment calculated in accordance with the Appendix to the Contract Agreement titled Terms and Procedures of Payment, and in the same currency or currencies.

13.2.2 The security shall be in the form provided in the Bidding documents or in another form acceptable to the Employer. The amount of the security shall be reduced in proportion to the value of the Facilities executed by and paid to the Contractor from time to time, and shall automatically become null and void when the full amount of the advance payment has been recovered by the Employer. The security shall be returned to the Contractor immediately after its expiration.

13.3 Performance Security

13.3.1 The Contractor shall, within twenty-eight (28) days of the notification of contract award, provide a security for the due performance of the Contract in the amount **specified in the PCC.**

13.3.2 The Performance Security shall be denominated in the currency or currencies of the Contract, or in a freely convertible currency acceptable to the Employer, and shall be in the form provided in Section X, Contract Forms, corresponding to the type of bank guarantee stipulated by the Employer **in the PCC**, or in another form acceptable to the Employer.

13.3.3 Unless otherwise specified **in the PCC**, the security shall be reduced by half on the date of the Operational Acceptance. The Security shall become null and void, or shall be reduced pro rata to the Contract Price of a part of the Facilities for which a separate Time for Completion is provided, five hundred and forty (540) days after Completion of the Facilities or three hundred and sixty five (365) days after Operational Acceptance of the Facilities, whichever occurs first; provided, however, that if the Defects Liability Period has been extended on any part of the Facilities pursuant to GCC Sub-Clause 27.8 hereof, the Contractor shall issue an additional security in an amount proportionate to the Contract Price of that part. The security shall be returned to the Contractor immediately after its expiration, provided, however, that if the Contractor, pursuant to GCC Sub-Clause 27.10, is liable for an extended defect liability obligation, the Performance Security shall be extended

for the period specified **in the PCC** pursuant to GCC Sub-Clause 27.10 and up to the amount specified **in the PCC**.

13.3.4 The Employer shall not make a claim under the Performance Security, except for amounts to which the Employer is entitled under the Contract. The Employer shall indemnify and hold the Contractor harmless against and from all damages, losses and expenses (including legal fees and expenses) resulting from a claim under the Performance Security to the extent to which the Employer was not entitled to make the claim.

14. Taxes and Duties

14.1 Except as otherwise specifically provided in the Contract, the Contractor shall bear and pay all taxes, duties, levies and charges assessed on the Contractor, its Subcontractors or their employees by all municipal, state or national government authorities in connection with the Facilities in and outside of the country where the Site is located.

14.2 Notwithstanding GCC Sub-Clause 14.1 above, the Employer shall bear and promptly pay

(a) all customs and import duties for the Plant specified in Price Schedule No. 1; and

(b) other domestic taxes such as, sales tax and value added tax (VAT) on the Plant specified in Price Schedules No. 1 and No. 2 and that is to be incorporated into the Facilities, and on the finished goods, imposed by the law of the country where the Site is located.

14.3 If any tax exemptions, reductions, allowances or privileges may be available to the Contractor in the country where the Site is located, the Employer shall use its best endeavors to enable the Contractor to benefit from any such tax savings to the maximum allowable extent.

14.4 For the purpose of the Contract, it is agreed that the Contract Price specified in Article 2 (Contract Price and Terms of Payment) of the Contract Agreement is based on the taxes, duties, levies and charges prevailing at the date twenty-eight (28) days prior to the date of Bid submission in the country where the Site is located (hereinafter called "Tax" in this GCC Sub-Clause 14.4). If any rates of Tax are increased or decreased, a new Tax is introduced, an existing Tax is abolished, or any change in interpretation or application of any Tax occurs in the course of the performance of Contract, which was or will be assessed on the Contractor, Subcontractors or their employees in connection with performance of the Contract, an equitable

adjustment of the Contract Price shall be made to fully take into account any such change by addition to the Contract Price or deduction therefrom, as the case may be, in accordance with GCC Clause 36 hereof.

D. Intellectual Property

15. License/Use of Technical Information

15.1 For the operation and maintenance of the Plant, the Contractor hereby grants a non-exclusive and non-transferable license (without the right to sub-license) to the Employer under the patents, utility models or other industrial property rights owned by the Contractor or by a third Party from whom the Contractor has received the right to grant licenses thereunder, and shall also grant to the Employer a non-exclusive and non-transferable right (without the right to sub-license) to use the know-how and other technical information disclosed to the Employer under the Contract. Nothing contained herein shall be construed as transferring ownership of any patent, utility model, trademark, design, copyright, know-how or other intellectual property right from the Contractor or any third Party to the Employer.

15.2 The copyright in all drawings, documents and other materials containing data and information furnished to the Employer by the Contractor herein shall remain vested in the Contractor or, if they are furnished to the Employer directly or through the Contractor by any third Party, including suppliers of materials, the copyright in such materials shall remain vested in such third Party.

16. Confidential Information

16.1 The Employer and the Contractor shall keep confidential and shall not, without the written consent of the other Party hereto, divulge to any third Party any documents, data or other information furnished directly or indirectly by the other Party hereto in connection with the Contract, whether such information has been furnished prior to, during or following termination of the Contract. Notwithstanding the above, the Contractor may furnish to its Subcontractor(s) such documents, data and other information it receives from the Employer to the extent required for the Subcontractor(s) to perform its work under the Contract, in which event the Contractor shall obtain from such Subcontractor(s) an undertaking of confidentiality similar to that imposed on the Contractor under this GCC Clause 16.

16.2 The Employer shall not use such documents, data and other information received from the Contractor for any purpose other than the operation and maintenance of the Facilities. Similarly, the

Contractor shall not use such documents, data and other information received from the Employer for any purpose other than the design, procurement of Plant, construction or such other work and services as are required for the performance of the Contract.

16.3 The obligation of a Party under GCC Sub-Clauses 16.1 and 16.2 above, however, shall not apply to that information which

(a) now or hereafter enters the public domain through no fault of that Party

(b) can be proven to have been possessed by that Party at the time of disclosure and which was not previously obtained, directly or indirectly, from the other Party hereto

(c) otherwise lawfully becomes available to that Party from a third Party that has no obligation of confidentiality.

(d) is being provided to the Bank.

16.4 The above provisions of this GCC Clause 16 shall not in any way modify any undertaking of confidentiality given by either of the Parties hereto prior to the date of the Contract in respect of the Facilities or any part thereof.

16.5 The provisions of this GCC Clause 16 shall survive termination, for whatever reason, of the Contract.

E. Execution of the Facilities

17. Representatives

17.1 Project Manager

If the Project Manager is not named in the Contract, then within fourteen (14) days of the Effective Date, the Employer shall appoint and notify the Contractor in writing of the name of the Project Manager. The Employer may from time to time appoint some other person as the Project Manager in place of the person previously so appointed, and shall give a notice of the name of such other person to the Contractor without delay. No such appointment shall be made at such a time or in such a manner as to impede the progress of work on the Facilities. Such appointment shall only take effect upon receipt of such notice by the Contractor. The Project Manager shall represent and act for the Employer at all times during the performance of the Contract. All notices, instructions, orders, certificates, approvals and all other communications under the Contract

shall be given by the Project Manager, except as herein otherwise provided.

All notices, instructions, information and other communications given by the Contractor to the Employer under the Contract shall be given to the Project Manager, except as herein otherwise provided.

17.2 Contractor's Representative & Construction Manager

17.2.1 If the Contractor's Representative is not named in the Contract, then within fourteen (14) days of the Effective Date, the Contractor shall appoint the Contractor's Representative and shall request the Employer in writing to approve the person so appointed. If the Employer makes no objection to the appointment within fourteen (14) days, the Contractor's Representative shall be deemed to have been approved. If the Employer objects to the appointment within fourteen (14) days giving the reason therefor, then the Contractor shall appoint a replacement within fourteen (14) days of such objection, and the foregoing provisions of this GCC Sub-Clause 17.2.1 shall apply thereto.

17.2.2 The Contractor's Representative shall represent and act for the Contractor at all times during the performance of the Contract and shall give to the Project Manager all the Contractor's notices, instructions, information and all other communications under the Contract.

All notices, instructions, information and all other communications given by the Employer or the Project Manager to the Contractor under the Contract shall be given to the Contractor's Representative or, in its absence, its deputy, except as herein otherwise provided.

The Contractor shall not revoke the appointment of the Contractor's Representative without the Employer's prior written consent, which shall not be unreasonably withheld. If the Employer consents thereto, the Contractor shall appoint some other person as the Contractor's Representative, pursuant to the procedure set out in GCC Sub-Clause 17.2.1.

17.2.3 The Contractor's Representative may, subject to the approval of the Employer which shall not be unreasonably withheld, at any time delegate to any person any of the powers, functions and authorities vested in him or her. Any such delegation may

be revoked at any time. Any such delegation or revocation shall be subject to a prior notice signed by the Contractor's Representative, and shall specify the powers, functions and authorities thereby delegated or revoked. No such delegation or revocation shall take effect unless and until a copy thereof has been delivered to the Employer and the Project Manager.

Any act or exercise by any person of powers, functions and authorities so delegated to him or her in accordance with this GCC Sub-Clause 17.2.3 shall be deemed to be an act or exercise by the Contractor's Representative.

17.2.4 From the commencement of installation of the Facilities at the Site until Completion, the Contractor's Representative shall appoint a suitable person as the Construction Manager. The Construction Manager shall supervise all work done at the Site by the Contractor and shall be present at the Site throughout normal working hours except when on leave, sick or absent for reasons connected with the proper performance of the Contract. Whenever the Construction Manager is absent from the Site, a suitable person shall be appointed to act as the Construction Manager's deputy.

17.2.5 The Project Manager may require the Contractor to remove (or cause to be removed) the Contractor's Representative or any other person employed by the Contractor in the execution of the Contract, who:

(a) persists in any misconduct or lack of care;

(b) carries out duties incompetently or negligently;

(c) fails to comply with any provision of the Contract;

(d) persists in any conduct which is prejudicial to safety, health, or the protection of the environment;

(e) based on reasonable evidence, is determined to have engaged in Fraud and Corruption during the execution of the Contract;

(f) has been recruited from the Employer's Personnel in breach of GCC Sub-Clause 22.2.2;

(g) undertakes behavior which breaches the Code of Conduct (ES), as applicable;

If appropriate, the Contractor shall then promptly appoint (or cause to be appointed) a suitable replacement with equivalent skills and experience.

Notwithstanding any requirement from the Project Manager to remove or cause to remove any person, the Contractor shall take immediate action as appropriate in response to any violation of (a) through (g) above. Such immediate action shall include removing (or causing to be removed) from the Site or other places where the Contract is being executed, any Contractor's Personnel who engages in (a), (b), (c), (d), (e) or (g) above or has been recruited as stated in (f) above.

17.2.6 If any representative or person employed by the Contractor is removed in accordance with GCC Sub-Clause 17.2.5, the Contractor shall, where required, promptly appoint a suitable replacement with equivalent skills and experience.

18. Work Program

18.1 Contractor's Organization

The Contractor shall supply to the Employer and the Project Manager a chart showing the proposed organization to be established by the Contractor for carrying out work on the Facilities within twenty-one (21) days of the Effective Date. The chart shall include the identities of the key personnel and the curricula vitae of such key personnel to be employed shall be supplied together with the chart. The Contractor shall promptly inform the Employer and the Project Manager in writing of any revision or alteration of such an organization chart.

18.2 Program of Performance

Within twenty-eight (28) days after the Effective Date, the Contractor shall submit to the Project Manager a detailed program of performance of the Contract, made in a form acceptable to the Project Manager and showing the sequence in which it proposes to design, manufacture, transport, assemble, install and precommission the Facilities, as well as the date by which the Contractor reasonably requires that the Employer shall have fulfilled its obligations under the Contract so as to enable the Contractor to execute the Contract in accordance with the program and to achieve Completion, Commissioning and Acceptance of the Facilities in accordance with the Contract. The program so submitted by the Contractor shall accord with the Time Schedule included in the Appendix to the Contract Agreement titled Time Schedule, and any other dates and periods specified in the Contract. The Contractor shall update and revise the program as and when appropriate or when required by the Project Manager, but without modification in

the Times for Completion specified in the PCC pursuant to Sub-Clause 8.2 and any extension granted in accordance with GCC Clause 40, and shall submit all such revisions to the Project Manager.

18.3 Progress Report

The Contractor shall monitor progress of all the activities specified in the program referred to in GCC Sub-Clause 18.2 above, and supply a progress report to the Project Manager every month.

The progress report shall be in a form acceptable to the Project Manager and shall indicate: (a) percentage completion achieved compared with the planned percentage completion for each activity; and (b) where any activity is behind the program, giving comments and likely consequences and stating the corrective action being taken.

Unless otherwise stated in the Specifications, each progress report shall include the Environmental and Social (ES) metrics set out in Appendix C.

In addition to the progress reports, the Contractor shall inform the Project Manager immediately of any allegation, incident or accident in the Site, which has or is likely to have a significant adverse effect on the environment, the affected communities, the public, Employer's Personnel or Contractor's Personnel. This includes, but is not limited to, any incident or accident causing fatality or serious injury; significant adverse effects or damage to private property; or any allegation of SEA and/or SH. In case of SEA and/or SH, while maintaining confidentiality as appropriate, the type of allegation (sexual exploitation, sexual abuse or sexual harassment), gender and age of the person who experienced the alleged incident should be included in the information.

The Contractor, upon becoming aware of the allegation, incident or accident, shall also immediately inform the Project Manager of any such incident or accident on the Subcontractors' or suppliers' premises relating to the Facilities which has or is likely to have a significant adverse effect on the environment, the affected communities, the public, Employer's Personnel, or Contractor's, its Subcontractors' and suppliers' personnel. The notification shall provide sufficient detail regarding such incidents or accidents. The Contractor shall provide full details of such incidents or accidents to the Project

Manager within the timeframe agreed with the Project Manager.

The Contractor shall require its Subcontractors and suppliers to immediately notify the Contractor of any incidents or accidents referred to in this Subclause.

18.4 Progress of Performance

If at any time the Contractor's actual progress falls behind the program referred to in GCC Sub-Clause 18.2, or it becomes apparent that it will so fall behind, the Contractor shall, at the request of the Employer or the Project Manager, prepare and submit to the Project Manager a revised program, taking into account the prevailing circumstances, and shall notify the Project Manager of the steps being taken to expedite progress so as to attain Completion of the Facilities within the Time for Completion under GCC Sub-Clause 8.2, any extension thereof entitled under GCC Sub-Clause 40.1, or any extended period as may otherwise be agreed upon between the Employer and the Contractor.

18.5 Procedures

The Contract shall be executed in accordance with the Contract Documents including the procedures given in the Forms and Procedures of the Employer's Requirements.

The Contractor may execute the Contract in accordance with its own standard project execution plans and procedures to the extent that they do not conflict with the provisions contained in the Contract.

19. Subcontracting

19.1 The Appendix to the Contract Agreement titled List of Major Items of Plant and Installation Services and List of Approved Subcontractors, specifies major items of supply or services and a list of approved Subcontractors against each item, including manufacturers. Insofar as no Subcontractors are listed against any such item, the Contractor shall prepare a list of Subcontractors for such item for inclusion in such list. The Contractor may from time to time propose any addition to or deletion from any such list. The Contractor shall submit any such list or any modification thereto to the Employer for its approval in sufficient time so as not to impede the progress of work on the Facilities. Such approval by the Employer for any

of the Subcontractors shall not relieve the Contractor from any of its obligations, duties or responsibilities under the Contract.

19.2 The Contractor shall select and employ its Subcontractors for such major items from those listed in the lists referred to in GCC Sub-Clause 19.1.

19.3 For items or parts of the Facilities not specified in the Appendix to the Contract Agreement titled List of Major Items of Plant and Installation Services and List of Approved Subcontractors, the Contractor may employ such Subcontractors as it may select, at its discretion.

19.4 Each sub-contract shall include provisions which would entitle the Employer to require the sub-contract to be assigned to the Employer under GCC 19.5 (if and when applicable), or in event of termination by the Employer under GCC 42.2.

19.5 If a subcontractor's obligations extend beyond the expiry date of the relevant Defects Liability Period and the Project Manager, prior to that date, instructs the Contractor to assign the benefits of such obligations to the Employer, then the Contractor shall do so.

19.6 The Contractor shall require that its Subcontractors execute the Facilities in accordance with the Contract, including complying with the relevant ES requirements and the obligations set out in GCC Sub-Clause 22.4.

20. Design and Engineering

20.1 Specifications and Drawings

20.1.1 The Contractor shall execute the basic and detailed design and the engineering work in compliance with the provisions of the Contract, or where not so specified, in accordance with good engineering practice.

The Contractor shall be responsible for any discrepancies, errors or omissions in the specifications, drawings and other technical documents that it has prepared, whether such specifications, drawings and other documents have been approved by the Project Manager or not, provided that such discrepancies, errors or omissions are not because of inaccurate information furnished in writing to the Contractor by or on behalf of the Employer.

20.1.2 The Contractor shall be entitled to disclaim responsibility for any design, data, drawing, specification or other document, or

any modification thereof provided or designated by or on behalf of the Employer, by giving a notice of such disclaimer to the Project Manager.

20.2 Codes and Standards

Wherever references are made in the Contract to codes and standards in accordance with which the Contract shall be executed, the edition or the revised version of such codes and standards current at the date twenty-eight (28) days prior to date of Bid submission shall apply unless otherwise specified. During Contract execution, any changes in such codes and standards shall be applied subject to approval by the Employer and shall be treated in accordance with GCC Clause 39.

20.3 Approval/Review of Technical Documents by Project Manager

20.3.1 The Contractor shall prepare or cause its Subcontractors to prepare, and furnish to the Project Manager the documents listed in the Appendix to the Contract Agreement titled List of Documents for Approval or Review, for its approval or review as specified and in accordance with the requirements of GCC Sub-Clause 18.2 (Program of Performance).

Any part of the Facilities covered by or related to the documents to be approved by the Project Manager shall be executed only after the Project Manager's approval thereof.

GCC Sub-Clauses 20.3.2 through 20.3.7 shall apply to those documents requiring the Project Manager's approval, but not to those furnished to the Project Manager for its review only.

20.3.2 Within fourteen (14) days after receipt by the Project Manager of any document requiring the Project Manager's approval in accordance with GCC Sub-Clause 20.3.1, the Project Manager shall either return one copy thereof to the Contractor with its approval endorsed thereon or shall notify the Contractor in writing of its disapproval thereof and the reasons therefor and the modifications that the Project Manager proposes.

If the Project Manager fails to take such action within the said fourteen (14) days, then the said document shall

be deemed to have been approved by the Project Manager.

20.3.3 The Project Manager shall not disapprove any document, except on the grounds that the document does not comply with the Contract or that it is contrary to good engineering practice.

20.3.4 If the Project Manager disapproves the document, the Contractor shall modify the document and resubmit it for the Project Manager's approval in accordance with GCC Sub-Clause 20.3.2. If the Project Manager approves the document subject to modification(s), the Contractor shall make the required modification(s), whereupon the document shall be deemed to have been approved.

20.3.5 If any dispute or difference occurs between the Employer and the Contractor in connection with or arising out of the disapproval by the Project Manager of any document and/or any modification(s) thereto that cannot be settled between the Parties within a reasonable period, then such dispute or difference may be referred to a Dispute Board for determination in accordance with GCC Sub-Clause 46.1 hereof. If such dispute or difference is referred to a Dispute Board, the Project Manager shall give instructions as to whether and if so, how, performance of the Contract is to proceed. The Contractor shall proceed with the Contract in accordance with the Project Manager's instructions, provided that if the Dispute Board upholds the Contractor's view on the dispute and if the Employer has not given notice under GCC Sub-Clause 46.3 hereof, then the Contractor shall be reimbursed by the Employer for any additional costs incurred by reason of such instructions and shall be relieved of such responsibility or liability in connection with the dispute and the execution of the instructions as the Dispute Board shall decide, and the Time for Completion shall be extended accordingly.

20.3.6 The Project Manager's approval, with or without modification of the document furnished by the Contractor, shall not relieve the Contractor of any responsibility or liability imposed upon it by any provisions of the Contract except to the extent that any

subsequent failure results from modifications required by the Project Manager.

20.3.7 The Contractor shall not depart from any approved document unless the Contractor has first submitted to the Project Manager an amended document and obtained the Project Manager's approval thereof, pursuant to the provisions of this GCC Sub-Clause 20.3.

If the Project Manager requests any change in any already approved document and/or in any document based thereon, the provisions of GCC Clause 39 shall apply to such request.

21. Procurement

21.1 Plant

Subject to GCC Sub-Clause 14.2, the Contractor shall procure and transport all Plant in an expeditious and orderly manner to the Site.

21.2 Employer-Supplied Plant

If the Appendix to the Contract Agreement titled Scope of Works and Supply by the Employer, provides that the Employer shall furnish any specific items to the Contractor, the following provisions shall apply:

21.2.1 The Employer shall, at its own risk and expense, transport each item to the place on or near the Site as agreed upon by the Parties and make such item available to the Contractor at the time specified in the program furnished by the Contractor, pursuant to GCC Sub-Clause 18.2, unless otherwise mutually agreed.

21.2.2 Upon receipt of such item, the Contractor shall inspect the same visually and notify the Project Manager of any detected shortage, defect or default. The Employer shall immediately remedy any shortage, defect or default, or the Contractor shall, if practicable and possible, at the request of the Employer, remedy such shortage, defect or default at the Employer's cost and expense. After inspection, such item shall fall under the care, custody and control of the Contractor. The provision of this GCC Sub-Clause 21.2.2 shall apply to any item supplied to remedy any such shortage or default or to substitute for any defective item, or shall apply to defective items that have been repaired.

21.2.3 The foregoing responsibilities of the Contractor and its obligations of care, custody and control shall not relieve the Employer of liability for any undetected shortage, defect or default, nor place the Contractor under any liability for any such shortage, defect or default whether under GCC Clause 27 or under any other provision of Contract.

21.3 Transportation

21.3.1 The Contractor shall at its own risk and expense transport all the materials and the Contractor's Equipment to the Site by the mode of transport that the Contractor judges most suitable under all the circumstances.

21.3.2 Unless otherwise provided in the Contract, the Contractor shall be entitled to select any safe mode of transport operated by any person to carry the materials and the Contractor's Equipment.

21.3.3 Upon dispatch of each shipment of materials and the Contractor's Equipment, the Contractor shall notify the Employer by telex, cable, facsimile or electronic means, of the description of the materials and of the Contractor's Equipment, the point and means of dispatch, and the estimated time and point of arrival in the country where the Site is located, if applicable, and at the Site. The Contractor shall furnish the Employer with relevant shipping documents to be agreed upon between the Parties.

21.3.4 The Contractor shall be responsible for obtaining, if necessary, approvals from the authorities for transportation of the materials and the Contractor's Equipment to the Site. The Employer shall use its best endeavors in a timely and expeditious manner to assist the Contractor in obtaining such approvals, if requested by the Contractor. The Contractor shall indemnify and hold harmless the Employer from and against any claim for damage to roads, bridges or any other traffic facilities that may be caused by the transport of the materials and the Contractor's Equipment to the Site.

21.4 Customs Clearance

The Contractor shall, at its own expense, handle all imported materials and Contractor's Equipment at the point(s) of import

and shall handle any formalities for customs clearance, subject to the Employer's obligations under GCC Sub-Clause 14.2, provided that if applicable laws or regulations require any application or act to be made by or in the name of the Employer, the Employer shall take all necessary steps to comply with such laws or regulations. In the event of delays in customs clearance that are not the fault of the Contractor, the Contractor shall be entitled to an extension in the Time for Completion, pursuant to GCC Clause 40.

22. Installation

22.1 Setting Out/Supervision

22.1.1 Bench Mark: The Contractor shall be responsible for the true and proper setting-out of the Facilities in relation to bench marks, reference marks and lines provided to it in writing by or on behalf of the Employer.

If, at any time during the progress of installation of the Facilities, any error shall appear in the position, level or alignment of the Facilities, the Contractor shall forthwith notify the Project Manager of such error and, at its own expense, immediately rectify such error to the reasonable satisfaction of the Project Manager. If such error is based on incorrect data provided in writing by or on behalf of the Employer, the expense of rectifying the same shall be borne by the Employer.

22.1.2 Contractor's Supervision: The Contractor shall give or provide all necessary superintendence during the installation of the Facilities, and the Construction Manager or its deputy shall be constantly on the Site to provide full-time superintendence of the installation. The Contractor shall provide and employ only technical personnel who are skilled and experienced in their respective callings and supervisory staff who are competent to adequately supervise the work at hand.

22.2 Labor:

22.2.1 Engagement of Staff and Labor

Except as otherwise stated in the Employer's Requirements, the Contractor shall make arrangements for the engagement of all staff and labor, local or otherwise, and for their payment, housing, feeding and transport.

The Contractor shall provide and employ on the Site in the installation of the Facilities such skilled, semi-skilled and unskilled labor as is necessary for the proper and timely execution of the Contract. The Contractor is encouraged to use local labor that has the necessary skills.

The Contractor shall be responsible for obtaining all necessary permit(s) and/or visa(s) from the appropriate authorities for the entry of all labor and personnel to be employed on the Site into the country where the Site is located. The Employer will, if requested by the Contractor, use his best endeavors in a timely and expeditious manner to assist the Contractor in obtaining any local, state, national or government permission required for bringing in the Contractor's personnel.

The Contractor shall at its own expense provide the means of repatriation to all of its Contractor's Personnel employed for the execution of the Contract at the Site or other places where the Installation Services are carried out to the place where they were recruited or to their domicile. It shall also provide suitable temporary maintenance of all such persons from the cessation of their employment on the Contract to the date programmed for their departure. In the event that the Contractor defaults in providing such means of transportation and temporary maintenance, the Employer may provide the same to such personnel and recover the cost of doing so from the Contractor.

22.2.2 Persons in the Service of Employer

The Contractor shall not recruit, or attempt to recruit, staff and labor from amongst the Employer's Personnel.

22.2.3 Labor Laws

The Contractor shall comply with all the relevant labor Laws applicable to the Contractor's Personnel, including Laws relating to their employment, health, safety, welfare, immigration and emigration, and shall allow them all their legal rights.

The Contractor shall at all times during the progress of the Contract use its best endeavors to prevent any unlawful, riotous or disorderly conduct or behavior by

or amongst its employees and the labor of its Subcontractors.

The Contractor shall, in all dealings with its labor and the labor of its Subcontractors currently employed on or connected with the Contract, pay due regard to all recognized festivals, official holidays, religious or other customs and all local laws and regulations pertaining to the employment of labor.

22.2.4 Rates of Wages and Conditions of Labor

The Contractor shall pay rates of wages, and observe conditions of labor, which are not lower than those established for the trade or industry where the work is carried out. If no established rates or conditions are applicable, the Contractor shall pay rates of wages and observe conditions which are not lower than the general level of wages and conditions observed locally by employers whose trade or industry is similar to that of the Contractor.

The Contractor shall inform the Contractor's Personnel about their liability to pay personal income taxes in the Country in respect of such of their salaries, wages,allowances and any benefits as are subject to tax under the Laws of the Country ~~as are chargeable under the Laws~~ for the time being in force, and the Contractor shall perform such duties in regard to such deductions thereof as may be imposed on him by such Laws.

22.2.5 Working Hours

No work shall be carried out on the Site on locally recognized days of rest, or outside the normal working hours **stated in the PCC,** unless:

(a) otherwise stated in the Contract,

(b) the Project Manager gives consent, or

(c) the work is unavoidable, or necessary for the protection of life or property or for the safety of the Facilities, in which case the Contractor shall immediately advise the Project Manager.

If and when the Contractor considers it necessary to carry out work at night or on public holidays so as to meet the

Time for Completion and requests the Project Manager's consent thereto, the Project Manager shall not unreasonably withhold such consent.

This Sub-Clause shall not apply to any work which is customarily carried out by rotary or double-shifts.

22.2.6 Facilities for Staff and Labor

Except as otherwise stated in the Specification, the Contractor shall provide and maintain all necessary accommodation and welfare facilities for the Contractor's Personnel employed for the execution of the Contract at the Site or other places where the Installation Services are carried out. The Contractor shall also provide facilities for the Employer's Personnel as stated in the Employer's Requirements.

The Contractor shall not permit any of the Contractor's Personnel to maintain any temporary or permanent living quarters within the structures forming part of the Facilities.

22.2.7 Health and Safety

The Contractor shall at all times take all reasonable precautions to maintain the health and safety of the Contractor's Personnel employed for the execution of Installation Services at the Site (or other places in the country where the Site is located).

Subject to GCC Sub-Clause 9.9, the Contractor shall submit to the Engineer for its approval a health and safety manual which has been specifically prepared for the Contract.

The health and safety manual shall be in addition to any other similar document required under applicable health and safety regulations and Laws.

The health and safety manual shall set out all the health and safety requirements under the Contract,

(a) which shall include at a minimum:

(i) the procedures to establish and maintain a safe working environment without risk to health at all workplaces, machinery, equipment and processes under the control of the Contractor, including control

measures for chemical, physical and biological substances and agents;

(ii) details of the training to be provided, records to be kept;

(iii) the procedures for prevention, preparedness and response activities to be implemented in the case of an emergency event (i.e. an unanticipated incident, arising from both natural and man-made hazards, typically in the form of fire, explosions, leaks or spills, which may occur for a variety of different reasons including failure to implement operating procedures that are designed to prevent their occurrence, extreme weather or lack of early warning);

(iv) the measures to be taken to avoid or minimize the potential for community exposure to water-borne, water-based, water-related, and vector-borne diseases,

(v) the measures to be implemented to avoid or minimize the spread of communicable diseases (including transfer of Sexually Transmitted Diseases or Infections (STDs), such as HIV virus) and non-communicable diseases associated with the execution of the Contract, taking into consideration differentiated exposure to and higher sensitivity of vulnerable groups. This includes taking measures to avoid or minimize the transmission of communicable diseases that may be associated with the influx of temporary or permanent Contract-related labor;

(vi) the policies and procedures on the management and quality of accommodation and welfare facilities if such accommodation and welfare facilities are provided by the Contractor in accordance with GCC Sub-Clause 22.2.6; and

any other requirements stated in the Specification.

22.2.8 Funeral Arrangements

In the event of the death of any of the Contractor's personnel or accompanying members of their families, the Contractor shall be responsible for making the appropriate arrangements for their return or burial, unless otherwise **specified in the PCC.**

22.2.9 Records of Contractor's Personnel

The Contractor shall keep accurate records of the Contractor's personnel, including the number of each class of Contractor's Personnel on the Site and the names, ages, genders, hours worked and wages paid to all workers. These records shall be summarized on a monthly basis in a form approved by the Project Manager and shall be available for inspection by the Project Manager until the Contractor has completed all work.

22.2.10 Supply of Foodstuffs

The Contractor shall arrange for the provision of a sufficient supply of suitable food as may be stated in the Employer's Requirements at reasonable prices for the Contractor's Personnel for the purposes of or in connection with the Contract.

22.2.11 Supply of Water

The Contractor shall, having regard to local conditions, provide on the Site an adequate supply of drinking and other water for the use of the Contractor's Personnel.

22.2.12 Measures against Insect and Pest Nuisance

The Contractor shall at all times take the necessary precautions to protect the Contractor's Personnel employed on the Site from insect and pest nuisance, and to reduce their danger to health. The Contractor shall comply with all the regulations of the local health authorities, including use of appropriate insecticide.

22.2.13 Alcoholic Liquor or Drugs

The Contractor shall not, otherwise than in accordance with the Laws of the Country, import, sell, give barter or otherwise dispose of any alcoholic liquor or drugs, or permit or allow importation, sale, gift barter or disposal by Contractor's Personnel.

22.2.14 Arms and Ammunition

The Contractor shall not give, barter, or otherwise dispose of, to any person, any arms or ammunition of any kind, or allow Contractor's Personnel to do so.

22.2.15 Workers' Organizations

In countries where the relevant labor laws recognize workers' rights to form and to join workers' organizations of their choosing and to bargain collectively without interference, the Contractor shall comply with such laws. In such circumstances, the role of legally established workers' organizations and legitimate workers' representatives will be respected, and they will be provided with information needed for meaningful negotiation in a timely manner. Where the relevant labor laws substantially restrict workers' organizations, the Contractor shall enable alternative means for the Contractor's and its Subcontractors' personnel to express their grievances and protect their rights regarding working conditions and terms of employment. The Contractor shall not seek to influence or control these alternative means. The Contractor shall not discriminate or retaliate against the Contractor's and its Subcontractors' personnel who participate, or seek to participate, in such organizations and collective bargaining or alternative mechanisms. Workers' organizations are expected to fairly represent the workers in the workforce.

22.2.16 Non-Discrimination and Equal Opportunity

The Contractor shall not make decisions relating to the employment or treatment of Contractor's Personnel on the basis of personal characteristics unrelated to inherent job requirements. The Contractor shall base the employment of Contractor's Personnel on the principle of equal opportunity and fair treatment, and shall not discriminate with respect to any aspects of the employment relationship, including recruitment and hiring, compensation (including wages and benefits), working conditions and terms of employment, access to training, job assignment, promotion, termination of employment or retirement, and disciplinary practices.

Special measures of protection or assistance to remedy past discrimination or selection for a particular job based on the inherent requirements of the job shall not be deemed discrimination. The Contractor shall provide protection and assistance as necessary to ensure non-

discrimination and equal opportunity, including for specific groups such as women, people with disabilities, migrant workers and children (of working age in accordance with GCC Sub-Clause 22.2.19).

22.2.17 Contractor's Personnel Grievance Mechanism

The Contractor shall have a grievance mechanism for the Contractor's Personnel, and where relevant the workers' organizations stated in subclause 22.2.15, to raise workplace concerns. The grievance mechanism shall be proportionate to the nature, scale, risks and impacts of the Contract. The mechanism shall address concerns promptly, using an understandable and transparent process that provides timely feedback to those concerned in a language they understand, without any retribution, and shall operate in an independent and objective manner.

The Contractor's Personnel shall be informed of the grievance mechanism at the time of engagement for the Contract, and the measures put in place to protect them against any reprisal for its use. Measures will be put in place to make the grievance mechanism easily accessible to all Contractor's and its Subcontractors' personnel.

The grievance mechanism shall not impede access to other judicial or administrative remedies that might be available, or substitute for grievance mechanisms provided through collective agreements.

The grievance mechanism may utilize existing grievance mechanisms, providing that they are properly designed and implemented, address concerns promptly, and are readily accessible to such project workers. Existing grievance mechanisms may be supplemented as needed with Contract-specific arrangements.

22.2.18 Forced Labor

The Contractor, including its Subcontractors, shall not employ or engage forced labor. Forced labor consists of any work or service, not voluntarily performed, that is exacted from an individual under threat of force or penalty, and includes any kind of involuntary or compulsory labor, such as indentured labor, bonded labor or similar labor-contracting arrangements.

No persons shall be employed or engaged who have been subject to trafficking. Trafficking in persons is defined as the recruitment, transportation, transfer, harbouring or receipt of persons by means of the threat or use of force or other forms of coercion, abduction, fraud, deception, abuse of power, or of a position of vulnerability, or of the giving or receiving of payments or benefits to achieve the consent of a person having control over another person, for the purposes of exploitation.

22.2.19 Child Labor

The Contractor, including its Subcontractors, shall not employ or engage a child under the age of 14 unless the national law specifies a higher age (the minimum age).

The Contractor, including its Subcontractors, shall not employ or engage a child between the minimum age and the age of 18 in a manner that is likely to be hazardous, or to interfere with, the child's education, or to be harmful to the child's health or physical, mental, spiritual, moral, or social development.

The Contractor including its Subcontractors, shall only employ or engage children between the minimum age and the age of 18 after an appropriate risk assessment has been conducted by the Contractor with the Engineer's consent. The Contractor shall be subject to regular monitoring by the Project Manager that includes monitoring of health, working conditions and hours of work.

Work considered hazardous for children is work that, by its nature or the circumstances in which it is carried out, is likely to jeopardize the health, safety, or morals of children. Such work activities prohibited for children include work:

(a) with exposure to physical, psychological or sexual abuse;

(b) underground, underwater, working at heights or in confined spaces;

(c) with dangerous machinery, equipment or tools, or involving handling or transport of heavy loads;

(d) in unhealthy environments exposing children to hazardous substances, agents, or processes, or to

temperatures, noise or vibration damaging to health; or

(e) under difficult conditions such as work for long hours, during the night or in confinement on the premises of the employer.

22.3 Contractor's Equipment

22.3.1 All Contractor's Equipment brought by the Contractor onto the Site shall be deemed to be intended to be used exclusively for the execution of the Contract. The Contractor shall not remove the same from the Site without the Project Manager's consent that such Contractor's Equipment is no longer required for the execution of the Contract.

22.3.2 Unless otherwise specified in the Contract, upon completion of the Facilities, the Contractor shall remove from the Site all Equipment brought by the Contractor onto the Site and any surplus materials remaining thereon.

22.3.3 The Employer will, if requested, use its best endeavors to assist the Contractor in obtaining any local, state or national government permission required by the Contractor for the export of the Contractor's Equipment imported by the Contractor for use in the execution of the Contract that is no longer required for the execution of the Contract.

22.4 Site Regulations

The Employer and the Contractor shall establish Site regulations setting out the rules to be observed in the execution of the Contract at the Site and shall comply therewith. The Contractor shall prepare and submit to the Project Manager with a copy to the Employer, proposed Site regulations for the Project Manager's approval, which approval shall not be unreasonably withheld.

Such Site regulations shall include, but shall not be limited to, Code of Conduct for environmental and social aspectssubmitted as part of the Bid and agreed to by the Employer, security arrangements in accordance with GCC Sub-Clause 22.8, safety

of the Facilities, gate control, sanitation, medical care, and fire prevention.

The Contractor shall take all necessary measures to ensure that each Contractor's Personnel, employed for the execution of the Contract at the Site or other places where the Installation Services are carried out, is made aware of the Code of Conduct including specific behaviors that are prohibited, and understands the consequences of engaging in such prohibited behaviors.

These measures include providing instructions and documentation that can be understood by the Contractor's Personnel and seeking to obtain that person's signature acknowledging receipt of such instructions and/or documentation, as appropriate.

The Contractor shall also ensure that the Code of Conduct is visibly displayed in multiple locations on the Site and any other place where the Installation Services will be carried out, as well as in areas outside the Site accessible to the local community and project affected people. The posted Code of Conduct shall be provided in languages comprehensible to Contractor's Personnel, Employer's Personnel and the local community.

The Contractor's Management Strategy and Implementation Plans shall include appropriate processes for the Contractor to verify compliance with these obligations.

22.5 Opportunities for Other Contractors

22.5.1 The Contractor shall, upon written request from the Employer or the Project Manager, give all reasonable opportunities for carrying out the work to any other contractors employed by the Employer on or near the Site.

22.5.2 If the Contractor, upon written request from the Employer or the Project Manager, makes available to other contractors any roads or ways the maintenance for which the Contractor is responsible, permits the use by such other contractors of the Contractor's Equipment, or provides any other service of whatsoever nature for such other contractors, the Employer shall fully compensate the Contractor for any loss or damage caused or occasioned by such other contractors in respect of any such use or service, and shall pay to the

Contractor reasonable remuneration for the use of such equipment or the provision of such services.

22.5.3 The Contractor shall also so arrange to perform its work as to minimize, to the extent possible, interference with the work of other contractors. The Project Manager shall determine the resolution of any difference or conflict that may arise between the Contractor and other contractors and the workers of the Employer in regard to their work.

22.5.4 The Contractor shall notify the Project Manager promptly of any defects in the other contractors' work that come to its notice, and that could affect the Contractor's work. The Project Manager shall determine the corrective measures, if any, required to rectify the situation after inspection of the Facilities. Decisions made by the Project Manager shall be binding on the Contractor.

22.6 Emergency Work

If, by reason of an emergency arising in connection with and during the execution of the Contract, any protective or remedial work is necessary as a matter of urgency to prevent damage to the Facilities, the Contractor shall immediately carry out such work.

If the Contractor is unable or unwilling to do such work immediately, the Employer may do or cause such work to be done as the Employer may determine is necessary in order to prevent damage to the Facilities. In such event the Employer shall, as soon as practicable after the occurrence of any such emergency, notify the Contractor in writing of such emergency, the work done and the reasons therefor. If the work done or caused to be done by the Employer is work that the Contractor was liable to do at its own expense under the Contract, the reasonable costs incurred by the Employer in connection therewith shall be paid by the Contractor to the Employer. Otherwise, the cost of such remedial work shall be borne by the Employer.

22.7 Site Clearance

22.7.1 Site Clearance in Course of Performance: In the course of carrying out the Contract, the Contractor shall keep the Site reasonably free from all unnecessary

obstruction, store or remove any surplus materials, clear away any wreckage, rubbish or temporary works from the Site, and remove any Contractor's Equipment no longer required for execution of the Contract.

22.7.2 Clearance of Site after Completion: After Completion of all parts of the Facilities, the Contractor shall clear away and remove all wreckage, rubbish and debris of any kind from the Site, and shall leave the Site and Facilities in a clean and safe condition.

22.8 Security of the Site

The Contractor shall be responsible for the security of the Site including providing and maintaining at its own expense all lighting, fencing, and watching when and where necessary for the proper execution and the protection of the Facilities, or for the safety of the owners and occupiers of adjacent property and for the safety of the public.

If required in the Employer's Requirements, the Contractor shall submit for the Project Manager's No-objection a security management plan that sets the security arrangements for the Site.

In making security arrangements, the Contractor shall be guided by applicable laws and any other requirements stated in the Employer's Requirements.

The Contractor shall (i) conduct appropriate background checks on any personnel retained to provide security; (ii) train the security personnel adequately (or determine that they are properly trained) in the use of force (and where applicable, firearms), and appropriate conduct towards Contractor's and Sub-contarctor's personnel, Employer's personnel and affected communities; and (iii) require the security personnel to act within the applicable Laws and any requirements set out in the Employer's Reqquirements.

The Contractor shall not permit any use of force by security personnel in providing security except when used for preventive and defensive purposes in proportion to the nature and extent of the threat.

22.9 Protection of the Environment

The Contractor shall take all necessary measures to:

i. protect the environment (both on and off the Site); and

ii. limit damage and nuisance to people and property resulting from pollution, noise and other results of the Contractor's operations and/ or activities.

The Contractor shall ensure that emissions, surface discharges, effluent and any other pollutants from the Contractor's activities shall exceed neither the values indicated in the Employer's Requirements, nor those prescribed by applicable laws.

In the event of damage to the environment, property and/or nuisance to people, on or off Site as a result of the Contractor's operations, the Contractor shall agree with the Project Manager the appropriate actions and time scale to remedy, as practicable, the damaged environment to its former condition. The Contractor shall implement such remedies at its cost to the satisfaction of the Project Manager.

22.10 Cultural Heritage Findings

All fossils, coins, articles of value or antiquity, structures, groups of structures, and other remains or items of geological, archaeological, paleontological, historical, architectural, religious interest found on the Site shall be placed under the care and custody of the Employer.

The Contractor shall take all reasonable precautions, including fencing-off the area or site of the finding, to avoid further disturbance and prevent Contractor's Personnel or other persons from removing or damaging any of these findings;

As soon as practicable after discovery of any such finding, the Contractor shall give a notice to the Project Manager, to give the Project Manager the opportunity to promptly inspect and/or investigate the finding before it is disturbed and to issue instructions for dealing with it.

23. Test and Inspection

23.1 The Contractor shall at its own expense carry out at the place of manufacture and/or on the Site all such tests and/or inspections of the Plant and any part of the Facilities as are specified in the Contract.

23.2 The Employer and the Project Manager or their designated representatives shall be entitled to attend the aforesaid test and/or inspection, provided that the Employer shall bear all costs and expenses incurred in connection with such attendance

including, but not limited to, all traveling and board and lodging expenses.

23.3 Whenever the Contractor is ready to carry out any such test and/or inspection, the Contractor shall give a reasonable advance notice of such test and/or inspection and of the place and time thereof to the Project Manager. The Contractor shall obtain from any relevant third Party or manufacturer any necessary permission or consent to enable the Employer and the Project Manager or their designated representatives to attend the test and/or inspection.

23.4 The Contractor shall provide the Project Manager with a certified report of the results of any such test and/or inspection.

If the Employer or Project Manager or their designated representatives fails to attend the test and/or inspection, or if it is agreed between the Parties that such persons shall not do so, then the Contractor may proceed with the test and/or inspection in the absence of such persons, and may provide the Project Manager with a certified report of the results thereof.

23.5 The Project Manager may require the Contractor to carry out any test and/or inspection not required by the Contract, provided that the Contractor's reasonable costs and expenses incurred in the carrying out of such test and/or inspection shall be added to the Contract Price. Further, if such test and/or inspection impede the progress of work on the Facilities and/or the Contractor's performance of its other obligations under the Contract, due allowance will be made in respect of the Time for Completion and the other obligations so affected.

23.6 If any Plant or any part of the Facilities fails to pass any test and/or inspection, the Contractor shall either rectify or replace such Plant or part of the Facilities and shall repeat the test and/or inspection upon giving a notice under GCC Sub-Clause 23.3.

23.7 If any dispute or difference of opinion shall arise between the Parties in connection with or arising out of the test and/or inspection of the Plant or part of the Facilities that cannot be settled between the Parties within a reasonable period of time, it may be referred to an Dispute Board for determination in accordance with GCC Sub-Clause 46.3.

23.8 The Contractor shall afford the Employer and the Project Manager, at the Employer's expense, access at any reasonable

time to any place where the Plant are being manufactured or the Facilities are being installed, in order to inspect the progress and the manner of manufacture or installation, provided that the Project Manager shall give the Contractor a reasonable prior notice. Without prejudice to GCC Sub-Clause 9.7, as instructed by the Project Manager, the Contractor shall also afford other relevant entities (at the Employer's or their respective entities' expense, as appropriate) access to the Facilities, to inspect progress and the manner of the execution of the Facilities, carry out environmental and social audit, as appropriate, or carry out any other duty as stated in the Employer's Requirements or as instructed by the Project Manager.

23.9 The Contractor agrees that neither the execution of a test and/or inspection of Plant or any part of the Facilities, nor the attendance by the Employer or the Project Manager, nor the issue of any test certificate pursuant to GCC Sub-Clause 23.4, shall release the Contractor from any other responsibilities under the Contract.

23.10 No part of the Facilities or foundations shall be covered up on the Site without the Contractor carrying out any test and/or inspection required under the Contract. The Contractor shall give a reasonable notice to the Project Manager whenever any such parts of the Facilities or foundations are ready or about to be ready for test and/or inspection; such test and/or inspection and notice thereof shall be subject to the requirements of the Contract.

23.11 The Contractor shall uncover any part of the Facilities or foundations, or shall make openings in or through the same as the Project Manager may from time to time require at the Site, and shall reinstate and make good such part or parts.

If any parts of the Facilities or foundations have been covered up at the Site after compliance with the requirement of GCC Sub-Clause 23.10 and are found to be executed in accordance with the Contract, the expenses of uncovering, making openings in or through, reinstating, and making good the same shall be borne by the Employer, and the Time for Completion shall be reasonably adjusted to the extent that the Contractor has thereby been delayed or impeded in the performance of any of its obligations under the Contract.

24. Completion of the Facilities

24.1 As soon as the Facilities or any part thereof has, in the opinion of the Contractor, been completed operationally and structurally and put in a tight and clean condition as specified in the Employer's Requirements, excluding minor items not materially affecting the operation or safety of the Facilities, the Contractor shall so notify the Employer in writing.

24.2 Within seven (7) days after receipt of the notice from the Contractor under GCC Sub-Clause 24.1, the Employer shall supply the operating and maintenance personnel specified in the Appendix to the Contract Agreement titled Scope of Works and Supply by the Employer for Precommissioning of the Facilities or any part thereof.

Pursuant to the Appendix to the Contract Agreement titled Scope of Works and Supply by the Employer, the Employer shall also provide, within the said seven (7) day period, the raw materials, utilities, lubricants, chemicals, catalysts, facilities, services and other matters required for Precommissioning of the Facilities or any part thereof.

24.3 As soon as reasonably practicable after the operating and maintenance personnel have been supplied by the Employer and the raw materials, utilities, lubricants, chemicals, catalysts, facilities, services and other matters have been provided by the Employer in accordance with GCC Sub-Clause 24.2, the Contractor shall commence Precommissioning of the Facilities or the relevant part thereof in preparation for Commissioning, subject to GCC Sub-Clause 25.5.

24.4 As soon as all works in respect of Precommissioning are completed and, in the opinion of the Contractor, the Facilities or any part thereof is ready for Commissioning, the Contractor shall so notify the Project Manager in writing.

24.5 The Project Manager shall, within fourteen (14) days after receipt of the Contractor's notice under GCC Sub-Clause 24.4, either issue a Completion Certificate in the form specified in the Employer's Requirements (Forms and Procedures), stating that the Facilities or that part thereof have reached Completion as of the date of the Contractor's notice under GCC Sub-Clause 24.4, or notify the Contractor in writing of any defects and/or deficiencies.

If the Project Manager notifies the Contractor of any defects and/or deficiencies, the Contractor shall then correct such

defects and/or deficiencies, and shall repeat the procedure described in GCC Sub-Clause 24.4.

If the Project Manager is satisfied that the Facilities or that part thereof have reached Completion, the Project Manager shall, within seven (7) days after receipt of the Contractor's repeated notice, issue a Completion Certificate stating that the Facilities or that part thereof have reached Completion as of the date of the Contractor's repeated notice.

If the Project Manager is not so satisfied, then it shall notify the Contractor in writing of any defects and/or deficiencies within seven (7) days after receipt of the Contractor's repeated notice, and the above procedure shall be repeated.

24.6 If the Project Manager fails to issue the Completion Certificate and fails to inform the Contractor of any defects and/or deficiencies within fourteen (14) days after receipt of the Contractor's notice under GCC Sub-Clause 24.4 or within seven (7) days after receipt of the Contractor's repeated notice under GCC Sub-Clause 24.5, or if the Employer makes use of the Facilities or part thereof, then the Facilities or that part thereof shall be deemed to have reached Completion as of the date of the Contractor's notice or repeated notice, or as of the Employer's use of the Facilities, as the case may be.

24.7 As soon as possible after Completion, the Contractor shall complete all outstanding minor items so that the Facilities are fully in accordance with the requirements of the Contract, failing which the Employer will undertake such completion and deduct the costs thereof from any monies owing to the Contractor.

24.8 Upon Completion, the Employer shall be responsible for the care and custody of the Facilities or the relevant part thereof, together with the risk of loss or damage thereto, and shall thereafter take over the Facilities or the relevant part thereof.

25. Commissioning and Operational Acceptance

25.1 <u>Commissioning</u>

25.1.1 Commissioning of the Facilities or any part thereof shall be commenced by the Contractor immediately after issue of the Completion Certificate by the Project Manager, pursuant to GCC Sub-Clause 24.5, or immediately after the date of the deemed Completion, under GCC Sub-Clause 24.6.

25.1.2 The Employer shall supply the operating and maintenance personnel and all raw materials, utilities, lubricants, chemicals, catalysts, facilities, services and other matters required for Commissioning.

25.1.3 In accordance with the requirements of the Contract, the Contractor's and Project Manager's advisory personnel shall attend the Commissioning, including the Guarantee Test, and shall advise and assist the Employer.

25.2 Guarantee Test

25.2.1 Subject to GCC Sub-Clause 25.5, the Guarantee Test and repeats thereof shall be conducted by the Contractor during Commissioning of the Facilities or the relevant part thereof to ascertain whether the Facilities or the relevant part can attain the Functional Guarantees specified in the Appendix to the Contract Agreement titled Functional Guarantees. The Employer shall promptly provide the Contractor with such information as the Contractor may reasonably require in relation to the conduct and results of the Guarantee Test and any repeats thereof.

25.2.2 If for reasons not attributable to the Contractor, the Guarantee Test of the Facilities or the relevant part thereof cannot be successfully completed within the period from the date of Completion **specified in the PCC** or any other period agreed upon by the Employer and the Contractor, the Contractor shall be deemed to have fulfilled its obligations with respect to the Functional Guarantees, and GCC Sub-Clauses 28.2 and 28.3 shall not apply.

25.3 Operational Acceptance

25.3.1 Subject to GCC Sub-Clause 25.4 below, Operational Acceptance shall occur in respect of the Facilities or any part thereof when

(a) the Guarantee Test has been successfully completed and the Functional Guarantees are met; or

(b) the Guarantee Test has not been successfully completed or has not been carried out for reasons not attributable to the Contractor within the period from the date of Completion specified in the PCC pursuant to GCC Sub-

Clause 25.2.2 above or any other period agreed upon by the Employer and the Contractor; or

(c) the Contractor has paid the liquidated damages specified in GCC Sub-Clause 28.3 hereof; and

(d) any minor items mentioned in GCC Sub-Clause 24.7 hereof relevant to the Facilities or that part thereof have been completed.

25.3.2 At any time after any of the events set out in GCC Sub-Clause 25.3.1 have occurred, the Contractor may give a notice to the Project Manager requesting the issue of an Operational Acceptance Certificate in the form provided in the Employer's Requirements (Forms and Procedures) in respect of the Facilities or the part thereof specified in such notice as of the date of such notice.

25.3.3 The Project Manager shall, after consultation with the Employer, and within seven (7) days after receipt of the Contractor's notice, issue an Operational Acceptance Certificate.

25.3.4 If within seven (7) days after receipt of the Contractor's notice, the Project Manager fails to issue the Operational Acceptance Certificate or fails to inform the Contractor in writing of the justifiable reasons why the Project Manager has not issued the Operational Acceptance Certificate, the Facilities or the relevant part thereof shall be deemed to have been accepted as of the date of the Contractor's said notice.

25.4 <u>Partial Acceptance</u>

25.4.1 If the Contract specifies that Completion and Commissioning shall be carried out in respect of parts of the Facilities, the provisions relating to Completion and Commissioning including the Guarantee Test shall apply to each such part of the Facilities individually, and the Operational Acceptance Certificate shall be issued accordingly for each such part of the Facilities.

25.4.2 If a part of the Facilities comprises facilities such as buildings, for which no Commissioning or Guarantee Test is required, then the Project Manager shall issue the Operational Acceptance Certificate for such facility when it attains Completion, provided that the Contractor

shall thereafter complete any outstanding minor items that are listed in the Operational Acceptance Certificate.

25.5 Delayed Precommissioning and/or Guarantee Test

25.5.1 In the event that the Contractor is unable to proceed with the Precommissioning of the Facilities pursuant to Sub-Clause 24.3, or with the Guarantee Test pursuant to Sub-Clause 25.2, for reasons attributable to the Employer either on account of non availability of other facilities under the responsibilities of other contractor(s), or for reasons beyond the Contractor's control, the provisions leading to "deemed" completion of activities such as Completion, pursuant to GCC Sub-Clause 24.6, and Operational Acceptance, pursuant to GCC Sub-Clause 25.3.4, and Contractor's obligations regarding Defect Liability Period, pursuant to GCC Sub-Clause 27.2, Functional Guarantee, pursuant to GCC Clause 28, and Care of Facilities, pursuant to GCC Clause 32, and GCC Clause 41.1, Suspension, shall not apply. In this case, the following provisions shall apply.

25.5.2 When the Contractor is notified by the Project Manager that he will be unable to proceed with the activities and obligations pursuant to above Sub-Clause 25.5.1, the Contractor shall be entitled to the following:

(a) the Time of Completion shall be extended for the period of suspension without imposition of liquidated damages pursuant to GCC Sub-Clause 26.2;

(b) payments due to the Contractor in accordance with the provision specified in the Appendix to the Contract Agreement titled Terms and Procedures of Payment, which would not have been payable in normal circumstances due to non-completion of the subject activities, shall be released to the Contractor against submission of a security in the form of a bank guarantee of equivalent amount acceptable to the Employer, and which shall become null and void when the Contractor will have complied with its obligations regarding those payments, subject to the provision of Sub-Clause 25.5.3 below;

(c) the expenses towards the above security and extension of other securities under the contract, of which validity needs to be extended, shall be reimbursed to the Contractor by the Employer;

(d) the additional charges towards the care of the Facilities pursuant to GCC Sub-Clause 32.1 shall be reimbursed to the Contractor by the Employer for the period between the notification mentioned above and the notification mentioned in Sub-Clause 25.5.4 below. The provision of GCC Sub-Clause 33.2 shall apply to the Facilities during the same period.

25.5.3 In the event that the period of suspension under above Sub-Clause 25.5.1 actually exceeds one hundred eighty (180) days, the Employer and Contractor shall mutually agree to any additional compensation payable to the Contractor.

25.5.4 When the Contractor is notified by the Project Manager that the plant is ready for Precommissioning, the Contractor shall proceed without delay in performing Precommissioning in accordance with Clause 24.

F. Guarantees and Liabilities

26. Completion Time Guarantee

26.1 The Contractor guarantees that it shall attain Completion of the Facilities (or a part for which a separate time for completion is specified) within the Time for Completion specified in the PCC pursuant to GCC Sub-Clause 8.2, or within such extended time to which the Contractor shall be entitled under GCC Clause 40 hereof.

26.2 If the Contractor fails to attain Completion of the Facilities or any part thereof within the Time for Completion or any extension thereof under GCC Clause 40, the Contractor shall pay to the Employer liquidated damages in the amount **specified in the PCC** as a percentage rate of the Contract Price or the relevant part thereof. The aggregate amount of such liquidated damages shall in no event exceed the amount **specified as "Maximum" in the PCC** as a percentage rate of the Contract Price. Once the "Maximum" is reached, the Employer may consider termination of the Contract, pursuant to GCC Sub-Clause 42.2.2.

Such payment shall completely satisfy the Contractor's obligation to attain Completion of the Facilities or the relevant part thereof within the Time for Completion or any extension thereof under GCC Clause 40. The Contractor shall have no further liability whatsoever to the Employer in respect thereof.

However, the payment of liquidated damages shall not in any way relieve the Contractor from any of its obligations to complete the Facilities or from any other obligations and liabilities of the Contractor under the Contract.

Save for liquidated damages payable under this GCC Sub-Clause 26.2, the failure by the Contractor to attain any milestone or other act, matter or thing by any date specified in the Appendix to the Contract Agreement titled Time Schedule, and/or other program of work prepared pursuant to GCC Sub-Clause 18.2 shall not render the Contractor liable for any loss or damage thereby suffered by the Employer.

26.3 If the Contractor attains Completion of the Facilities or any part thereof before the Time for Completion or any extension thereof under GCC Clause 40, the Employer shall pay to the Contractor a bonus in the amount **specified in the PCC.** The aggregate amount of such bonus shall in no event exceed the amount **specified as "Maximum" in the PCC.**

27. Defect Liability

27.1 The Contractor warrants that the Facilities or any part thereof shall be free from defects in the design, engineering, materials and workmanship of the Plant supplied and of the work executed.

27.2 The Defect Liability Period shall be five hundred and forty (540) days from the date of Completion of the Facilities (or any part thereof) or one year from the date of Operational Acceptance of the Facilities (or any part thereof), whichever first occurs, unless specified otherwise in the PCC pursuant to GCC Sub-Clause 27.10.

If during the Defect Liability Period any defect should be found in the design, engineering, materials and workmanship of the Plant supplied or of the work executed by the Contractor, the Contractor shall promptly, in consultation and agreement with the Employer regarding appropriate remedying of the defects, and at its cost, repair, replace or otherwise make good as the Contractor shall determine at its discretion, such defect as well as any damage to the Facilities caused by such defect. The Contractor shall not be responsible for the repair, replacement or making good of any

defect or of any damage to the Facilities arising out of or resulting from any of the following causes:

(a) improper operation or maintenance of the Facilities by the Employer;

(b) operation of the Facilities outside specifications provided in the Contract; or

(c) normal wear and tear.

27.3 The Contractor's obligations under this GCC Clause 27 shall not apply to:

(a) any materials that are supplied by the Employer under GCC Sub-Clause 21.2, are normally consumed in operation, or have a normal life shorter than the Defect Liability Period stated herein;

(b) any designs, specifications or other data designed, supplied or specified by or on behalf of the Employer or any matters for which the Contractor has disclaimed responsibility herein; or

(c) any other materials supplied or any other work executed by or on behalf of the Employer, except for the work executed by the Employer under GCC Sub-Clause 27.7.

27.4 The Employer shall give the Contractor a notice stating the nature of any such defect together with all available evidence thereof, promptly following the discovery thereof. The Employer shall afford all reasonable opportunity for the Contractor to inspect any such defect.

27.5 The Employer shall afford the Contractor all necessary access to the Facilities and the Site to enable the Contractor to perform its obligations under this GCC Clause 27.

The Contractor may, with the consent of the Employer, remove from the Site any Plant or any part of the Facilities that are defective if the nature of the defect, and/or any damage to the Facilities caused by the defect, is such that repairs cannot be expeditiously carried out at the Site.

27.6 If the repair, replacement or making good is of such a character that it may affect the efficiency of the Facilities or any part thereof, the Employer may give to the Contractor a notice requiring that tests of the defective part of the Facilities shall be

made by the Contractor immediately upon completion of such remedial work, whereupon the Contractor shall carry out such tests.

If such part fails the tests, the Contractor shall carry out further repair, replacement or making good, as the case may be, until that part of the Facilities passes such tests. The tests shall be agreed upon by the Employer and the Contractor.

27.7 If the Contractor fails to commence the work necessary to remedy such defect or any damage to the Facilities caused by such defect within a reasonable time (which shall in no event be considered to be less than fifteen (15) days), the Employer may, following notice to the Contractor, proceed to do such work, and the reasonable costs incurred by the Employer in connection therewith shall be paid to the Employer by the Contractor or may be deducted by the Employer from any monies due the Contractor or claimed under the Performance Security.

27.8 If the Facilities or any part thereof cannot be used by reason of such defect and/or making good of such defect, the Defect Liability Period of the Facilities or such part, as the case may be, shall be extended by a period equal to the period during which the Facilities or such part cannot be used by the Employer because of any of the aforesaid reasons.

27.9 Except as provided in GCC Clauses 27 and 33, the Contractor shall be under no liability whatsoever and howsoever arising, and whether under the Contract or at law, in respect of defects in the Facilities or any part thereof, the Plant, design or engineering or work executed that appear after Completion of the Facilities or any part thereof, except where such defects are the result of the gross negligence, fraud, or criminal or willful action of the Contractor.

27.10 In addition, any such component of the Facilities, and during the period of time as may be **specified in the PCC,** shall be subject to an extended defect liability period. Such obligation of the Contractor shall be in addition to the defect liability period specified under GCC Sub-Clause 27.2.

28. Functional Guarantees

28.1 The Contractor guarantees that during the Guarantee Test, the Facilities and all parts thereof shall attain the Functional Guarantees specified in the Appendix to the Contract Agreement titled Functional Guarantees, subject to and upon the conditions therein specified.

28.2 If, for reasons attributable to the Contractor, the minimum level of the Functional Guarantees specified in the Appendix to the Contract Agreement titled Functional Guarantees, are not met either in whole or in part, the Contractor shall at its cost and expense make such changes, modifications and/or additions to the Plant or any part thereof as may be necessary to meet at least the minimum level of such Guarantees. The Contractor shall notify the Employer upon completion of the necessary changes, modifications and/or additions, and shall request the Employer to repeat the Guarantee Test until the minimum level of the Guarantees has been met. If the Contractor eventually fails to meet the minimum level of Functional Guarantees, the Employer may consider termination of the Contract, pursuant to GCC Sub-Clause 42.2.2.

28.3 If, for reasons attributable to the Contractor, the Functional Guarantees specified in the Appendix to the Contract Agreement titled Functional Guarantees, are not attained either in whole or in part, but the minimum level of the Functional Guarantees specified in the said Appendix to the Contract Agreement is met, the Contractor shall, at the Contractor's option, either

(a) make such changes, modifications and/or additions to the Facilities or any part thereof that are necessary to attain the Functional Guarantees at its cost and expense, and shall request the Employer to repeat the Guarantee Test or

(b) pay liquidated damages to the Employer in respect of the failure to meet the Functional Guarantees in accordance with the provisions in the Appendix to the Contract Agreement titled Functional Guarantees.

28.4 The payment of liquidated damages under GCC Sub-Clause 28.3, up to the limitation of liability specified in the Appendix to the Contract Agreement titled Functional Guarantees, shall completely satisfy the Contractor's guarantees under GCC Sub-Clause 28.3, and the Contractor shall have no further liability whatsoever to the Employer in respect thereof. Upon the payment of such liquidated damages by the Contractor, the Project Manager shall issue the Operational Acceptance Certificate for the Facilities or any part thereof in respect of which the liquidated damages have been so paid.

29. Patent Indemnity

29.1 The Contractor shall, subject to the Employer's compliance with GCC Sub-Clause 29.2, indemnify and hold harmless the Employer and its employees and officers from and against any

and all suits, actions or administrative proceedings, claims, demands, losses, damages, costs, and expenses of whatsoever nature, including attorney's fees and expenses, which the Employer may suffer as a result of any infringement or alleged infringement of any patent, utility model, registered design, trademark, copyright or other intellectual property right registered or otherwise existing at the date of the Contract by reason of: (a) the installation of the Facilities by the Contractor or the use of the Facilities in the country where the Site is located; and (b) the sale of the products produced by the Facilities in any country.

Such indemnity shall not cover any use of the Facilities or any part thereof other than for the purpose indicated by or to be reasonably inferred from the Contract, any infringement resulting from the use of the Facilities or any part thereof, or any products produced thereby in association or combination with any other equipment, plant or materials not supplied by the Contractor, pursuant to the Contract Agreement.

29.2 If any proceedings are brought or any claim is made against the Employer arising out of the matters referred to in GCC Sub-Clause 29.1, the Employer shall promptly give the Contractor a notice thereof, and the Contractor may at its own expense and in the Employer's name conduct such proceedings or claim and any negotiations for the settlement of any such proceedings or claim.

If the Contractor fails to notify the Employer within twenty-eight (28) days after receipt of such notice that it intends to conduct any such proceedings or claim, then the Employer shall be free to conduct the same on its own behalf. Unless the Contractor has so failed to notify the Employer within the twenty-eight (28) day period, the Employer shall make no admission that may be prejudicial to the defense of any such proceedings or claim.

The Employer shall, at the Contractor's request, afford all available assistance to the Contractor in conducting such proceedings or claim, and shall be reimbursed by the Contractor for all reasonable expenses incurred in so doing.

29.3 The Employer shall indemnify and hold harmless the Contractor and its employees, officers and Subcontractors from and against any and all suits, actions or administrative proceedings, claims, demands, losses, damages, costs, and expenses of whatsoever nature, including attorney's fees and expenses, which the Contractor may suffer as a result of any infringement or alleged infringement of any patent, utility model, registered design, trademark, copyright or other intellectual property right registered

or otherwise existing at the date of the Contract arising out of or in connection with any design, data, drawing, specification, or other documents or materials provided or designed by or on behalf of the Employer.

30. Limitation of Liability

30.1 Except in cases of criminal negligence or willful misconduct,

(a) neither Party shall be liable to the other Party, whether in contract, tort, or otherwise, for any indirect or consequential loss or damage, loss of use, loss of production, or loss of profits or interest costs, which may be suffered by the other Party in connection with the Contract, other than specifically provided as any obligation of the Party in the Contract, and

(b) the aggregate liability of the Contractor to the Employer, whether under the Contract, in tort or otherwise, shall not exceed the amount resulting from the application of the multiplier specified **in the PCC**, to the Contract Price or, if a multiplier is not so specified, the total Contract Price, provided that this limitation shall not apply to the cost of repairing or replacing defective equipment, or to any obligation of the Contractor to indemnify the Employer with respect to patent infringement.

G. Risk Distribution

31. Transfer of Ownership

31.1 Ownership of the Plant (including spare parts) to be imported into the country where the Site is located shall be transferred to the Employer upon loading on to the mode of transport to be used to convey the Plant from the country of origin to that country.

31.2 Ownership of the Plant (including spare parts) procured in the country where the Site is located shall be transferred to the Employer when the Plant are brought on to the Site.

31.3 Ownership of the Contractor's Equipment used by the Contractor and its Subcontractors in connection with the Contract shall remain with the Contractor or its Subcontractors.

31.4 Ownership of any Plant in excess of the requirements for the Facilities shall revert to the Contractor upon Completion of the Facilities or at such earlier time when the Employer and the

Contractor agree that the Plant in question are no longer required for the Facilities.

31.5 Notwithstanding the transfer of ownership of the Plant, the responsibility for care and custody thereof together with the risk of loss or damage thereto shall remain with the Contractor pursuant to GCC Clause 32 (Care of Facilities) hereof until Completion of the Facilities or the part thereof in which such Plant are incorporated.

32. Care of Facilities

32.1 The Contractor shall be responsible for the care and custody of the Facilities or any part thereof until the date of Completion of the Facilities pursuant to GCC Clause 24 or, where the Contract provides for Completion of the Facilities in parts, until the date of Completion of the relevant part, and shall make good at its own cost any loss or damage that may occur to the Facilities or the relevant part thereof from any cause whatsoever during such period. The Contractor shall also be responsible for any loss or damage to the Facilities caused by the Contractor or its Subcontractors in the course of any work carried out, pursuant to GCC Clause 27. Notwithstanding the foregoing, the Contractor shall not be liable for any loss or damage to the Facilities or that part thereof caused by reason of any of the matters specified or referred to in paragraphs (a), (b) and (c) of GCC Sub-Clauses 32.2 and 38.1.

32.2 If any loss or damage occurs to the Facilities or any part thereof or to the Contractor's temporary facilities by reason of

(a) insofar as they relate to the country where the Site is located, nuclear reaction, nuclear radiation, radioactive contamination, pressure wave caused by aircraft or other aerial objects, or any other occurrences that an experienced contractor could not reasonably foresee, or if reasonably foreseeable could not reasonably make provision for or insure against, insofar as such risks are not normally insurable on the insurance market and are mentioned in the general exclusions of the policy of insurance, including War Risks and Political Risks, taken out under GCC Clause 34 hereof; or

(b) any use or occupation by the Employer or any third Party other than a Subcontractor, authorized by the Employer of any part of the Facilities; or

(c) any use of or reliance upon any design, data or specification provided or designated by or on behalf of the Employer, or

any such matter for which the Contractor has disclaimed responsibility herein,

the Employer shall pay to the Contractor all sums payable in respect of the Facilities executed, notwithstanding that the same be lost, destroyed or damaged, and will pay to the Contractor the replacement value of all temporary facilities and all parts thereof lost, destroyed or damaged. If the Employer requests the Contractor in writing to make good any loss or damage to the Facilities thereby occasioned, the Contractor shall make good the same at the cost of the Employer in accordance with GCC Clause 39. If the Employer does not request the Contractor in writing to make good any loss or damage to the Facilities thereby occasioned, the Employer shall either request a change in accordance with GCC Clause 39, excluding the performance of that part of the Facilities thereby lost, destroyed or damaged, or, where the loss or damage affects a substantial part of the Facilities, the Employer shall terminate the Contract pursuant to GCC Sub-Clause 42.1 hereof.

32.3 The Contractor shall be liable for any loss of or damage to any Contractor's Equipment, or any other property of the Contractor used or intended to be used for purposes of the Facilities, except (i) as mentioned in GCC Sub-Clause 32.2 with respect to the Contractor's temporary facilities, and (ii) where such loss or damage arises by reason of any of the matters specified in GCC Sub-Clauses 32.2 (b) and (c) and 38.1.

32.4 With respect to any loss or damage caused to the Facilities or any part thereof or to the Contractor's Equipment by reason of any of the matters specified in GCC Sub-Clause 38.1, the provisions of GCC Sub-Clause 38.3 shall apply.

33. Loss of or Damage to Property; Accident or Injury to Workers; Indemnification

33.1 Subject to GCC Sub-Clause 33.3, the Contractor shall indemnify and hold harmless the Employer and its employees and officers from and against any and all suits, actions or administrative proceedings, claims, demands, losses, damages, costs, and expenses of whatsoever nature, including attorney's fees and expenses, in respect of the death or injury of any person or loss of or damage to any property other than the Facilities whether accepted or not, arising in connection with the supply and installation of the Facilities and by reason of the negligence of the Contractor or its Subcontractors, or their employees, officers or agents, except any injury, death or property damage caused by the

negligence of the Employer, its contractors, employees, officers or agents.

33.2 If any proceedings are brought or any claim is made against the Employer that might subject the Contractor to liability under GCC Sub-Clause 33.1, the Employer shall promptly give the Contractor a notice thereof and the Contractor may at its own expense and in the Employer's name conduct such proceedings or claim and any negotiations for the settlement of any such proceedings or claim.

If the Contractor fails to notify the Employer within twenty-eight (28) days after receipt of such notice that it intends to conduct any such proceedings or claim, then the Employer shall be free to conduct the same on its own behalf. Unless the Contractor has so failed to notify the Employer within the twenty-eight (28) day period, the Employer shall make no admission that may be prejudicial to the defense of any such proceedings or claim.

The Employer shall, at the Contractor's request, afford all available assistance to the Contractor in conducting such proceedings or claim, and shall be reimbursed by the Contractor for all reasonable expenses incurred in so doing.

33.3 The Employer shall indemnify and hold harmless the Contractor and its employees, officers and Subcontractors from any liability for loss of or damage to property of the Employer, other than the Facilities not yet taken over, that is caused by fire, explosion or any other perils, in excess of the amount recoverable from insurances procured under GCC Clause 34, provided that such fire, explosion or other perils were not caused by any act or failure of the Contractor.

33.4 The Party entitled to the benefit of an indemnity under this GCC Clause 33 shall take all reasonable measures to mitigate any loss or damage which has occurred. If the Party fails to take such measures, the other Party's liabilities shall be correspondingly reduced.

34. Insurance

34.1 To the extent specified in the Appendix to the Contract Agreement titled Insurance Requirements, the Contractor shall at its expense take out and maintain in effect, or cause to be taken out and maintained in effect, during the performance of the Contract, the insurances set forth below in the sums and with the deductibles and other conditions specified in the said Appendix. The identity of the insurers and the form of the policies shall be subject to the

approval of the Employer, who should not unreasonably withhold such approval.

(a) Cargo Insurance During Transport

Covering loss or damage occurring while in transit from the Contractor's or Subcontractor's works or stores until arrival at the Site, to the Plant (including spare parts therefor) and to the Contractor's Equipment.

(b) Installation All Risks Insurance

Covering physical loss or damage to the Facilities at the Site, occurring prior to Completion of the Facilities, with an extended maintenance coverage for the Contractor's liability in respect of any loss or damage occurring during the Defect Liability Period while the Contractor is on the Site for the purpose of performing its obligations during the Defect Liability Period.

(c) Third Party Liability Insurance

Covering bodily injury or death suffered by third Parties including the Employer's personnel, and loss of or damage to property occurring in connection with the supply and installation of the Facilities.

(d) Automobile Liability Insurance

Covering use of all vehicles used by the Contractor or its Subcontractors, whether or not owned by them, in connection with the execution of the Contract.

(e) Workers' Compensation

In accordance with the statutory requirements applicable in any country where the Contract or any part thereof is executed.

(f) Employer's Liability

In accordance with the statutory requirements applicable in any country where the Contract or any part thereof is executed.

(g) Other Insurances

Such other insurances as may be specifically agreed upon by the Parties hereto as listed in the Appendix to the Contract Agreement titled Insurance Requirements.

34.2 The Employer shall be named as co-insured under all insurance policies taken out by the Contractor pursuant to GCC Sub-Clause 34.1, except for the Third Party Liability, Workers' Compensation and Employer's Liability Insurances, and the Contractor's Subcontractors shall be named as co-insureds under all insurance policies taken out by the Contractor pursuant to GCC Sub-Clause 34.1 except for the Cargo Insurance During Transport, Workers' Compensation and Employer's Liability Insurances. All insurer's rights of subrogation against such co-insureds for losses or claims arising out of the performance of the Contract shall be waived under such policies.

34.3 The Contractor shall, in accordance with the provisions of the Appendix to the Contract Agreement titled Insurance Requirements, deliver to the Employer certificates of insurance or copies of the insurance policies as evidence that the required policies are in full force and effect. The certificates shall provide that no less than twenty-one (21) days' notice shall be given to the Employer by insurers prior to cancellation or material modification of a policy.

34.4 The Contractor shall ensure that, where applicable, its Subcontractor(s) shall take out and maintain in effect adequate insurance policies for their personnel and vehicles and for work executed by them under the Contract, unless such Subcontractors are covered by the policies taken out by the Contractor.

34.5 The Employer shall at its expense take out and maintain in effect during the performance of the Contract those insurances specified in the Appendix to the Contract Agreement titled Insurance Requirements, in the sums and with the deductibles and other conditions specified in the said Appendix. The Contractor and the Contractor's Subcontractors shall be named as co-insureds under all such policies. All insurers' rights of subrogation against such co-insureds for losses or claims arising out of the performance of the Contract shall be waived under such policies. The Employer shall deliver to the Contractor satisfactory evidence that the required insurances are in full force and effect. The policies shall provide that not less than twenty-one (21) days' notice shall be given to the Contractor by all insurers prior to any cancellation or material modification of the policies. If so requested by the

Contractor, the Employer shall provide copies of the policies taken out by the Employer under this GCC Sub-Clause 34.5.

34.6 If the Contractor fails to take out and/or maintain in effect the insurances referred to in GCC Sub-Clause 34.1, the Employer may take out and maintain in effect any such insurances and may from time to time deduct from any amount due the Contractor under the Contract any premium that the Employer shall have paid to the insurer, or may otherwise recover such amount as a debt due from the Contractor. If the Employer fails to take out and/or maintain in effect the insurances referred to in GCC 34.5, the Contractor may take out and maintain in effect any such insurances and may from time to time deduct from any amount due the Employer under the Contract any premium that the Contractor shall have paid to the insurer, or may otherwise recover such amount as a debt due from the Employer. If the Contractor fails to or is unable to take out and maintain in effect any such insurances, the Contractor shall nevertheless have no liability or responsibility towards the Employer, and the Contractor shall have full recourse against the Employer for any and all liabilities of the Employer herein.

34.7 Unless otherwise provided in the Contract, the Contractor shall prepare and conduct all and any claims made under the policies effected by it pursuant to this GCC Clause 34, and all monies payable by any insurers shall be paid to the Contractor. The Employer shall give to the Contractor all such reasonable assistance as may be required by the Contractor. With respect to insurance claims in which the Employer's interest is involved, the Contractor shall not give any release or make any compromise with the insurer without the prior written consent of the Employer. With respect to insurance claims in which the Contractor's interest is involved, the Employer shall not give any release or make any compromise with the insurer without the prior written consent of the Contractor.

35. Unforeseen Conditions

35.1 If, during the execution of the Contract, the Contractor shall encounter on the Site any physical conditions other than climatic conditions, or artificial obstructions that could not have been reasonably foreseen prior to the date of the Contract Agreement by an experienced contractor on the basis of reasonable examination of the data relating to the Facilities including any data as to boring tests, provided by the Employer, and on the basis of information that it could have obtained from a visual inspection of the Site if access thereto was available, or other data readily available to it relating to the Facilities, and if the Contractor

determines that it will in consequence of such conditions or obstructions incur additional cost and expense or require additional time to perform its obligations under the Contract that would not have been required if such physical conditions or artificial obstructions had not been encountered, the Contractor shall promptly, and before performing additional work or using additional Plant or Contractor's Equipment, notify the Project Manager in writing of

(a) the physical conditions or artificial obstructions on the Site that could not have been reasonably foreseen;

(b) the additional work and/or Plant and/or Contractor's Equipment required, including the steps which the Contractor will or proposes to take to overcome such conditions or obstructions;

(c) the extent of the anticipated delay; and

(d) the additional cost and expense that the Contractor is likely to incur.

On receiving any notice from the Contractor under this GCC Sub-Clause 35.1, the Project Manager shall promptly consult with the Employer and Contractor and decide upon the actions to be taken to overcome the physical conditions or artificial obstructions encountered. Following such consultations, the Project Manager shall instruct the Contractor, with a copy to the Employer, of the actions to be taken.

35.2 Any reasonable additional cost and expense incurred by the Contractor in following the instructions from the Project Manager to overcome such physical conditions or artificial obstructions referred to in GCC Sub-Clause 35.1 shall be paid by the Employer to the Contractor as an addition to the Contract Price.

If the Contractor is delayed or impeded in the performance of the Contract because of any such physical conditions or artificial obstructions referred to in GCC Sub-Clause 35.1, the Time for Completion shall be extended in accordance with GCC Clause 40.

36. Change in Laws and Regulations

36.1 If, after the date twenty-eight (28) days prior to the date of Bid submission, in the country where the Site is located, any law, regulation, ordinance, order or by-law having the force of law is enacted, promulgated, abrogated or changed which shall be deemed to include any change in interpretation or application by the competent authorities, that subsequently affects the costs and expenses of the Contractor and/or the Time for Completion, the Contract Price shall be correspondingly increased or decreased, and/or the Time for Completion shall be reasonably adjusted to the extent that the Contractor has thereby been affected in the performance of any of its obligations under the Contract. Notwithstanding the foregoing, such additional or reduced costs shall not be separately paid or credited if the same has already been accounted for in the price adjustment provisions where applicable, in accordance with the PCC pursuant to GCC Sub-Clause 11.2.

37. Force Majeure

37.1 "Force Majeure" shall mean any event beyond the reasonable control of the Employer or of the Contractor, as the case may be, and which is unavoidable notwithstanding the reasonable care of the Party affected, and shall include, without limitation, the following:

(a) war, hostilities or warlike operations whether a state of war be declared or not, invasion, act of foreign enemy and civil war

(b) rebellion, revolution, insurrection, mutiny, usurpation of civil or military government, conspiracy, riot, civil commotion and terrorist acts

(c) confiscation, nationalization, mobilization, commandeering or requisition by or under the order of any government or de jure or de facto authority or ruler or any other act or failure to act of any local state or national government authority

(d) strike, sabotage, lockout, embargo, import restriction, port congestion, lack of usual means of public transportation and communication, industrial dispute, shipwreck, shortage or restriction of power supply, epidemics, quarantine and plague

(e) earthquake, landslide, volcanic activity, fire, flood or inundation, tidal wave, typhoon or cyclone, hurricane, storm, lightning, or other inclement weather condition,

nuclear and pressure waves or other natural or physical disaster

(f) shortage of labor, materials or utilities where caused by circumstances that are themselves Force Majeure.

37.2 If either Party is prevented, hindered or delayed from or in performing any of its obligations under the Contract by an event of Force Majeure, then it shall notify the other in writing of the occurrence of such event and the circumstances thereof within fourteen (14) days after the occurrence of such event.

37.3 The Party who has given such notice shall be excused from the performance or punctual performance of its obligations under the Contract for so long as the relevant event of Force Majeure continues and to the extent that such Party's performance is prevented, hindered or delayed. The Time for Completion shall be extended in accordance with GCC Clause 40.

37.4 The Party or Parties affected by the event of Force Majeure shall use reasonable efforts to mitigate the effect thereof upon its or their performance of the Contract and to fulfill its or their obligations under the Contract, but without prejudice to either Party's right to terminate the Contract under GCC Sub-Clauses 37.6 and 38.5.

37.5 No delay or nonperformance by either Party hereto caused by the occurrence of any event of Force Majeure shall

(a) constitute a default or breach of the Contract, or

(b) give rise to any claim for damages or additional cost or expense occasioned thereby, subject to GCC Sub-Clauses 32.2, 38.3 and 38.4

if and to the extent that such delay or nonperformance is caused by the occurrence of an event of Force Majeure.

37.6 If the performance of the Contract is substantially prevented, hindered or delayed for a single period of more than sixty (60) days or an aggregate period of more than one hundred and twenty (120) days on account of one or more events of Force Majeure during the currency of the Contract, the Parties will attempt to develop a mutually satisfactory solution, failing which either Party may terminate the Contract by giving a notice to the other, but without prejudice to either Party's right to terminate the Contract under GCC Sub-Clause 38.5.

37.7 In the event of termination pursuant to GCC Sub-Clause 37.6, the rights and obligations of the Employer and the Contractor shall be as specified in GCC Sub-Clauses 42.1.2 and 42.1.3.

37.8 Notwithstanding GCC Sub-Clause 37.5, Force Majeure shall not apply to any obligation of the Employer to make payments to the Contractor herein.

38. War Risks

38.1 "War Risks" shall mean any event specified in paragraphs (a) and (b) of GCC Sub-Clause 37.1 and any explosion or impact of any mine, bomb, shell, grenade or other projectile, missile, munitions or explosive of war, occurring or existing in or near the country (or countries) where the Site is located.

38.2 Notwithstanding anything contained in the Contract, the Contractor shall have no liability whatsoever for or with respect to

(a) destruction of or damage to Facilities, Plant, or any part thereof;

(b) destruction of or damage to property of the Employer or any third Party; or

(c) injury or loss of life

if such destruction, damage, injury or loss of life is caused by any War Risks, and the Employer shall indemnify and hold the Contractor harmless from and against any and all claims, liabilities, actions, lawsuits, damages, costs, charges or expenses arising in consequence of or in connection with the same.

38.3 If the Facilities or any Plant or Contractor's Equipment or any other property of the Contractor used or intended to be used for the purposes of the Facilities shall sustain destruction or damage by reason of any War Risks, the Employer shall pay the Contractor for

(a) any part of the Facilities or the Plant so destroyed or damaged to the extent not already paid for by the Employer

and so far as may be required by the Employer, and as may be necessary for completion of the Facilities

(b) replacing or making good any Contractor's Equipment or other property of the Contractor so destroyed or damaged

(c) replacing or making good any such destruction or damage to the Facilities or the Plant or any part thereof.

If the Employer does not require the Contractor to replace or make good any such destruction or damage to the Facilities, the Employer shall either request a change in accordance with GCC Clause 39, excluding the performance of that part of the Facilities thereby destroyed or damaged or, where the loss, destruction or damage affects a substantial part of the Facilities, shall terminate the Contract, pursuant to GCC Sub-Clause 42.1.

If the Employer requires the Contractor to replace or make good on any such destruction or damage to the Facilities, the Time for Completion shall be extended in accordance with GCC 40.

38.4 Notwithstanding anything contained in the Contract, the Employer shall pay the Contractor for any increased costs or incidentals to the execution of the Contract that are in any way attributable to, consequent on, resulting from, or in any way connected with any War Risks, provided that the Contractor shall as soon as practicable notify the Employer in writing of any such increased cost.

38.5 If during the performance of the Contract any War Risks shall occur that financially or otherwise materially affect the execution of the Contract by the Contractor, the Contractor shall use its reasonable efforts to execute the Contract with due and proper consideration given to the safety of its and its Subcontractors' personnel engaged in the work on the Facilities, provided, however, that if the execution of the work on the Facilities becomes impossible or is substantially prevented for a single period of more than sixty (60) days or an aggregate period of more than one hundred and twenty (120) days on account of any War Risks, the Parties will attempt to develop a mutually satisfactory solution, failing which either Party may terminate the Contract by giving a notice to the other.

38.6 In the event of termination pursuant to GCC Sub-Clauses 38.3 or 38.5, the rights and obligations of the Employer and the Contractor shall be specified in GCC Sub-Clauses 42.1.2 and 42.1.3.

H. Change in Contract Elements

39. Change in the Facilities

39.1 Introducing a Change

39.1.1 Subject to GCC Sub-Clauses 39.2.5 and 39.2.7, the Employer shall have the right to propose, and subsequently require, that the Project Manager order the Contractor from time to time during the performance of the Contract to make any change, modification, addition or deletion to, in or from the Facilities hereinafter called "Change", provided that such Change falls within the general scope of the Facilities and does not constitute unrelated work and that it is technically practicable, taking into account both the state of advancement of the Facilities and the technical compatibility of the Change envisaged with the nature of the Facilities as specified in the Contract.

39.1.2 Value Engineering: The Contractor may prepare, at its own cost, a value engineering proposal at any time during the performance of the contract. The value engineering proposal shall, at a minimum, include the following;

(a) the proposed change(s), and a description of the difference to the existing contract requirements;

(b) a full cost/benefit analysis of the proposed change(s) including a description and estimate of costs (including life cycle costs) the Employer may incur in implementing the value engineering proposal; and

(c) a description of any effect(s) of the change on performance/functionality.

The Employer may accept the value engineering proposal if the proposal demonstrates benefits that:

(a) accelerates the delivery period; or

(b) reduces the Contract Price or the life cycle costs to the Employer; or

(c) improves the quality, efficiency, safety or sustainability of the Facilities; or

(d) yields any other benefits to the Employer,

without compromising the necessary functions of the Facilities.

If the value engineering proposal is approved by the Employer and results in:

(a) a reduction of the Contract Price; the amount to be paid to the Contractor shall be the percentage specified **in the PCC** of the reduction in the Contract Price; or

(b) an increase in the Contract Price; but results in a reduction in life cycle costs due to any benefit described in (a) to (d) above, the amount to be paid to the Contractor shall be the full increase in the Contract Price.

39.1.3 Notwithstanding GCC Sub-Clauses 39.1.1 and 39.1.2, no change made necessary because of any default of the Contractor in the performance of its obligations under the Contract shall be deemed to be a Change, and such change shall not result in any adjustment of the Contract Price or the Time for Completion.

39.1.4 The procedure on how to proceed with and execute Changes is specified in GCC Sub-Clauses 39.2 and 39.3, and further details and forms are provided in the Employer's Requirements (Forms and Procedures).

39.2 <u>Changes Originating from Employer</u>

39.2.1 If the Employer proposes a Change pursuant to GCC Sub-Clause 39.1.1, it shall send to the Contractor a "Request for Change Proposal," requiring the Contractor to prepare and furnish to the Project Manager as soon as reasonably practicable a "Change Proposal," which shall include the following:

(a) brief description of the Change

(b) effect on the Time for Completion

(c) estimated cost of the Change

(d) effect on Functional Guarantees (if any)

(e) effect on the Facilities

(f) effect on any other provisions of the Contract.

39.2.2 Prior to preparing and submitting the "Change Proposal," the Contractor shall submit to the Project Manager an

"Estimate for Change Proposal," which shall be an estimate of the cost of preparing and submitting the Change Proposal.

Upon receipt of the Contractor's Estimate for Change Proposal, the Employer shall do one of the following:

(a) accept the Contractor's estimate with instructions to the Contractor to proceed with the preparation of the Change Proposal

(b) advise the Contractor of any part of its Estimate for Change Proposal that is unacceptable and request the Contractor to review its estimate

(c) advise the Contractor that the Employer does not intend to proceed with the Change.

39.2.3 Upon receipt of the Employer's instruction to proceed under GCC Sub-Clause 39.2.2 (a), the Contractor shall, with proper expedition, proceed with the preparation of the Change Proposal, in accordance with GCC Sub-Clause 39.2.1.

39.2.4 The pricing of any Change shall, as far as practicable, be calculated in accordance with the rates and prices included in the Contract. If such rates and prices are inequitable, the Parties thereto shall agree on specific rates for the valuation of the Change.

39.2.5 If before or during the preparation of the Change Proposal it becomes apparent that the aggregate effect of compliance therewith and with all other Change Orders that have already become binding upon the Contractor under this GCC Clause 39 would be to increase or decrease the Contract Price as originally set forth in Article 2 (Contract Price) of the Contract Agreement by more than fifteen percent (15%), the Contractor may give a written notice of objection thereto prior to furnishing the Change Proposal as aforesaid. If the Employer accepts the Contractor's objection, the Employer shall withdraw the proposed Change and shall notify the Contractor in writing thereof.

The Contractor's failure to so object shall neither affect its right to object to any subsequent requested Changes or Change Orders herein, nor affect its right to take into account, when making such subsequent objection, the

percentage increase or decrease in the Contract Price that any Change not objected to by the Contractor represents.

39.2.6 Upon receipt of the Change Proposal, the Employer and the Contractor shall mutually agree upon all matters therein contained. Within fourteen (14) days after such agreement, the Employer shall, if it intends to proceed with the Change, issue the Contractor with a Change Order.

If the Employer is unable to reach a decision within fourteen (14) days, it shall notify the Contractor with details of when the Contractor can expect a decision.

If the Employer decides not to proceed with the Change for whatever reason, it shall, within the said period of fourteen (14) days, notify the Contractor accordingly. Under such circumstances, the Contractor shall be entitled to reimbursement of all costs reasonably incurred by it in the preparation of the Change Proposal, provided that these do not exceed the amount given by the Contractor in its Estimate for Change Proposal submitted in accordance with GCC Sub-Clause 39.2.2.

39.2.7 If the Employer and the Contractor cannot reach agreement on the price for the Change, an equitable adjustment to the Time for Completion, or any other matters identified in the Change Proposal, the Employer may nevertheless instruct the Contractor to proceed with the Change by issue of a "Pending Agreement Change Order."

Upon receipt of a Pending Agreement Change Order, the Contractor shall immediately proceed with effecting the Changes covered by such Order. The Parties shall thereafter attempt to reach agreement on the outstanding issues under the Change Proposal.

If the Parties cannot reach agreement within sixty (60) days from the date of issue of the Pending Agreement Change Order, then the matter may be referred to the Dispute Board in accordance with the provisions of GCC Sub-Clause 46.1.

39.3 <u>Changes Originating from Contractor</u>

39.3.1 If the Contractor proposes a Change pursuant to GCC Sub-Clause 39.1.2, the Contractor shall submit to the Project Manager a written "Application for Change Proposal,"

giving reasons for the proposed Change and including the information specified in GCC Sub-Clause 39.1.2.

Upon receipt of the Application for Change Proposal, the Parties shall follow the procedures outlined in GCC Sub-Clauses 39.2.6 and 39.2.7. However, the Contractor shall not be entitled to recover the costs of preparing the Application for Change Proposal.

40. Extension of Time for Completion

40.1 The Time(s) for Completion specified in the PCC pursuant to GCC Sub-Clause 8.2 shall be extended if the Contractor is delayed or impeded in the performance of any of its obligations under the Contract by reason of any of the following:

(a) any Change in the Facilities as provided in GCC Clause 39

(b) any occurrence of Force Majeure as provided in GCC Clause 37, unforeseen conditions as provided in GCC Clause 35, or other occurrence of any of the matters specified or referred to in paragraphs (a), (b) and (c) of GCC Sub-Clause 32.2

(c) any suspension order given by the Employer under GCC Clause 41 hereof or reduction in the rate of progress pursuant to GCC Sub-Clause 41.2 or

(d) any changes in laws and regulations as provided in GCC Clause 36 or

(e) any default or breach of the Contract by the Employer, Appendix to the Contract Agreement titled, or any activity, act or omission of the Employer, or the Project Manager, or any other contractors employed by the Employer, or

(f) any delay on the part of a Subcontractor, provided such delay is due to a cause for which the Contractor himself would have been entitled to an extension of time under this sub-clause, or

(g) delays attributable to the Employer or caused by customs, or

(h) any other matter specifically mentioned in the Contract

by such period as shall be fair and reasonable in all the circumstances and as shall fairly reflect the delay or impediment sustained by the Contractor.

40.2 Except where otherwise specifically provided in the Contract, the Contractor shall submit to the Project Manager a notice of a claim for an extension of the Time for Completion, together with particulars of the event or circumstance justifying such extension as soon as reasonably practicable after the commencement of such event or circumstance. As soon as reasonably practicable after receipt of such notice and supporting particulars of the claim, the Employer and the Contractor shall agree upon the period of such extension. In the event that the Contractor does not accept the Employer's estimate of a fair and reasonable time extension, the Contractor shall be entitled to refer the matter to a Dispute Board, pursuant to GCC Sub-Clause 46.1.

40.3 The Contractor shall at all times use its reasonable efforts to minimize any delay in the performance of its obligations under the Contract.

40.4 In all cases where the Contractor has given a notice of a claim for an extension of time under GCC 40.2, the Contractor shall consult with the Project Manager in order to determine the steps (if any) which can be taken to overcome or minimize the actual or anticipated delay. The Contractor shall there after comply with all reasonable instructions which the Project Manager shall give in order to minimize such delay. If compliance with such instructions shall cause the Contractor to incur extra costs and the Contractor is entitled to an extension of time under GCC 40.1, the amount of such extra costs shall be added to the Contract Price.

41. Suspension

41.1 The Employer may request the Project Manager, by notice to the Contractor, to order the Contractor to suspend performance of any or all of its obligations under the Contract. Such notice shall specify the obligation of which performance is to be suspended, the effective date of the suspension and the reasons therefor. The Contractor shall thereupon suspend performance of such obligation, except those obligations necessary for the care or preservation of the Facilities, until ordered in writing to resume such performance by the Project Manager.

If, by virtue of a suspension order given by the Project Manager, other than by reason of the Contractor's default or breach of the Contract, the Contractor's performance of any of its obligations is suspended for an aggregate period of more than ninety (90) days,

then at any time thereafter and provided that at that time such performance is still suspended, the Contractor may give a notice to the Project Manager requiring that the Employer shall, within twenty-eight (28) days of receipt of the notice, order the resumption of such performance or request and subsequently order a change in accordance with GCC Clause 39, excluding the performance of the suspended obligations from the Contract.

If the Employer fails to do so within such period, the Contractor may, by a further notice to the Project Manager, elect to treat the suspension, where it affects a part only of the Facilities, as a deletion of such part in accordance with GCC Clause 39 or, where it affects the whole of the Facilities, as termination of the Contract under GCC Sub-Clause 42.1.

41.2 If

(a) the Employer has failed to pay the Contractor any sum due under the Contract within the specified period, has failed to approve any invoice or supporting documents without just cause pursuant to the Appendix to the Contract Agreement titled Terms and Procedures of Payment, or commits a substantial breach of the Contract, the Contractor may give a notice to the Employer that requires payment of such sum, with interest thereon as stipulated in GCC Sub-Clause 12.3, requires approval of such invoice or supporting documents, or specifies the breach and requires the Employer to remedy the same, as the case may be. If the Employer fails to pay such sum together with such interest, fails to approve such invoice or supporting documents or give its reasons for withholding such approval, or fails to remedy the breach or take steps to remedy the breach within fourteen (14) days after receipt of the Contractor's notice or

(b) the Contractor is unable to carry out any of its obligations under the Contract for any reason attributable to the Employer, including but not limited to the Employer's failure to provide possession of or access to the Site or other areas in accordance with GCC Sub-Clause 10.2, or failure to obtain any governmental permit necessary for the execution and/or completion of the Facilities,

then the Contractor may by fourteen (14) days' notice to the Employer suspend performance of all or any of its obligations under the Contract, or reduce the rate of progress.

41.3 If the Contractor's performance of its obligations is suspended or the rate of progress is reduced pursuant to this GCC Clause 41, then the Time for Completion shall be extended in accordance with GCC Sub-Clause 40.1, and any and all additional costs or expenses incurred by the Contractor as a result of such suspension or reduction shall be paid by the Employer to the Contractor in addition to the Contract Price, except in the case of suspension order or reduction in the rate of progress by reason of the Contractor's default or breach of the Contract.

41.4 During the period of suspension, the Contractor shall not remove from the Site any Plant, any part of the Facilities or any Contractor's Equipment, without the prior written consent of the Employer.

42. Termination

42.1 Termination for Employer's Convenience

42.1.1 The Employer may at any time terminate the Contract for any reason by giving the Contractor a notice of termination that refers to this GCC Sub-Clause 42.1.

42.1.2 Upon receipt of the notice of termination under GCC Sub-Clause 42.1.1, the Contractor shall either immediately or upon the date specified in the notice of termination

(a) cease all further work, except for such work as the Employer may specify in the notice of termination for the sole purpose of protecting that part of the Facilities already executed, or any work required to leave the Site in a clean and safe condition

(b) terminate all subcontracts, except those to be assigned to the Employer pursuant to paragraph (d) (ii) below

(c) remove all Contractor's Equipment from the Site, repatriate the Contractor's and its Subcontractors' personnel from the Site, remove from the Site any wreckage, rubbish and debris of any kind, and leave the whole of the Site in a clean and safe condition, and

(d) subject to the payment specified in GCC Sub-Clause 42.1.3,

(i) deliver to the Employer the parts of the Facilities executed by the Contractor up to the date of termination

(ii) to the extent legally possible, assign to the Employer all right, title and benefit of the Contractor to the Facilities and to the Plant as of the date of termination, and, as may be required by the Employer, in any subcontracts concluded between the Contractor and its Subcontractors; and

(iii) deliver to the Employer all non-proprietary drawings, specifications and other documents prepared by the Contractor or its Subcontractors as at the date of termination in connection with the Facilities.

42.1.3 In the event of termination of the Contract under GCC Sub-Clause 42.1.1, the Employer shall pay to the Contractor the following amounts:

(a) the Contract Price, properly attributable to the parts of the Facilities executed by the Contractor as of the date of termination

(b) the costs reasonably incurred by the Contractor in the removal of the Contractor's Equipment from the Site and in the repatriation of the Contractor's and its Subcontractors' personnel

(c) any amounts to be paid by the Contractor to its Subcontractors in connection with the termination of any subcontracts, including any cancellation charges

(d) costs incurred by the Contractor in protecting the Facilities and leaving the Site in a clean and safe condition pursuant to paragraph (a) of GCC Sub-Clause 42.1.2

(e) the cost of satisfying all other obligations, commitments and claims that the Contractor may in good faith have undertaken with third Parties in connection with the Contract and that are not covered by paragraphs (a) through (d) above.

42.2 Termination for Contractor's Default

42.2.1 The Employer, without prejudice to any other rights or remedies it may possess, may terminate the Contract forthwith in the following circumstances by giving a notice

of termination and its reasons therefor to the Contractor, referring to this GCC Sub-Clause 42.2:

(a) if the Contractor becomes bankrupt or insolvent, has a receiving order issued against it, compounds with its creditors, or, if the Contractor is a corporation, a resolution is passed or order is made for its winding up, other than a voluntary liquidation for the purposes of amalgamation or reconstruction, a receiver is appointed over any part of its undertaking or assets, or if the Contractor takes or suffers any other analogous action in consequence of debt

(b) if the Contractor assigns or transfers the Contract or any right or interest therein in violation of the provision of GCC Clause 43.

(c) if the Contractor, in the judgment of the Employer has engaged in Fraud and Corruption, as defined in paragrpah 2.2 a. of Appendix B to the GCC, in competing for or in executing the Contract.

42.2.2 If the Contractor

(a) has abandoned or repudiated the Contract

(b) has without valid reason failed to commence work on the Facilities promptly or has suspended, other than pursuant to GCC Sub-Clause 41.2, the progress of Contract performance for more than twenty-eight (28) days after receiving a written instruction from the Employer to proceed

(c) persistently fails to execute the Contract in accordance with the Contract or persistently neglects to carry out its obligations under the Contract without just cause

(d) refuses or is unable to provide sufficient materials, services or labor to execute and complete the Facilities in the manner specified in the program furnished under GCC Sub-Clause 18.2 at rates of progress that give reasonable assurance to the Employer that the Contractor can attain Completion of the Facilities by the Time for Completion as extended,

then the Employer may, without prejudice to any other rights it may possess under the Contract, give a notice to the Contractor stating the nature of the default and requiring the Contractor to remedy the same. If the Contractor fails to remedy or to take steps to remedy the same within fourteen (14) days of its receipt of such notice, then the Employer may terminate the Contract forthwith by giving a notice of termination to the Contractor that refers to this GCC Sub-Clause 42.2.

42.2.3 Upon receipt of the notice of termination under GCC Sub-Clauses 42.2.1 or 42.2.2, the Contractor shall, either immediately or upon such date as is specified in the notice of termination,

(a) cease all further work, except for such work as the Employer may specify in the notice of termination for the sole purpose of protecting that part of the Facilities already executed, or any work required to leave the Site in a clean and safe condition

(b) terminate all subcontracts, except those to be assigned to the Employer pursuant to paragraph (d) below

(c) deliver to the Employer the parts of the Facilities executed by the Contractor up to the date of termination

(d) to the extent legally possible, assign to the Employer all right, title and benefit of the Contractor to the Facilities and to the Plant as of the date of termination, and, as may be required by the Employer, in any subcontracts concluded between the Contractor and its Subcontractors

(e) deliver to the Employer all drawings, specifications and other documents prepared by the Contractor or its Subcontractors as of the date of termination in connection with the Facilities.

42.2.4 The Employer may enter upon the Site, expel the Contractor, and complete the Facilities itself or by employing any third Party. The Employer may, to the exclusion of any right of the Contractor over the same, take over and use with the payment of a fair rental rate to the Contractor, with all the maintenance costs to the account of the Employer and with an indemnification by the Employer

for all liability including damage or injury to persons arising out of the Employer's use of such equipment, any Contractor's Equipment owned by the Contractor and on the Site in connection with the Facilities for such reasonable period as the Employer considers expedient for the supply and installation of the Facilities.

Upon completion of the Facilities or at such earlier date as the Employer thinks appropriate, the Employer shall give notice to the Contractor that such Contractor's Equipment will be returned to the Contractor at or near the Site and shall return such Contractor's Equipment to the Contractor in accordance with such notice. The Contractor shall thereafter without delay and at its cost remove or arrange removal of the same from the Site.

42.2.5 Subject to GCC Sub-Clause 42.2.6, the Contractor shall be entitled to be paid the Contract Price attributable to the Facilities executed as of the date of termination, the value of any unused or partially used Plant on the Site, and the costs, if any, incurred in protecting the Facilities and in leaving the Site in a clean and safe condition pursuant to paragraph (a) of GCC Sub-Clause 42.2.3. Any sums due the Employer from the Contractor accruing prior to the date of termination shall be deducted from the amount to be paid to the Contractor under this Contract.

42.2.6 If the Employer completes the Facilities, the cost of completing the Facilities by the Employer shall be determined.

If the sum that the Contractor is entitled to be paid, pursuant to GCC Sub-Clause 42.2.5, plus the reasonable costs incurred by the Employer in completing the Facilities, exceeds the Contract Price, the Contractor shall be liable for such excess.

If such excess is greater than the sums due the Contractor under GCC Sub-Clause 42.2.5, the Contractor shall pay the balance to the Employer, and if such excess is less than the sums due the Contractor under GCC Sub-Clause 42.2.5, the Employer shall pay the balance to the Contractor.

The Employer and the Contractor shall agree, in writing, on the computation described above and the manner in which any sums shall be paid.

42.3 Termination by the Contractor

42.3.1 If

(a) the Employer has failed to pay the Contractor any sum due under the Contract within the specified period, has failed to approve any invoice or supporting documents without just cause pursuant to the Appendix to the Contract Agreement titled Terms and Procedures of Payment, or commits a substantial breach of the Contract, the Contractor may give a notice to the Employer that requires payment of such sum, with interest thereon as stipulated in GCC Sub-Clause 12.3, requires approval of such invoice or supporting documents, or specifies the breach and requires the Employer to remedy the same, as the case may be. If the Employer fails to pay such sum together with such interest, fails to approve such invoice or supporting documents or give its reasons for withholding such approval, fails to remedy the breach or take steps to remedy the breach within fourteen (14) days after receipt of the Contractor's notice, or

(b) the Contractor is unable to carry out any of its obligations under the Contract for any reason attributable to the Employer, including but not limited to the Employer's failure to provide possession of or access to the Site or other areas or failure to obtain any governmental permit necessary for the execution and/or completion of the Facilities,

then the Contractor may give a notice to the Employer thereof, and if the Employer has failed to pay the outstanding sum, to approve the invoice or supporting documents, to give its reasons for withholding such approval, or to remedy the breach within twenty-eight (28) days of such notice, or if the Contractor is still unable to carry out any of its obligations under the Contract for any reason attributable to the Employer within twenty-eight (28) days of the said notice, the Contractor may by a further notice to the Employer referring to this GCC Sub-Clause 42.3.1, forthwith terminate the Contract.

42.3.2 The Contractor may terminate the Contract forthwith by giving a notice to the Employer to that effect, referring to this GCC Sub-Clause 42.3.2, if the Employer becomes

bankrupt or insolvent, has a receiving order issued against it, compounds with its creditors, or, being a corporation, if a resolution is passed or order is made for its winding up (other than a voluntary liquidation for the purposes of amalgamation or reconstruction), a receiver is appointed over any part of its undertaking or assets, or if the Employer takes or suffers any other analogous action in consequence of debt.

42.3.3 If the Contract is terminated under GCC Sub-Clauses 42.3.1 or 42.3.2, then the Contractor shall immediately

(a) cease all further work, except for such work as may be necessary for the purpose of protecting that part of the Facilities already executed, or any work required to leave the Site in a clean and safe condition

(b) terminate all subcontracts, except those to be assigned to the Employer pursuant to paragraph (d) (ii)

(c) remove all Contractor's Equipment from the Site and repatriate the Contractor's and its Subcontractors' personnel from the Site, and

(d) subject to the payment specified in GCC Sub-Clause 42.3.4,

(i) deliver to the Employer the parts of the Facilities executed by the Contractor up to the date of termination

(ii) to the extent legally possible, assign to the Employer all right, title and benefit of the Contractor to the Facilities and to the Plant as of the date of termination, and, as may be required by the Employer, in any subcontracts concluded between the Contractor and its Subcontractors, and

(iii) deliver to the Employer all drawings, specifications and other documents prepared by the Contractor or its Subcontractors as of the date of termination in connection with the Facilities.

42.3.4 If the Contract is terminated under GCC Sub-Clauses 42.3.1 or 42.3.2, the Employer shall pay to the Contractor all payments specified in GCC Sub-Clause 42.1.3, and reasonable compensation for all loss, except for loss of profit, or damage sustained by the Contractor arising out of, in connection with or in consequence of such termination.

42.3.5 Termination by the Contractor pursuant to this GCC Sub-Clause 42.3 is without prejudice to any other rights or remedies of the Contractor that may be exercised in lieu of or in addition to rights conferred by GCC Sub-Clause 42.3.

42.4 In this GCC Clause 42, the expression "Facilities executed" shall include all work executed, Installation Services provided, and all Plant acquired, or subject to a legally binding obligation to purchase, by the Contractor and used or intended to be used for the purpose of the Facilities, up to and including the date of termination.

42.5 In this GCC Clause 42, in calculating any monies due from the Employer to the Contractor, account shall be taken of any sum previously paid by the Employer to the Contractor under the Contract, including any advance payment paid pursuant to the Appendix to the Contract Agreement titled Terms and Procedures of Payment.

43. Assignment

43.1 Neither the Employer nor the Contractor shall, without the express prior written consent of the other Party, which consent shall not be unreasonably withheld, assign to any third Party the Contract or any part thereof, or any right, benefit, obligation or interest therein or thereunder, except that the Contractor shall be entitled to assign either absolutely or by way of charge any monies due and payable to it or that may become due and payable to it under the Contract.

44. Export Restrictions

44.1 Notwithstanding any obligation under the Contract to complete all export formalities, any export restrictions attributable to the Employer, to the country of the Employer or to the use of the Plant and Installation Services to be supplied which arise from trade regulations from a country supplying those Plant and Installation Services, and which substantially impede the Contractor from meeting its obligations under the Contract, shall release the Contractor from the obligation to provide deliveries or services, always provided, however, that the Contractor can demonstrate to the satisfaction of the Employer and of the Bank that it has

completed all formalities in a timely manner, including applying for permits, authorizations and licenses necessary for the export of the Plant and Installation Services under the terms of the Contract. Termination of the Contract on this basis shall be for the Employer's convenience pursuant to Sub-Clause 42.1.

I. Claims, Disputes and Arbitration

45. Contractor's Claims

45.1 If the Contractor considers himself to be entitled to any extension of the Time for Completion and/or any additional payment, under any Clause of these Conditions or otherwise in connection with the Contract, the Contractor shall submit a notice to the Project Manager, describing the event or circumstance giving rise to the claim. The notice shall be given as soon as practicable, and not later than 28 days after the Contractor became aware, or should have become aware, of the event or circumstance.

If the Contractor fails to give notice of a claim within such period of 28 days, the Time for Completion shall not be extended, the Contractor shall not be entitled to additional payment, and the Employer shall be discharged from all liability in connection with the claim. Otherwise, the following provisions of this Sub-Clause shall apply.

The Contractor shall also submit any other notices which are required by the Contract, and supporting particulars for the claim, all as relevant to such event or circumstance.

The Contractor shall keep such contemporary records as may be necessary to substantiate any claim, either on the Site or at another location acceptable to the Project Manager. Without admitting the Employer's liability, the Project Manager may, after receiving any notice under this Sub-Clause, monitor the record-keeping and/or instruct the Contractor to keep further contemporary records. The Contractor shall permit the Project Manager to inspect all these records, and shall (if instructed) submit copies to the Project Manager.

Within 42 days after the Contractor became aware (or should have become aware) of the event or circumstance giving rise to the claim, or within such other period as may be proposed by the Contractor and approved by the Project Manager, the Contractor shall send to the Project Manager a fully detailed claim which includes full supporting particulars of the basis of the claim and of the extension of time and/or additional payment claimed. If the

event or circumstance giving rise to the claim has a continuing effect:

(a) this fully detailed claim shall be considered as interim;

(b) the Contractor shall send further interim claims at monthly intervals, giving the accumulated delay and/or amount claimed, and such further particulars as the Project Manager may reasonably require; and

(c) the Contractor shall send a final claim within 28 days after the end of the effects resulting from the event or circumstance, or within such other period as may be proposed by the Contractor and approved by the Project Manager.

Within 42 days after receiving a claim or any further particulars supporting a previous claim, or within such other period as may be proposed by the Project Manager and approved by the Contractor, the Project Manager shall respond with approval, or with disapproval and detailed comments. He may also request any necessary further particulars, but shall nevertheless give his response on the principles of the claim within such time.

Each Payment Certificate shall include such amounts for any claim as have been reasonably substantiated as due under the relevant provision of the Contract. Unless and until the particulars supplied are sufficient to substantiate the whole of the claim, the Contractor shall only be entitled to payment for such part of the claim as he has been able to substantiate.

The Project Manager shall agree with the Contractor or estimate: (i) the extension (if any) of the Time for Completion (before or after its expiry) in accordance with GCC Clause 40, and/or (ii) the additional payment (if any) to which the Contractor is entitled under the Contract.

The requirements of this Sub-Clause are in addition to those of any other Sub-Clause which may apply to a claim. If the Contractor fails to comply with this or another Sub-Clause in relation to any claim, any extension of time and/or additional payment shall take account of the extent (if any) to which the failure has prevented or prejudiced proper investigation of the claim, unless the claim is excluded under the second paragraph of this Sub-Clause.

In the event that the Contractor and the Employer cannot agree on any matter relating to a claim, either Party may refer the matter to the Dispute Board pursuant to GCC 46 hereof.

46. Disputes and Arbitration

46.1 Appointment of the Dispute Board

Disputes shall be referred to a DB for decision in accordance with GCC Sub-Clause 46.3. The Parties shall appoint a DB by the date stated **in the PCC**.

The DB shall comprise, as stated **in the PCC**, either one or three suitably qualified persons ("the members"), each of whom meet the criteria set forth in Sub-Clause 3 of Appendix A- General Conditions of Dispute Board Agreement. If the number is not so stated and the Parties do not agree otherwise, the DB shall comprise three persons, one of whom shall serve as chairman.

If the Contract is with a foreign Contractor, the DB members shall not have the same nationality as the Employer or the Contractor

If the Parties have not jointly appointed the DB 21 days before the date stated in the PCC and the DB is to comprise three persons, each Party shall nominate one member for the approval of the other Party. The first two members shall recommend and the Parties shall agree upon the third member, who shall act as chairman.

However, if a list of potential members is included in the PCC, the members shall be selected from those on the list, other than anyone who is unable or unwilling to accept appointment to the DB.

The agreement between the Parties and either the sole member or each of the three members shall incorporate by reference the General Conditions of Dispute Board Agreement contained in the Appendix to these General Conditions, with such amendments as are agreed between them.

The DB shall be deemed to be constituted on the date the Parties and the sole member or the three members (as the case may be) of the DB have all signed a DB agreement.

The terms of the remuneration of either the sole member or each of the three members, including the remuneration of any expert whom the DB consults, shall be mutually agreed upon by the Parties when agreeing the terms of appointment of the member or

such expert (as the case may be). Each Party shall be responsible for paying one-half of this remuneration.

If a member declines to act or is unable to act as a result of death, disability, resignation or termination of appointment, a replacement shall be appointed in the same manner as the replaced person was required to have been nominated or agreed upon, as described in this Sub-Clause.

The appointment of any member may be terminated by mutual agreement of both Parties, but not by the Employer or the Contractor acting alone. Unless otherwise agreed by both Parties, the appointment of the DB (including each member) shall expire when the Operational Acceptance Certificate has been issued in accordance with GCC Sub-Clause 25.3.

46.2 Failure to Agree on the Composition of the Dispute Board

If any of the following conditions apply, namely:

(a) the Parties fail to agree upon the appointment of the sole member of the DB by the date stated in the first paragraph of GCC Sub-Clause 46.1,

(b) either Party fails to nominate a member (for approval by the other Party) of a DB of three persons by such date,

(c) the Parties fail to agree upon the appointment of the third member (to act as chairman) of the DB by such date, or

(d) the Parties fail to agree upon the appointment of a replacement person within 42 days after the date on which the sole member or one of the three members declines to act or is unable to act as a result of death, disability, resignation or termination of appointment,

then the appointing entity or official **named in the PCC** shall, upon the request of either or both of the Parties and after due consultation with both Parties, appoint this member of the DB. This appointment shall be final and conclusive. Each Party shall be responsible for paying one-half of the remuneration of the appointing entity or official.

46.3 Obtaining Dispute Board's Decision

If a dispute (of any kind whatsoever) arises between the Parties in connection with the performance of the Contract, including any dispute as to any certificate, determination, instruction, opinion or valuation of the Project Manager, either Party may refer the dispute in writing to the DB for its decision, with copies to the other Party and the Project Manager. Such reference shall state that it is given under this Sub-Clause.

For a DB of three persons, the DB shall be deemed to have received such reference on the date when it is received by the chairman of the DB.

Both Parties shall promptly make available to the DB all such additional information, further access to the Site, and appropriate facilities, as the DB may require for the purposes of making a decision on such dispute. The DB shall be deemed to be not acting as arbitrator(s).

Within 84 days after receiving such reference, or within such other period as may be proposed by the DB and approved by both Parties, the DB shall give its decision, which shall be reasoned and shall state that it is given under this Sub-Clause. The decision shall be binding on both Parties, who shall promptly give effect to it unless and until it shall be revised in an amicable settlement or an arbitral award as described below. Unless the Contract has already been abandoned, repudiated or terminated, the Contractor shall continue with the performance of the Facilities in accordance with the Contract.

If either Party is dissatisfied with the DB's decision, then either Party may, within 28 days after receiving the decision, give notice to the other Party of its dissatisfaction and intention to commence arbitration. If the DB fails to give its decision within the period of 84 days (or as otherwise approved) after receiving such reference, then either Party may, within 28 days after this period has expired, give notice to the other Party of its dissatisfaction and intention to commence arbitration.

In either event, this notice of dissatisfaction shall state that it is given under this Sub-Clause, and shall set out the matter in dispute and the reason(s) for dissatisfaction. Except as stated in GCC Sub-Clauses 46.6 and 46.7, neither Party shall be entitled to commence arbitration of a dispute unless a notice of dissatisfaction has been given in accordance with this Sub-Clause.

If the DB has given its decision as to a matter in dispute to both Parties, and no notice of dissatisfaction has been given by either

Party within 28 days after it received the DB's decision, then the decision shall become final and binding upon both Parties.

46.4 Amicable Settlement

Where notice of dissatisfaction has been given under GCC Sub-Clause 46.3 above, both Parties shall attempt to settle the dispute amicably before the commencement of arbitration. However, unless both Parties agree otherwise, arbitration may be commenced on or after the fifty-sixth day after the day on which notice of dissatisfaction and intention to commence arbitration was given, even if no attempt at amicable settlement has been made.

46.5 Arbitration

Unless **indicated otherwise in the PCC,** any dispute not settled amicably and in respect of which the DB's decision (if any) has not become final and binding shall be finally settled by arbitration. Unless otherwise agreed by both Parties, arbitration shall be conducted as follows:

(a) For contracts with foreign contractors:

unless otherwise specified in the PCC; the dispute shall be finally settled under the Rules of Arbitration of the International Chamber of Commerce; by one or three arbitrators appointed in accordance with these Rules. The place of arbitration shall be the neutral location stated in the PCC; and the arbitration shall be conducted in the ruling language stated in the PCC;

and (b) For contracts with domestic contractors, arbitration with proceedings conducted in accordance with the laws of the Employer's Country.

The arbitrator(s) shall have full power to open up, review and revise any certificate, determination, instruction, opinion or valuation of the Project Manager, and any decision of the DB, relevant to the dispute. Nothing shall disqualify the Project Manager from being called as a witness and giving evidence before the arbitrator(s) on any matter whatsoever relevant to the dispute.

Neither Party shall be limited in the proceedings before the arbitrator(s) to the evidence or arguments previously put before

the DB to obtain its decision, or to the reasons for dissatisfaction given in its notice of dissatisfaction. Any decision of the DB shall be admissible in evidence in the arbitration.

Arbitration may be commenced prior to or after completion of the Facilities. The obligations of the Parties, the Project Manager and the DB shall not be altered by reason of any arbitration being conducted during the progress of the execution of the Facilities.

46.6 Failure to Comply with Dispute Board's Decision

In the event that a Party fails to comply with a DB decision which has become final and binding, then the other Party may, without prejudice to any other rights it may have, refer the failure itself to arbitration under GCC Sub-Clause 46.5. GCC Sub-Clauses 46.3 and 46.4 shall not apply to this reference.

46.7 Expiry of Dispute Board's Appointment

If a dispute arises between the Parties in connection with the performance of the Contract, and there is no DB in place, whether by reason of the expiry of the DB's appointment or otherwise:

(a) GCC Sub-Clauses 46.3 and 46.4 shall not apply, and

(b) the dispute may be referred directly to arbitration under GCC Sub-Clause 46.5

APPENDIX A

General Conditions of Dispute Board Agreement

1. Definitions

Each "Dispute Board Agreement" is a tripartite agreement by and between:

the "Employer";

the "Contractor"; and

the "Member" who is defined in the Dispute Board Agreement as being:

(i) the sole member of the "DB" and, where this is the case, all references to the "Other Members" do not apply, or

(ii) one of the three persons who are jointly called the "DB" (or "dispute board") and, where this is the case, the other two persons are called the "Other Members".

The Employer and the Contractor have entered (or intend to enter) into a contract, which is called the "Contract" and is defined in the Dispute Board Agreement, which incorporates this Appendix. In the Dispute Board Agreement, words and expressions which are not otherwise defined shall have the meanings assigned to them in the Contract.

2. General Provisions

Unless otherwise stated in the Dispute Board Agreement, it shall take effect on the latest of the following dates:

(a) the Commencement Date defined in the Contract,

(b) when the Employer, the Contractor and the Member have each signed the Dispute Board Agreement, or

(c) when the Employer, the Contractor and each of the Other Members (if any) have respectively each signed a dispute board agreement.

This employment of the Member is a personal appointment. At any time, the Member may give not less than 70 days' notice of resignation to the Employer and to the Contractor, and the Dispute Board Agreement shall terminate upon the expiry of this period.

3. Warranties

The Member warrants and agrees that he/she is and shall be impartial and independent of the Employer, the Contractor and the Project Manager. The Member shall promptly disclose, to each of them and to the Other Members (if any), any fact or circumstance which might appear inconsistent with his/her warranty and agreement of impartiality and independence.

When appointing the Member, the Employer and the Contractor relied upon the Member's representations that he/she:

a) has at least a bachelor's degree in relevant disciplines such as law, engineering, construction management or contract management;
b) has at least ten years of experience in contract administration/management and dispute resolution, out of which at least five years of experience as an arbitrator or adjudicator in construction-related disputes;
c) has received formal training as an adjudicator from an internationally recognized organization;
d) has experience and/or is knowledgeable in the type of work which the Contractor is to carry out under the Contract;
e) has experience in the interpretation of construction and/or engineering contract documents; and
f) is fluent in the language for communications defined in GCC Sub-Clause 5.3 (or the language as agreed between the Parties and the DB).

4. General Obligations of the Member

The Member shall:

(a) have no interest financial or otherwise in the Employer, the Contractor or the Project Manager, nor any financial interest in the Contract except for payment under the Dispute Board Agreement;

(b) not previously have been employed as a consultant or otherwise by the Employer, the Contractor or the Project Manager, except in such circumstances as were disclosed in writing to the Employer and the Contractor before they signed the Dispute Board Agreement;

(c) have disclosed in writing to the Employer, the Contractor and the Other Members (if any), before entering into the Dispute Board Agreement and to his/her best knowledge and recollection, any professional or personal relationships with any director, officer or employee of the Employer, the Contractor or the Project Manager, and any previous involvement in the overall project of which the Contract forms part;

(d) not, for the duration of the Dispute Board Agreement, be employed as a consultant or otherwise by the Employer, the Contractor or the Project Manager, except as may be agreed in writing by the Employer, the Contractor and the Other Members (if any);

(e) comply with the annexed procedural rules and with GCC Sub-Clause 46.3;

(f) not give advice to the Employer, the Contractor, the Employer's Personnel or the Contractor's Personnel concerning the conduct of the Contract, other than in accordance with the annexed procedural rules;

(g) not while a Member enter into discussions or make any agreement with the Employer, the Contractor or the Project Manager regarding employment by any of them, whether as a consultant or otherwise, after ceasing to act under the Dispute Board Agreement;

(h) ensure his/her availability for all site visits and hearings as are necessary;

(i) become conversant with the Contract and with the progress of the Facilities (and of any other parts of the project of which the Contract forms part) by studying all documents received which shall be maintained in a current working file;

(j) treat the details of the Contract and all the DB's activities and hearings as private and confidential, and not publish or disclose them without the prior written consent of the Employer, the Contractor and the Other Members (if any); and

(k) be available to give advice and opinions, on any matter relevant to the Contract when requested by both the Employer and the Contractor, subject to the agreement of the Other Members (if any).

5. General Obligations of the Employer and the Contractor

The Employer, the Contractor, the Employer's Personnel and the Contractor's Personnel shall not request advice from or consultation with the Member regarding the Contract, otherwise than in the normal course of the DB's activities under the Contract and the Dispute Board Agreement. The Employer and the Contractor shall be responsible for compliance with this provision, by the Employer's Personnel and the Contractor's Personnel respectively.

The Employer and the Contractor undertake to each other and to the Member that the Member shall not, except as otherwise agreed in writing by the Employer, the Contractor, the Member and the Other Members (if any):

(a) be appointed as an arbitrator in any arbitration under the Contract;

(b) be called as a witness to give evidence concerning any dispute before arbitrator(s) appointed for any arbitration under the Contract; or

(c) be liable for any claims for anything done or omitted in the discharge or purported discharge of the Member's functions, unless the act or omission is shown to have been in bad faith.

The Employer and the Contractor hereby jointly and severally indemnify and hold the Member harmless against and from claims from which he is relieved from liability under the preceding paragraph.

Whenever the Employer or the Contractor refers a dispute to the DB under GCC Sub-Clause 46.3, which will require the Member to make a site visit and attend a hearing, the Employer or the Contractor shall provide appropriate security for a sum equivalent to the reasonable expenses to be incurred by the Member. No account shall be taken of any other payments due or paid to the Member.

6. Payment

The Member shall be paid as follows, in the currency named in the Dispute Board Agreement:

(a) a retainer fee per calendar month, which shall be considered as payment in full for:

(i) being available on 28 days' notice for all site visits and hearings;

(ii) becoming and remaining conversant with all project developments and maintaining relevant files;

(iii) all office and overhead expenses including secretarial services, photocopying and office supplies incurred in connection with his duties; and

(iv) all services performed hereunder except those referred to in sub-paragraphs (b) and (c) of this Clause.

The retainer fee shall be paid with effect from the last day of the calendar month in which the Dispute Board Agreement becomes effective; until the last day of the calendar month in which the Operational Acceptance Certificate is issued for the whole of the Works.

With effect from the first day of the calendar month following the month in which Operational Acceptance Certificate is issued for the whole of the Works, the retainer fee shall be reduced by one third This reduced fee shall be paid until the first day of the calendar month in which the Member resigns or the Dispute Board Agreement is otherwise terminated.

(b) a daily fee which shall be considered as payment in full for:

(i) each day or part of a day up to a maximum of two days' travel time in each direction for the journey between the Member's home and the site, or another location of a meeting with the Other Members (if any);

(ii) each working day on site visits, hearings or preparing decisions; and

(iii) each day spent reading submissions in preparation for a hearing.

(c) all reasonable expenses including necessary travel expenses (air fare in less than first class, hotel and subsistence and other direct travel expenses) incurred in connection with the Member's duties, as well as the cost of telephone calls, courier charges, faxes and telexes: a receipt shall be required for each item in excess of five percent of the daily fee referred to in sub-paragraph (b) of this Clause;

(d) any taxes properly levied in the Country on payments made to the Member (unless a national or permanent resident of the Country) under this Clause 6.

The retainer and daily fees shall be as specified in the Dispute Board Agreement. Unless it specifies otherwise, these fees shall remain fixed for the first 24 calendar months, and shall thereafter be adjusted by agreement between the Employer, the Contractor and the Member, at each anniversary of the date on which the Dispute Board Agreement became effective.

If the Parties fail to agree on the retainer fee or the daily fee the appointing entity or official named in the PCC shall determine the amount of the fees to be used.

The Member shall submit invoices for payment of the monthly retainer and air fares quarterly in advance. Invoices for other expenses and for daily fees shall be submitted following the conclusion of a site visit or hearing. All invoices shall be accompanied by a brief description of activities performed during the relevant period and shall be addressed to the Contractor.

The Contractor shall pay each of the Member's invoices in full within 56 calendar days after receiving each invoice and shall apply to the Employer (in the Statements under the Contract) for reimbursement of one-half of the amounts of these invoices. The Employer shall then pay the Contractor in accordance with the Contract.

If the Contractor fails to pay to the Member the amount to which he/she is entitled under the Dispute Board Agreement, the Employer shall pay the amount due to the Member and any other amount which may be required to maintain the operation of the DB; and without prejudice to the Employer's rights or remedies. In addition to all other rights arising from this default, the Employer shall be entitled to reimbursement of all sums paid in excess of one-half of these payments, plus all costs of recovering these sums and financing charges calculated at the rate specified in accordance with GCC Sub-Clause 12.3.

If the Member does not receive payment of the amount due within 70 days after submitting a valid invoice, the Member may (i) suspend his/her services (without notice) until the payment is received, and/or (ii) resign his/her appointment by giving notice under Clause 7.

7. Termination

At any time: (i) the Employer and the Contractor may jointly terminate the Dispute Board Agreement by giving 42 days' notice to the Member; or (ii) the Member may resign as provided for in Clause 2.

If the Member fails to comply with the Dispute Board Agreement, the Employer and the Contractor may, without prejudice to their other rights, terminate it by notice to the Member. The notice shall take effect when received by the Member.

If the Employer or the Contractor fails to comply with the Dispute Board Agreement, the Member may, without prejudice to his other rights, terminate it by notice to the Employer and the Contractor. The notice shall take effect when received by them both.

Any such notice, resignation and termination shall be final and binding on the Employer, the Contractor and the Member. However, a notice by the Employer or the Contractor, but not by both, shall be of no effect.

8. Default of the Member

If the Member fails to comply with any of his obligations under Clause 4 concerning his impartiality or independence in relation to the Employer or the Contractor, he/she shall not be entitled to any fees or expenses hereunder and shall, without prejudice to their other rights, reimburse each of the Employer and the Contractor for any fees and expenses received by the

Member and the Other Members (if any), for proceedings or decisions (if any) of the DB which are rendered void or ineffective by the said failure to comply.

9. Disputes

Any dispute or claim arising out of or in connection with this Dispute Board Agreement, or the breach, termination or invalidity thereof, shall be finally settled by institutional arbitration. If no other arbitration institute is agreed, the arbitration shall be conducted under the Rules of Arbitration of the International Chamber of Commerce by one arbitrator appointed in accordance with these Rules of Arbitration.

Appendix A

DISPUTE BOARD GUIDELINES

1. Unless otherwise agreed by the Employer and the Contractor, the DB shall visit the site at intervals of not more than 140 days, including times of critical construction events, at the request of either the Employer or the Contractor. Unless otherwise agreed by the Employer, the Contractor and the DB, the period between consecutive visits shall not be less than 70 days, except as required to convene a hearing as described below.

2. The timing of and agenda for each site visit shall be as agreed jointly by the DB, the Employer and the Contractor, or in the absence of agreement, shall be decided by the DB. The purpose of site visits is to enable the DB to become and remain acquainted with the progress of the execution of the Contract and of any actual or potential problems or claims, and, as far as reasonable, to prevent potential problems or claims from becoming disputes.

3. Site visits shall be attended by the Employer, the Contractor and the Project Manager and shall be coordinated by the Employer in co-operation with the Contractor. The Employer shall ensure the provision of appropriate conference facilities and secretarial and copying services. At the conclusion of each site visit and before leaving the site, the DB shall prepare a report on its activities during the visit and shall send copies to the Employer and the Contractor.

4. The Employer and the Contractor shall furnish to the DB one copy of all documents which the DB may request, including Contract documents, progress reports, variation instructions, certificates and other documents pertinent to the performance of the Contract. All communications between the DB and the Employer or the Contractor shall be copied to the other Party. If the DB comprises three persons, the Employer and the Contractor shall send copies of these requested documents and these communications to each of these persons.

5. If any dispute is referred to the DB in accordance with GCC Sub-Clause 46.3, the DB shall proceed in accordance with GCC Sub-Clause 46.3 and these Guidelines. Subject to the time allowed to give notice of a decision and other relevant factors, the DB shall:

(a) act fairly and impartially as between the Employer and the Contractor, giving each of them a reasonable opportunity of putting his case and responding to the other's case, and

(b) adopt procedures suitable to the dispute, avoiding unnecessary delay or expense.

6. The DB may conduct a hearing on the dispute, in which event it will decide on the date and place for the hearing and may request that written documentation and arguments from the Employer and the Contractor be presented to it prior to or at the hearing.

7. Except as otherwise agreed in writing by the Employer and the Contractor, the DB shall have power to adopt an inquisitorial procedure, to refuse admission to hearings or audience at hearings to any persons other than representatives of the Employer, the Contractor and the Project Manager, and to proceed in the absence of any Party who the DB is satisfied

received notice of the hearing; but shall have discretion to decide whether and to what extent this power may be exercised.

8. The Employer and the Contractor empower the DB, among other things, to:

(a) establish the procedure to be applied in deciding a dispute,

(b) decide upon the DB's own jurisdiction, and as to the scope of any dispute referred to it,

(c) conduct any hearing as it thinks fit, not being bound by any rules or procedures other than those contained in the Contract and these Guidelines,

(d) take the initiative in ascertaining the facts and matters required for a decision,

(e) make use of its own specialist knowledge, if any,

(f) decide upon the payment of financing charges in accordance with the Contract,

(g) decide upon any provisional relief such as interim or conservatory measures,

(h) open up, review and revise any certificate, decision, determination, instruction, opinion or valuation of the Project Manager, relevant to the dispute, and

(i) appoint, should the DB so consider necessary and the Parties agree, a suitable expert/s (including legal and technical expert(s)) at the cost of the Parties to give advice on a specific matter relevant to the dispute.

9. The DB shall not express any opinions during any hearing concerning the merits of any arguments advanced by the Parties. Thereafter, the DB shall make and give its decision in accordance with GCC Sub-Clause 46.3, or as otherwise agreed by the Employer and the Contractor in writing. If the DB comprises three persons:

(a) it shall convene in private after a hearing, in order to have discussions and prepare its decision;

(b) it shall endeavor to reach a unanimous decision: if this proves impossible the applicable decision shall be made by a majority of the Members, who may require the minority Member to prepare a written report for submission to the Employer and the Contractor; and

(c) if a Member fails to attend a meeting or hearing, or to fulfil any required function, the other two Members may nevertheless proceed to make a decision, unless:

(i) either the Employer or the Contractor does not agree that they do so, or

(ii) the absent Member is the chairman and he/she instructs the other Members to not make a decision.

APPENDIX B

Fraud and Corruption

1. Purpose

1.1 The Bank's Anti-Corruption Guidelines and this annex apply with respect to procurement under Bank Investment Project Financing operations.

2. Requirements

2.3 The Bank requires that Borrowers (including beneficiaries of Bank financing); bidders (applicants/proposers), consultants, contractors and suppliers; any sub-contractors, sub-consultants, service providers or suppliers; any agents (whether declared or not); and any of their personnel, observe the highest standard of ethics during the procurement process, selection and contract execution of Bank-financed contracts, and refrain from Fraud and Corruption.

2.4 To this end, the Bank:

a. Defines, for the purposes of this provision, the terms set forth below as follows:

i. "corrupt practice" is the offering, giving, receiving, or soliciting, directly or indirectly, of anything of value to influence improperly the actions of another party;

ii. "fraudulent practice" is any act or omission, including misrepresentation, that knowingly or recklessly misleads, or attempts to mislead, a party to obtain financial or other benefit or to avoid an obligation;

iii. "collusive practice" is an arrangement between two or more parties designed to achieve an improper purpose, including to influence improperly the actions of another party;

iv. "coercive practice" is impairing or harming, or threatening to impair or harm, directly or indirectly, any party or the property of the party to influence improperly the actions of a party;

v. "obstructive practice" is:

(a) deliberately destroying, falsifying, altering, or concealing of evidence material to the investigation or making false statements to investigators in order to materially impede a Bank investigation into allegations of a corrupt, fraudulent, coercive, or collusive practice; and/or threatening, harassing, or intimidating any party to prevent it from disclosing its knowledge of matters relevant to the investigation or from pursuing the investigation; or

(b) acts intended to materially impede the exercise of the Bank's inspection and audit rights provided for under paragraph 2.2 e. below.

b. Rejects a proposal for award if the Bank determines that the firm or individual recommended for award, any of its personnel, or its agents, or its sub-consultants, sub-contractors, service providers, suppliers and/ or their employees, has, directly or indirectly, engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices in competing for the contract in question;

c. In addition to the legal remedies set out in the relevant Legal Agreement, may take other appropriate actions, including declaring misprocurement, if the Bank determines at any time that representatives of the Borrower or of a recipient of any part of the proceeds of the loan engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices during the procurement process, selection and/or execution of the contract in question, without the Borrower having taken timely and appropriate action satisfactory to the Bank to address such practices when they occur, including by failing to inform the Bank in a timely manner at the time they knew of the practices;

d. Pursuant to the Bank's Anti- Corruption Guidelines and in accordance with the Bank's prevailing sanctions policies and procedures, may sanction a firm or individual, either indefinitely or for a stated period of time, including by publicly declaring such firm or individual ineligible (i) to be awarded or otherwise benefit from a Bank-financed contract, financially or in any other manner;1 (ii) to be a nominated2 sub-contractor, consultant, manufacturer or supplier, or service provider of an otherwise eligible firm being awarded a Bank-financed contract; and (iii) to receive the proceeds of any loan made by the Bank or otherwise to participate further in the preparation or implementation of any Bank-financed project;

e. Requires that a clause be included in bidding/request for proposals documents and in contracts financed by a Bank loan, requiring (i) bidders (applicants/proposers), consultants, contractors, and suppliers, and their sub-contractors, sub-consultants, service providers, suppliers, agents personnel, permit the Bank to inspect[3] all accounts, records and other documents relating to the procurement process, selection and/or contract execution, and to have them audited by auditors appointed by the Bank.

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[1] For the avoidance of doubt, a sanctioned party's ineligibility to be awarded a contract shall include, without limitation, (i) applying for pre-qualification, expressing interest in a consultancy, and bidding, either directly or as a nominated sub-contractor, nominated consultant, nominated manufacturer or supplier, or nominated service provider, in respect of such contract, and (ii) entering into an addendum or amendment introducing a material modification to any existing contract.

[2] A nominated sub-contractor, nominated consultant, nominated manufacturer or supplier, or nominated service provider (different names are used depending on the particular bidding document) is one which has been: (i) included by the bidder in its pre-qualification application or bid because it brings specific and critical experience and know-how that allow the bidder to meet the qualification requirements for the particular bid; or (ii) appointed by the Borrower.

[3] Inspections in this context usually are investigative (i.e., forensic) in nature. They involve fact-finding activities undertaken by the Bank or persons appointed by the Bank to address specific matters related to investigations/audits, such as evaluating the veracity of an allegation of possible Fraud and Corruption, through the appropriate mechanisms. Such activity includes but is not limited to: accessing and examining a firm's or individual's financial records and information, and making copies thereof as relevant; accessing and examining any other documents, data and information (whether in hard copy or electronic format) deemed relevant for the investigation/audit, and making copies thereof as relevant; interviewing staff and other relevant individuals; performing physical inspections and site visits; and obtaining third party verification of information.

APPENDIX C

Metrics for Progress Reports- Environmental and Social (ES)

The following Metrics should be used for regular reporting:

a. environmental incidents or non-compliances with Contract Agreement requirements, including contamination, pollution or damage to ground or water supplies;
b. health and safety incidents, accidents, injuries and all fatalities that require treatment; further provided that for accidents involving any fatality, the Employer should be informed within 24 hours of the occurrence or the earliest, in case the emergency does not allow to meet this limit.
c. interactions with regulators: identify agency, dates, subjects, outcomes (report the negative if none);
d. status of all permits and agreements:
   i. work permits: number required, number received, actions taken for those not received;
   ii. status of permits and consents if required:
   - *list areas/facilities with permits required (quarries, asphalt & batch plants), dates of application, dates issued (actions to follow up if not issued), dates submitted to resident engineer (or equivalent), status of area (waiting for permits, working, abandoned without reclamation, decommissioning plan being implemented, etc.);*
   - *list areas with landowner agreements required (borrow and spoil areas, camp sites), dates of agreements, dates submitted to resident engineer (or equivalent);*
   - *identify major activities undertaken in each area this month and highlights of environmental and social protection (land clearing, boundary marking, topsoil salvage, traffic management, decommissioning planning, decommissioning implementation);*
   - *for quarries: status of relocation and compensation (completed, or details of monthly activities and current status).*
e. health and safety supervision:
   i. safety officer: number days worked, number of full inspections & partial inspections, reports to construction/project management;
   ii. number of workers, work hours, metric of PPE use (percentage of workers with full personal protection equipment (PPE), partial, etc.), worker violations observed (by type of violation, PPE or otherwise), warnings given, repeat warnings given, follow-up actions taken (if any);
f. worker accommodations:
   i. number of migrants housed in accommodations, number of locals;
   ii. date of last inspection, and highlights of inspection including status of accommodations' compliance with national and local law and good practice, including sanitation, space, etc.;
   iii. actions taken to recommend/require improved conditions, or to improve conditions.
g. Measures adopted for prevention of COVID-19 transmission, if applicable

h. HIV/AIDS: provider of health services, information and/or training, location of clinic, number of non-safety disease or illness treatments and diagnoses (no names to be provided);
i. gender (for migrants and locals separately): number of female workers, percentage of workforce, gender and gender-based violence (GBV) related issues raised and dealt with (cross-reference grievances or other sections as needed);
j. training:
   i. number of new workers, number receiving induction training, dates of induction training;
   ii. number and dates of toolbox talks, number of workers receiving Occupational Health and Safety (OHS), environmental and social training;
   iii. number and dates of HIV/AIDS sensitization training, no. workers receiving training (this month and in the past); same questions for gender sensitization, flaglady/flagman training.
k. environmental and social supervision:
   i. environmentalist: days worked, areas inspected and numbers of inspections of each part of the Facilities created, highlights of activities/findings (including violations of environmental and/or social best practices, actions taken), reports to environmental specialist/construction/site management; and,
   ii. sociologist: days worked, number of partial and full site inspections of each part of the Facilities created, highlights of activities (including violations of social requirements observed, actions taken), reports to social specialist/construction/site management.
l. Grievances: list this month's and unresolved past grievances by date received, complainant, how received, to whom referred to for action, resolution and date (if completed), data resolution reported to complainant, any required follow-up (Cross-reference other sections as needed):
   i. Worker grievances;
   ii. Community grievances
m. Traffic and vehicles/equipment:
   i. traffic accidents involving project vehicles & equipment: provide date, location, damage, cause, follow-up;
   ii. accidents involving non-project vehicles or property (also reported under immediate metrics): provide date, location, damage, cause, follow-up;
   iii. overall condition of vehicles/equipment (subjective judgment by environmentalist); non-routine repairs and maintenance needed to improve safety and/or environmental performance (to control smoke, etc.).
n. Environmental mitigations and issues (what has been done):
   i. dust: number of working bowsers, number of waterings/day, number of complaints, warnings given by environmentalist, actions taken to resolve; highlights of quarry dust control (covers, sprays, operational status); % of rock/muram/spoil lorries with covers, actions taken for uncovered vehicles;
   ii. erosion control: controls implemented by location, status of water crossings, environmentalist inspections and results, actions taken to resolve issues, emergency repairs needed to control erosion/sedimentation;
   iii. quarries, borrow areas, spoil areas, asphalt plants, batch plants: identify major activities undertaken this month at each, and highlights of environmental and social

protection: land clearing, boundary marking, topsoil salvage, traffic management, decommissioning planning, decommissioning implementation;

iv. blasting: number of blasts (and locations), status of implementation of blasting plan (including notices, evacuations, etc.), incidents of off-site damage or complaints (cross-reference other sections as needed);

v. spill cleanups, if any: material spilled, location, amount, actions taken, material disposal (report all spills that result in water or soil contamination);

vi. waste management: types and quantities generated and managed, including amount taken offsite (and by whom) or reused/recycled/disposed on-site;

vii. details of tree plantings and other mitigations required undertaken this month;

viii. details of water body protection mitigations required undertaken this month.

o. compliance:

i. compliance status for conditions of all relevant consents/permits, for the Work, including quarries, etc.): statement of compliance or listing of issues and actions taken (or to be taken) to reach compliance;

ii. compliance status of ESMP/ES-MSIP requirements: statement of compliance or listing of issues and actions taken (or to be taken) to reach compliance

iii. other unresolved issues from previous months related to environmental and social: continued violations, continued failure of equipment, continued lack of vehicle covers, spills not dealt with, continued compensation or blasting issues, etc. Cross-reference other sections as needed.

Appendix C-1

(Refer GCC 22.2.3)

Salient Features of Labour & Environment Protection Laws[1]

SALIENT FEATURES OF SOME MAJOR LABOUR LAWS

APPLICABLE TO ESTABLISHMENTS ENGAGED IN BUILDING AND OTHER CONSTRUCTION WORK

(a) Employees Compensation Act 1923: The Act provides for compensation in case of injury, disease or death arising out of and during the course of employment.

(b) Payment of Gratuity Act 1972: gratuity is payable to an employee under the Act on satisfaction of certain conditions on separation if an employee has completed 5 years' service or more or on death at the rate of 15 days wages for every completed year of service. The Act is applicable to all establishments employing 10 or more employees.

(c) Employees P.F. and Miscellaneous Provision Act 1952 (*since amended*): The Act provides for monthly contribution by the employer plus workers @ 10% or 8.33%. The benefits payable under the Act are:

(i) Pension or family pension on retirement or death, as the case may be.

(ii) Deposit linked insurance on the death in harness of the worker.

(iii) Payment of P.F. accumulation on retirement/death etc.

(d) Maternity Benefit Act 1961: The Act provides for leave and some other benefits to women employees in case of confinement or miscarriage etc.

(e) Sexual Harassment of Women at the Workplace (Prevention, Prohibition and Redressal) Act, 2013: This Act defines sexual harassment in the workplace, provides for an enquiry procedure in case of complaints and mandates the setting up of an Internal Complaints Committee or a Local Complaints Committee

[1] This list is only illustrative and not exhaustive. Bidders and Contractors are responsible for checking the correctness and completeness of the list. The law as current on the date of bid opening will apply.

(f) Contract Labour (Regulation & Abolition) Act 1970: The Act provides for certain welfare measures to be provided by the Contractor to contract labour and in case the Contractor fails to provide, the same are required to be provided, by the Principal Employer by law. The Principal Employer is required to take Certificate of Registration and the Contractor is required to take license from the designated Officer. The Act is applicable to the establishments or Contractor of Principal Employer if they employ 20 or more contract labour.

(g) Minimum Wages Act 1948: The Employer is supposed to pay not less than the Minimum Wages fixed by appropriate Government as per provisions of the Act if the employment is a scheduled employment. Construction of Buildings, Roads, Runways are scheduled employments.

(h) Payment of Wages Act 1936: It lays down the mode, manner and by what date the wages are to be paid, what deductions can be made from the wages of the workers.

(i) Equal Remuneration Act 1976: The Act provides for payment of equal wages for work of equal nature to male and female workers and for not making discrimination against Female employees in the matters of transfers, training and promotions etc.

(j) Payment of Bonus Act 1965: The Act is applicable to all establishments employing 20 or more employees. Some of the State Governments have reduced this requirement from 20 to 10. The Act provides for payments of annual bonus subject to a minimum of 8.33% of the wages drawn in the relevant year. It applies to skilled or unskilled manual, supervisory, managerial, administrative, technical or clerical work for hire or reward to employees who draw a salary of Rs. 10,000/- per month or less. To be eligible for bonus, the employee should have worked in the establishment for not less than 30 working days in the relevant year. The Act does not apply to certain establishments.

(k) Industrial Disputes Act 1947: The Act lays down the machinery and procedure for resolution of Industrial disputes, in what situations, a strike or lock-out becomes illegal and what are the requirements for laying off or retrenching the employees or closing down the establishment.

(l) Trade Unions Act 1926: The Act lays down the procedure for registration of trade unions of workmen and employers. The Trade Unions registered under the Act have been given certain immunities from civil and criminal liabilities.

(m) Child Labour (Prohibition & Regulation) Act 1986: The Act prohibits employment of children below 14 years of age in certain occupations and processes and provides for regulation of employment of children in all other occupations and processes.

Employment of Child Labour is prohibited in the Building and Construction Industry.

(n) Inter-State Migrant workmen's (Regulation of Employment & Conditions of Service) Act 1979: The Act is applicable to an establishment which employs 5 or more inter-state migrant workmen through an intermediary (who has recruited workmen in one state for employment in the establishment situated in another state). The Inter-State migrant workmen, in an establishment to which this Act becomes applicable, are required to be provided certain facilities such as housing, medical aid, traveling expenses from home upto the establishment and back, etc.

(o) The Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act 1996 and the Building and Other Construction Workers Welfare Cess Act, 1996 (BOCWW Cess Act): All the establishments who carry on any building or other construction work and employ 10 or more workers are covered under these Acts. All such establishments are required to pay cess at the rate not exceeding 2% of the cost of construction as may be notified by the Government. The Employer of the establishment is required to provide safety measures at the building or construction work and other welfare measures, such as Canteens, First – Aid facilities, Ambulance, Housing accommodations for workers near the workplace etc. The Employer to whom the Act applies has to obtain a registration certificate from the Registering Officer appointed by the Government.

(p) Factories Act 1948: the Act lays down the procedure for approval of plans before setting up a factory engaged in manufacturing processes, health and safety provisions, welfare provisions, working hours, annual earned leave and rendering information regarding accidents or dangerous occurrences to designated authorities. It is applicable to premises employing 10 persons or more with aid of power or 20 or more persons without the aid of power.

(q) Weekly Holidays Act -1942

(r) Bonded Labour System (Abolition) Act, 1976: The Act provides for the abolition of bonded labour system with a view to preventing the economic and physical exploitation of weaker sections of society. Bonded labour covers all forms of forced labour, including that arising out of a loan, debt or advance.

(s) Employer's Liability Act, 1938: This Act protects workmen who bring suits for damages against employers in case of injuries endured in the course of employment. Such injuries could be on account of negligence on the part of the employer or persons employed by them in maintenance of all machinery, equipment etc. in healthy and sound condition.

(t) Employees State Insurance Act 1948: The Act provides for certain benefits to insured employees and their families in case of sickness, maternity and disablement arising out of an employment injury. The Act applies to all employees in factories (as defined) or establishments which may be so notified by the appropriate Government. The Act provides for the setting up of an Employees' State Insurance Fund, which is to be administered by the Employees State Insurance Corporation. Contributions to the Fund are paid by the employer and the employee at rates as prescribed by the Central Government. The Act also provides for benefits to dependents of insured persons in case of death as a result of an employment injury.

(u) The Personal Injuries (Compensation Insurance) Act, 1963: This Act provides for the employer's liability and responsibility to pay compensation to employees where workmen sustain personal injuries in the course of employment.

(v) Industrial Employment (Standing Order) Act 1946: It is applicable to all establishments employing 100 or more workmen (employment size reduced by some of the States and Central Government to 50). The Act provides for laying down rules governing the conditions of employment by the Employer on matters provided in the Act and get the same certified by the designated Authority.

SALIENT FEATURES OF SOME OF THE MAJOR LAWS THAT ARE APPLICABLE FOR PROTECTION OF ENVIRONMENT.
(Refer GCC 22.2.3)

1. The Environment (Protection) Act, 1986 and as amended: This provides for the protection and improvement of environment and for matters connected therewith, and the prevention of hazards to human beings, other living creatures, plants and property. 'Environment' includes water, air and land and the inter-relationship which exists among and between water, air and land, and human beings, other living creatures, plants, micro-organism and property.

2. The Forest Conservation Act, 1980, as amended, and Forest (Conservation) Rules, 1981 as amended: These provides for protection of forests by restricting conversion of forested areas into non- forested areas and prevention of deforestation, and stipulates the procedures for cutting any trees that might be required by the applicable rules. Permissions under the Act also stipulates the norms and compliance requirements of the employer and any contractor on behalf of the employer.

3. State Tree Preservation Acts as may be in force: These provide for protection of trees of important species. Contractors will be required to obtain prior permission for full or partial cutting, uprooting, or pruning of any such trees.

4. The Wildlife (Protection) Act, 1972, and as amended: This provides for protection of wildlife through notifying National Parks and Sanctuaries and buffer areas around these zones; and to protect individuals of nationally important species listed in the Annex of the Act.

5. The Biological Diversity Act, 2002: This provides for conservation of biological diversity, sustainable use of components of biological diversity, and fair and equitable sharing of the benefits arising out of the use of biological resources, knowledge and for matters connected therewith or incidental thereto.

6. The Public Liability Insurance Act, 1991 as amended and The Public Liability Insurance Rules, 1991 as amended: These provide for public liability insurance for the purpose of providing immediate relief to the persons affected by accident occurring while handling hazardous substances and for mattes connected herewith or incidental thereto. Hazardous substance means any substance or preparation which is defined as hazardous substance under the Environment (Protection) Act 1986, and exceeding such quantity as may be specified by notification by the Central Government.

7. The Ancient Monuments and Archaeological Sites and Remains Act, 1958 and the Ancient Monuments and Archaeological Sites and Remains (Amendment and Validation) Act, 2010, the Ancient Monuments and Archaeological Sites and Remains Rules, 1959 amended 2011, the National Monuments Authority Rules, 2011 and the similar State Acts: These provide for conservation of cultural and historical remains found in India. Accordingly, area within the radii of 100m and 300m from the "protected property" are designated as "protected area" and "controlled area" respectively. No development activity (including building, mining, excavating, blasting) is permitted in the "protected area" and development activities likely to damage the protected property is not permitted in the "controlled area" without prior permission of the Archaeological Survey of India (ASI) or the State Departments of Art and Culture or Archaeology as applicable.

8. The Environmental Impact Assessment Notification, 2006 and as amended: This provides for prior environmental clearance for new, modernization and expansion projects listed in Schedule 1 of the Notification. Contractors will be required to ensure that no work starts until applicable clearances under the Notification is not available. Contractors will be responsible for implementation of any environmental management plan stipulated as per the permission under this Notification; and will be required to prepare and submit to the employer and compliance report stipulated in the permission under the Notification.

9. The Water (Prevention and Control of Pollution) Act, 1974 as amended, and the Water (Prevention and Control of Pollution) Rules, 1975 as amended: These provide for the prevention and control of water pollution and the maintaining and restoring of wholesomeness of water. 'Pollution' means such contamination of water or such alteration of the physical, chemical or biological properties of water or such discharge of any sewage or trade effluent or of any other liquid, gaseous or solid substance into water(whether directly or indirectly) as may, or is likely to, create a nuisance or render such water harmful or injurious to public health or safety, or to domestic, commercial, industrial, agricultural or other legitimate uses, or to the life and health of animals or plants or of aquatic organisms. Contractors will need to obtain

consent for establishment and consent for operation of any item of work or installation of equipment that generates waste water, and observe the required standards of establishment and operation of these items of work or installations; as well as install and operate all required waste water treatment facilities.

10. The Water (Prevention and Control of Pollution) Cess Act, 1977 and The Water (Prevention and Control of Pollution) Cess Rules, 1978: These provide for the levy and collection of a cess on water consumed by persons carrying on certain industries and by local authorities, with a view to augment the resources of the Central Board and the State Boards for the prevention and control of water pollution under the Water (Prevention and Control of Pollution) Act, 1974.

11. The Air (Prevention and Control of Pollution) Act, 1981 as amended, and the Air (Prevention and Control of Pollution) Rules, 1982: These provides for prevention, control and abatement of air pollution. 'Air Pollution' means the presence in the atmosphere of any 'air pollutant', which means any solid, liquid or gaseous substance (including noise) present in the atmosphere in such concentration as may be or tend to be injurious to human beings or other living creatures or plants or property or environment. Contractors will need to obtain consent for establishment and consent for operation of any item of work or installation of equipment that generates air pollution such as batching plants, hot mix plants, power generators, backup power generation, material handling processes, and observe the required standards of establishment and operation of these items of work or installations.

12. Noise Pollution (Control and Regulation) Rules, 2000, and as amended: This provides for standards for noise for day and night for various land uses and specifies special standards in and around sensitive receptors of noise such as schools and hospitals. Contractors will need to ensure compliance to the applicable standards, and install and operate all required noise control devices as may be required for all plants and work processes.

13. Chemical Accidents (Emergency Planning, Preparedness and Response) Rules, 1996: This provides for Requirement of preparation of on-site and off-site Disaster Management Plans for accident-prone areas.

14. The Explosives Act 1884 and the Explosives Rules, 2008: These provide for safe manufacture, possession, sale, use, transportation and import of explosive materials such as diesel, Oil and lubricants etc.; and also for regulating the use of any explosives used in blasting and/or demolition. All applicable provisions will need compliance by the contractors.

15. The Petroleum Rules, 2002: This provides for safe use and storage of petroleum products, and will need to be complied by the contractors.

16. The Gas Cylinder Rules 2004 and amendments: This provides for regulations related to storage of gas, and possession of gas cylinder more than the exempted quantity. Contractors should comply with all the requirements of this Rule.

17. Manufacture, Storage and Import of Hazardous Chemical Rules of 1989 and as amended: These provide for use and storage of hazardous material such as highly inflammable liquids

like HSD/LPG. Contractors will need to ensure compliance to the Rules; and in the event where the storage quantity exceeds the regulated threshold limit, the contractors will be responsible for regular safety audits and other reporting requirements as prescribed in the Rules.

18. Hazardous & Other Wastes (Management and Transboundary Movement) Rules, 2016: These provide for protection of general public from improper handling storage and disposal of hazardous waste. The rules prescribe the management requirement of hazardous wastes from its generation to final disposal. Contractors will need to obtain permission from the State Pollution Control Boards and other designated authorities for storage and handling of any hazardous material; and will to ensure full compliance to these rules and any conditions imposed in the permit.

19. The Bio Medical Waste Management Rules, 2016: This provides for control, storage, transportation and disposal of bio-medical wastes. As and where the contractor has any first aid facility and dispensaries, established in either temporary or permanent manner, compliance to these Rules are mandatory.

20. Construction and Demolition Waste Management Rules, 2016: This provides for management of construction and demolition waste (such as building materials possible to be reused, rubble and debris or the like); and applies to all those waste resulting from construction, re-modelling, repair or demolition of any civil structure. Contractor will need to prepare a waste disposal plan and obtain required approval from local authorities, if waste generation is more than 20 tons in any day or 300 tons in any month during the contract period; and ensure full compliance to these rules and any conditions imposed in the regulatory approval.

21. The E-Waste (Management) Rules, 2016: This provides for management of E-wastes (but not covering lead acid batteries and radio-active wastes) aiming to enable the recovery and/or reuse of useful material from e-waste, thereby reducing the hazardous wastes destined for disposal and to ensure the environmentally sound management of all types of waste of electrical and electronic equipment. This Rule applies to every manufacturer, producer, consumer, bulk consumer, collection centers, dealers, e-retailer, refurbisher, dismantler and recycler involved in manufacture, sale, transfer, purchase, collection, storage and processing of e-waste or electrical and electronic equipment listed in Schedule I, including their components, consumables, parts and spares which make the product operational.

22. Plastic waste Management Rules, 2016: This provides for control and management of the plastic waste generated from any activity. Contractors will ensure compliance to this Rule.

23. The Batteries (Management and Handling) Rules 2001: This provides for ensuring safe disposal and recycling of discarded lead acid batteries likely to be used in any equipment during construction and operation stage. Rules require proper control and record keeping on the sale or import of lead acid batteries and recollection of the used batteries by registered recyclers to ensure environmentally sound recycling of used batteries. Contractors will ensure compliance to this Rule.

24. The Ozone Depleting Substances (Regulation and Control) Rules, 2000 and as amended: This provides for regulation of production and consumption of ozone depleting substances in the country, and specifically prohibits export to or import from countries not specified in the Rules, and prohibits unless specifically permitted, any use of ozone depleting substance.

25. The Coastal Regulation Zone Notifications, 1991 and as amended: This provides for regulation of development activities within the 500m of high tide line in coastal zone and 100m of stretches of rivers and estuaries influenced by tides. Contractors will be required to ensure that no work starts until applicable clearances under the Notification is not available. Contractors will be responsible for implementation of any plan stipulated as per the permission under this Notification; and will be required to prepare and submit to the employer and compliance report stipulated in the permission under the Notification.

26. The Motor Vehicle Act 1988 as amended (and State Motor Vehicle Acts as may be in force) and the Motor Vehicle Rules, 1989, and as amended (and State Motor Vehicle Rules as may be in force): To minimize the road accidents, penalizing the guilty, provision of compensation to victim and family and check vehicular air and noise pollution. Contractors will be required to ensure full compliance to these rules.

27. Easement Act, 1882: This provides for the rights of landowners on groundwater. Contractors will need to ensure that other landowners' rights under the Act is not affected by any groundwater abstraction by the contractors.

28. State Groundwater Acts and Rules as may be in force and the Guidelines for Groundwater Abstraction for drinking and domestic purposes in Notified Areas and Industry/Infrastructure project proposals in Non-Notified areas, 2012: These provide for regulating extraction of ground water for construction/industrial and drinking and domestic purposes. Contractors will need to obtain permission from Central/State Groundwater Boards prior to groundwater abstraction through digging any bore well or through any other means; and will to ensure full compliance to these rules and any conditions imposed in the permit.

29. The Mines Act, 1952 as amended; the Minor Mineral and concession Rules as amended; and the State Mineral (Rights and Taxation) Acts as may be in force: These provide for for safe and sound mining activity. The contractors will procure aggregates and other building materials from quarries and borrow areas approved under such Acts. In the event the contractors open any new quarry and/or borrow areas, appropriate prior permission from the State Departments of Minerals and Geology will need to be obtained. Contractors will also need to ensure full compliance to these rules and any conditions imposed in the permit.

30. The Insecticides Act, 1968 and Insecticides Rules, 1971 and as amended: These provide for regulates the manufacture, sale, transport, distribution, export, import and use of pesticides to prevent risk to human beings or animals, and for matters connected therewith. No one should import or manufacture; sell, stock or exhibit foe sale; distribute, transport, use: (i) any misbranded insecticides, (ii) any insecticide the sale, distribution or use of which is for the

time being prohibited under the Act; and (iii) any insecticide except in accordance with the condition on which it was registered under the Act.

31. National Building Codes of India, 2005 and as amended: This provides guidelines for regulating the building construction activities in India. The code mainly contains administrative regulations, development control rules and general building requirements; stipulations regarding materials, structural design and construction; and building and plumbing services. Contractors will be required to comply with all Bureau of Indian Standards Codes dealing with: (i) use and disposal of asbestos containing materials in construction; (ii) paints containing lead; (iii) permanent and temporary ventilations in workplace; (iv) safety, and hygiene at the workplace; (v) prevention of fire; (vi) prevention of accidents from faulty electrical gadgets, equipment and accessories; and all other such codes incidental to the Contract.

Section IX - Particular Conditions of Contract

The following Particular Conditions of Contract shall supplement the General Conditions of Contract in Section VIII. Whenever there is a conflict, the provisions herein shall prevail over those in the General Conditions.

Particular Conditions of Contract (PCC)

The following Particular Conditions (PCC) shall supplement the General Conditions (GCC). Whenever there is a conflict, the provisions herein shall prevail over those in the GCC. The clause number of the PCC is the corresponding clause number of the GCC.

PCC 1. Definitions	The Employer is: **Solar Energy Corporation of India Limited (SECI), New Delhi** The Project Manager is: TBN The Bank is: **International Bank for Reconstruction & Development (IBRD)** Country of Origin: all countries and territories as indicated in Section V of the bidding document, Eligible Countries. Effective Date: "Effective Date" of the Contract will be starting from the date as mentioned in the Contract Agreement or Notice to Proceed (NTP) provided by the Employer, whichever is later. NTP will be provided by the employer in the shortest possible time and all contractual obligations will be started from the date of Contract Agreement (CA) or Notice to Proceed, whichever is later.
PCC 5. Law and Language	PCC 5.1 The Contract shall be interpreted in accordance with the laws of: **India**. PCC 5.2 The ruling language is: **English** PCC 5.3 The language for communications is: **English**
PCC 7. Scope of Facilities [Spare Parts] (GCC Clause 7)	PCC 7.3 The Contractor agrees to supply spare parts for a period of years: **During the entire O&M period of 10 years** The Contractor shall carry sufficient inventories to ensure an ex-stock supply of consumable spares for the Plant. Other spare parts and components shall be supplied as promptly as possible. In addition, in the event of termination of the production of spare parts, advance notification will be made to the Employer of the pending termination, with sufficient time to permit the Employer to procure the needed requirement. Following such termination, the Contractor will furnish to the extent possible and at no cost to the Employer the blueprints, drawings and specifications of the spare parts, if requested.
PCC 8. Time for Commencement and Completion	PCC 8.1 The Contractor shall commence work on the Facilities within **20 (Twenty) Days** from the Effective Date of the contract agreement for determining Time for Completion as specified in the Contract Agreement. However, Works shall not commence on any portion of the site until Contractor's ESMP is approved

	and relevant pre-construction measures have been implemented to the satisfaction of the Employer. PCC 8.2 The Time for Completion of the whole of the Plant Facilities shall be **18 (Eighteen) Months till commissioning** from the Effective Date as described in the Contract Agreement or NTP, whichever is later. And Operation & Maintenance (O&M) of the Plant facility for a period of **10 (Ten) years** from the date of Operational acceptance of the Plant Facilities. Complete Operation & Maintenance of the Plant Facilities is part of this contract. The scope of work, service level agreement and specific payment for O&M is consolidated and Annexed as "**Annexure C"** to the bidding document as "Part of **Operations and Maintenance Agreement For the 100 MW Solar PV Plant with 150 MWh BESS"**
PCC 9. Contractor's Responsibilities	PCC 9.6 - Substitute the word 'persons' with 'firms' in lines 2 and 4. Add a new PCC subclause PCC 9.11 as: PCC 9.11 The Contractor shall be overall responsible for monitoring, implementation & compliance of the environmental and social norms for the Project related activities as per the requirements" given below: **Part 1 – Link to the Environment and Social Management Framework (ESMF) to be followed for Innovation in Solar Power and Hybrid Technologies (ISHTP) Project** Environmental and Social Management Framework (ESMF) of ISHTP Project: http://documents1.worldbank.org/curated/pt/406541534751743414/pdf/SFG4529-REVISED-EA-P160379-PUBLIC-Disclosed-11-16-2018.pdf **Part 2 – The World Bank Group EHS Guidelines Safeguard** Given below are the links to relevant World Bank Group Safeguard Policies and Performance Standards with respect to Environment, Social, Health and Safety requirements to be followed while developing the EHS Documents - 1. WBG Safeguard Policies / Performance Standards: https://policies.worldbank.org/sites/PPF3/Pages/Manuals/Operational%20Manual.aspx

	2. WBG Guidance Note on Project Induced Labor Influx: http://pubdocs.worldbank.org/en/497851495202591233/Managing-Risk-of-Adverse-impact-from-project-labor-influx.pdf In line with the environmental and social norms requirements of the Projects, the contractor will appoint/hire suitable Environmental and social development officers/Experts (as described in "Contractor's Representative and Key Personnel", so as to execute the laid down ESMP effectively. The contractor will be overall responsible for ESMP implementation, coordinating and liaising, sub-contractors and other agencies, with respect to different social and environmental issues. The contractor will also be responsible for progress monitoring of Environmental and social safeguards during project construction and execution stage and submission of monthly report (during construction stage) and quarterly report (during operations stage) on ESMP compliance to SECI. In case of any default or Noncompliance to the ESMP plan as stated in the Contract, Employer reserve the discretion to recover the cost of such default/Noncompliance as liquidated damages for a maximum of 2% (Two Percent) of the Total Performance Security amount as submitted by the contractor. EHS Guidelines: The Contractor (or whatever is the Term in the Contract) shall follow the World Bank Group Environmental, Health and Safety Guidelines (WBG EHSG) during the execution of the Contract to the extent that their activities are covered in these operations. These are available at: https://www.ifc.org/wps/wcm/connect/554e8d80488658e4b76af76a6515bb18/Final%2B-%2BGeneral%2BEHS%2BGuidelines.pdf?MOD=AJPERES; https://www.ifc.org/wps/wcm/connect/66b56e00488657eeb36af36a6515bb18/Final%2B-%2BElectric%2BTransmission%2Band%2BDistribution.pdf?MOD=AJPERES&id=1323162154847 **Requirements for preparation of ES Management Strategies and Implementation Plans (MSIP)**

	The Contractor shall submit comprehensive Environmental and Social (ES) Management Strategies and Implementation Plans (ES-MSIP) in a Contractors' Environmental and Social Management Plan. These strategies and plans shall describe in detail the actions, materials, equipment, management processes etc. that will be implemented by the Contractor, and its subcontractors. In developing these strategies and plans, the Contractor shall have regard to the EHS provisions of the Contract Agreement including those as may be more fully described in the following: a. ESMF b. Environmental and Social Due Diligence Report (ESDDR) which also includes Environmental and Social Management Plan (ESMP). **Requirements for the construction of Fencing of the Project Boundary:** **Contractor shall be required to mobilize its team within 20 (Twenty) days from the date of Notice to Proceed (NTP) for the immediate construction of the fencing of the Project boundary so as to safeguard the land parcels related to the project, in line with the fencing specifications provided in Annexure A "Employers requirement"**
PCC 10.3 **Employer's Responsibility**	10.3 The Employer shall facilitate the contractor in acquiring and obtaining for all permits, approvals and/or licenses from all local, state or national government authorities or public service undertakings in the country where the Site is located which (a) such authorities or undertakings are to obtain in the Employer's name, (b) are necessary for the execution of the Contract, including those required for the performance by both the Contractor and the Employer of their respective obligations under the Contract, and (c) are specified in the Appendix (Scope of Works and Supply by the Employer). The related payments/fees of obtaining permits, approvals and/or licenses from all local, state or national government authorities or public service undertakings in the country where the Site is located will be in the contractor scope.
PCC 10.5, 10.6 & 10.7 **Employer's Responsibility**	Not applicable as the comprehensive O&M for 10 years is in the scope of the contractor.

PCC 11. Contract Price	PCC 11.2 The Contract Price shall be adjusted in accordance with the provisions of the Appendix to the Contract Agreement titled Adjustment Clause: **NA**
PCC 13. Securities	PCC 13.3.1 The amount of Performance Security, as a percentage of the Contract Price for the Plant Facility, shall be in following stages: • **First Stage**: The value of the Contract Performance Security shall be 10% (Ten) of the Contract Value {i.e. total sum of the Supply (Abroad & Employer's country) & Service (Freight, Design, Installation & Civil Works) and will remain valid for 90 (Ninety) days beyond the Operational Acceptance of the Plant Facilities. • **Second Stage**: The value of the Contract Performance Security shall be 5% (Five) of the Contract Value {i.e. total sum of the Supply (Abroad & Employer's country) & Service (Freight, Design, Installation & Civil Works) starting from the Operational Acceptance of the Plant Facilities, valid till the end of 10th year of the O&M period. Contractor needs to furnish the revised Contract Performance Security in the Second Stage amounting to 5% of the total Contract Value as mentioned above within the validity period of the Contract Performance Security submitted at First Stage. In case of extension of the Operational Acceptance, the validity of the Performance Security will be extended suitably. Envisaging the difficulty in obtaining the longer tenure of CPS in the form of BG, the successful bidder can submit Contract Performance Security in the form of Bank Guarantee with initial validity period of 36 Months and the same may be extended for the balance period or further 36 months, within 60 days of expiry of the original CPS. • In case the Contractor fails to furnish the Contract, Performance Security mentioned under the Second Stage within the indicated time period as mentioned above (Within the due validity period of the existing Performance Security) Employer at their sole discretion will forfeit the Contract Performance Security furnished at the respective stage. • Contract Performance Security submitted at the Second Stage shall be released to the Contractor without any interest not later than 75 (Seventy-Five) days after the successful completion of the complete O&M period (10 Years) subject to the approval and acceptance of the O&M period deliverables by the Engineer in charge/Technical Team.

	• O&M Period will start from the Operational acceptance of the Plant Facilities • The Bidder will be responsible to operate and maintain the Plant after Commissioning till the Operational acceptance of Plant Facilities, without any additional cost to the Employer. GCC 13.3.1 - Add the following at the end of the para: If the performance security is a bank guarantee, it shall be issued either (a) by a Nationalized or Scheduled bank in India; or (ii) by a foreign bank through a correspondent Nationalized or Scheduled Bank located in India; or (c) directly by a foreign bank which has been determined in advance to be acceptable to the Employer. PCC 13.3.2 The Performance Security shall be in the form of the bank guarantee attached hereto in Section X, Contract Forms. PCC 13.3.3 The Performance Security shall not be reduced on the date of the Operational Acceptance.
PCC 14 Taxes and Duties	In GCC 14.2 (b) replace the words 'sales tax and value added tax (VAT)' with 'GST and other similar taxes, in respect of direct transaction between the Employer and the Contractor' Add clause 14.5 to the existing clause **<u>Billing Break-up (BBU):</u>** • For each item of SOR 1,2,3 & 4, the BBU shall be prepared in the same SOR format (Item name, UoM, Quantity, unit Ex Works (EXW)/CIP price, Duties, Taxation, GST, Total price etc) and the sum of all billing break-up item prices shall be equivalent to the each respective SORs item price with discounted rate of e-RA. • The Contractor would be required to provide detailed Bill of Quantity (BOQ) along with the break-up of Contract Price (including Duties/Taxes/GST) which should match with the Price Quoted by the Contractor in its Price Bids and accepted by the Employer. This will be used by the Employer at the time of payment to the Contractor. Accordingly, bidders should diligently quote the Duties/Taxes/GST component in the bid. • BCD+SWS & SGD/ADD being of reimbursement nature duties, Employer will reimburse the amount for BCD+SWS & SGD/ADD at actuals against the submission of documentary evidence only, with a MAXIMUM CEILING of BCD+SWS & SGD/ADD charges as mentioned

	by the Bidder in the Price Schedules No 1 at the time of bidding. Bidders are required to quote the applicable BCD+SWS & SGD/ADD with due diligence & appropriate financial prudence, as afterwards bidders will not be able to change or claim such taxes & duties already quoted during the bid. No BCD+SWS & SGD/ADD will be reimbursed to the contractor in the absence of documentary proofs. • Employer shall reimburse the amount of GST as per the rates mentioned by Contractor in the detailed BOQ. In case of any statutory variation in GST during the currency of the Contract, same will be reimbursed to the Contractor subject to the treatment provided under the RfB document, only in respect of the items/quantity which have been mentioned by the Contractor in the detailed BOQ. • In case of imported Equipment/items purchased from third party (Bought-Out Items) are supplied to the Employer in execution of the Project, the price of such Goods shall be inclusive of all cost as well as any duties paid/payable in relation to import/purchase of such goods (viz., customs duties, GST & levies etc.) considering and taking into account the ITC as may be available under the applicable laws including GST. • In case of any statutory variation in GST during the currency of the Contract, same will be reimbursed to the Contractor only in respect of the taxes which are levied during the direct transaction held between Employer and the Contractor. Any statutory variation applicable in respect of the items/services procurement between third party/sub-contractor and the Contractor would not be reimbursed by Employer.
PCC 22 Installation	GCC 22.2.3 – Add the following at the end of GCC 22.2.3 'Salient features of major labour and other laws that are applicable to construction industry in India are given as Appendix C-1 to these General Conditions of Contract.' PCC 22.2.5 Working Hours Normal working hours are: **08 Hours Shift**
PCC 23 **Test & Inspection**	Add Sub Clause 23.12 as The cost of inspection/ pre-dispatch inspection/ in-stage inspection shall be borne by Contractor. Such pre-dispatch inspection(s) at the manufacturer's facility shall be carried out in the presence of the Employer or their authorized representatives, for such items as is specified by the Engineer-in-Charge/Project Manager. Travel expenses for such inspections shall be borne by the Employer. However, in case re-inspection is necessitated on account of non-acceptance of item(s) due to failure on Factory Acceptance Test(s), the cost of associated travel and

	accommodation borne by the Employer shall be on account of the Contractor
PCC 24.2 **Completion of the facilities**	NA as the comprehensive O&M for 10 years is in the scope of the contractor
PCC 24.8 **Completion of the facilities**	NA as the comprehensive O&M for 10 years is in the scope of the contractor
PCC 25. Commissioning and Operational Acceptance	PCC 25.2.2 The functional guarantee tests & their respective liquidated damages clauses related to the Plant facility & individual plants (Solar PV and BESS) is mentioned under Annexure C (PG Test Procedure) to Annexure – A, Employer's Requirements of the RfB
PCC 26. Completion Time Guarantee	PCC 26.2 Applicable rate for liquidated damages: **0.5% per Week** There shall not be any intermediate LDs for the delays in completing the individual plant (Solar and BESS). The LD for delay is applicable only if the entire plant facility is not completed by the Schedule Date of Completion/Contract Period as mentioned in the bidding document. The above rate applies to full contract value (excluding O&M). Maximum deduction for liquidated damages: **5%** PCC 26.3 No bonus will be given for earlier Completion of the Facilities or part thereof.
PCC 27. Defect Liability	PCC 27.10 The critical components covered under the extended defect liability are _____, and the period shall be _____ : **NA**
PCC 30. Limitation of Liability	PCC 30.1 (b) The multiplier of the Contract Price is: **1 (One)**

PCC 39. Value Engineering	PCC 39.1.2 If the value engineering proposal is approved by the Employer the amount to be paid to the Contractor shall be ___% (insert appropriate percentage. : **NA**
PCC 46. Disputes and Arbitration	PCC 46.1 The DB shall be appointed within [28 days] after the Effective Date. PCC 46.1 List of potential DB members is: "**To be decided before contract signature**" PC 46.5 Rules of arbitration (foreign contractors) - United Nations Commission on International Trade Law (UNCITRAL), The place of arbitration – a neutral location to be mutually agreed before signing of contract; arbitration shall be conducted in English Rules of arbitration (Indian contractors) - The Arbitration and Conciliation Act, 1996 (India) as updated from time to time, The place of arbitration – Delhi; arbitration shall be conducted in English PCC 46.2 Appointment (if not agreed) to be made by: (a) In case the Contractor is an Indian firm : Institution of Engineers, India (b) In case the Contractor is a firm from foreign country : Court of Arbitration of the International Chamber of Commerce, Paris.

APPENDIX A General Conditions of Dispute Board Agreement

In Sub-clause 6. Payment 2nd and 3rd paragraphs, substitute (a) the words 'Operational Acceptance' by the word 'Taking-Over'; and (b) the word 'Works' by the word 'Facilities' at both occurrences of these words.

Section X - Contract Forms

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Notification of Intention to Award

[*This Notification of Intention to Award shall be sent to each Bidder that submitted a Bid.*]

[*Send this Notification to the Bidder's Authorized Representative named in the Bidder Information Form*]

For the attention of Bidder's Authorized Representative

Name: *[insert Authorized Representative's name]*

Address: *[insert Authorized Representative's Address]*

Telephone/Fax numbers: *[insert Authorized Representative's telephone/fax numbers]*

Email Address: *[insert Authorized Representative's email address]*

[IMPORTANT: insert the date that this Notification is transmitted to Bidders. The Notification must be sent to all Bidders simultaneously. This means on the same date and as close to the same time as possible.]

DATE OF TRANSMISSION: This Notification is sent by: [*email/fax*] on [*date*] (local time)

Notification of Intention to Award

Employer: *[insert the name of the Employer]*

Project: *[insert name of project]*

Contract title: *[insert the name of the contract]*

Country: *[insert country where RFB is issued]*

Loan No. /Credit No. / Grant No.: *[insert reference number for loan/credit/grant]*

RFB No: *[insert RFB reference number from Procurement Plan]*

This Notification of Intention to Award (Notification) notifies you of our decision to award the above contract. The transmission of this Notification begins the Standstill Period. During the Standstill Period, you may:

a) request a debriefing in relation to the evaluation of your Bid, and/or

b) submit a Procurement-related Complaint in relation to the decision to award the contract.

1. The successful Bidder

Name:	[*insert name of successful Bidder*]
Address:	[*insert address of the successful Bidder*]

Contract price:	[*insert contract price of the successful Bid*]

2. Other Bidders *[INSTRUCTIONS: insert names of all Bidders that submitted a Bid. If the Bid's price was evaluated include the evaluated price as well as the Bid price as read out.]*

Name of Bidder	Bid price	Evaluated Bid Cost
[*insert name*]	[*insert Bid price*]	[*insert evaluated* **cost**]
[*insert name*]	[*insert Bid price*]	[*insert evaluated cost*]
[*insert name*]	[*insert Bid price*]	[*insert evaluated cost*]
[*insert name*]	[*insert Bid price*]	[*insert evaluated cost*]
[*insert name*]	[*insert Bid price*]	[*insert evaluated cost*]

3. Reason/s why your Bid was unsuccessful

[INSTRUCTIONS: State the reason/s why this Bidder's Bid was unsuccessful. Do NOT include: (a) a point by point comparison with another Bidder's Bid or (b) information that is marked confidential by the Bidder in its Bid.]

4. How to request a debriefing

DEADLINE: The deadline to request a debriefing expires at midnight on [*insert date*] (local time).

You may request a debriefing in relation to the results of the evaluation of your Bid. If you decide to request a debriefing, your written request must be made within three (3) Business Days of receipt of this Notification of Intention to Award.

Provide the contract name, reference number, name of the Bidder, contact details; and address the request for debriefing as follows:

Attention: [*insert full name of person, if applicable*]

Title/position: [*insert title/position*]

Agency: [*insert name of Employer*]

Email address: [*insert email address*]

Fax number: [*insert fax number*] ***delete if not used***

If your request for a debriefing is received within the 3 Business Days deadline, we will provide the debriefing within five (5) Business Days of receipt of your request. If we are unable to provide the debriefing within this period, the Standstill Period shall be extended

by five (5) Business Days after the date that the debriefing is provided. If this happens, we will notify you and confirm the date that the extended Standstill Period will end.

The debriefing may be in writing, by phone, video conference call or in person. We shall promptly advise you in writing how the debriefing will take place and confirm the date and time.

If the deadline to request a debriefing has expired, you may still request a debriefing. In this case, we will provide the debriefing as soon as practicable, and normally no later than fifteen (15) Business Days from the date of publication of the Contract Award Notice.

5. How to make a complaint

Period: Procurement-related Complaint challenging the decision to award shall be submitted by midnight, [*insert date*] (local time).

Provide the contract name, reference number, name of the Bidder, contact details; and address the Procurement-related Complaint as follows:

Attention: [*insert full name of person, if applicable*]

Title/position: [*insert title/position*]

Agency: [*insert name of Employer*]

Email address: [*insert email address*]

Fax number: [*insert fax number*] ***delete if not used***

At this point in the procurement process, you may submit a Procurement-related Complaint challenging the decision to award the contract. You do not need to have requested, or received, a debriefing before making this complaint. Your complaint must be submitted within the Standstill Period and received by us before the Standstill Period ends.

Further information:

For more information see the Procurement Regulations for IPF Borrowers (Procurement Regulations)[https://policies.worldbank.org/sites/ppf3/PPFDocuments/Forms/DispPage.aspx?docid=4005] (Annex III). You should read these provisions before preparing and submitting your complaint. In addition, the World Bank's Guidance "How to make a Procurement-related Complaint" [http://www.worldbank.org/en/projects-operations/products-and-services/brief/procurement-new-framework#framework] provides a useful explanation of the process, as well as a sample letter of complaint.

In summary, there are four essential requirements:

1. You must be an 'interested party'. In this case, that means a Bidder who submitted a Bid in this bidding process, and is the recipient of a Notification of Intention to Award.
2. The complaint can only challenge the decision to award the contract.

3. You must submit the complaint within the period stated above.
4. You must include, in your complaint, all of the information required by the Procurement Regulations (as described in Annex III).

6. Standstill Period

DEADLINE: The Standstill Period is due to end at midnight on [*insert date*] (local time).

The Standstill Period lasts ten (10) Business Days after the date of transmission of this Notification of Intention to Award.

The Standstill Period may be extended as stated in Section 4 above.

If you have any questions regarding this Notification please do not hesitate to contact us.

On behalf of the Employer:

Signature: _____

Name: _____

Title/position: _____

Telephone: _____

Email: _____

Beneficial Ownership Disclosure Form

(To be submitted by all JV Partners in case of JV)

INSTRUCTIONS TO BIDDERS: DELETE THIS BOX ONCE YOU HAVE COMPLETED THE FORM

This Beneficial Ownership Disclosure Form ("Form") is to be completed by the successful Bidder. In case of joint venture, the Bidder must submit a separate Form for each member. The beneficial ownership information to be submitted in this Form shall be current as of the date of its submission.

For the purposes of this Form, a Beneficial Owner of a Bidder is any natural person who ultimately owns or controls the Bidder by meeting one or more of the following conditions:

- *directly or indirectly holding 25% or more of the shares*
- *directly or indirectly holding 25% or more of the voting rights*
- *directly or indirectly having the right to appoint a majority of the board of directors or equivalent governing body of the Bidder*

RFB No.: [*insert number of RFB process*]

Request for Bid No.: [*insert identification*]

To: **[*insert complete name of Employer*]**

In response to your request in the Letter of Acceptance *dated [insert date of letter of Acceptance]* to furnish additional information on beneficial ownership: *[select one option as applicable and delete the options that are not applicable]*

(i) we hereby provide the following beneficial ownership information.

Details of beneficial ownership

Identity of Beneficial Owner	Directly or indirectly holding	Directly or indirectly holding 25 % or more of the Voting Rights	Directly or indirectly having the right to appoint a majority of

	25% or more of the shares (Yes / No)	(Yes / No)	the board of the directors or an equivalent governing body of the Bidder (Yes / No)
[include full name (last, middle, first), nationality, country of residence]			

OR

(ii) *We declare that there is no Beneficial Owner meeting one or more of the following conditions:*

- directly or indirectly holding 25% or more of the shares
- directly or indirectly holding 25% or more of the voting rights
- directly or indirectly having the right to appoint a majority of the board of directors or equivalent governing body of the Bidder

OR

(iii) We declare that we are unable to identify any Beneficial Owner meeting one or more of the following conditions. [If this option is selected, the Bidder shall provide explanation on why it is unable to identify any Beneficial Owner]

- directly or indirectly holding 25% or more of the shares
- directly or indirectly holding 25% or more of the voting rights
- directly or indirectly having the right to appoint a majority of the board of directors or equivalent governing body of the Bidder]"

Name of the Bidder: *[*insert complete name of the Bidder*]_____

Name of the person duly authorized to sign the Bid on behalf of the Bidder: **[*insert complete name of person duly authorized to sign the Bid*]_____

Title of the person signing the Bid: [*insert complete title of the person signing the Bid*]_____

Signature of the person named above: [*insert signature of person whose name and capacity are shown above*]_____

Date signed [*insert date of signing*] **day of** [*insert month*], [*insert year*]_____

[*] In the case of the Bid submitted by a Joint Venture specify the name of the Joint Venture as Bidder. In the event that the Bidder is a joint venture, each reference to "Bidder" in the Beneficial Ownership Disclosure Form (including this Introduction thereto) shall be read to refer to the joint venture member.

[**] Person signing the Bid shall have the power of attorney given by the Bidder. The power of attorney shall be attached with the Bid Schedules.

Letter of Acceptance

_____

To: _____

This is to notify you that your Bid dated _____ for execution of the _____ for the Contract Price in the aggregate of _____ _____, as corrected and modified in accordance with the Instructions to Bidders is hereby accepted by our Agency.

You are requested to furnish (i) the Performance Security, plus additional security for unbalanced bids in terms of ITB Clause 51 within 28 days in accordance with the Conditions of Contract, using for that purpose one of the Performance Security Form*s* and (ii) the additional information on beneficial ownership in accordance with BDS ITB 50.1, within eight (8) Business days using the Beneficial Ownership Disclosure Form, included in Section X, - Contract Forms, of the bidding document.

Authorized Signature: _____

Name and Title of Signatory: _____

Name of Agency: _____

Attachment: Contract Agreement

Contract Agreement

THIS AGREEMENT is made the _____ day of _____, _____,

BETWEEN

(1) _____, a corporation incorporated under the laws of _____ and having its principal place of business at _____ (hereinafter called "the Employer"), and (2) _____, a corporation incorporated under the laws of _____ and having its principal place of business at _____ (hereinafter called "the Contractor").

WHEREAS the Employer desires to engage the Contractor to design, manufacture, test, deliver, install, complete and commission certain Facilities, viz. _____ ("the Facilities"), and the Contractor has agreed to such engagement upon and subject to the terms and conditions hereinafter appearing.

NOW IT IS HEREBY AGREED as follows:

Article 1. Contract Documents

1.1 Contract Documents (Reference GCC Clause 2)

The following documents shall constitute the Contract between the Employer and the Contractor, and each shall be read and construed as an integral part of the Contract:

(a) This Contract Agreement and the Appendices hereto

(b) Letter of Bid and Price Schedules submitted by the Contractor

(c) Particular Conditions

(d) General Conditions

(e) Specification

(f) Drawings

(g) Other completed Bidding forms submitted with the Bid

(h) Any other documents forming part of the Employer's Requirements

(i) Any other documents forming part of the contract, including, but not limited to:

i. the ES Management Strategies and Implementation Plans; and

ii. Code of Conduct for Contractor's Personnel (ES).

[Any other documents shall be added here]

1.2 Order of Precedence (Reference GCC Clause 2)

In the event of any ambiguity or conflict between the Contract Documents listed above, the order of precedence shall be the order in which the Contract Documents are listed in Article 1.1 (Contract Documents) above.

1.3 Definitions (Reference GCC Clause 1)

Capitalized words and phrases used herein shall have the same meanings as are ascribed to them in the General Conditions.

Article 2. Contract Price and Terms of Payment

2.1 Contract Price (Reference GCC Clause 11)

The Employer hereby agrees to pay to the Contractor the Contract Price in consideration of the performance by the Contractor of its obligations hereunder. The Contract Price shall be the aggregate of: _____, _____ as specified in Price Schedule No. 6 (Grand Summary), and_____, _____, or such other sums as may be determined in accordance with the terms and conditions of the Contract.

2.2 Terms of Payment (Reference GCC Clause 12)

The terms and procedures of payment according to which the Employer will reimburse the Contractor are given in the Appendix (Terms and Procedures of Payment) hereto.

The Employer may at its option instruct its bank to issue an irrevocable confirmed documentary credit made available to the Contractor in a bank in the country of the Contractor. The credit shall be for an amount of _____; and shall be subject to the Uniform Customs and Practice for Documentary Credits 2007 Revision, ICC Publication No. 600.

In the event that the amount payable under Schedule No. 1 is adjusted in accordance with GCC 11.2 or with any of the other terms of the Contract, the Employer shall arrange for the documentary credit to be amended accordingly.

Article 3. Effective Date

3.1 Effective Date (Reference GCC Clause 1)

The Effective Date from which the Time for Completion of the Facilities shall be counted is the date when all of the following conditions have been fulfilled:

(a) This Contract Agreement has been duly executed for and on behalf of the Employer and the Contractor;

(b) The Contractor has submitted to the Employer the Performance Security and the advance payment guarantee;

(c) The Employer has paid the Contractor the advance payment

(d) The Contractor has been advised that the documentary credit referred to in Article 2.2 above has been issued in its favor.

(e) constitution of the DB.

Each party shall use its best efforts to fulfill the above conditions for which it is responsible as soon as practicable.

3.2 If the conditions listed under 3.1 are not fulfilled within two (2) months from the date of this Contract notification because of reasons not attributable to the Contractor, the Parties shall discuss and agree on an equitable adjustment to the Contract Price and the Time for Completion and/or other relevant conditions of the Contract.

Article 4. Communications

4.1 The address of the Employer for notice purposes, pursuant to GCC 4.1 is: _____.

4.2 The address of the Contractor for notice purposes, pursuant to GCC 4.1 is: _____.

Article 5. Appendices

5.1 The Appendices listed in the attached List of Appendices shall be deemed to form an integral part of this Contract Agreement.

5.2 Reference in the Contract to any Appendix shall mean the Appendices attached hereto, and the Contract shall be read and construed accordingly.

IN WITNESS WHEREOF the Employer and the Contractor have caused this Agreement to be duly executed by their duly authorized representatives the day and year first above written.

Signed by, for and on behalf of the Employer

_____

[Signature]

_____

[Title]

in the presence of _____

Signed by, for and on behalf of the Contractor

_____

[Signature]

_____

[Title]

in the presence of _____

APPENDICES

Appendix 1 Terms and Procedures of Payment

Appendix 2 Price Adjustment

Appendix 3 Insurance Requirements

Appendix 4 Time Schedule

Appendix 5 List of Major Items of Plant and Installation Services and List of Approved Subcontractors

Appendix 6 Scope of Works and Supply by the Employer

Appendix 7 List of Documents for Approval or Review

Appendix 8 Functional Guarantees

Appendix 1. Terms and Procedures of Payment

In accordance with the provisions of GCC Clause 12 (Terms of Payment), the Employer shall pay the Contractor in the following manner and at the following times, on the basis of the Price Breakdown given in the section on Price Schedules. Payments will be made in the currencies quoted by the Bidder unless otherwise agreed between the Parties. Applications for payment in respect of part deliveries may be made by the Contractor as work proceeds. The complete plant is an integration of Solar or BESS. Below mentioned payment terms will apply uniformly for Solar or BESS.

TERMS OF PAYMENT

Schedule No. 1. Plant and Equipment Supplied from Abroad

In respect of plant and equipment supplied from abroad, the following payments shall be made:

Ten percent (10%) of the total amount (of Schedule No. 1) as an advance payment against receipt of Proforma invoice and an irrevocable advance payment security for the 100 % amount made out in favor of the Employer. The advance payment security may be reduced in proportion to the value of the 10% advance payment adjusted against plant and equipment delivered to the site, as evidenced by shipping and delivery documents[2].

Seventy percent (70%) of the total or pro rata amount (of Schedule No. 1), upon delivery to the destination within forty-five (45) days after receipt of materials and relevant documents[3][4].

Ten percent (10%) of the total or pro rata amount (of Schedule No. 1), upon successful erection, testing and commissioning of materials at site and Operational Acceptance of the plant pursuant to successful functional Guarantee Tests.

Ten percent (10 %) of the total or pro rata amount (of Schedule No. 1) within forty-five (45) days of receipt of invoice after final acceptance of the Plant facilities or completion

[2] Income Tax Order/Tax Residency Certificate in case of CIP supplies,

[3] Packing list, evidence of dispatch (GR/ LR/BL/AWB copy), Copies of Custom Duty/Taxation, Insurance Certificate, Manufacturer's/ Contractor's Guarantee certificate and MDCC (Material Dispatch Clearance Certificate) issued by Employer's authorized representative in original. BCD+SWS & SGD/ADD being of reimbursement nature duties, Employer will reimburse the amount for BCD+SWS & SGD/ADD at actuals against the submission of documentary evidence only, with a MAXIMUM CEILING of BCD+SWS & SGD/ADD charges as mentioned by the Bidder in the Price Schedules No 1 at the time of bidding.

[4] At this stage, contractor shall submit the Invoice against for adjustment of advance payment apart from the mentioned milestone.

All the above requirements will be suitably applied for all other Schedules, wherever applicable.

of First year of O&M of Plant, whichever is later, pursuant to submission of all requisite documentation including submission of all as-built drawings and documents.

Schedule No. 2. Plant and Equipment Supplied from within the Employer's Country

In respect of plant and equipment supplied from within the Employer's Country, the following payments shall be made:

Ten percent (10%) of the total amount (of Schedule No. 2) as an advance payment against receipt of invoice and an irrevocable advance payment security for the 100% amount made out in favor of the Employer. The advance payment security may be reduced in proportion to the value of the 10% advance payment adjusted against plant and equipment delivered to the site, as evidenced by shipping and delivery documents.

Seventy percent (70%) of the total or pro rata amount (of Schedule No. 2), upon delivery to the destination within forty-five (45) days after receipt of materials and relevant documents.

Ten percent (10%) of the total or pro rata amount (of Schedule No. 2), upon successful erection, testing and commissioning of materials at site and Operational Acceptance of the plant pursuant to successful functional Guarantee Tests.

Ten percent (10 %) of the total or pro rata amount (of Schedule No. 2) within forty-five (45) days of receipt of invoice after final acceptance of the Plant facilities or completion of First year of O&M of Plant, whichever is later, pursuant to submission of all requisite documentation including submission of all as-built drawings and documents.

Schedule No. 3. Design Services

In respect of design services for both the foreign currency and the local currency portions, the following payments shall be made:

Ten percent (10%) of the total design services amount as an advance payment against receipt of invoice, and an irrevocable advance payment security for the 100% amount made out in favor of the Employer. For the purpose of advance settlement, the Contractor will provide the invoice of advance taken, during further course of payments.

Ninety percent (90%) of the total or pro rata design services amount upon acceptance of design in accordance with GCC Clause 20 by the Project Manager within forty-five (45) days after receipt of invoice.

Schedule No. 4. Installation and other Services

In respect of installation and other services for the local currency portion, the following payments shall be made:

Ten percent (10%) of the total installation and other services amount (of Schedule No. 4) as an advance payment against receipt of invoice, and an irrevocable advance payment security for the 100% amount made out in favor of the Employer. The advance payment

security may be reduced in proportion to the value of 10% advance payment adjusted against work performed by the Contractor as evidenced by the invoices for installation and other services.

Eighty percent (80%) of the measured value of work performed by the Contractor, as identified in the said Program of Performance, during the preceding month, as evidenced by the Employer's authorization of the Contractor's application, will be made monthly within forty-five (45) days after receipt of invoice.

Five percent (5%) of the total or pro rata value of installation and other services (of Schedule No. 4) within forty-five (45) days of Operational Acceptance of the plant pursuant to successful integration with existing internal grid system & functional Guarantee Tests and completion of all the civil works including finishing and debris removal.

Five percent (5%) of the total or pro rata value of installation and services (of Schedule No. 4) within forty-five (45) days after receipt of invoice after final acceptance of the Plant facilities or completion of First year of O&M of Plant, whichever is later, pursuant to submission of all requisite documentation including submission of all as-built drawings and documents.

Interest on Delayed Payments:

In the event that the Employer fails to make any payment on its respective due date, the Employer shall pay to the Contractor interest on amount of such delayed payment at the rate as applicable for 46 days term deposit scheme as established by State Bank of India for Local currency payment and London Inter Bank Offered Rate (LIBOR) for Foreign currency payment, shall become payable for the period of delay until payment has been made in full.

PAYMENT PROCEDURES

Method of Payment

In case of an Indian bidder, following additional clauses will be applicable

(a) In case of supply from within India or wherever the GST is applicable in the tendering process, if there is difference in HSN/SAC classification and corresponding rate of GST of an item as confirmed/deemed confirmed by the bidder in its bid and HSN/SAC and corresponding rate of GST as interpreted under any interpretation/ judgment/ Notification/ Circular issued under the GST law before or after the award of contract, GST reimbursable to the bidder/Bidder shall be lower of the GST applicable at the rate as confirmed/deemed confirmed in the bid or actual GST paid/payable by the bidder for that item.

(b) While raising invoice/proforma invoice for Supply of Goods from within India, Contactor shall bill to and ship to the address of the Employer where the Goods or part thereof is to be Supplied and mention GSTIN of Employer. In case of Supply of Services from within India, the Bidder shall invoice the Employer using the GSTIN of Employer in the state in which the service or part thereof is to be rendered. In the event that the Bidder fails to provide the invoice

in the form and manner prescribed under the GST Act and Rules, the Employer shall not be liable to make any payment against such invoice.

(c) The recovery of TDS under GST/Income Tax Act and any other acts as per Govt. regulation related to this work shall be done by the Employer. TDS so deducted by Employer shall be deposited with the relevant tax authorities and TDS certificates shall be issued using PAN, TIN, TAN of Employer accordingly. Relevant challans and copies of the TDS certificates shall be forwarded to 'Employer for filing necessary returns. In case, wherever E-filing system is applicable, the relevant information would be given to the Employer for issuing TDS certificate, filing returns, etc.

(d) Notwithstanding anything above or elsewhere in the Contract, in the event that the input tax credit of the GST charged by the Bidder is denied by the tax authorities to the Employer for reasons associated with non-compliance/ incorrect compliance by the Bidder, the Employer shall be entitled to recover such amount from the Bidder by way of adjustment from any of the subsequent invoices submitted by the Bidder to the Employer. In addition to the amount of GST, the Employer shall also be entitled to recover interest and penalty, in case any interest and/or penalty are imposed by the tax authorities on the Employer for incorrect/wrong availment of Input Tax Credit. The Employer shall determine whether the denial of credit is linked to the non-compliance/ incorrect compliance of the Bidder and the said determination shall be binding on the Bidder.

(e) Any income tax payable in respect of supervisory services rendered by foreign Seller under the Contract shall be as per the Indian Income Tax Act and shall be borne by SELLER. It is up to the bidder/seller to ascertain the amount of these taxes and to include them in his bid price. The bidder will have to bear all income tax liability, if any both Corporate as well as for his personal.

(f) 'The Employer shall make payments promptly within Forty-Five (45) days of submission of an invoice/claim by the Contractor, complete in all respects and supported by the requisite documents and fulfillment of stipulated conditions, if any. All the payment shall be released to the Contractor directly.

(g) All payments to be made directly to the Contractor shall be made by the Employer though electronic payment mechanism (e-payment) for which necessary details shall be tied up during execution of the Contract. However, a request for payment to be released through cheque shall be considered on case to case basis and merit of the same.

(h) All invoices shall be raised in the name of Employer, Solar Energy Corporation of India (SECI) Limited, New Delhi

(i) In case of Contractor being a Joint Venture of two or more firms, the payment under the Contract shall be received by the Lead Partner on behalf of the Joint Venture, as per power conferred to it in the Power of Attorney. The payment under the Contract, however, can also be received by other Partner (s) based on authorization of the Lead Partner.

The day the payment is made, a mail stating the "Bill number, net payment amount and details of the bank from where the payment has been made" will be sent to the Contractor.

Note: Pro-rata shall refer to functionally complete part(s) of the facilities, for which rates are identified in the contract.

Appendix 2. Price Adjustment

Not Applicable

Appendix 3. Insurance Requirements

Insurances to be Taken Out by the Contractor

In accordance with the provisions of GCC Clause 34, the Contractor shall at its expense take out and maintain in effect, or cause to be taken out and maintained in effect, during the performance of the Contract, the insurances set forth below in the sums and with the deductibles and other conditions specified. The identity of the insurers and the form of the policies shall be subject to the approval of the Employer, such approval not to be unreasonably withheld.

(a) Cargo Insurance

Covering loss or damage occurring, while in transit from the supplier's or manufacturer's works or stores until arrival at the Site, to the Facilities (including spare parts therefor) and to the construction equipment to be provided by the Contractor or its Subcontractors.

Amount	Deductible limits	Parties Insured	From	To
110% of the (Ex-works valueCIP value)	NIL	Contractor & Employer	Warehouse	Warehouse + 60 days

(b) Installation All Risks Insurance

Covering physical loss or damage to the Facilities at the Site, occurring prior to completion of the Facilities, with an extended maintenance coverage for the Contractor's liability in respect of any loss or damage occurring during the defect liability period while the Contractor is on the Site for the purpose of performing its obligations during the defect liability period.

Amount	Deductible limits	Parties Insured	From	To
110% of the (Contract Price)	NIL	Contractor/ Sub-contractor & Employer	Receipt at site	Upto Defect Liability period

(c) Third Party Liability Insurance

Covering bodily injury or death suffered by third parties (including the Employer's Personnel) and loss of or damage to property (including the Employer's property and any parts of the Facilities that have been accepted by the Employer) occurring in connection with the supply and installation of the Facilities.

Amount	Deductible limits	Parties Insured	From	To
Rs. 0.5 million per person per occasion	NIL	Contractor/ Sub-contractor	Commencement of work	Upto Defect Liability period

(d) Automobile Liability Insurance

Covering use of all vehicles used by the Contractor or its Subcontractors (whether or not owned by them) in connection with the supply and installation of the Facilities. Comprehensive insurance in accordance with statutory requirements.

(e) Workers' Compensation

In accordance with the statutory requirements applicable in any country where the Facilities or any part thereof is executed.

(f) Employer's Liability

In accordance with the statutory requirements applicable in any country where the Facilities or any part thereof is executed.

(g) Other Insurances

The Contractor is also required to take out and maintain at its own cost the following insurances:

Details:

Amount	**Deductible limits**	**Parties Insured**	**From**	**To**
To be indicated by the Contractor	NIL	Contractor/ Sub-contractor & Employer	Receipt at site	Upto Defect Liability period

The Employer shall be named as co-insured under all insurance policies taken out by the Contractor pursuant to GCC Sub-Clause 34.1, except for the Third Party Liability, Workers' Compensation and Employer's Liability Insurances, and the Contractor's Subcontractors shall be named as co-insureds under all insurance policies taken out by the Contractor pursuant to GCC Sub-Clause 34.1, except for the Cargo, Workers' Compensation and Employer's Liability Insurances. All insurer's rights of subrogation against such co-insureds for losses or claims arising out of the performance of the Contract shall be waived under such policies.

Insurances To Be Taken Out By The Employer

The Employer shall at its expense take out and maintain in effect during the performance of the Contract the following insurances.

Details:

Amount	Deductible limits	Parties insured	From	To

NIL

Appendix 4. Time Schedule

Appendix 5. List of Major Items of Plant and Installation Services and List of Approved Subcontractors

A list of major items of Plant and Installation Services is provided below.

The following Subcontractors and/or manufacturers are approved for carrying out the items of the Facilities indicated below. Where more than one Subcontractor is listed, the Contractor is free to choose between them, but it must notify the Employer of its choice in good time prior to appointing any selected Subcontractor. In accordance with GCC Sub-Clause 19.1, the Contractor is free to submit proposals for Subcontractors for additional items from time to time. No Subcontracts shall be placed with any such Subcontractors for additional items until the Subcontractors have been approved in writing by the Employer and their names have been added to this list of Approved Subcontractors.

Major Items of Plant and Installation Services	Approved Subcontractors/Manufacturers	Nationality
----------NA ----------		

Appendix 6. Scope of Works and Supply by the Employer

The following personnel, facilities, works and supplies will be provided/supplied by the Employer, and the provisions of GCC Clauses 10, 21 and 24 shall apply as appropriate.

All personnel, facilities, works and supplies will be provided by the Employer in good time so as not to delay the performance of the Contractor, in accordance with the approved Time Schedule and Program of Performance pursuant to GCC Sub-Clause 18.2.

Unless otherwise indicated, all personnel, facilities, works and supplies will be provided free of charge to the Contractor.

Personnel	Charge to Contractor (if any)
NA	

Facilities	Charge to Contractor (if any)
NA	

Works	Charge to Contractor (if any)
NA	

Supplies	Charge to Contractor (if any)

Appendix 7. List of Documents for Approval or Review

Pursuant to GCC Sub-Clause 20.3.1, the Contractor shall prepare, or cause its Subcontractor to prepare, and present to the Project Manager in accordance with the requirements of GCC Sub-Clause 18.2 (Program of Performance), the following documents for

A. Approval*

1. Equipment Document- GTP, Sizing Calculation, Type Test Reports and QAP
2. Investigation Reports
3. Design Basis Reports and Calculations
4. Drawings

B. Review*

1. Equipment Document- GTP, Sizing Calculation, Type Test Reports and QAP
2. Investigation Reports
3. Design Basis Reports and Calculations
4. Drawings

* Classified for approval/ review/ information as per agreed Master Drawing List (MDL)

Appendix 8. Functional Guarantees

1. General

This Appendix sets out

(a) the functional guarantees referred to in GCC Clause 28 (Functional Guarantees) and ANNEXURE 2 - Functional Guarantees of Annexure C – Operation and Maintenance of the RFB

(b) the preconditions to the validity of the functional guarantees, either in production and/or consumption, set forth below

(c) the minimum level of the functional guarantees

(d) the formula for calculation of liquidated damages for failure to attain the functional guarantees.

(e) Annexure C (PG Test Procedure) of Annexure – A, Employer's Requirements.

2. Preconditions

The Contractor gives the functional guarantees (specified herein) for the facilities, subject to the following preconditions being fully satisfied: NA

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3. Functional Guarantees

Subject to compliance with the foregoing preconditions, the Contractor guarantees as follows:

- Performance Ratio (PR) for Operational Acceptance : 82%
- Capacity Utilization Factor (CUF) 36.5%
- BESS Availability 99 %

1. Performance Ratio Guarantee

Annexure C (PG Test Procedure) of Annexure – A, Employer's Requirements shall be referred.

2. Annual CUF Guarantee

A. In consideration for the payment of the O&M Price , from the Commencement Date until the end of the Term, the Contractor grants to the Employer the CUF Guarantee on the terms and conditions set forth in the contract.

B. The Contractor guarantees the annual CUF committed herein over the O&M Period ("**Annual CUF Guarantee**") from the date of Operational Acceptance. In the event the CUF is less than the Guaranteed CUF, the Contractor shall immediately, upon demand, indemnify the Employer, as liquidated damages and not as penalty, amounts equivalent to remuneration of the equivalent Energy, subject to a maximum of hundred (100%) percent of the Total Annual O&M Price.

C. The Procedure for measurement and verification of the CUF Guarantee is as per Annexure-C: Performance Guarantee Test procedure, defined under the Annexure A (Employers' Requirement) of the bid document.

D. The Procedure for measurement and verification of the BESS Availability shall be as per relevant section (Battery energy Storage System: System Rating Verification) of Annexure-F: Plant Documentation, Commissioning and Test Procedure, Section VII defined under the Annexure A (Employers' Requirement) of the bid document

E. Liquidated Damages for Shortfall in Annual CUF for Solar PV Plant

(i) If the Contractor fails to achieve guaranteed annual CUF, then the Contractor shall pay compensation to the Employer an amount equal to the difference in units (kWh) derived from guaranteed CUF and achieved CUF multiplied by Rs.4 per unit (kWh).

(ii) If the Contractor fails to achieve the annual guaranteed CUF at the end of 10th year, then the Contractor shall pay compensation to the Employer an amount equal to the Net Present Value (NPV) of the revenue loss for 10th to 25th year calculated as below.

(a) % CUF drop i.e. [(Guaranteed CUF of 10th year – Actual CUF of 10th year) / Guaranteed CUF of 10th year]*100 in the 10th year shall be considered as the representative CUF drop for each subsequent year starting from 11th to 25th year.

(b) Estimated revenue loss @ Rs.4 per unit (kWh) for each subsequent year will be calculated as % CUF drop in the 10th year (as per (a) above) multiplied by the respective year's estimated generation.

(c) The Net Present Value (NPV) of the revenue loss for 10th to 25th year with discount factor of 8.61% will be considered as the LD payable by the Contractor.

F. In case the Project fails to generate any power continuously for 1 month any time during the O&M period, apart from the force majeure and grid outages as certified by competent authority from STU/ CTU, it shall be considered as "an event of default". In the case of default, the entire Contract Performance Security will be forfeited.

G. Penalty during O&M period against breakdown of other Infrastructure of Plant Facilities that don 't affect the generation of power directly, such as but not limited to, civil infrastructure, water supply system/network, other Infrastructure developed by the Contractor as a Scope of Work for the Project (Section-VII: Scope of Works & Technical Specifications) shall be penalised @ Rs.1000/day, for non-compliance with PM Schedule (Initiation/Completion of Scheduled maintenance Activity as agreed under this Contract) beyond 48 hours. Cumulative value of such liquidated damages shall be limited

to 50% of yearly O&M cost. Cumulative value of such liquidated damages shall be limited to 50% of yearly O&M cost.

For the purpose of this Clause, the PM shall be inclusive of, but not limited to, the following PM activities:

Item	**Scope of Maintenance Activity**	**Periodicity**
Environmental/Corrosive Protective Coatings	White-washing/Application/Re-application of Distemper, Epoxy coatings	Once in every 2 years under the O&M Contract period, in consultation with the Owner
Roads and Access paths	Repair and maintenance of all roads – Access, Internal and Periphery roads, walkways as well as fences, gates, cable-trenches and outdoor equipment platforms.	Once every year prior to Monsoon season, in Consultation with the Owner
Water Supply Network	Repair and Maintenance of Water Supply Network including piping network, valves, pumps etc.	Once Every Year in Consultation with the Owner.
Periphery Lighting	Repair and maintenance of Peripheral Lighting including replacement of non-functional lighting fixtures, Junction Boxes, Conduits etc.	Once every Six Months
Rodent Entry Points	Application/re-application of Anti-rodent protection measures	Once every Six Months

	like PUF filling, sealant etc. at Checker/Gland Plates, Cable Entry Points (in PCU/SMU, Switchgear Panels, Buildings, Enclosures)	
All bolted/tightened structures	Tightening/fastening of bolts that are exposed to winds/vibrations like MMS members/foundation bolts	Once every Year before onset of Windy season, in consultation with the Owner.
Enclosures of Equipment requiring Temperature and Dust Controlled environment for Normal Operation	Application/re-application of insulation/Dust-Filters/Temperature-control equipment at Enclosures/Buildings housing BESS, PCU, Switchgear	Once every Year, consultation with the Owner.
Entire Plant Facility	Oversight management of the hazardous/toxic materials including its handling and disposal as per Government of India Rules and environmental and safety assessments by a qualified Specialist	Once every Year, in consultation with the Owner.

Note : *The Contractor shall ensure intimation and submission of requisite Reports to the owner at least 15 days prior to initiation of maintenance action for the activity.*

H. For breakdown of generation related infrastructure, the generation loss estimated based on the outage equipment's weightage (Wi) multiplied by estimated total energy output in the outage period beyond 48 hours, in the event of no breakdown (E_{est}) multiplied by

Rs. 4/kWh will be levied. E_{est} for the period shall be calculated from the guaranteed CUF (i.e. Guaranteed CUF* outage period beyond 48 hours). Cumulative value of such liquidated damages shall be limited to 50% of yearly O&M cost. The Equipment weightage (Wi) shall be calculated as below:

$$Wi = \frac{\text{Equipment Rating (in MW)}}{\text{Plant AC Capacity (MW)}}$$

I. The Penalty specified on account of delays, as specified in Liquidated Damages and Penalty specified on account of deviations in Functional Guarantees as above shall be assessed independent of each other. Above mentioned Penalties specified under this clause of SCC are independent of each other.

3. **BESS Availability**

A. The Contractor shall maintain all BESS equipment to ensure Annual Equipment Availability not less than 99%. Equipment Availability includes the availability of Batteries, Battery Management System (BMS), Power Conversion System (PCS), Energy Management System (EMS) as well as the power evacuation system for BESS up to interface with the solar PV arrays.

B. BESS Equipment Availability is the percentage of hours that the BESS is available during the year. The availability guarantee shall begin upon facility commissioning till the end of O&M period. BESS annual equipment availability shall be calculated as follows.

Equipment Availability =

$$\left[1 - \left(\frac{\sum Accountable\ BESS\ Outage\ duration\ in\ hours\ x\ We}{8760}\right)\right] \times 100$$

Where:

- W_e, Weightage is $\frac{Outage\ Capacity}{Rated\ Capacity}$, where Outage and Rated Capacity shall be in Energy terms i.e. MWh. Rated Capacity in a given year shall correspond to the daily throughput capacity guarantee for the beginning of the year.

C. Accountable BESS outages are outages caused or necessitated by the BESS equipment that result in reduced capacity or loss of essential function of the BESS. These outages may be initiated by failure of components, loss of battery capacity, operation of protective devices, alarms, or manual action. Such outages include both forced outages due to equipment problems and scheduled outages for BESS maintenance.

D. Accountable BESS outage duration is the elapsed time of accountable BESS outages from the instant the BESS experiences reduced capacity or is out of service to the instant it is returned to service or full capacity. If the BESS experiences reduced capacity but is determined by the Employer to be available for service even if the Employer elects not to immediately return the equipment to full capacity, such time will be discounted from the outage duration.

E. The Procurement specific nameplate ratings shall be as defined in Technical Specifications under Annexure A: (Employer's Requirement). The BESS shall be considered to be under an accountable outage if any of those ratings cannot be met. The BESS shall also be considered to be under an accountable outage if a scheduled (or required) charge cycle cannot be completed.

F. The data required for assessment of the availability of the BESS shall be collected through the Plant's integrated SCADA system.

G. Grid outage hours shall be subtracted from total no. of hours in the year.

H. If the Plane of Array Radiation is less than 2kWh/m2 on a day, the day (i.e. 24 hours) shall be excluded.

I. Liquidated Damages for Shortfall in Equipment Availability

If the annual equipment availability for BESS is less than 99% during any year, then Contractor shall compensate the Employer an amount calculated as per the following formula.

$$COM = \left(\frac{99 - EA}{EA}\right) \times C \times E$$

where,

COM is Compensation payable to the Employer in rupees

EA is Annual BESS Equipment Availability

C is ₹8/kWh

E is the intended energy output from BESS in kWh during the respective year in 99% availability condition after considering any degradation.

Recovery of Compensation

The above compensations shall be deducted from CPS submitted by the developer.

Scheduling and Forecasting:

The Contractor shall be responsible for appointing a Qualified Coordinating Agency if required by concerned authorities at the Pooling Substation Level for scheduling and forecasting activity. Also, the contractor shall be responsible for carrying out the forecasting and scheduling of the energy generation from the plant facility (In accordance with the Deviation Settlement Mechanism Regulations of the Chhattisgarh Electricity Regulatory Commission). Scheduling given by the Contractors is such that no penalty is levied on the Employer due to any deviation of actual generation from scheduling beyond the allowed limit. If any penalty is imposed on the Employer due to such deviations beyond allowed limit the same shall be recovered from the CPS given by the contractor.

Performance Security Form– Bank Guarantee[5]

[Guarantor letterhead or SWIFT identifier code]

Beneficiary: *[insert name and Address of* Employer*]*

Date: _ *[Insert date of issue]*

PERFORMANCE GUARANTEE No.: ____*[Insert guarantee reference number]*

Guarantor: *[Insert name and address of place of issue, unless indicated in the letterhead]*

We have been informed that _____ (hereinafter called "the Applicant") has entered into Contract No. _____dated _____ with the Beneficiary, for the execution of _____ (hereinafter called "the Contract").

Furthermore, we understand that, according to the conditions of the Contract, a performance guarantee is required.

At the request of the Applicant, we as Guarantor, hereby irrevocably undertake to pay the Beneficiary any sum or sums not exceeding in total an amount of _____(___)[6],such sum being payable in the types and proportions of currencies in which the Contract Price is payable, upon receipt by us of the Beneficiary's complying demand supported by the Beneficiary's statement, whether in the demand itself or in a separate signed document accompanying or identifying the demand, stating that the Applicant is in breach of its obligation(s) under the Contract, without the Beneficiary needing to prove or to show grounds for your demand or the sum specified therein.

This guarantee shall be reduced by half upon our receipt of following, and upon prior consent of the Employer:

(a) a copy of the Operational Acceptance Certificate; or

(b) a registered letter from the Applicant (i) attaching a copy of its notice requesting issuance of the Operational Acceptance Certificate and (ii) stating that the Project Manager has failed to issue such Certificate within the time required or provide in writing justifiable reasons why such Certificate has not been issued, so that Operational Acceptance is deemed to have occurred.

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[5] *The Employer should insert either the Bank Guarantee or the Conditional Guarantee.*

[6] The Guarantor shall insert an amount representing the percentage of the Contract Price specified in the Contract and denominated either in the currency(ies) of the Contract or a freely convertible currency acceptable to the *Employer*.

This guarantee shall expire no later than the earlier of:

(a) twelve months after our receipt of (a) above; or

(b) eighteen months after our receipt of:

(i) a copy of the Completion Certificate; or

(c) the ____ day of _____, 2___.

Consequently, any demand for payment under this guarantee must be received by us at this office on or before that date.

This guarantee is subject to the Uniform Rules for Demand Guarantees (URDG) 2010 Revision, ICC Publication No. 758, except that the supporting statement under Article 15(a) is hereby excluded.

_____

[signature(s)]

Note: All italicized text (including footnotes) is for use in preparing this form and shall be deleted from the final product.

Performance Security Form- Conditional Bank Guarantee

Not Applicable

Advance Payment Security

Demand Guarantee

[Guarantor letterhead or SWIFT identifier code]

Beneficiary: ..... ***Name and Address of Employer*** .....

Date:*[Insert date of issue]*.....

Advance Payment Guarantee No.:*[Insert guarantee reference number]*

Guarantor: *[Insert name and address of place of issue, unless indicated in the letterhead]*

.....

We have been informed that . . . . (hereinafter called "the Applicant") has entered into Contract No. . . . . dated . . . .with the Beneficiary, for the execution of, ... (hereinafter called "the Contract").

Furthermore, we understand that, according to the Conditions of the Contract, an advance payment in the sum . . . . (. . . . .) is to be made against an advance payment guarantee.

At the request of the Applicant, we as Guarantor, hereby irrevocably undertake to pay the Beneficiary any sum or sums not exceeding in total an amount of . (. . . . .) upon receipt by us of the Beneficiary's complying demand supported by the Beneficiary's statement whether in the demand itself or in a separate signed document accompanying or identifying the demand, stating either that the applicant:

(a) has used the advance payment for purposes other than the costs of mobilization in respect of the Facilities; or

(b) has failed to repay the advance payment in accordance with the Contract conditions, specifying the amount which the Applicant has failed to repay.

A demand under this guarantee may be presented as from the presentation to the Guarantor of a certificate from the Beneficiary's bank stating that the advance payment referred to above has been credited to the Applicant on its account number _____ at _____.

The maximum amount of this guarantee shall be progressively reduced by the amount of the advance payment repaid by the Applicant as indicated in copies of interim statements or payment certificates which shall be presented to us. This guarantee shall expire, at the latest, upon our receipt of documentation indicating full repayment by the Applicant of the amount of the advance payment, or on the . . . day of . . . . . , ...,

whichever is earlier. Consequently, any demand for payment under this guarantee must be received by us at this office on or before that date.

This guarantee is subject to the Uniform Rules for Demand Guarantees (URDG) 2010 Revision, ICC Publication No. 758, except that the supporting statement under Article 15(a) is hereby excluded.

_____ *[signature(s)]*

Note: All italicized text (including footnotes) is for use in preparing this form and shall be deleted from the final product.

Operations and Maintenance Requirements

"Scope of work, Service Level Agreement and special payment terms for 10 Years Plant Operation & Maintenance of 100 MW (AC) Solar PV Project (200MWp DC capacity) along with 50MW/150 MWh Battery Energy Storage System at Rajnandgaon, Chhattisgarh, India"

as

Annexure C

"Part of Operations and Maintenance Agreement For 100 MW (AC) Solar PV Project (200MWp DC capacity) along with 50MW/150 MWh Battery Energy Storage System"

SCHEDULE NO 6 /SCHEDULE OF RATES [SOR-6] - GRAND TOTAL SUMMARY	
Total Price of Schedule No 1/SOR 1	0.00
Total Price of Schedule No 2/SOR 2	0.00
Total Price of Schedule No 3/SOR 3	0.00
Total Price of Schedule No 4/SOR 4	0.00
Total Price of Schedule No 5/SOR 5	0.00
Evaluated Bid Value of the Plant Facility (SOR 1+SOR 2+SOR 3+SOR 4+SOR 5)	0.00

****In case of Foreign Bidders, the price values of SOR 1, SOR 2 , SOR 3 & SOR 4 will be first converted to INR for evaluation purpose & then accordingly the final EBV will be calculated**

Schedule No. 1. Plant and Mandatory Spare Parts Supplied from Abroad

SCHEDULE OF RATES [SOR-1] - SOLAR PART {100 MW (AC), 200MWp (DC)} - Part- A

Item	Description	Country of Origin	Qty (Ls)	CIP Price												
				Unit CIP Price		Total CIP Price	BCD + SWS			SGD/ADD			GST			Total CIP Price including BCD+SWS+SGD/ADD+GST
				Currency	Amount		Currency	% of BCD & SWS considered	Amount in figures	Currency	% of SGD or ADD considered	Amount in figures	Currency	% of GST considered	Amount in figures	
1	2	3	4	5	6	7=4*6	8	9	10	11	12	13	14	15	16	17=7+10+13+16
	A - SUPPLY															
1	Supply of PV Modules as specified in the Tender Documents		1			0										0.00
2	Supply of Inverters as specified in the Tender Documents		1			0										0.00
3	Supply of Inverter Transformer as specified in the Tender Documents		1			0										0.00
4	Supply of Panels & Switchgears as specified in the Tender Documents		1			0										0.00
5	Supply of Module Mounting Structure as specified in the Tender Documents		1			0										0.00
6	Spare Modules (As Mandatory Spares, 0.50% of total supply of solar modules)		1			0										0.00
7	Mandatory Spares excluding Modules		1			0										0.00
8	Cables (All DC, LT & HT)		1			0										0.00
9	Weather Monitoring Station		1			0										0.00
10	Manufacture & Supply of Balance of System including all Equipment's, Materials, Spares, Accessories, Safety & Fire Fighting System etc. excluding in above Solar Part supply and any other Supplies specified in the Tender Documents		1			0										0.00
11	132 Kv Double Cicrcuit Double String (DCDS) overhead Transmission line of approx 33 Kms from Plant substation to CSPTCL 220/132 Kv Thelkadi substation		1			0										0.00
	Sub Total - A					0										0.00

SCHEDULE OF RATES [SOR-1] - BESS PART (50MW/150 MWh) - Part - B

	C - SUPPLY															
12	Supply of Battery as specified in the Tender Documents		1			0										0.00
13	Supply of Battery Management System (BMS) as specified in the Tender Documents		1			0										0.00
14	Supply of Bidirectional Inverter (PCS) as specified in the Tender Documents		1			0										0.00
15	Supply of Step-up Transformer as specified in the Tender Documents		1			0										0.00
16	Supply of MV Switchgear/ RMU as specified in the Tender Documents		1			0										0.00
17	Manufacture & Supply of Balance of System including all Equipment's, Materials, Spares, Accessories, Grounding, Lighting, Lightning, Safety & Fire Fighting System etc. excluding BESS part supply above and any other Supplies specified in the Tender Documents		1			0										0.00
	Sub Total - B					0										0.00
	Grand Total (Supply from Abroad) A+B					0										0.00

General instructions to fill the Price Schedules

1	The price evaluation for Schedule 1 will be done based on the total CIP price mentioned under CELL NO H 32 excluding of any applicable taxes & duties. However, For the Purpose of Contract award, the total price mentioned under CELL No R 32 including CIP Price+BCD+SWS+SGD/ADD+GST will be considered from Schedule No 1.
2	BCD+SWS & SGD/ADD being of reimbursement nature duties, Employer will reimburse the amount for BCD+SWS & SGD/ADD at actuals against the submission of documentary evidence only, with a MAXIMUM CEILING of BCD+SWS & SGD/ADD charges as mentioned by the Bidder in the Price Schedules No 1 at the time of bidding. Bidders are required to quote the applicable BCD+SWS & SGD/ADD with due diligence & appropriate financial prudence, as afterwards bidders will not be able to change or claim such taxes & duties already quoted during the bid. No BCD+SWS & SGD/ADD will be reimbursed to the contractor in the absence of documentary proofs
3	As BCD+SWS & SGD/ADD will be reimbursed by the employer, the GST will be applicable on the actual CIP price only. The payment of GST by the Employer shall only be at the CEILING of GSTas mentioned by the Bidder in the Schedule No 1 at the time of bidding. Bidders are required to quote the applicable GST with due diligence & appropriate financial prudence, as afterwards bidders will not be able to change or claim the GST charges already quoted during the bid.
4	Bidders are required to fill the relevant portion/Parts/Line items/scope of the respective Price Schedules only. In case, any line item is left blank by the bidder, it will be deemed assumed by the Employer that such portion/Parts/line item/Scope has been considered by the bidder suitably somewhere else in the Price schedules.
5	In case the bidder don't want to mention any quantity/price in any particular line item, then he has to put zero (0) against that particular line item.

Schedule No. 2. Plant and Mandatory Spare Parts Supplied from Within the Employer's Country

SCHEDULE OF RATES [SOR-2] - SOLAR PART {100 MW (AC), 200MWp (DC)} - Part- A

Item	Description	Qty (Ls)	Currency	Unit EX Works (EXW) Price	Total EX Works (EXW) Price	Goods & Service Tax (GST) in absolute figures	% (Percentage) of Goods & Service Tax (GST) considered	Total Ex Works (EXW) Price with GST
1	2	3	4	5	6=3*5	7	8	9=6+7
					A - SUPPLY			
1	Supply of PV Modules as specified in the Tender Documents	1			0			0.00
2	Supply of Inverters as specified in the Tender Documents	1			0			0.00
3	Supply of Inverter Transformer as specified in the Tender Documents	1			0			0.00
4	Supply of MV Switchgear and RMU as specified in the Tender Documents	1			0			0.00
5	Supply of Module Mounting Structure as specified in the Tender Documents	1			0			0.00
6	Spare Modules (As Mandatory Spares, 0.50% of total supply of solar modules)	1			0			0.00
7	Mandatory Spares excluding Modules	1			0			0.00
8	Cables (All DC, LT & HT)	1			0			0.00
9	Weather Monitoring Station	1			0			0.00
10	Manufacture & Supply of Balance of System including all Equipment's, Materials, Spares, Accessories, Safety & Fire Fighting System etc. excluding in above Solar Part supply and any other Supplies specified in the Tender Documents	1			0			0.00
11	132 Kv Double Cicrcuit Double String (DCDS) overhead Transmission line of approx 33 Kms from Plant substation to CSPTCL 220/132 Kv Thelkadi substation	1			0			0.00
	Sub Total - A				0			0.00

SCHEDULE OF RATES [SOR-2] - BESS PART (50MW/150 MWh) - Part - B

					C - SUPPLY			
12	Supply of Battery as specified in the Tender Documents	1			0			0.00
13	Supply of Battery Management System (BMS) as specified in the Tender Documents	1			0			0.00
14	Supply of Bidirectional Inverter (PCS) as specified in the Tender Documents	1			0			0.00
15	Supply of Step-up Transformer as specified in the Tender Documents	1			0			0.00
16	Supply of MV Switchgear/ RMU as specified in the Tender Documents	1			0			0.00
16	Manufacture & Supply of Balance of System including all Equipment's, Materials, Spares, Accessories, Grounding, Lighting, Lightning, Safety & Fire Fighting System etc. excluding BESS part supply above and any other Supplies specified in the Tender Documents	1			0			0.00
	Sub Total - B				0			0.00
	Grand Total (Supply from Employer's Country) - A+B				0			0.00

	General instructions to fill the Price Schedules
1	The price evaluation for Schedule 2 will be done based on the total Ex Works (EXW) price mentioned under CELL NO G 30 excluding of applicable GST. However, For the Purpose of Contract award, the total price mentioned under CELL No J 30 including Total Ex Works (EXW) Price + GST will be considered from Schedule No 2.
2	The payment of GST by the Employer shall only be at the CEILING of GST as mentioned by the Bidder in the Schedule No 2 at the time of bidding. Bidders are required to quote the applicable GST with due diligence & appropriate financial prudence, as afterwards bidders will not be able to change or claim the GST charges already quoted during the bid.
3	Bidders are required to fill the relevant portion/Parts/Line items/scope of the respective Price Schedules only. In case, any line item is left blank by the bidder, it will be deemed assumed by the Employer that such portion/Parts/line item/Scope has been considered by the bidder suitably somewhere else in the Price schedules.
4	In case the bidder don't want to mention any quantity/price in any particular line item, then he has to put zero (0) against that particular line item.

Schedule No. 3. Design Services

SCHEDULE OF RATES [SOR-3] - SOLAR PART {100 MW (AC), 200MWp (DC)} - Part- A											
Sl. No.	Description of Item	Quantity (Ls)	Price					Total Charges including Local & Foreign currency	Total value of Applicable GST / Taxation in absolute figures	% (Percentage) of Goods & Service Tax (GST)/Taxation considered	Total Price including GST / Taxation
			Local currency Portion		Foreign currency Portion (Optional)						
			Unit Charges (INR)	Total Charges (INR)	Currency	Unit Charges	Total Charges				
1	2	3	4	5=3*4	6	7	8=3*7	9=5+8	10	11	12=9+10
A - DESIGN SERVICES											
1	Design & Engineering in respect of all the Equipments Supplied under SOR 1 & SOR 2 for Part A	1		0			0	0			0.00
	Sub Total - A										0.00
SCHEDULE OF RATES [SOR-3] - BESS PART (50MW/150 MWh) - Part - B											
B - DESIGN SERVICES											
2	Design & Engineering in respect of all the Equipments Supplied under SOR 1 & SOR 2 for Part B	1		0			0	0			0.00
	Sub Total - B										0.00
	Grand Total (Design Services) A+B							0			0.00

General instructiosn to fill the Price Schedules	
1	The price evaluation for Schedule 3 will be done based on the total basic price mentioned under CELL NO J 17 excluding of applicable GST/Taxation. However, For the Purpose of Contract award, the total price mentioned under CELL No M 17 including Total basic price + GST/Taxation will be considered from Schedule No 3.
2	The payment of GST/Taxation by the Employer shall only be at the CEILING of GST/Taxation as mentioned by the Bidder in the Schedule No 3 at the time of bidding. Bidders are required to quote the applicable GST/Taxation with due diligence & appropriate financial prudence, as afterwards bidders will not be able to change or claim the GST charges already quoted during the bid.
3	Bidders are required to fill the relevant portion/Parts/Line items/scope of the respective Price Schedules only. In case, any line item is left blank by the bidder, it will be deemed assumed by the Employer that such portion/Parts/line item/Scope has been considered by the bidder suitably somewhere else in the Price schedules.
4	In case the bidder don't want to mention any quantity/price in any particular line item, then he has to put zero (0) against that particular line item.

Schedule No. 4. Installation and Other Services

SCHEDULE OF RATES [SOR-4] - SOLAR PART {100 MW (AC), 200MWp (DC)} - Part- A											
Sl. No.	Description of Item	Quantity (Ls)	Price					Total Charges including Local & Foreign currency	Total value of Applicable GST / Taxation in absolute figures	% (Percentage) of Goods & Service Tax (GST)/Taxation considered	Total Price including GST / Taxation
			Local currency Portion		Foreign currency Portion (Optional)						
			Unit Charges (INR)	Total Charges (INR)	Currency	Unit Charges	Total Charges				
1	2	3	4	5=3*4	6	7	8=3*7	9=5+8	10	11	12 = 9+10
A - INSTALLATION & OTHER SERVICES											
1	Inland Freight and Transit Insurance upto Site for all the mentioned supply portion under SOR 1 & SOR 2 for Part A	1		0	NA	NA	NA	0			0.00
2	Installation, Erection, Testing and Commissioning including Performance Testing and insurance in respect of all the Equipments Supplied under SOR 1 & SOR 2 for Part A	1		0			0	0			0.00
3	Civil and allied works including construction and installation of Trenches, Module Mounting Structure, foundations, etc. of all the Equipments Supplied under SOR 1 & SOR 2 for Part A	1		0			0	0			0.00
	Sub Total - A							0			0.00
SCHEDULE OF RATES [SOR-4] - BESS PART (50MW/150 MWh) - Part - B											
B - INSTALLATION & OTHER SERVICES											
4	Inland Freight and Transit Insurance upto Site for all the mentioned supply portion under SOR 1 & SOR 2 for Part B	1		0	NA	NA	NA	0			0.00
5	Installation, Erection, Testing and Commissioning including Performance Testing and insurance in respect of all the Equipments Supplied under SOR 1 & SOR 2 for Part B	1		0			0	0			0.00
6	Civil and allied works including construction and installation of Trenches, Module Mounting Structure, foundations, etc. of all the Equipments Supplied under SOR 1 & SOR 2 for Part B	1		0			0	0			0.00
	Sub Total - C							0			0.00
	Grand Total (Installation & Other Services) A+B							0			0.00

General instructiosn to fill the Price Schedules	
1	The price evaluation for Schedule 4 will be done based on the total basic price mentioned under CELL NO J 21 excluding of applicable GST/Taxation. However, For the Purpose of Contract award, the total price mentioned under CELL No M 21 including Total basic price + GST/Taxation will be considered from Schedule No 4.
2	The payment of GST/Taxation by the Employer shall only be at the CEILING of GST/Taxation as mentioned by the Bidder in the Schedule No 4 at the time of bidding. Bidders are required to quote the applicable GST/Taxation with due diligence & appropriate financial prudence, as afterwards bidders will not be able to change or claim the GST charges already quoted during the bid.
3	Bidders are required to fill the relevant portion/Parts/Line items/scope of the respective Price Schedules only. In case, any line item is left blank by the bidder, it will be deemed assumed by the Employer that such portion/Parts/line item/Scope has been considered by the bidder suitably somewhere else in the Price schedules..
4	In case the bidder don't want to mention any quantity/price in any particular line item, then he has to mandatorily put zero (0) against that particular line item.

Schedule No. 5. Operation & Maintenance

SCHEDULE OF RATES [SOR-5] [OPERATION AND MAINTENANCE]- PLANT FACILITIES

Sl. No.	Description of Item	Year	PRICES (INR)								
			Currency	Yearly O&M Price in INR (Excluding GST)		Total O&M Price (INR) (Excluding GST) in figures	Total value of Applicable GST in absolute figures [GST to be calculated on absolute O&M Price	% (Percentage) of Goods & Service Tax (GST) considered	Total O&M Price including GST	Present Value Factor (PVF)	Total NPV of O&M Price excluding GST
				Solar PV - Part-A	BESS - Part-B						
1	2	3	4	5	6	7=5+6	8	9	10=7+8	9.36%	11=7*PVF
OPERATION & MAINTENANCE											
1	Operation and Maintenance of the Plant Facility for FIRST YEAR	1		0.00	0.00	0.00	0.00		0.00	0.914	0.000
2	Operation and Maintenance of the Plant Facility for SECOND YEAR	2		0.00	0.00	0.00	0.00		0.00	0.836	0.000
3	Operation and Maintenance of the Plant Facility for THIRD YEAR	3		0.00	0.00	0.00	0.00		0.00	0.765	0.000
4	Operation and Maintenance of the Plant Facility for FOURTH YEAR	4		0.00	0.00	0.00	0.00		0.00	0.699	0.000
5	Operation and Maintenance of the Plant Facility for FIFTH YEAR	5		0.00	0.00	0.00	0.00		0.00	0.639	0.000
6	Operation and Maintenance of the Plant Facility for SIXTH YEAR	6		0.00	0.00	0.00	0.00		0.00	0.585	0.000
7	Operation and Maintenance of the Plant Facility for SEVENTH YEAR	7		0.00	0.00	0.00	0.00		0.00	0.535	0.000
8	Operation and Maintenance of the Plant Facility for EIGHTH YEAR	8		0.00	0.00	0.00	0.00		0.00	0.489	0.000
9	Operation and Maintenance of the Plant Facility for NINETH YEAR	9		0.00	0.00	0.00	0.00		0.00	0.447	0.000
10	Operation and Maintenance of the Plant Facility for TENTH YEAR	10		0.00	0.00	0.00	0.00		0.00	0.409	0.000
	TOTAL NPV OF O&M FOR 10 YEARS (1+2+3+4+5+6+7+8+9+10)					0.00	0.00		0.00		0.00

General instructiosn to fill the Price Schedules	
1	The price evaluation for Schedule 5 will be done based on the NPV of O&M price excluding GST mentioned under CELL NO M 25. However, For the Purpose of Contract award, the total price mentioned under CELL No K 25 including Total O&M price of 10 years + GST will be considered from Schedule No 5.
2	The payment of GST by the Employer shall only be at the CEILING of GST as mentioned by the Bidder in the Schedule No 5 at the time of bidding. Bidders are required to quote the applicable GST/Taxation with due diligence & appropriate financial prudence, as afterwards bidders will not be able to change or claim the GST charges already quoted during the bid.
1	Bidders are required to fill the relevant portion/Parts/Line items/scope of the respective Price Schedules only. In case, any line item is left blank by the bidder, it will be deemed assumed by the Employer that such portion/Parts/line item/Scope has been considered by the bidder suitably somewhere else in the Price schedules.
2	In case the bidder don't want to mention any quantity/price in any particular line item, then he has to mandatorily put zero (0) against that particular line item.

ANNEXURE A: Employer's Requirements

A.1. SCOPE OF WORKS

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1 Project Particulars

Design and Engineering	
Proposed AC capacity (MW)	100
Minimum DC Capacity (MWp)	200
Cell/Module Technology	Bifacial, Mono-crystalline PERC
Cumulative Inverter Capacity (Min.)	175 MW
Cumulative Inverter Transformer Capacity (Min.)	175 MVA
Power Transformer Capacity	2*50 MVA
Battery Energy Storage System (BESS)	50 MW/ 150 MWh (Dispatchable)
Origin of manufacturer	Open
O&M period	10 years
Design life of PV Power plant	25 years
Site Location and Land Details (Please refer ANNEXURE A, A3. Special Technical Conditions for details)	
Site coordinates	**Refer Annexure E:** Project Location
Villages	Rangakathera, Dundera, Dhaba, Kokha, Amlidih, Girgaon, Margaon, Ghugkhwa, Odarbandh, Tolagaon
Tehsil	Dongargaon
District	Rajnandgaon
State	Chhattisgarh
Type of Land	Govt. Land
Owner of Project	Solar Energy Corporation of India Limited
Owner of Land	Chhattisgarh State Revenue Department
Electrical Interconnection Details	
Substation Details	220/132 kV Telkadih Substation
Interconnection Voltage Level	132 kV, through Double circuit Double string transmission line from project site till S/S
Distance to connecting substation (approx.)	31 kMs.
Access	

Nearest Urban Area	Rajnandgaon (25 km)
Nearest Highway	Nagpur – Bhandara – Rajnandgaon – Raipur Highway (AH46 or NH-6)- Adjacent at the southern extreme
Nearest Railway Station	Dongargarh (15 km)
Nearest Domestic Airport	Swami Vivekananda Airport, Raipur (approx. 80 kms)
Performance Guarantee Parameters	
Performance Ratio (PR)	82%
Capacity Utilization Factor (CUF)	36.5%
BESS Availability	99%
Other Details	
Construction Water	It is the responsibility of the EPC contractor.
Construction Power	It is the responsibility of the EPC contractor.

2 Brief Scope of Work

Scope of Supply & Work includes all design & engineering, procurement & supply of equipment and materials, testing at manufacturers works, multi – level inspections, packing and forwarding, supply, receipt, unloading and storage at site, associated civil works, services, permits, licences, installation and incidentals, insurance at all stages, erection, testing and commissioning of a total of 100 MW (AC) Grid Interactive Solar PV Power Plant with 150 MWh Battery Energy Storage System (BESS) and performance demonstration with associated equipment and materials on turnkey basis at different locations and capacity as mentioned in the table below along with 10 (Ten) years comprehensive operation and maintenance from the date of Operational Acceptance.

All works shall be executed as per Technical Specifications given in Annexure A.2. Annexure A.3 lays down Special Technical Conditions with reference to site specific design requirements. However, in case of any conflict in requirements between Annexure A.3 and Annexure A.2, Annexure A.3: Special Technical Conditions shall have precedence.

3 Design and Engineering

3.1 The Contractor shall prepare the detailed design basis report (DBR) along with relevant standards (with respective clause description), PERT Chart and MDL. The Contractor shall submit a copy to Employer for review and approval prior to detail engineering.

3.2 All documents and drawings shall be submitted to the Employer both in soft as well as hard copies (5 nos.) for review and approval. Every drawing shall also be submitted in '*.dwg' format. In case of design calculations done in spread sheet, editable (working) soft copy of the spread sheet shall also be submitted along with 'pdf' copies during every submission. The Employer shall return, as suitable, either soft or hard copies to the Contractor with category of approval marked thereon. The drawings/documents shall be approved in any one of the following categories based on nature of the comments/ type of drawing or document.

- Category-I: Approved
- Category-II: Approved subject to incorporation of comments. Re-submit for approval after incorporation of comments
- Category-III: Not approved. Re-submit for approval after incorporation of comments
- Category-IV: Kept for record/ reference
- Category-IV (R): Re-submit for record/ reference after incorporation of comments

(Note: Approval of document neither relieves the Vendor/ Contractor of his contractual obligations and responsibilities for correctness of design, drawings, dimensions, quality & specifications of materials, weights, quantities, assembly fits, systems/ performance requirement and conformity of supplies with Technical Specifications, Indian statutory laws as may be applicable, nor does it limit the Employer/ Purchaser's rights under the contract)

3.3 Submission of basic design data, design documents, drawings and engineering information including GTP and test reports to Employer or its authorized representative for review and approval in hard copy and soft copy from time to time as per project schedule. The documents typically include, but not limited to, the following:

- Solar insolation data and basis for generation
- Detailed technical specifications (GTP) of all the equipment
- General arrangement and assembly drawings of all major equipment
- Schematic diagram for entire electrical system (DC, AC and auxiliary systems)
- GTP & G.A. drawings for all types of structures/ components, 132kV or 33kV

switchgears (as applicable) & other interfacing panels

- Test reports (for type, routine and acceptance tests)
- Relay setting charts
- Design calculations and sheets (licenced software as well as design templates)
- Geo technical investigation data and Topographical survey report including topographical survey data in digital format (Excel file) and Contour plan of the area.
- GA drawings of the entire project including equipment rooms/ inverter control rooms, office cum control room, roads, storm water drainage, sewage networks, security gate, fire protection system, perimeter fencing, transformer yard fencing etc.
- Transmission line drawings and erection plans as per DISCOM/ STU guidelines
- Quality assurance plans for manufacturing (MQP), Standard Operating procedure (SOP) and field activities (FQP)
- Detailed site EHS plan, fire safety & evacuation plan and disaster management plan.
- Detailed risk assessment and mitigation plan.
- O&M Instruction's and maintenance manuals for major equipment
- As-built drawings / documents and deviation list from good for construction (GFC)

3.4 Estimation of the plant generation based on Solar Radiation and other climatic conditions prevailing at site.

3.5 Design of associated civil, structural, electrical & mechanical auxiliary systems includes preparation of single line diagrams and installation drawings, manuals, electrical layouts, erection key diagrams, electrical and physical clearance diagrams, design calculations for Earth- mat, Bus Bar & Spacers indoor and outdoor lighting/ illumination etc., GTP and GA drawings for the major equipment including transmission line, design basis & calculation sheets, and other relevant drawings and documents required for engineering of all facilities within the periphery to be provided under this contract.

3.6 All drawings shall be fully corrected to match with the actual "As – Built" site conditions and submitted to Employer after commissioning of the project for record purpose. All as-built drawings must include the Good for Construction deviation list.

4 Procurement & Supply

4.1 The equipment and materials for Grid Interactive Solar PV Power Plant with associated system (Typical) shall include but not limited to the transit insurance, receipt, unloading, storage, erection, testing and commissioning of all supplied material for the following:

4.1.1 Adequate capacity of Solar PV modules of suitable rating including module mounting

structures, fasteners, suitable MMS foundations and module interconnections.

4.1.2 Array Junction boxes, distribution boxes and Fuse boxes with string monitoring capabilities: MCBs/ isolators, Surge Arrestors and with proper lugs, glands, ferrules, terminations and mounting structures.

4.1.3 DC and AC cables of appropriate sizes with adequate safety and insulation

4.1.4 Power Conditioning Units (PCU) with SCADA compatibility, common AC power evacuation panel with bus bars and circuit breakers LT & HT Power Interfacing Panels, Plant Monitoring Desk, AC & DC Distribution boards and UPS for emergency power supply along with required batteries

4.1.5 Step – up transformers (inverter duty) in relevance with state grid code and inverter manufacturer requirements.

4.1.6 Power Transformer in relevance with technical specifications provided in this document and state grid code requirements.

4.1.7 Battery Energy Storage System (BESS) of required power and energy capacity (Refer Clause 1: Project Parameters, Scope of Works) including battery Packs with Battery Management System (BMS), Bidirectional Power Conditioning Systems (PCS), Step-up transformers, LT & HT switchgear panels (min. two nos. of outgoing feeders), Auxiliary supply system, DC & AC power cables, control and communication cables, along with RTU and related accessories for communication with the Plant Energy Management System (EMS), HVAC system, fire-fighting system, protection switchgear and other related accessories to be coupled with the Solar PV system at the AC bus.

4.1.8 Auxiliary transformer (s) along with cables and accessories for plant internal consumption.

4.1.9 Relay and protection system along with battery system.

4.1.10 LT Power and Control Cables including end terminations and other required accessories for both AC & DC power

4.1.11 Internal 415V interconnection & Indoor feeder panels to cater auxiliary needs of plant

4.1.12 Indoor panels / outdoor structures having incoming and outgoing feeders with VCBs, CTs, PTs, Bus bars, cables terminals kits and Bus coupler having Main and transfer Bus. Each bay shall consist of VCB, CT, Isolators with earth switch, LAs and PT's etc.

4.1.13 ABT meters (Main, Check and standby) with all necessary metering rated CT's and PT's at the plant take off point as well as at the substation as per CEA Metering Regulation 2006 as amended time to time and state metering code.

4.1.14 Providing necessary communication and Data Acquisition System to transfer real time

data to SLDC, Danganiya, Raipur, Chhattisgarh as per the specifications of SLDC wing and as per grid connectivity approving authority.

4.1.15 Lightning arrestors for entire plant area.

4.1.16 HDPE pipes, cable conduits, cable trays and accessories/trenches.

4.1.17 Earthing of the entire plant as per relevant standards.

4.1.18 Control room equipment

4.1.19 Testing instruments for maintenance and monitoring of equipment.

4.1.20 Mandatory spares as per Annexure-D for each package

4.1.21 CCTV cameras for plant surveillance

4.1.22 Fire protection system in buildings and fire extinguishers.

4.1.23 Weather monitoring station shall include but not be limited to the following:

- Pyranometers – for measuring irradiance in horizontal and tilted plane and to measure Albedo
- Ultrasonic Anemometer (wind speed and direction)
- Temperature Sensor – Ambient and module surface
- Power source to the all sensors
- Data Logger

4.1.24 Controller based Energy Management System (EMS) along with required accessories and communication links for integrated monitoring and control of active power, reactive power as well as voltage at the interconnection point of PV arrays and BESS.

4.1.25 Construction of suitable structures for termination of transmission line for taking off from plant end and receipt of lines at Substation end.

4.1.26 Design & construction of Transmission line/ cable at required voltage level from plant take off point to the designated substation including right of way (ROW) and construction of bay at designated substation as per TRANSCO requirements/procedures.

4.1.27 Any re-arrangement/ replacement of substation equipment/ materials, including bay construction, if required, at the evacuating substation necessary for evacuation of power from the Plant.

4.1.28 All safety equipment including PPE, mats etc. for safe working environment

4.1.29 Materials and accessories, which are required for satisfactory and trouble-free operation and maintenance of the above equipment like module cleaning system, supply of spares for all equipment, supply of tools and tackles etc.,

4.1.30 Any other equipment / material, not mentioned but required to complete the Solar Power Plant facilities in all respect.

5 Construction and Erection Works

5.1 The items of civil design and construction work shall include all works required for solar PV project and should be performed specifically with respect to following but not limited to:

5.1.1 Conducting geotechnical investigation and topographical survey of the given area.

5.1.2 Earthwork for site grading, cutting, filling, levelling & compaction of land.

5.1.3 Construction and erection of boundary wall/fence and main/ security gate(s).

5.1.4 Construction of foundation for mounting structures for SPV panels.

5.1.5 Civil foundation work of transformers, switchgears, equipment, Water tank etc.

5.1.6 Installation, Testing and Commissioning of ABT meters with all necessary metering rated CTs and PTs as per CEA Metering Regulation 2006 as amended time to time and state metering code.

5.1.7 Installation, Testing and Commissioning of auxiliary power supply system consisting of auxiliary transformers, AC distribution boards, AC LT cables and related accessories

5.1.8 Installation, Testing and Commissioning of Uninterrupted Power Supply (UPS) with battery bank

5.1.9 Installation, Testing and Commissioning of EMS hardware, software and required power and communication interconnection

5.1.10 Construction of internal roads and peripheral roads with WBM base.

5.1.11 Construction of Equipment room with necessary illumination system and finishing as required.

5.1.12 Office cum stores cum control room building with Supervisor room, pantry, wash room, conference room etc. along with requisite furniture, workstations, air conditioning, internal and external illumination, other equipment as per the specifications.

5.1.13 Suitable arrangement of water shall be ensured to cater to day-to-day requirement of drinking water and permanent water supply for module cleaning and other needs of SPV power plant during entire O&M period.

5.1.14 Suitable Communication System for telemetry, EMS/SCADA with remote monitoring capabilities and internet facility.

5.1.15 Construction of Storm water drainage to its nearest outfall point & sewage network including rain water harvesting mechanism.

5.1.16 Suitable earthing for plant equipment along with earth pits as per standards

5.1.17 Laying of underground / over ground cables (all types, as applicable) with proper

arrangements along with appropriate sized ferrules, lugs, glands and terminal blocks. Laying of cables inside the building trench and other locations as required shall be over GI cable trays with proper support and accessories.

5.1.18 Installation of lightning protection system for entire plant facilities

5.1.19 Installation of indoor & outdoor illumination system including all required accessories and laying of power supply cables

5.1.20 Installation, Testing and Commissioning of Weather Monitoring Station along with laying of required power supply and communication cables.

5.1.21 Installation of CCTV cameras on strategic locations including all required accessories, laying of power/communication cables and installation of monitoring station

5.1.22 Installation of fire detection and fire protection system for buildings/containers, BESS, transformer yard and switchyard.

5.1.23 Pre-commissioning checks and tests for all equipment.

5.1.24 Synchronization and Commissioning of plant.

5.1.25 Construction of transmission line including Design, route survey, foundation, erection stringing, commissioning as per TRANSCO/DISCOM procedure from take-off point at plant end/ substation to the delivery point at the evacuation substation as per Project Particulars provided above.

5.1.26 Construction of RCC Type Guest House as per Plan attached in Annexure A.3 – Special Technical Specifications.

5.1.27 All approvals, for equipment, items and works, which are not otherwise specifically mentioned in this document but are required for successful completion of the work in all aspects, including construction, commissioning, O&M of Solar PV Power Plant and guaranteed performance are deemed to be included in the scope of the contractor.

6 Statutory Approvals

6.1 Obtaining statutory approvals /clearances/ compliances on behalf of the Employer from various Government Departments, not limited to, the following: -

- Pollution control board clearance, if required
- Mining Department, if required
- Forest Department, if required
- All other approval as and when, as necessary for setting up of a solar power plant including CEIG/ CEA, power evacuation, railways, PTCC power line crossing, panchayat, NHAI etc. as per the suggested guidelines.

6.1.1 All statutory approvals/permissions and/or No Objection Certificates (NoC) etc. from the DISCOM for obtaining connectivity at the substation as per Project Particulars provided above.

6.1.2 All other statutory approvals and permissions and their respective compliances, not mentioned specifically but are required to carry out hassle free Construction and O&M of the plant.

6.1.3 Adequate and seamless insurance coverage during EPC and O&M period to mitigate all risks related to construction and O&M of the plant to indemnify the Employer.

6.2 The Contractor shall comply with the provision of all relevant acts of Central or State Governments including payment of Wages Act 1936, Minimum Wages Act 1948, Employer's Liability Act 1938, Workmen's Compensation Act 1923, Industrial Dispute Act 1947, Maturity Benefit Act 1961, Mines Act 1952, Employees State Insurance Act 1948, Contract Labour (Regulations & Abolishment) Act 1970, Electricity Act 2003, Grid Code, Metering Code, MNRE guidelines or any modification thereof or any other law relating whereto and rules made there under or amended from time to time.

7 Operation and Maintenance

7.1 Total Operation & Maintenance of the SPV Plant shall be with the Contractor, after operational acceptance of the plant till culmination of the O&M period and shall include deployment of engineering personnel, technicians and security personnel.

7.2 To provide a detailed training plan for all O&M procedures to Employer's nominated staff, which shall have prior approval from the Employer.

7.3 Employ and coordinate the training of contractors' personnel who will be qualified and experienced to operate and monitor the facility and to coordinate operations of the facility with the grid system.

7.4 Discharge obligations relating to retirement/ Superannuating benefits to employees or any other benefit accruing to them in the nature of compensation, profit in lieu / in addition to salary, etc. for the period of service with the contractor, irrespective continuance of employees with the project as employees of Contractor, after conclusion of O&M period.

7.5 To maintain accurate and up-to-date operating logs, records and monthly Operation & Maintenance reports at the facility. Contractor shall keep the measured daily data at regular intervals and provide the same to Employer in electronic form, compatible in CSV format. The right to use the data shall remain with the Employer.

7.6 The Contractor shall establish forecasting tools for submitting schedule and comply with

Chhattisgarh State Electricity Regulatory Commission (Intra-state Availability Based Tariff and Deviation Settlement Mechanism) Regulations, 2016. The scope under this Clause shall also include establishing and maintaining forecasting tools and appointment of QCA/Aggregator, if required. % Error (Deviation) shall be calculated as per the said regulations and DSM Charges in case of deviation beyond the permissible limits shall be borne by the Contractor.

7.7 Procurement of spare parts, overhaul parts, tools & tackles, equipment, consumables, etc. required for smooth operation and maintenance of the plant as per prudent/ standard utility practices, OEM recommendations and warranty clauses for the entire O&M period

7.8 To upkeep all administrative offices, roads, tool room, stores room, equipment in clean, green and workable conditions.

7.9 To carry out periodic overhauls or maintenance required as per the recommendations of the original equipment manufacturer (OEM) and to furnish all such periodic maintenance schedules at the time of plant commissioning/ start of O&M contract.

7.10 Handover the system to maintain an inventory of spare parts, tools, equipment, consumables and supplies for the facility's operation along-with required details of recommended spares list with all associated information regarding replacement records, supplier details, tentative cost, storage details, specifications on the basis of replacement frequency and mean time between failures and mean time to restore at the culmination of penultimate year under O&M period.

7.11 Availability of vehicles for Employer staff during construction and O&M period as per requirement may be ensured, failing which Employer shall have full right for alternate arrangement at the risk & cost of the contractor.

7.12 The contractor shall be responsible for all the required activities for the successful running, committed energy generation & maintenance of the Solar Photovoltaic Power Plant covering:

- Deputation of qualified and experienced engineers and technicians at the facility.
- Deputation of Security personnel for the complete security of plant.
- Successful running of Solar Power Plant for committed energy generation.
- Co-ordination with STU/SLDC/other statutory organizations as per the requirement on behalf of Employer for Joint Metering Report (JMR), furnishing generations schedules as per requirement, revising schedules as necessary and complying with grid requirements.

- Monitoring, controlling, troubleshooting maintaining of logs & records, registers.
- Furnishing generation data monthly to Employer/Owner by 1st week of every month for the previous month to enable Employer raise commercial bills on consumers.
- Periodic cleaning of solar modules as approved by the Employer and water quality as per the recommendations of OEM
- Replacement of Modules, Invertors/PCU's and other equipment as and when required during the O&M period without additional cost to Employer

7.13 Continuous monitoring the performance of the Solar Power Plant and regular maintenance of the whole system including Modules, PCU's, transformers, overhead line, outdoor/indoor panels/ kiosks etc. are necessary for extracting and maintaining the maximum energy output from the Solar Power Plant.

7.14 Preventive and corrective O&M of the Solar Photovoltaic Power Plant including supply of spares, consumables, wear and tear, overhauling, replacement of damaged modules, invertors, battery packs/modules, PCUs and insurance covering all risks (Fire & allied perils, earth quake, terrorists, burglary and others) as required.

7.15 The period of Operation and Maintenance will be deemed to commence from the date of completion of performance demonstration/Operational acceptance and successively the complete Solar Photovoltaic Power Plant to be handed over to the O&M contractor for operation and maintenance of the same. O&M contract shall further be extended on the mutually agreed terms and conditions for the mutually agreed period.

7.16 All the equipment required for Testing, Commissioning and O&M for the healthy operation of the Plant must be calibrated, time to time, from the NABL accredited labs and the certificate of calibration must be provided prior to its deployment.

7.17 The Contractor shall ensure that all safety measures are taken at the site to avoid accidents to his or his sub-contractor or Employer's Workmen. This will include procurement of all safety gadgets during Construction and O&M period including but not limited to, rubber mats of appropriate grade, PPE, rubber gloves and suitable shoes etc.

8 Operation and Performance Monitoring

8.1 Operation part consists of deputing necessary manpower necessary to operate the Solar Photovoltaic Power Plant at the full capacity. Operation procedures such as preparation to starting, running, routine operations with safety precautions, monitoring etc., shall be carried out as per the manufacturer's instructions to have trouble free operation of the complete system.

8.2 Daily work of the operation and maintenance in the Solar Photovoltaic Power Plant involves periodic cleaning of Modules including periodic tilt angle change as and when required, logging the voltage, current, power factor, power and energy output of the Plant at different levels. The operator shall also note down time/ failures, interruption in supply and tripping of different relays, reason for such tripping, duration of such interruption etc. The other task of the operators is to check battery voltage-specific gravity and temperature. The operator shall record monthly energy output, down time, etc.

8.3 Earth resistance of Plant as well as individual earth pit is to be measured and recorded every month. If the earth resistance is high (compared to standards) suitable action is to be taken to bring down the same.

8.4 A maintenance record is to be maintained by the operator/ O&M-in-charge to record the regular maintenance work carried out as well as any breakdown maintenance along with the reasons for the breakdowns and steps taken to attend the breakdown, duration of the breakdown etc.

8.5 The Preventive Maintenance Schedules will be drawn such that some of the jobs other than breakdown, which may require comparatively long stoppage of the Power Plant, shall be carried out preferably during the non-sunny days or evenings. Prior information shall be provided to the Employer for such preventive maintenance prior to start.

8.6 The Contractor will attend to any breakdown jobs immediately for repair/ replacement/ adjustments and complete at the earliest working round the clock. During breakdowns (not attributable to normal wear and tear) in O&M period, the Contractor shall immediately report the accidents, if any, to the Employer showing the circumstances under which it happened and the extent of damage and/or injury caused.

8.7 The contractor shall at his own expense provide all amenities to his workmen as per applicable laws and rules.

8.8 If negligence / mal operation of the contractor's operator results in failure of equipment, such equipment should be repaired/replaced by the contractor free of cost.

9 Security Services

9.1 The contractor has to arrange proper security system including deputation of security personnel at his own cost for the check vigil for the Solar Power Plant for the complete scope of works including comprehensive O&M period.

9.2 The security staff may be organized to work on suitable shift system; proper checking & recording of all incoming & outgoing materials vehicles shall be maintained. Any

occurrence of unlawful activities shall be informed to Employer immediately. A monthly report shall be sent to Employer on the security aspects.

9.3 Any other activities required for completion of project, but not specified in the above shall be in the scope of contractor. The Contractor must provide the BOM of the plant as per the design during the time of submission of design basis report. The detailed technical specifications of major equipment to be followed strictly and are described in the technical specification section.

ANNEXURE A

A.2. TECHNICAL SPECIFICATIONS

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DISCLAMIER:

1. Though adequate care has been taken while preparing the Bidding documents, the Bidders/Applicants shall satisfy themselves that the document is complete in all respects. Intimation of any discrepancy shall be given to this office immediately. If no intimation is received from any Bidder within twenty (20) days from the date of notification of NIT/ Issue of the NIT documents, it shall be considered that the NIT documents are complete in all respects has been received by the Bidder.
2. Solar Energy Corporation of India Limited (SECI), the Employer, reserves the right to modify, amend or supplement this NIT documents including all formats and Annexures.
3. While this bidding documents have been prepared in good faith, neither Employer or its authorized representatives nor their employees or advisors make any representation or warranty, express or implied, or accept any responsibility or liability, whatsoever, in respect of any statements or omissions herein, or the accuracy, completeness or reliability of information, and shall incur no liability under any law, statute, rules or regulations as to the accuracy, reliability or completeness of this bidding documents, even if any loss or damage is caused by any act or omission on their part.
4. The specifications mentioned for all the equipment which include Solar modules, PCU, combiner boxes, DC cables, module mounting structures, transformer, CT, PT, LT/ HT cables, interfacing panels, switch gears & other associated equipment etc., to complete the power generation and evacuation to the designated substation, in the present bidding documents are for the **reference** only. It is subject to revise/ alter as per the design/ planning/ good engineering practices etc., to be carried out by the selected bidder, to the satisfaction of the Employer or its authorized representatives. It is advised that the bidders must satisfy himself with the prevailing site conditions before design/ plan. The design must be optimized as per the site conditions and directed to achieve the maximum output from the installed capacity at all times. Moreover, the components not separately mentioned, but are required to complete the plant for operation is also included in the scope of bidder and shall be vetted by the Employer or its authorised representatives.

Place:

(Signature)

Date:

Name and Designation of bidder

A Design Philosophy

1 The main objective of the design philosophy is to construct the plant with in-built Quality and appropriate redundancy to achieve high availability and reliability with minimum maintenance efforts. In order to achieve this, the following principles shall be adopted while designing the system.

1.1 Adequate capacity of SPV modules, PCUs, Junction boxes etc. to ensure generation of power as per design estimates. This will be done by applying liberal de-rating factors for the array and recognizing the efficiency parameters of PCUs, transformers, conductor losses, system losses, site conditions etc.

1.2 Use of equipment and systems with proven design and performance that have high availability track records under similar service conditions.

1.3 Selection of the equipment and adoption of a plant layout to ensure ease of maintenance.

1.4 Strict compliance with approved and proven quality assurance (QA) systems and procedures during different stages of the project, starting from sizing, selection of make, shipment, storage (at site), during erection, testing and commissioning.

1.5 Proper monitoring of synchronization and recording, to ensure availability of power to the grid.

1.6 The plant instrumentation and control system should be designed to ensure high availability and reliability of the plant to assist the operators in the safe and efficient operation of the plant with minimum effort.

1.7 It should also provide the analysis of the historical data and help in the plant maintenance people to take up the plant and equipment on predictive maintenance.

1.8 System design shall have intelligent protection mechanism which may include very fast responsive microprocessor-based relays etc., so that any disturbance from the grid will not cause any damage to the equipment of the Solar Power Plant.

2 The basic and detailed engineering of the plant shall aim at achieving high standards of operational performance especially considering following:

2.1 SPV power plant should be designed to operate satisfactorily in synchronization with the grid within permissible limits of high voltage and frequency fluctuation conditions. It is also extremely important to safeguard the system during major disturbances, internal and external surge conditions while ensuring safe operation of the plant.

2.2 The Module Mounting Structures shall be designed for optimising the tilt angle and

elevation of the module to minimise self-shading and maximise the capture of diffuse light.

2.3 Shadow free plant layout to ensure minimum losses in generation during the day time.

2.4 Higher system voltage and lower current options to be followed to minimise ohmic losses.

2.5 Selection of PCUs with proven reliability and minimum downtime. Ready availability of requisite spares.

2.6 Careful logging of operational data / historical information from the Data Monitoring Systems, and periodical analysis of the same to identify any abnormal or slowly deteriorating conditions.

2.7 The designed array capacity at STC shall be suitably determined to meet the proposed guaranteed generation output at the point of interconnection by the contractor in his bid. The contractor shall take care of first year degradation also by installing additional DC capacity as the CUF calculations will not factor the first-year degradation of the modules.

2.8 Each component offered by the bidder shall be of established reliability. The minimum target reliability of each equipment shall be established by the bidder considering its mean time between failures and mean time to restore, such that the availability of complete system is assured. Bidder's recommendation of the spares shall be on the basis of established reliability.

2.9 Bidder shall design the plant and equipment in order to have sustained life of 25 years with minimum maintenance efforts.

2.10 The work execution planning for supply, erection, commissioning and all other allied works for SPV Power Plant shall be such that it is completed within stipulated time from the date of order/ LOI/ NTP, whichever is later.

3 The specifications provided with this bid document are functional ones; any design provided in this document is only meant as an example. The Contractor must submit a detailed design philosophy document for the project to meet the functional requirements based upon their own design in-line with the above. The bidders are advised to visit the site and satisfy themselves before bidding.

4 All works shall be executed as per Technical Specifications given in Annexure A.2. Annexure A.3 lays down Special Technical Conditions with reference to site specific design requirements. However, in case of any conflict in requirements between Annexure A.3 and Annexure A.2, Annexure A.3: Special Technical Conditions shall have

precedence.

B Electrical System

1 Photovoltaic Modules

1.1 Standards and Codes

Photovoltaic Modules shall comply with the specified edition of the following standards and codes.

Standard	Description
IEC 61215-1:2016 Ed.1	Terrestrial photovoltaic (PV) modules - Design qualification and type approval - Part 2: Test requirements
IEC 61215-1-1:2016 Ed.1	Terrestrial photovoltaic (PV) modules - Design qualification and type approval - Part 1-1: Special requirements for testing of crystalline silicon photovoltaic (PV) modules
IEC 61215-1-2 Ed.1	Terrestrial photovoltaic (PV) modules - Design qualification and type approval - Part 1-2: Special requirements for testing of thin-film Cadmium Telluride (CdTe) based photovoltaic (PV) modules
IEC 61730-1:2016 Ed.2	Photovoltaic (PV) module safety qualification - Part 1: Requirements for construction
IEC 61730-2:2016 Ed.2	Photovoltaic (PV) module safety qualification - Part 2: Requirements for testing
IEC 61701:2011 Ed.2	Salt mist corrosion testing of photovoltaic (PV) modules (Applicable for coastal and marine environment)
IEC 62716:2013 Ed.1	Photovoltaic (PV) modules - Ammonia corrosion testing (if applicable)
IEC TS 62804-1:2015 Ed.1	Photovoltaic (PV) modules - Test methods for the detection of potential-induced degradation - Part 1: Crystalline silicon (under conditions of 85°C/85% RH for minimum 192 hours)
As per the Solar Photovoltaics, Systems, Devices and Components Goods (Requirements for Compulsory Registration) Order, 2017, PV Modules used in the grid connected solar power projects shall be registered with BIS and bear the Standard Mark as notified by the Bureau of Indian Standards. Further, PV Modules should have been included in the ALMM list as per MNRE Approved Models and Manufacturers of Solar Photovoltaic Modules (Requirements for Compulsory Registration) Order, 2019.	

1.2 Technical Requirements

Parameter	Specification

Cell type	Mono-crystalline or Multi-crystalline, Bifacial
Module Efficiency (Frontside)	≥ 19.5%
Bifacialitiy Factor, ø (P_{mp} Back / P_{mp} Front at STC)	0.7 ± 0.05
Rated power at STC	No negative tolerance is allowed
Temperature co-efficient of power	Not less than -0.40%/°C
Application Class as per IEC 61730	Class A

Note: Bifaciality Factor shall be verified in accordance with IEC TS 60904-1-2:2019 - Photovoltaic devices - Part 1-2: Measurement of current-voltage characteristics of bifacial photovoltaic (PV) devices. Refer Annexure A to Annexure A: Employer's Requirements.

1.3 Supplier Qualification Criteria

1.3.1 The PV Modules Supplier should have supplied minimum 5 GW capacity globally or 1 GW in India in the past 5 years.

1.4 Component Specifications

1.4.1 The PV Modules glass panel shall be:

(i) Glass-glass Modules, with minimum of 2 mm glass thickness on each side. It shall be laminated using a laminator with symmetrical structure, i.e. heating plates on both sides.

(ii) The glass used shall have transmittance of above 90%.

1.4.2 Void

1.4.3 The encapsulant used for the PV modules should be polyolefin based, UV resistant and PID resistant in nature. No yellowing of the encapsulant with prolonged exposure shall occur. The encapsulant shall have the following properties.

Parameter	**Value**
Gel content	> 75%
Transmittance	>90%
Volume resistivity	> 1×10^{15} Ω.cm
Peeling strength with glass	> 40 N/cm

1.4.4 The sealant used for edge sealing of PV modules shall have excellent moisture ingress protection with good electrical insulation (Break down voltage >15 kV/mm) and with good adhesion strength. Edge tapes for sealing are not allowed.

1.4.5 The module frame shall be made of anodized Aluminium, which shall be electrically

& chemically compatible with the structural material used for mounting the modules. It is required to have provision for earthing to connect it to the earthing grid. The anodization thickness shall not be less than 15 micron.

1.4.6 The material used for junction box shall be UV resistant to avoid degradation during module life. The degree of protection of the junction box shall be at least IP67. Minimum three number of bypass diodes and two number of IEC 62852/EN 50521 certified MC4 compatible connectors with appropriate length of IEC 62930/EN 50618 certified 4 sq.mm copper cable shall be provided. The cable length shall be in accordance with the PV Module wiring strategy and adequate to ensure that the cable bending radius standard is not exceeded.

1.4.7 Each PV Module shall be provided a bar code which is embedded inside the module lamination and must be able to withstand harsh environmental conditions. The bar code data base shall contain the following information. Bar code scanner and database of all the modules containing the following information shall also be provided.

(i) Name of the manufacturer of PV Module
(ii) Name of the Manufacturer of Solar cells
(iii) Type of cell: Mono / Multi
(iv) Month and year of the manufacture (separately for solar cells and module)
(v) Country of origin (separately for solar cells and module)
(vi) I-V curve for the module
(vii) Peak Wattage, I_m, V_m and FF for the module
(viii) Unique Serial No. and Model No. of the module.
(ix) Date and year of obtaining IEC PV module qualification certificate
(x) Name of the test lab issuing IEC certificate
(xi) Other relevant information on traceability of solar cells and modules as per ISO 9000 series.

1.5 Warranty

1.5.1 PV modules must be warranted with linear degradation rate of power output except for first year (maximum 3% including LID) and shall guarantee 80% of the initial rated power output at the end of 30 years.

1.5.2 The modules shall be warranted, against all material/ manufacturing defects and workmanship for minimum of 10 years from the date of supply.

1.5.3 The above warranties shall be backed by third party insurance.

1.6 Approval

1.6.1 The Contractor shall provide Guaranteed Technical Particular (GTP) datasheet and Bill of Materials (BOM) of the module that is submitted for approval along with the datasheets of each component. The component datasheet shall contain all the information to substantiate the compliance for component specifications mentioned above.

1.6.2 The Contractor shall also provide test certificates corresponding to the standards mentioned above along with complete test reports for the proposed module. The tests should have been conducted at a test laboratory compliant with ISO 17025 for testing and calibration and accredited by an ILAC/IECEE member signatory. Laboratory accreditation certificate or weblink along with scope of accreditation shall also be submitted.

1.6.3 The BOM proposed shall be the subset of Constructional Data Form (CDF)'s of all the test reports.

1.6.4 The Contractor shall submit a detailed Manufacturing Quality Plan (MQP) for the PV Module with list of checks/tests performed during incoming material inspection, production, pre-dispatch and package.

1.6.5 The Contractor shall obtain the approval of the proposed module make & model prior to manufacturing/ inspection call.

1.7 Manufacturing and Inspection

1.7.1 The Contractor shall inform the module manufacturing schedule to the Employer at least 15 (fifteen) working days before the start of proposed schedule.

1.7.2 The Employer shall perform material inspection at the Manufacturer's factory before the start of proposed manufacturing schedule. Proof of procurement of components as per the approved BOM mentioning manufacturer name, manufacturing date and relevant test certificate shall be submitted during material inspection for verification.

1.7.3 The Manufacturing shall start only after the clearance by the Employer after the material inspection.

1.7.4 The cells used for module making shall be free from all defects like edge chipping, breakages, printing defects, discoloration of top surface etc. Only Class A solar cell shall be used.

1.7.5 The modules shall be uniformly laminated without any lamination defects.

1.7.6 Current binning of modules shall be employed to limit current mismatch of modules. Different colour codes shall be provided on the modules as well as pallet for

identification of different bins. Maximum three nos. of bins will be allowed for each module rating.

1.7.7 Pre-dispatch inspection of modules shall be performed as per the inspection protocol attached in Annexure – A: PV Module Pre-dispatch Inspection Protocol.

1.8 Transportation, Handling, Storage and Installation

1.8.1 Transportation, handling, storage and installation of modules shall be in accordance with the manufacturer manual so as not to breach warranty conditions. The Standard Operating Procedure (SOP) for the same shall be shared by the Contractor prior to dispatch.

1.8.2 It is required to construct a temporary platform (graded) while keeping the modules at least above the highest flood level. If the contractor scheduled/ planned to mount the modules immediately after the receipt at site, then the module shall be kept in common storage area with proper arrangement.

1.8.3 The stacked modules, in any case, shall be stacked as per the manufacturer's recommendation only and shall be covered with tarpaulin sheet.

2 String Monitoring Unit

2.1 Standards and Codes

Standard/Code	Description
IEC 60529	Enclosure Ingress Protection
IEC 62262	Enclosure Impact Protection
IEC 60269	Fuse
IEC 61643-11	Surge Protection Device
IEC 62852 or EN 50521	Solar cable connector
IEC 60695-2-11	Fire hazard testing

2.2 Construction

2.2.1 SMU enclosure shall be made of UV resistant, fire retardant, thermoplastic material. Enclosure degree of protection shall be at least IP65 and mechanical impact resistance shall be at least IK08.

2.2.2 Not more than two strings can be connected in parallel to a single input of SMU. One spare input terminal along with connector shall be provided for each SMU.

2.2.3 Every SMU input shall be provided with fuses on both positive and negative side. The rating of the fuses shall be selected such that it protects the modules from reverse current overload. The fuses shall be 'gPV' type conforming to IEC 60269-6.

2.2.4 DC switch disconnector of suitable rating shall be provided at SMU output to disconnect both positive and negative side simultaneously.

2.2.5 Type-II surge protective device (SPD) conforming to IEC 61643-11 shall be connected between positive/negative bus and earth.

2.2.6 Resistance Temperature Detector (RTD) type or semiconductor type temperature sensor shall be provided to monitor the cabinet temperature.

2.2.7 MC4 connector conforming to IEC 62852 or EN 50521 shall be provided at each SMU input. Cable gland (double compression metallic) of suitable size for DC cables shall be provided at the SMU output.

2.2.8 UV resistant printed cable ferrules for solar cables & communication cables and punched/ embossed aluminium tags for DC cables shall be provided at cable termination points for identification.

2.2.9 Suitable communication interface shall be provided to communicate the data to SCADA. The following parameters shall be measured/ monitored and made available at SCADA.

(i) String current
(ii) Bus voltage
(iii) Output current
(iv) Cabinet temperature
(v) DC disconnector switch ON/OFF status
(vi) SPD operating status

2.3 Warranty

The SMU unit shall be warranted against all material/manufacturing defects and workmanship for minimum of 5 (five) years from the date of supply.

2.4 Tests

Routine tests and acceptance tests for the assembled unit shall be as per the Quality Assurance Plan (QAP) approved by the Employer.

3 Solar and DC Cables

3.1 Standards and Codes

Cable	From	To	Conductor/ Insulation	Voltage Rating	Applicable Standard
Solar Cable*	Module	SMU	Copper/ XLPO	1.1 kV DC/ 1.5 kV DC	IEC 62930/ EN 50618/

DC Cable	SMU	PCU	Copper or Aluminium/ XLPE	1.1 kV DC/ 1.5 kV DC	IS 7098 Part I
* Cable used for module interconnection shall also be referred as solar cable.					

3.2 Solar cable outer sheath shall be flame retardant, UV resistant and black in colour. Solar cable with positive polarity should have marking of red line on black outer sheath.

3.3 DC cables shall be single core, armoured, Flame Retardant Low smoke (FRLS), PVC outer sheath conforming to IS 7098-I. DC cable with positive polarity should have marking of red line on black outer sheath.

3.4 In addition to manufacturer's identification on cables as per relevant standard, following marking shall also be provided over outer sheath.

(i) Cable size and voltage grade

(ii) Word 'FRNC/ FRLS' (as applicable) at every metre

(iii) Sequential marking of length of the cable in metres at every metre

3.5 Cables shall be sized based on the following considerations:

(i) Rated current of module

(ii) The average voltage drop in the cables (Modules to Inverter) shall be limited to 1.5 % of the rated voltage. The Contractor shall provide voltage drop calculations in excel sheet.

(iii) Short circuit withstand capability

(iv) De-rating factors according to laying pattern

3.6 Warranty

The cables (Solar and DC) shall be warranted against all material/ manufacturing defects and workmanship for minimum of 1 (one) year from the date of supply.

3.7 Tests

Type test, routine test and acceptance tests requirements shall be as per IEC 62930/EN 50618 for solar cables and IS 7098-1 for DC cables.

3.8 Installation

3.8.1 Cable installation shall be as per IS 1255.

3.8.2 Only terminal cable joints shall be accepted. No cable joint to join two cable ends shall be accepted.

3.8.3 Solar cables shall be provided with UV resistant printed ferrules and DC cables shall be provided with punched/ embossed aluminium tags. The marking shall be done with good quality letter and numbers of proper size so that the cables can be identified

easily.

3.8.4 Cable terminations shall be made with properly crimped lugs and passed through cable glands at the entry & exit point of the cubicles. Bimetallic lugs shall be used for connecting Cu bus bar and Al cables or vice-versa.

3.8.5 Solar cables, wherever exposed to direct sunlight and buried underground, shall be laid through Double Wall Corrugated (DWC) HDPE conduits. The size of the conduit or pipe shall be selected on the basis of 40% fill criteria.

3.8.6 Solar cables shall be aesthetically tied to Module Mounting Structure using UV resistant cable-ties suitable for outdoor application.

3.8.7 A.C and D.C cables shall be kept in separate trenches. The horizontal and vertical clearances between power and communication cable shall not be less than 300mm.

3.9 Cable Sealing System

3.9.1 Cable sealing system: Modular multi-diameter cable sealing system consisting of frames, blocks and accessories shall be installed where the underground and over ground cables enter or leave LCR/MCR/BESS enclosures. Cable sealing system shall consist of multi-diameter type peel-able blocks of different sizes to suit the various cables. It should be simple, easy and quick to assemble & re-assemble the cable sealing system. Solid blocks shall not be used on frame. Frames & stay-plate material shall be of galvanized steel and for compression, single piece wedge with galvanized steel bolts shall be used. 30% spare blocks on the frame shall be provided for expansion in future. Cable sealing system should have been tested for fire/ water /smoke tightness

4 Power Conditioning Unit

4.1 Standards and Codes

Power Conditioning Unit (PCU) shall comply with the specified edition of the following standards and codes.

Standard	Description
IEC 61683 Ed. 1	Photovoltaic systems - Power conditioners - Procedure for measuring efficiency
IEC 62109-1 Ed. 1	Safety of power converters for use in photovoltaic power systems - Part 1: General requirements
IEC 62109-2 Ed. 1	Safety of power converters for use in photovoltaic power systems - Part 2: Particular requirements for inverters

IEC 61000-6-2 Ed. 2	Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity standard for industrial environments
IEC 61000-6-4 Ed. 2.1	Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Emission standard for industrial environments
IEC 62116 Ed. 2	Utility-interconnected photovoltaic inverters - Test procedure of islanding prevention measures
IEC 60068-2-1:2007	Environmental testing - Part 2-1: Tests - Test A: Cold
IEC 60068-2-2:2007	Environmental testing - Part 2-2: Tests - Test B: Dry heat
IEC 60068-2-14:2009	Environmental testing - Part 2-14: Tests - Test N: Change of temperature
IEC 60068-2-30:2005	Environmental testing - Part 2-30: Tests - Test Db: Damp heat, cyclic (12 h + 12 h cycle)
CEA Technical Standards for Connectivity to the Grid Regulations 2007 with 2013 Amendment	
As per the Solar Photovoltaics, Systems, Devices and Components Goods (Requirements for Compulsory Registration) Order, 2017, Inverters used in the grid connected solar power projects shall be registered with BIS and bear the Standard Mark as notified by the Bureau of Indian Standards.	

4.2 Supplier Qualification Criteria

4.2.1 The Inverter Supplier should have supplied minimum 5 GW capacity globally or 1 GW in India in the past 5 years

4.3 Technical Requirements

Parameter	Specification
Rated AC power	As per design
Maximum input voltage	1500 V
Rated AC output voltage	As per design
Tolerance on rated AC output voltage	+/-10%
Rated frequency	50 Hz
Operating frequency range	47.5 Hz to 52 Hz
Power factor control range	0.9 lag to 0.9 lead
European efficiency	Minimum 98%
Maximum loss in Sleep Mode	0.05% of rated AC power

Total Harmonic Distortion	Less than 3% at 100% load
Degree of protection	IP 20 (Indoor)/IP 54 (Outdoor)

4.3.1 The rated/ name plate AC capacity of the PCU shall be AC power output of the PCU at 50°C.

4.3.2 Maximum power point tracker (MPPT) shall be integrated in the PCU to maximize energy drawn from the Solar PV array. The MPPT voltage window shall be sufficient enough to accommodate the output voltage of the PV array at extreme temperatures prevailing at site.

4.3.3 The PCU output shall always follow the grid in terms of voltage and frequency. The operating voltage and frequency range of the PCU shall be sufficient enough to accommodate the allowable grid voltage and frequency variations.

4.4 Construction

4.4.1 Power Conditioning Unit (PCU) shall consist of an electronic three phase inverter along with associated control, protection, filtering, measurement and data logging devices.

4.4.2 Every DC input terminal of PCU shall be provided with fuse/MCB/MCCB of appropriate rating. The combined DC feeder shall have suitably rated isolators for safe start up and shut down of the system. One spare DC input terminal shall be provided for each PCU.

4.4.3 Type-II surge protective device (SPD) conforming to IEC 61643-11 shall be connected between positive/ negative bus and earth.

4.4.4 In case external auxiliary power supply is required, UPS shall be used to meet auxiliary power requirement of PCU. It shall have a backup storage capacity of 2 hours.

4.4.5 Circuit Breaker of appropriate voltage and current rating shall be provided at the output to isolate the PCU from grid in case of faults.

4.4.6 The PCU shall be tropicalized and the design shall be compatible with conditions prevailing at site. Suitable number of exhaust fan with proper ducting shall be provided for cooling keeping in mind the extreme climatic condition of the site as per the recommendations of OEM to achieve desired performance and life expectancy.

4.4.7 All the conducting parts of the PCU that are not intended to carry current shall be bonded together and connected to dedicated earth pits through protective conductor of appropriate size. DC negative terminal shall be grounded. In case DC negative

grounding is not possible, appropriate anti-PID device shall be provided.

4.4.8 Dedicated communication interface shall be provided to monitor the PCU from SCADA.

4.4.9 PCU front panel shall be provided with LCD/ LED to display all the relevant parameters related to PCU operation and fault conditions. It shall include, but not limited to, the following parameters.

(i) DC input power
(ii) DC input voltage
(iii) DC input current (for each terminal)
(iv) AC output power
(v) AC output voltage (all the 3 phases and line)
(vi) AC output current (all the 3 phases and line)
(vii) Frequency
(viii) Power Factor

In case of outdoor PCU, PCU without LCD display with provision for Data access over Bluetooth shall be acceptable.

4.5 Operating Modes

Operating modes of PCU shall include, but not limited to, the following modes. These operating modes and conditions for transition are indicative only. The Contractor shall provide the detailed flow chart indicating the various operating modes and conditions for transition during detailed engineering.

4.5.1 Standby Mode

The PCU shall continuously monitor the input DC voltage and remain on Standby Mode until it reaches the pre-set value.

4.5.2 MPPT Mode

When the input DC voltage is above the pre-set value and AC grid connection conditions are fulfilled, the PCU shall enter into MPPT mode.

4.5.3 Sleep Mode

When the AC output power/DC input voltage decreases below the pre-set value for pre-set time delay, the PCU shall switch into Sleep Mode.

4.6 Protection Features

The PCU shall include appropriate self-protective and self-diagnostic feature to protect itself and the PV array from damage in the event of PCU component failure or from

parameters beyond the PCU's safe operating range due to internal or external causes. The self-protective features shall not allow signals from the PCU front panel to cause the PCU to be operated in a manner which may be unsafe or damaging. Faults due to malfunctioning within the PCU, including commutation failure, shall be cleared by the PCU protective devices.

The PCU shall provide protection against the following type of faults, among others.

(i) DC/AC over current
(ii) DC/AC over voltage
(iii) DC reverse polarity
(iv) DC earth fault
(v) AC under voltage
(vi) AC under frequency/over frequency
(vii) Islanding
(viii) Over temperature
(ix) Lightning surges

4.7 Grid Support Functions

4.7.1 Active power regulation

The PCU shall be able to limit the active power exported to the grid based on the set point provided through PCU front control panel. The PCU shall also be able to automatically the limit the active power after an increase in grid frequency above a pre-set value. The ramp rate shall be adjustable during operation and start-up after fault. The applicability of the requirement shall be as per CEA regulation and compliance.

4.7.2 Reactive power control

The PCU shall be able to inject /absorb reactive power to/ from the grid based on the set point provided through PCU front control panel. The same shall be performed automatically with adjustable ramp rate based on dynamic changes in grid voltage or reactive power reference.

4.7.3 Voltage Ride Through

The PCU shall remain connected to the grid during temporary dip or rise in grid voltage as per the LVRT and HVRT requirements of CEA Technical Standards for Connectivity to the Grid Regulations. The PCU shall also be able to inject reactive power during the period of voltage dip.

4.8 Warranty

The complete Power Conditioning Unit shall be warranted against all material/ manufacturing defects and workmanship for minimum of 5 (five) years from the date of supply.

4.9 Tests

4.9.1 Type Tests

The type test certificates as per the standards mentioned above should be from any of the ILAC/IECEE member signatory accredited Test Centres. Laboratory accreditation certificate or weblink along with scope of accreditation shall also be submitted. It is the responsibility of the Contractor to substantiate the compliance for CEA Regulations using test reports.

4.9.2 Routine Tests

Routine tests and acceptance tests shall be as per the Quality Assurance Plan (QAP) approved by the Employer.

5 Inverter Transformer and Auxiliary Transformer

5.1 Standards and Codes

Inverter transformer and auxiliary transformer, wherever applicable, shall comply with the latest edition of the following standards and codes including amendments.

Standard	Description
IS 2026, IEC 60076	Specification of Power Transformers
IS 11171, IEC 60076	Dry-Type Power Transformers
IS 2099, IEC 60137	Bushings for alternate voltage above 1000 V
IS 335, IEC 60296	Insulating oil
IS 3639	Fittings and Accessories for Power Transformers
IS 12063	Degree of protection provided by enclosures
CBIP publication no. 295	
Indian Electricity rules and other statutory regulations	

5.2 Technical Requirements

Parameters	Inverter Transformer	Auxiliary Transformer
VA Rating	As per system design requirement	

Voltage Ratio	33 kV / Inverter output voltage	As per system design
Duty, Service & Application	Continuous Solar Inverter application and converter Duty (Outdoor)	Continuous application (Outdoor/Indoor)
Winding	As per system design requirement	2
Frequency	50 Hz	50Hz
Nos. of Phase	3	3
Vector Group & Neutral earthing	As per system/inverter manufacturer requirement	Dyn11
Cooling	ONAN	ONAN/ AN
Tap Changer	OCTC, No. of steps shall be as per system requirement	
Impedance at 75°C	As per Inverter Manufacturer requirement	As per system requirement
Permissible Temperature rise over an ambient of 50°C (irrespective of tap)		
Top Oil	50°C	As per IS/IEC
Winding	55°C	As per IS/IEC
SC withstand time (thermal)	2 second	2 second
Short Circuit Apparent power	As per system requirement	
Termination	As per system requirement	
Bushing rating, Insulation class (Winding & bushing)	36 kV – porcelain bushings 1.1 kV – epoxy bushings	As per the system requirement
Noise level	As per NEMA TR-1	
Loading Capability	Continuous operation at rated MVA on any tap with voltage variation of +/-3%, also transformer shall be capable of being loaded in accordance with IEC 60076-7	

5.3 Construction

5.3.1 The transformer shall be provided with conventional single compartment conservator with prismatic toughened glass oil gauge. The top of the conservator shall be connected to the atmosphere through indicating type cobalt free silica gel breather with transparent enclosure. Silica gel shall be isolated from atmosphere by an oil seal. Inverter transformers shall be provided with Magnetic Oil Gauge (MOG) with

Flux density	Not to exceed 1.9 Wb/sq.m. at any tap position with combined frequency and voltage variation from rated V/f ratio by 10% corresponding to the tap. Transformer shall also withstand following over fluxing conditions due to combined voltage and frequency fluctuations: a) 110% for continuous rating b) 125% for at least one minute c) 140% for at least five seconds. Bidder shall furnish over fluxing characteristic up to 150%
Air Clearance	As per CBIP

low oil level alarm contact.

5.3.2 It is the responsibility of the Contractor to ensure that the inverter transformer comply with all the requirements of inverter provided by the inverter manufacturer.

5.3.3 Inverter Transformer shall be designed for at least 5% total harmonic distortion (THD) to withstand distortion generated by the inverter as well as possible outside harmonics from the network.

5.3.4 The transformer shall be suitable for continuous operation with a frequency variation of ± 2.5% from nominal frequency of 50 Hz without exceeding the specified temperature rise.

5.3.5 Inverter Transformer shall have shield winding between LV & HV windings. Each LV winding must be capable of handling non-sinusoidal voltage with voltage gradient as specified by the inverter manufacturer. Also, shield winding shall be taken out from tank through shield bushing and the same shall be brought down to the bottom of the tank using copper flat and support insulator for independent grounding.

5.3.6 Neutral bushing of Inverter duty transformer shall be brought outside the tank for the testing purpose. It shall be covered with MS sheet and a sticker “For testing purpose only. Do not earth”. Neutral bushing of auxiliary transformer shall be brought outside the tank for earthing.

5.3.7 Inverter transformer shall have 150 mm dial type Oil Temperature Indicator (OTI) and Winding Temperature Indicator (WTI) with alarm and trip contacts. All indicators shall have accuracy of 1.5%. For inverter transformers, WTI shall be provided for all the windings.

5.3.8 The radiators shall be detachable type, mounted on the tank with shut off valve at each point of connection to the tank, lifts, along with drain plug/ valve at the bottom and air release plug at the top.

5.3.9 Marshalling Box shall be of sheet steel, dust and vermin proof provided with proper

lighting and thermostatically controlled space heaters. The degree of protection shall be IP 55. Marshalling Box of all transformers shall be preferably Tank Mounted. One dummy terminal block in between each trip wire terminal shall be provided. At least 10% spare terminals shall be provided on each panel. The gasket used shall be of neoprene rubber. Wiring scheme (TB details) shall be engraved in a stainless-steel plate with viewable font size and the same shall be fixed inside the Marshalling Box door.

5.3.10 Buchholz relay, double float type with alarm and trip contacts, along with suitable gas collecting arrangement shall be provided.

5.3.11 Inverter transformer shall be provided with spring operated Pressure Relief Device (with trip contacts) with suitable discharge arrangement for oil. For Auxiliary transformers, diaphragm type explosion vent shall be provided.

5.3.12 Filter valve at top the tank and drain cum sampling valve at bottom of the tank shall be provided.

5.3.13 All external surface of the transformer shall be painted with two coats of epoxy-based paint of colour shade RAL 7032. Internal surface of cable boxes and marshalling box shall be painted with epoxy enamel white paint. The minimum dry film thickness (DFT) shall be 100 microns.

5.3.14 LV and HV cable box shall be provided with disconnecting chamber to facilitate the movement of transformer without disturbing cable box and termination.

5.3.15 Air release plug, bi-directional wheel/skids, cover lifting eyes, transformer lifting lugs, jacking pads, towing holes, core and winding lifting lugs, inspection cover, rating plate, valve schedule plate, accessories and terminal marking plates, two nos. of earthing terminals shall be provided.

5.3.16 Rain hoods to be provided on Buchholz, MOG & PRD. Entry points of wires shall be suitably sealed.

5.3.17 The accessories listed above are indicative only. Accessories which are not mentioned above but required for satisfactory operation of the transformers are deemed to be included in the contract without extra charges.

5.3.18 Fire-protection for inverter transformer shall be provided in accordance with relevant CEA regulations as amended time to time.

5.4 Dry Type Auxiliary Transformer

5.4.1 Transformer shall be cast resin encapsulated dry type transformer, made of cold rolled grain-oriented silicon steel laminations of M4 grade or better. Winding

conductor shall be electrolytic grade Copper/Aluminium and insulation shall be Class F or better.

5.4.2 The transformers shall be housed in a metal protective housing, having a degree of protection of IP-23 suitable for indoor installation. The enclosure shall be provided with suitable hardware and accessories required for satisfactory operation of the transformer per the relevant standard.

5.5 Warranty

The transformer shall be warranted for minimum of 5 (five) years against all material/ manufacturing defects and workmanship.

5.6 Testing and Inspection

5.6.1 Type Tests and Special Tests

The following type test and special test reports shall be submitted during detailed engineering. The tests should have been conducted on a similar transformer by NABL accredited laboratory.

5.6.1.1 Type Tests

(i) Lightning impulse (Full & Chopped Wave) test on windings as per IEC 60076-3

(ii) Temperature Rise test at a tap corresponding to maximum losses as per IEC 60076-2

5.6.1.2 Special Tests

(i) Measurement of zero-sequence impedance as per IEC 60076-1

(ii) Measurement of harmonics of no-load current as per IEC 60076-1

(iii) Measurement of acoustic noise level as per NEMA TR-1

(iv) Short-circuit withstand test as per IEC 60076-5

In case the contractor is not able to submit the test reports during detailed engineering, the contractor shall submit the reports of type/special tests either conducted by NABL accredited laboratory or witnessed by Employer.

5.6.1.3 Type and Special tests are not required for auxiliary transformers of rating including 100 KVA and below. However, auxiliary transformer shall have minimum 3 star BEE rating as per BIS guidelines.

5.6.2 Routine Tests

Each completed transformer shall be subjected to following routine tests as per the latest edition of IEC 60076 unless specified otherwise.

(i) Measurement of winding resistance at each tap
(ii) Measurement of voltage ratio between HV and LV windings at each tap
(iii) Check of vector group
(iv) Measurement of no-load loss and no-load current
(v) Measurement of short-circuit impedance and load loss
(vi) Magnetic balance test as per CBIP manual publication no. 295
(vii) Separate source voltage withstand test
(viii) Induced over voltage withstand test
(ix) Measurement of insulation resistance
(x) Marshalling box functional test
(xi) IR Measurement on wiring of marshalling box
(xii) Breakdown voltage test on transformer oil as per IS 335
(xiii) Oil leakage test on completely assembled transformer along with radiators

5.6.3 Tests at Site

After erection at site all transformer(s) shall be subjected to the following tests.

(i) Measurement of voltage ratio
(ii) Check of vector group
(iii) Magnetic balance test
(iv) Measurement of insulation resistance
(v) Breakdown voltage test on transformer oil

In case the equipment is not found as per the requirements of the Technical Specifications of NIT, all expenses incurred during site testing will be to the Contractor's account and the equipment shall be replaced by him at free of cost.

6 HT Switchgear

6.1 Standards and Codes

All equipment provided under HT switchgear shall comply with latest editions and amendments of the relevant IEC standards and IS codes. In particular, the switchgear shall comply with the following standards and codes.

Standard/Code	Description
IS/IEC 62271-1	High Voltage Switchgear and Control gear - Part 1: Common Specifications

IS/IEC 62271-100	High Voltage Switchgear and Control gear - Part 100: AC Circuit Breakers
IS/IEC 62271-102	High Voltage Switchgear and Control gear - Part 102: AC Disconnectors and Earthing Switches
IS/IEC 62271-200	High Voltage Switchgear and Control gear - Part 200: AC Metal Enclosed Switchgear and Control gear for Rated Voltages Above 1 kV and Up to and Including 52 kV
IEC 61869	Instrument Transformers
IS 3231	Electrical relays for power systems protection
IEC 60255	Measuring relays and protection equipment
IEC 61850	Communication networks and systems for power utility automation
IEC 61131-3	Programmable controllers - Part 3: Programming languages
IS 9385	High voltage fuses
IS 9431	Indoor post insulators of organic material for systems with nominal voltages greater than 1000 V up to and including 300 kV
IEC 60099-4	Surge arresters - Part 4: Metal-oxide surge arresters without gaps for A.C. systems
IS 3070-3	Lightning Arresters for Alternating Current Systems - Part 3: Metal Oxide Lightning Arresters Without Gaps
IEC 62052-11	Electricity metering equipment (A.C.) - General requirements, tests and test conditions - Part 11: Metering equipment
IEC 62053	Electricity metering equipment (A.C.) - Particular requirements
IS 14697	AC Static Transformer Operated Watthour and Var-hour Meters, Class 0.2S and 0.5S

6.2 Technical Parameters

Parameter	**Specification**
System Parameters	
Highest system voltage	36 kV
Rated system voltage	33 kV
Rated frequency	50 Hz
Number of phases	3
Power frequency withstand voltage	70 kV (r.m.s.)
Lightning impulse withstand voltage	170 kV (peak)

System fault current	As per system requirement
Circuit Breaker	
Type	Vacuum type
Operating duty cycle	O – 0.3sec – CO – 3min – CO
Short circuit breaking current	As per system requirement
Short circuit making current	2.5 times S.C. breaking current
Re-strike performance class	C2
Mechanical endurance class	M1
Current Transformer	
Accuracy class	0.2 for metering (0.2s for metering at outgoing feeder), 5P20 for protection
Rated VA burden	As per requirement
Insulation class	Class F
Voltage Transformer	
Accuracy class	0.2 for metering, 3P for protection
Rated VA burden	As per requirement
Insulation class	Class F

6.3 Switchgear Panel

6.3.1 The switchgear panel shall be free standing, floor mounted, single front, single tier fully compartmentalized, metal enclosed construction. Each panel shall have separate compartments for circuit breaker, bus bars, cable termination and auxiliary circuit.

6.3.2 The circuit breakers shall be mounted on horizontally withdrawable trucks with locking facility in SERVICE and TEST positions.

6.3.3 The panel enclosure shall be constructed with CRCA steel/Aluzinc sheet. The thickness of load bearing members shall be minimum 3 mm and that of non-load bearing members shall be minimum 2 mm.

6.3.4 All surfaces shall be painted with two coats of epoxy-based paint of colour shade RAL 7032. The minimum dry film thickness (DFT) shall be 100 microns.

6.3.5 The circuit breaker and auxiliary circuit compartments provided on the front side shall have separate concealed hinged doors. Cable and bus bar compartments provided on the rear side shall have separate bolted covers. All doors and covers shall be provided with neoprene/synthetic rubber gaskets to prevent entry of vermin and dust.

6.3.6 Pressure relief device shall be provided in each high voltage compartment of a panel to safely vent the gases in the event of internal arc. Seal-off bushing arrangement shall be provided between the breaker compartment and bus bar/cable compartments to prevent transfer of arc from one compartment to other.

6.3.7 Automatic safety shutters shall be provided to cover up the fixed high voltage contacts on bus bar and cable sides when the truck is moved to TEST position.

6.3.8 Degree of protection shall not be less than IP 5X for auxiliary circuit compartment. However, for remaining compartments it shall not be less than IP 4X. For outdoor panels, degree of protection shall not be less than IP 55.

6.3.9 Mechanical /Electrical interlocks shall be provided to prevent mal-operation and in particular to ensure the following.

(i) The breaker shall be operated only if it is in SERVICE or TEST position.

(ii) Movement of the breaker truck between SERVICE and TEST positions shall be possible only if the breaker is OFF.

(iii) It shall be possible to open the door only when the breaker is in TEST position.

6.3.10 Panel shall be provided with local bus-bar protection

6.3.11 Each switchgear panel shall be provided with thermostatically controlled space heaters, separately for breaker, cable and bus bar compartments, to prevent condensation within the compartment. The space heater shall be connected to 240 V, 50 Hz, single phase AC supply through suitable switch and fuse.

6.3.12 240 V, 5 A, SPN industrial socket-outlet with ON/OFF switch shall be provided in each panel.

6.3.13 Each panel shall be provided with LED lamp rated for 240 V, 50 Hz, single phase AC supply for interior illumination controlled by door switch.

6.3.14 Gapless, metal-oxide surge arrestors shall be provided between line and earth in cable compartment of the switchgear panel.

6.3.15 Suitable lifting hooks shall be provided for each panel.

6.4 Circuit Breakers

6.4.1 Circuit breakers shall be of vacuum type. It shall comprise of three separate identical single pole units operated through the common shaft and shall be fully interchangeable both electrically and mechanically.

6.4.2 The circuit breaker operating mechanism shall be based on motor operated spring charging and it shall be re-strike free, trip free both electrically and mechanically, with anti-pumping feature.

6.4.3 The rated control voltage of the spring charging motor shall be 110 VDC/230 VAC. Closing coil shall operate at all values of voltages between 85% and 110% of rated voltage. Opening coil shall operate correctly under all operating conditions of the circuit breaker up to the rated breaking capacity and at all values of supply voltage between 70% and 110% of rated voltage.

6.4.4 The spring charging motor shall have adequate thermal rating such that continuous sequence of the closing and opening operations is possible as long as power supply is available to the motor. It shall also be possible to charge the spring manually and close the breaker in the event of failure of motor / control supply to motor. Operating handle shall be provided for charging the operating mechanism. After failure of control supply to the motor, one open-close-open operation shall be possible with the energy contained in the operating mechanism.

6.4.5 The motor rating shall be such that it requires not more than 30 seconds for full charging of the closing spring. Closing action of the circuit breaker shall compress the opening spring ready for tripping. When closing springs are discharged after closing the breaker, they shall be automatically charged for the next operation.

6.4.6 Mechanical indicators shall be provided to indicate OPEN/CLOSED positions of the circuit breaker and CHARGED/ DISCHARGED positions of the closing spring. An operation counter shall also be provided. These indicators and counter shall be visible from the panel front door without opening it.

6.5 Relays

6.5.1 All relays shall be microprocessor based numerical type. However, auxiliary relays can be static or electromechanical type. The relays shall be flush mounted on panel front with connections from the inside.

6.5.2 The relays shall be capable of operating continuously between 80 – 120% of auxiliary voltage.

6.5.3 All numerical relays shall have adequate number of freely configurable, optically isolated, Binary Inputs (BI) and potential free Binary Outputs (BO).

6.5.4 All numerical relays shall have minimum four no. of current inputs, three for phase current and one for earth current, suitable for CT secondary current of 1A. The current inputs shall be compatible with both residual connected CT and Core Balance CT (CBCT). In addition, numerical relay in main outgoing feeder shall have three no. of voltage inputs for Under Voltage/Over Voltage protection.

6.5.5 All I/O's shall have galvanic isolation. Analog inputs shall be protected against

switching surges and harmonics.

6.5.6 Making, breaking and continuous capacity of the relay contacts shall be adequate enough for the circuits in which they are used.

6.5.7 The numerical relay shall have the following protection functions with at least two independent protection setting groups. The protection functions shall be selectable from any of the IEC characteristic curves.

(i) Definite time (DT) phase over current protection
(ii) Inverse Definite Minimum Time (IDMT) phase over current protection
(iii) Definite time (DT) earth fault current protection
(iv) Inverse Definite Minimum Time (IDMT) earth fault current protection
(v) Under Voltage protection
(vi) Over Voltage protection

6.5.8 Transformer feeder protection relay shall have provision for the following protection functions.

(i) Buchholz alarm & trip
(ii) Oil Temperature Indicator (OTI) alarm & trip
(iii) Winding Temperature Indicator (WTI) alarm & trip
(iv) Pressure Relief Valve (PRV) trip
(v) Magnetic Oil Gauge (MOG) alarm

6.5.9 All numerical relays shall have provision for measurement and storage of electrical parameters such as voltage, current, frequency, active power, reactive power etc.

6.5.10 The numerical relay shall be able to record faults and events in non-volatile memory.

(i) Fault record – At least 5 recent faults including the protection function operated, operating phase(s), voltages and currents along with date and time stamp.
(ii) Event record – At least 200 events with date and time stamp.

6.5.11 The numerical relay shall have trip circuit supervision facility to monitor the circuit breaker trip circuit both in pre-trip and post-trip conditions. The relay shall also be able to provide circuit breaker monitoring, CT and VT supervision.

6.5.12 The numerical relay shall have self-diagnostic feature with separate output contact for indication of any internal relay failure.

6.5.13 The numerical relay shall have RS-232/RS-485/RJ-45/USB ports on front side for local communication with PC and on rear side for remote communication to SCADA system.

6.5.14 The numerical relay shall have feature for time synchronization through the SCADA System / networking.

6.5.15 The numerical relay shall be provided with backlit alphanumeric LCD to access protection settings, measurement parameters, fault and event records. Read and write access to protection settings shall be password protected.

6.6 Instrument Transformers

6.6.1 Instrument transformers shall be completely encapsulated cast resin type, suitable for continuous operation at the ambient temperature prevailing inside the switchgear enclosure, when the switchgear is operating at its rated load and the outside ambient temperature is 50°C.

6.6.2 Polarity marks shall indelibly be marked on each instrument transformer and at the lead terminals at the associated terminal block.

6.6.3 Voltage transformers shall be single phase units. Bus voltage transformers shall be housed in a separate panel on withdrawable truck.

6.6.4 HRC fuses of suitable rating shall be provided on primary side of voltage transformers. For secondary side, four pole Miniature Circuit Breakers (MCB) shall be provided with its supervision facility.

6.7 Earthing

6.7.1 An earth bus made of copper shall be provided throughout the length of the panel. It shall be bolted to the framework of each panel and brazed to each breaker earthing contact bar.

6.7.2 The earth bus shall have sufficient cross section to carry maximum fault current without exceeding the allowable temperature rise.

6.7.3 All non-current carrying conductors of the panel shall be connected to the earth bus. All joints to the earth bus shall be made through at least two bolts. Hinged doors shall be earthed through flexible earthing braid of adequate cross section. Suitable provision shall be provided at each end of the earth bus for connection with Owner's Earth conductor.

6.7.4 Positive earthing of the breaker truck and frame shall be maintained when it is in the connected position and in all other positions whilst the auxiliary circuits are not totally disconnected.

6.7.5 All metallic cases of relays, instruments and other panel mounted equipment shall be connected to earth bus by independent copper wires of size not less than 2.5 sq. mm with green colour insulation.

6.7.6 Instrument transformer secondary neutral point shall be earthed at one place only on the terminal block. Such earthing shall be made through links so that earthing of one circuit may be removed without disturbing the earthing of other circuits.

6.7.7 Separate earthing trucks shall be provided for earthing of busbars and incoming/outgoing feeders. The trucks shall have voltage transformer to indicate presence of voltage prior to earthing. An audible alarm shall also be provided in case of voltage on the earthing terminal. Integral earth switches may also be considered instead of earthing trucks. The earthing truck/switch shall have short circuit withstand capability equal to that of the associated switchgear panel.

6.7.8 The interlocks shall be provided to ensure the following.

(i) It is not possible to rack-in the earthing truck/close the earthing switch when the breaker truck is in SERVICE position.

(ii) It is not possible to rack-in the breaker truck into SERVICE position when earthing truck is connected/earthing switch is in closed position.

6.8 Bus bar

6.8.1 Bus bar shall be made of copper or aluminium with uniform cross section throughout their length. They shall be adequately supported on insulators to withstand electrical and mechanical stresses due to specified short circuit current.

6.8.2 All bus bars joints shall be thoroughly cleaned and anti-oxide grease shall be applied. Plain and spring washers shall be provided to ensure good contacts at the joints and taps. Wherever aluminium to copper connections are required, suitable bimetallic connectors or clamps shall be used.

6.8.3 Bus bars shall be provided with heat shrinkable sleeves of suitable insulation class throughout their length with proper colour coding. All bus bar joints and taps shall be shrouded.

6.8.4 Bus bar support insulators shall be made of non-hygroscopic, arc and track resistant, high strength material suitable to withstand stresses due to over voltage and short circuit current.

6.8.5 The Contractor shall submit busbar sizing calculation for specified continuous and short time current ratings during detailed engineering.

6.9 Measuring Instruments

6.9.1 All the measuring instruments shall be digital, flush mounting type with communication facility.

6.9.2 All feeders except main outgoing feeder shall be provided with digital Multi-Function

Meter (MFM). Tri Vector Meter (TVM) shall be provided for the main outgoing feeder (in the HT Panel). Accuracy class of MFM shall be 0.2 and that of TVM shall be 0.2S.

6.9.3 Measuring instruments shall have provision to display the following parameters.

(i) Line and phase voltages
(ii) Line and phase currents
(iii) Active power, Reactive power, Apparent power
(iv) Frequency
(v) Power factor
(vi) Total Harmonic Distortion (THD)

6.10 Wiring and Terminal blocks

6.10.1 All internal wiring shall be done with 650 V grade, 1.5 sq.mm. PVC insulated stranded flexible copper wire. For CT secondary circuits, 2.5 sq.mm copper wire shall be used.

6.10.2 Wire terminations shall be made with solderless crimping type tinned copper lugs, which shall firmly grip the conductor. Insulation sleeves shall be provided at all the wire terminations.

6.10.3 Printed identification ferrules, marked to correspond with panel wiring diagram shall be provided at both ends of each wire. The ferrules shall be firmly located on each wire so that they cannot move or turn freely on the wire. Wire identification shall be done in accordance with IS 11353.

6.10.4 The Contractor shall be solely responsible for the completeness and correctness of the internal wiring and for the proper functioning of the connected equipment.

6.10.5 All internal wiring to be connected to the external equipment shall terminate on terminal blocks. Terminal blocks shall be rated for 650 V, 10 A and made of non-inflammable material.

6.10.6 CT and VT secondary circuits shall be terminated on stud type, non-disconnecting terminal blocks.

6.10.7 At least 10% spare terminals shall be provided on each panel and these spare terminals shall be distributed on all terminal blocks.

6.11 Warranty

The HT panel unit shall be warranted for minimum of 5 (five) years against all material/ manufacturing defects and workmanship.

6.12 Testing and Inspection

6.12.1 Type Tests

The switchgear panel shall be of type tested design. The following type test reports shall be submitted during detailed engineering. The tests should have been conducted on the similar equipment by NABL accredited laboratory.

Test	**Standard**	**Relevant IEC Clause**
Switchgear Panel		
Dielectric tests		
Power frequency voltage test	IEC 62271-200	6.2.6.1
Lightning impulse voltage test	IEC 62271-200	6.2.6.2
Dielectric tests on auxiliary and control circuits	IEC 62271-200	6.2.10
Measurement of the resistance of the main circuit	IEC 62271-200	6.4.1
Temperature-rise tests	IEC 62271-200	6.5
Short-time withstand current and peak withstand current tests	IEC 62271-200	6.6
Verification of the IP coding	IEC 62271-200	6.7.1
Verification of making and breaking capacities	IEC 62271-200	6.101
Mechanical operation test	IEC 62271-200	6.102
Internal arc test	IEC 62271-200	6.106
Circuit Breaker		
Mechanical operation test at ambient air temperature (M2 Class)	IEC 62271-100	6.101.2
Basic short-circuit test-duties	IEC 62271-100	6.106
Relays		
Vibration tests	IEC 60255-21-1	
Shock and bump tests	IEC 60255-21-2	
Seismic tests	IEC 60255-21-3	
Electromagnetic compatibility requirements	IEC 60255-26	
Product safety requirements	IEC 60255-27	
Common requirements	IEC 60255-1	

Functional requirements	Relevant parts of IEC 60255-100 series	
Current Transformers		
Temperature-rise test	IEC 61869-2	7.2.2
Impulse voltage withstand test on primary terminals	IEC 61869-2	7.2.3
Tests for accuracy	IEC 61869-2	7.2.6
Short-time current tests	IEC 61869-2	7.2.201
Voltage Transformer		
Temperature-rise test	IEC 61869-3	7.2.2
Impulse voltage withstand test on primary terminals	IEC 61869-3	7.2.3
Test for accuracy	IEC 61869-3	7.2.6
Short-circuit withstand capability test	IEC 61869-3	7.2.301

In case the contractor is not able to submit the test reports during detailed engineering, the contractor shall submit the reports of type/special tests either conducted by NABL accredited laboratory or witnessed by Employer.

6.12.2 Routine Tests

Routine tests and acceptance tests shall be as per the Quality Assurance Plan (QAP) approved by the Employer.

7 AC Cables

7.1 Standards and Codes

All AC Cables shall conform to the following standards and codes.

IS 7098	Crosslinked polyethylene insulated PVC sheathed cables, Part 1: For working voltage up to and including 1100 V
IS 7098	Crosslinked Polyethylene Insulated Thermoplastics Sheathed Cables Part 2: for Working Voltages from 3.3 kV up to and Including 33 kV

7.2 All AC cables shall be flame retardant, low smoke (FRLS) type designed to withstand all mechanical, electrical and thermal stresses develop under steady state and transient operating conditions.

7.3 Only terminal cable joints shall be accepted. No cable joint to join two cable ends shall

be accepted. However, cable joints may be allowed if the route length is more than maximum available drum length subject to Employer's approval.

7.4 In addition to manufacturer's identification on cables as per relevant standard, following marking shall also be provided over outer sheath.

(i) Cable size and voltage grade

(ii) Word 'FRLS' at every metre

(iii) Sequential marking of length of the cable in metres at every metre

7.5 Cables shall be sized based on the following considerations:

(i) Rated current the equipment

(ii) Maximum voltage drop in LT cable (from inverter to inverter transformer) shall be limited to 0.5% of the rated voltage. For HT cables (from inverter transformer to interconnection point), maximum voltage drop shall be limited to 0.5 % of the rated voltage. The Contactor shall provide voltage drop calculations in excel sheet.

(iii) Short circuit withstand capability as per design for 1s.

(iv) De-rating factors according to laying pattern

7.6 Warranty

All cables shall be warranted for minimum of 1 (one) year against all material/ manufacturing defects and workmanship.

7.7 Testing

Type routine and acceptance tests requirements shall be as per relevant standards for all cable sizes.

7.8 Installation

7.8.1 Cable installation shall be as per IS 1255.

7.8.2 Cables within transformer yard and switchyard shall be laid through RCC cable trench with supports.

7.8.3 Cable terminations shall be made with properly crimped lugs and passed through cable glands at the entry & exit point of the cubicles. Bimetallic lugs shall be used for connecting Cu bus bar and Al cables or vice-versa.

7.8.4 All AC cables shall be provided with punched/embossed aluminium tags. The marking shall be done with good quality letter and numbers of proper size so that the cables can be identified easily.

8 Auxiliary Supply System

8.1 Scheme for Auxiliary supply system shall be submitted by contractor during detailed

engineering for the approval by Employer.

8.2 It shall mainly comprise of auxiliary transformer, AC distribution board(s) (ACDB), Battery & battery charger system, emergency lighting network, Uninterrupted power supply (UPS), distribution cables and metering & protective devices.

8.3 Auxiliary system shall be provided with two independent sources for reliable auxiliary power supply.

8.4 Following consideration shall be taken into account while sizing the auxiliary transformer:

(i) 20% future load margin

(ii) 20% design margin

(iii) Total connected load at 0.8 power factor

9 LT Switchgear

9.1 Standards and Codes

All equipment provided under LT switchgear shall comply with latest revisions and amendments of the relevant IEC standards and IS codes. In particular, the switchgear shall comply with the following standards and codes.

Standard/Code	Description
IS/IEC 61439-1	Low-voltage switchgear and control gear assemblies - Part 1: General rules
IS/IEC 61439-2	Low-voltage switchgear and control gear assemblies - Part 2: Power switchgear and control gear assemblies
IEC 60947-1	Low-voltage switchgear and control gear - Part 1: General rules
IEC 60947-2	Low-Voltage Switchgear and Control gear: Circuit Breakers
IEC 60947-3	Low voltage switchgear and control gear: Part 3 Switches, disconnectors, switch-disconnectors and fuse combination units
IEC 60947-4-1	Low-voltage switchgear and control gear - Part 4-1: Contactors and motor-starters - Electromechanical contactors and motor-starters
IEC 60947-5-1	Low-voltage switchgear and control gear - Part 5-1: Control circuit devices and switching elements - Electromechanical control circuit devices
IEC 62052-11	Electricity metering equipment (a.c.) - General requirements, tests and test conditions - Part 11: Metering equipment

IS 694	Polyvinyl chloride insulated unsheathed-and sheathed cables/ cords with rigid and flexible conductor for rated voltages - up to and including 450/750V
IEC 61869	Instrument Transformers
IS 3043	Code of practice for earthing
IEC 60255	Measuring relays and protection equipment - Part 1: Common requirements

9.2 Technical Parameters

System Details	
Rated system voltage	415 V ± 10%, 3 Phase, 50Hz, 4 wire, Neutral Solidly Earthed
Digital Multifunctional Meter (MFM)	
Accuracy class	0.5 class for main distribution board at main control room and 0.5 class for DB at inverter room(s)
Communication with SCADA	RS485 communication with Modbus RTU
Current transformer (CT)	
Type	Cast Resin Bar Primary
Voltage class and frequency	650V, 50Hz
CT Secondary Current	1 or 5 A
Class of insulation	Class F
Accuracy class & burden	
a) For Protection	5P20, 5VA PS Class for REF and core balance CT (CBCT)
b) For Metering	Class 0.5, 5VA (min)
Minimum primary earth fault current to be detected by CBCT	1 A
Instrument Security Factor for metering CT	5
Voltage transformer (VT)	
Type	Cast Resin
Accuracy class	0.5
Rated Voltage factor	1.1 continuous, 1.5 for 30 seconds
Class of insulation	E or better

Moulded case circuit breaker (MCCB)	
Rated voltage	415V
Release	Thermal-Magnetic/Microprocessor
Rated current	As per system requirement
Poles	4 poles
Rated insulation level	690V
Rated ultimate and service short circuit breaking Capacity	As per system requirement
Rated Making capacity (as per system requirement)	2.1 X Short circuit breaking Capacity
Utilization category	A

9.3 Constructional Details

9.3.1 The panel shall be metal enclosed, free standing, floor mounted, modular type with compartmentalized construction having degree of protection of IP 24 (Indoor) and IP54 (outdoor) as per IS/IEC 60529. All doors and covers shall be provided with neoprene gaskets to prevent entry of vermin and dust.

9.3.2 All switches, push buttons etc. shall be operated front and shall be flush/semi-flush mounted.

9.3.3 The panel shall be fabricated from 2 mm CRCA sheet steel for frame & load bearing surfaces. Partitions may be fabricated from 1.6 mm CRCA if no components are mounted on them.

9.3.4 Cable entries shall be from bottom. The opening of cable entry shall be covered by 3mm thick gland plates with proper sealing to avoid water and rodent entry.

9.3.5 Earthing bus bar of suitable cross section shall be provided throughout the length of panel.

9.3.6 The panel shall be duly wired with suitable size of 1.1kV, PVC insulated cable and terminals shall be brought out for cable connections. 10% spare terminals subjected to minimum one of each rating shall be provided on each distribution switchgear. All wire shall have ferrules as per wiring diagram.

9.3.7 The panel shall be painted with 2 coats of primer after pre-treatment and 2 coats of Polyurethane / epoxy paint with shade as decided by the Owner.

9.3.8 The panel shall be of dead front construction suitable for front operated and back maintained functioning.

9.3.9 240 V, 5 A, 3 pin industrial socket-outlet with ON/OFF switch shall be provided in

each panel.

9.3.10 Each panel shall be provided with LED lamp rated for 240 V, 50 Hz, single phase AC supply for interior illumination controlled by door switch.

9.3.11 Suitable lifting hooks shall be provided for each panel.

9.3.12 Each switchgear panel shall be provided with thermostatically controlled space heaters to prevent condensation within the enclosure. The space heater shall be connected to 240 V, 50 Hz, single phase AC supply through suitable switch and fuse.

9.3.13 Earth leakage relay with Core balance CTs (CBCT) shall be provided on main incoming feeders having phase CT ratio more than 50/1A. CBCT's shall be circular window type with window size based on the overall diameter of the cables, to be finalized during detailed engineering.

9.4 Warranty

Distribution panels (ACDB and DCDB) shall be warranted for minimum of 1 (one) year against all material/ manufacturing defects and workmanship

9.5 Testing

Routine test and acceptance tests requirements shall be as per relevant standards for all cable sizes.

10 Uninterrupted Power Supply

10.1 Standards and Codes

Standard/Code	Description
IEC 62040-1	Uninterruptible power systems (UPS) - Part 1: General and safety requirements for UPS
IEC 62040-2	Uninterruptible power systems (UPS) - Part 2: Electromagnetic compatibility (EMC) requirements
IEC 62040-3	Uninterruptible power systems (UPS) - Part 3: Method of specifying the performance and test requirements

10.2 General Requirements

10.2.1 The Uninterrupted Power Supply (UPS) system shall be designed to supply power to following loads (but not limited to).

(i) Data logger / SCADA

(ii) Fire Detection/ Alarm Panel

(iii) HMI of SCADA

(iv) Emergency Lighting

(v) Inverter's Auxiliary supply (if applicable)

(vi) HT panel auxiliary

(vii) CCTV

10.2.2 Sizing of UPS shall be done considering the above-mentioned load at power factor of 0.8 lagging inclusive of 10% design margin at 50 ˚C.

10.3 System Description

10.3.1 The UPS shall automatically provide continuous, regulated AC power to critical loads under normal and abnormal conditions, including loss of input AC power. The UPS system shall consist of the following major equipment.

(i) UPS Module

(a) Insulated Gate Bipolar Transistor (IGBT) Converter

(b) Insulated Gate Bipolar Transistor (IGBT) Inverter

(c) Digital Signal Processor (DSP) using Pulse Width Modulation (PWM) for Direct Digital Control (DDC) of all UPS control and monitoring functions

(d) Static bypass switch

(ii) Battery system for 2 hours

(iii) Battery protective and disconnect device

(iv) Maintenance bypass switch

(v) LCD display panel and LED indications

(vi) Integrated UPS Communications Protocols capable of communicating with SCADA system

10.3.2 The UPS shall meet the following minimum specifications.

Parameter	**Specification**
Topology	Online double conversion UPS
Input	
Voltage	230 V ± 10% AC
Frequency	50 ± 5 Hz
Power factor	0.95
Output	
Voltage	230V ± 1% AC
Frequency	50 Hz
Power factor	0.8

Battery	
Type	Sealed, Maintenance-Free (AGM) battery
Capacity	100% UPS load for 2 hours
Monitoring and communication	
LED Indicators	Load on Inverter, Battery operation, Load on Bypass, Overload, LCD Fault, UPS Fault
Electrical contacts	Closing contacts for each of the following conditions: 1. Unit on Battery 2. Low Battery 3. Summary Alarm 4. UPS On 5. Input Fail
Local Display	LCD/ LED
SCADA communications	RS-232 & RS-485 Interface Port
Overall efficiency	>90%
Electrical Protection	Input/ output under voltage, over temperature, overload, Short circuit, battery low trip

10.3.3 The UPS shall be forced air cooled by internally mounted fans. The fans shall be redundant in nature to ensure maximum reliability. The fans shall be easily replaceable without the use of special tools.

10.3.4 Contractor shall provide the Operation & Maintenance Manual and mandatory spare parts list along with the equipment

10.4 Warranty

UPS shall be warranted for minimum of 5 (five) years and batteries shall be warranted for a minimum of 2 (two) years against all material/ manufacturing defects and workmanship

10.5 Tests

10.5.1 Routine tests and acceptance tests on final product shall be done as per QAP approved by the Employer.

10.5.2 On completion of installation and commissioning of the equipment on site tests shall be carried out with the max. available load, which does not exceed the rated continuous load. An on-site test procedure shall be submitted by contractor include a check of controls and indicators after installation of the equipment.

11 Battery and Battery Charger

11.1 Standards and Codes

Standard/Code	Description
IEC 60896-22:2004	Stationary lead-acid batteries - Part 22: Valve regulated types - Requirements
IEC 60896-21:2004	Stationary lead-acid batteries - Part 21: Valve regulated types - Methods of test
IS 1652	Specification for stationary cells and batteries, lead acid type (with plante positive plates)
IS 8320	General requirements and methods of tests for lead acid storage batteries.
IS 15549	Stationary Regulated Lead Acid Batteries

11.2 General

110 V DC system (Battery, Battery Charger & DCDB) in accordance with this specification and standards stated herein, shall comprise of the following.

(i) Sealed Maintenance Free (VRLA) Battery complete with racks & accessories.
(ii) One No. Float charger.
(iii) One No. Float cum Boost charger.
(iv) DC Distribution Board (DCDB)

11.3 Battery

11.3.1 Battery shall be used to supply the following loads with back up of two hours in case of complete power failure:

(i) Trip and closing coil of HT circuit breaker
(ii) Spring charging motors for HT circuit breaker
(iii) Annunciator and Indication circuit of HT panel
(iv) Auxiliary supply to protection relays

11.3.2 The battery sizing shall account for suitable temperature correction factors, ageing factors of 1.25, design margin of 1.25 & depth of discharge of 80%.

11.3.3 The design of the battery bank and sizing calculation along with the data sheet for the battery and battery charger shall be submitted for approval.

11.3.4 Battery voltage – 220V dc or 110V dc

11.4 Battery Charger

11.4.1 The Float Charger shall be used to supply normal DC loads and float charging current

of charged battery. The Float cum Boost charger shall be designed to supply boost charging current requirement of the associated battery as well as to supply normal DC load. After full discharge of battery bank, the Float Cum boost charger shall be capable of charging the battery to its full capacity in 8 hours duration while supplying normal DC load.

11.4.2 The float charger shall have both auto and manual voltage regulation arrangements with provision of selector switch.

11.4.3 Suitable filter circuits shall be provided in all the chargers to limit the ripple content (peak to peak) in the output voltage and current to 2% and 5% respectively.

11.4.4 Digital Outputs shall be configured for connection to the SCADA to monitor the outputs like charger output current, output voltage, float/boost mode, etc.

11.4.5 The charging equipment shall be housed in a free standing, floor mounted compartmentalized panels. Panel shall have provision for bottom cable entry with removable undrilled cable gland plate of 3.0 mm thickness.

11.4.6 The panel shall be of CRCA sheet steel construction having thickness of at least 2.0 mm. Degree of protection provided by the enclosure to the internals of charger shall be IP-42.

11.4.7 The instruments, switches and indicating lamps shall be flush mounted on the front panel.

11.5 DC distribution board (DCDB)

11.5.1 DCDB shall be a separate panel but shall form an integral part of a battery charger panel board.

11.5.2 Doors and covers shall be provided with neoprene gaskets to prevent entry of vermin and dust. Also, door shall be provided with lock and key arrangement to prevent unauthorized access to the board.

11.5.3 DCDB shall have adequate number of outgoing feeders with double pole, DC MCBs. At least 20% feeders shall be provided as spare.

11.6 Warranty

Batteries and battery charger shall be warranted for minimum of 2 (two) years against all material/ manufacturing defects and workmanship.

11.7 Tests

Routine tests and acceptance tests shall be as per the Quality Assurance Plan (QAP) approved by the Employer.

12 Earthing

12.1 Standards and Codes

Earthing system shall comply with latest revisions and amendments of the relevant IEC standards and IS codes. In particular, earthing system shall comply with the following standards and codes.

Standard/Code	Description
IS 3043	Code of Practice for Earthing
IEC 62561-2	Requirements for conductors and earth electrodes
IEC 62561-7	Requirements for earthing enhancing compounds
IEEE 80	IEEE Guide for Safety in AC Substation Grounding
IEEE 142	IEEE Recommended Practice for Grounding of Industrial and Commercial Power Systems
Indian Electricity Rules	

12.2 General Requirements

12.2.1 Earthing system shall be designed based on system fault current and soil resistivity value obtained from geo-technical investigation report. Earth grid shall be formed consisting of number of earth electrodes sufficient enough to dissipate the system fault current interconnected by earthing conductors.

12.2.2 The earth electrode shall be made of high tensile low carbon steel rod, molecularly bonded by high conductivity copper on outer surface with coating thickness not less than 250 micron as per relevant standards. Suitable earth enhancing material shall be filled around the electrode to lower the resistance to earth. Inspection chamber and lid shall be provided as per IS 3043.

12.2.3 Earth conductors shall be made of copper bonded steel or galvanized steel of sufficient cross section to carry the fault current and withstand corrosion.

12.2.4 Earth conductors buried in ground shall be laid minimum 600 mm below ground level unless otherwise indicated in the drawing. Back filling material to be placed over buried conductors shall be free from stones and harmful mixtures.

12.2.5 Earth electrodes shall not be situated within 1.5m from any building whose installation system is being earthed. Minimum distance between earth electrodes shall be two times the driven depth of the electrode.

12.2.6 Transformer yard and switchyard fence shall be connected to the earth grid by one GS flat and gates by flexible lead to the earthed post.

12.2.7 All welded connections shall be made by electric arc welding. For rust protection, the welds should be treated with red lead compound and afterwards thickly coated with bitumen compound.

12.3 Earthing of PV array field

12.3.1 All PV Modules, Module Mounting Structures (MMS) and String Monitoring Unit (SMU) structures in the PV array field shall be bonded to the earthing system by two distinct connections.

12.3.2 Each PV Module frame shall be earthed using copper wire of sufficient cross section. The copper wire shall be connected to the earth hole provided in the module frame using suitable arrangement in line with the manufacturer recommendation. The earthing arrangement shall use stainless washers to prevent galvanic corrosion between aluminium frame and copper wire. In order to achieve effective earthing, serrated washers shall be employed to penetrate the anodization layer of the module frame.

12.3.3 Continuous copper earthing wire shall be run to connect a group of modules and both ends of the loop shall be bolted to the DC earth grid using bimetallic lugs and stainless-steel fasteners. The copper earthing wire shall be routed in such a way to avoid physical contact with the module aluminium frame.

12.3.4 The connection between MMS and DC earth grid shall be bolted or welded. Portion of the MMS which undergoes welding at site shall be coated with two coats of cold galvanising and anti-corrosion paint afterwards.

12.3.5 Earth electrodes of the DC earth grid shall be uniformly distributed throughout the PV array field so that optimum earth resistance is offered to leakage current flowing from any module frame or MMS.

12.3.6 SMU equipment earthing point shall be connected to the DC earth grid using flexible copper cable of sufficient cross section as recommended by the manufacturer. The connection with the DC earth grid shall be done using suitable bimetallic lugs and stainless-steel fasteners.

12.4 PCU Earthing

DC negative bus bar of the PCU shall be earthed to avoid Potential Induced Degradation (PID). DC negative bus bar and PCU equipment earth shall be bonded to the PCU earth bus and connected to earth electrodes through flexible copper cable of sufficient cross section as mentioned by the manufacturer. The interconnection of PCU

earth electrodes with DC earth grid shall be as per PCU manufacturer recommendation.

12.5 Transformer Earthing

12.5.1 Inverter transformer neutral shall be floating, not to be earthed. However, recommendation of inverter manufacturer shall also be taken into account.

12.5.2 Transformer tank, cable box, marshalling box and all other body earth points shall be earthed.

12.5.3 Inverter transformer shield shall be earthed separately using minimum two no. of earth electrodes. Earthing conductor between shield bushing and earth electrodes shall be copper flat of suitable size not less than 25 x 6 mm.

12.5.4 Neutral and body of the auxiliary transformer shall be earthed.

12.6 Inverter Room and Main Control Room Earthing

12.6.1 Metallic enclosure of all electrical equipment inside the inverter room and main control room shall be connected to the earth grid by two separate and distinct connections.

12.6.2 Cable racks and trays shall be connected to the earth grid at minimum two places using galvanized steel flat.

12.6.3 SCADA and other related electronic devices shall be earthed separately using minimum two no. of earth electrodes.

12.7 Switchyard Earthing

The metallic frame work of all switchyard equipment and support structures shall be connected to the earth grid by means of two separate and distinct connections.

Switchyard shall be shielded against direct lightning stroke by provision of over head shield wire or earth wire or spikes(masts) or a combination there of as per CEA regulations 2010 (Technical standards)- 42(2)(C).

12.8 Tests

Type test reports for earthing electrode, earth enhancing compound and its associated accessories shall be submitted during detailed engineering for approval.

On completion of installation, continuity of earth conductors and efficiency of all bonds and joints shall be checked. Earth resistance at earth terminations shall be measured and recorded.

The earth plate shall be provided to facilitate its identification and for carrying out periodical inspection.

13 Lightning Protection System

13.1 Lightning Protection System (LPS) for entire plant against direct lighting strokes shall be provided as per IEC 62305:2010 or NFC 17-102:2011.

13.2 Protection level for the entire plant shall be Level-I.

13.3 LPS as per IEC 62305

Location of air terminals shall be designed as per rolling sphere method.

13.4 LPS as per NFC 17-102

Lightning Protection System shall consist of following accessories.

(i) Early Streamer Emission (ESE) air terminal

(ii) Highly insulated poly-plastic adaptor to fix the ESE air terminal with the FRP mast

(iii) Fiberglass Reinforced Plastic (FRP) mast

(iv) Coupler to connect FRP mast with GI mast

(v) Galvanized Iron mast with base plate and guy wire kit

(vi) Down-conductor: PVC insulated flexible copper cable of suitable size complying with EN 50164-2 or equivalent standard. It shall be routed along the mast with suitable fixings and connecters

(vii) Test joint with each down conductor

(viii) Lightning event counter complying with EN 50164-6 or equivalent standard. It shall be fixed at suitable height in series with the down conductor.

(ix) Earth termination system in accordance with NFC 17-102. Earth electrodes shall comply with the EN 50164-2 or equivalent standard. Earth enhancing compounds complying with EN 50164-7 or equivalent standard, may be used where soil resistivity is higher and making it impossible to achieve system resistance within specified limit.

13.5 Accessories listed above are indicative only and any other fittings or accessories, which are usual or necessary for satisfactory operation of the lightning protection shall be provided by the Contractor without extra charges.

13.6 Necessary foundation/anchoring for holding the lightning mast in position to be made after giving due consideration to shadow on PV array, maximum wind speed and maintenance requirement at site in future.

13.7 The product shall be warranted for minimum of 2 (two) years against all material/

manufacturing defects and workmanship.

13.8 Type test reports as per IEC 62305:2010 or NFC 17-102:2011 shall be submitted during detailed engineering for approval.

14 Communication Cables

14.1 Optical Fibre Cables

14.1.1 Optic Fibre cable shall be 4/8/12 core, galvanized corrugated steel taped armoured, fully water blocked with dielectric central member for outdoor/ indoor application so as to prevent any physical damage.

14.1.2 The cable shall have multiple single-mode or multimode fibres on as required basis so as to avoid the usage of any repeaters.

14.1.3 The outer sheath shall have Flame Retardant, UV resistant properties and are to be identified with the manufacturer's name, year of manufacturing, progressive automatic sequential on-line marking of length in meters at every meter on outer sheath.

14.1.4 The cable core shall have suitable characteristics and strengthening for prevention of damage during pulling.

14.1.5 All testing of the optic fibre cable being supplied shall be as per the relevant IEC, EIA and other international standards.

14.1.6 The Contractor shall ensure that minimum 100% cores are kept as spare in all types of optical fibre cables.

14.1.7 Cables shall be suitable for laying in conduits, ducts, trenches, racks and underground buried installation.

14.1.8 Spliced/ Repaired cables are not acceptable. Penetration of water resistance and impact resistance shall be as per IEC standard.

14.2 Communication Cable (Modbus)

14.2.1 Data (Modbus) Cable to be used shall be shielded type with stranded copper conductor. Cable shall have minimum 2 pair each with conductor size of 0.5 Sq.mm. Cable shall be flame retardant according to IEC 60332-1-2.

14.2.2 Cable shall be tested for Peak working voltage of not less than 300 V and shall be suitable for serial interfaces (RS 422 and RS 485).

14.2.3 Communication cable shall be laid through underground with suitable HDPE ducts.

15 SCADA

15.1 General Requirements

15.1.1 The Contractor shall provide complete SCADA system with all accessories, auxiliaries and associated equipment and cables for the safe, efficient and reliable operation and monitoring of entire solar plant and its auxiliary systems.

15.1.2 The Contractor shall provide all the components including, but not limited to, Hardware, Software, Panels, Power Supply, HMI, Laser Printer, Gateway, Networking equipment and associated Cables, firewall etc. needed for the completeness.

15.1.3 SCADA System shall have the provision to perform the following features and/or functions:

(i) Web enabled Operator Dashboards: Showing key information on Generation, Performance and Current Status of various equipment in Single Line Diagram (SLD) format with capability to monitor PV array string level parameters.

(ii) Real time Data Logging with Integrated Analytics & Reporting: Logging of all parameters - AC, DC, Weather, System Run Hours, Equipment Status and Alarms as well as derived/ calculated/ integrated values. The SCADA User interface shall be customizable and enable Report Generation and Graphical Analysis.

(iii) Fault and System Diagnostics with time stamped event logging.

(iv) Support for O&M Activities: The interface shall allow integration with Surveillance System(s), Module Cleaning System and various other O&M support systems to provide a Data Analysis and Decision Support System for smooth and efficient Plant Operations.

(v) AI based Distributed Analytics for Predictive Maintenance, trend analysis and Alerts.

(vi) Generate, store and retrieve user configurable Sequence of Event (SOE) Reports.

(vii) Interface with different field equipment in the plant and work seamlessly with field equipment supplied by different companies.

(viii) Transfer of plant data reliably, to an Owner designated server or Cloud on any kind of remote network including low bandwidth and wireless links such as 2G/3G/VSAT

(Note: Telecom Lease line connection, if required for transferring data from Plant over internet shall be taken by Contractor in the name of Employer for O&M period)

15.1.4 The Control system shall be designed to operate in non-air-conditioned area.

However, the Contractor shall provide a Package/ Split AC of suitable capacity decided by heat load requirement in SCADA room at Main Control Room.

15.2 Architecture

15.2.1 The SCADA System shall be built over Industrial IoT architecture with integrated Analytics, secure web access, enterprise software and Database.

15.2.2 Data acquisition shall be distributed across MCR and LCRs while plant level data aggregation shall be done in both local and remote server (as specified by Owner).

15.2.3 Analog and Digital IO modules shall have integrated processor for distributed IO processing and control.

15.2.4 Data communication system shall be built over fibre optic cables/ wireless network with high bandwidth TCP/IP communication (Fast Ethernet or 802.11a/b/g/n) across all Inverter and Control Rooms with Internet/Intranet access at Main Control Room. Firewall shall be provided for network security.

15.2.5 Plant SCADA Server shall have Industrial Grade server hardware running SCADA & Monitoring Software with data storage (complete plant data) space for 2 years.

15.2.6 Plant data for monitoring and control operations should be accessible without dependence on external network.

15.2.7 A virtual/cloud server running SCADA & Monitoring Software shall be configured in parallel with Plant Server to enable easy access to plant data from outside the plant without having to login to plant server. Effectively, the plant data shall be replicated in both places i.e. between systems at the Plant Server and Remote Server to provide data redundancy for complete plant data.

Note: Configuration of Cloud server and procurement of associated subscription services shall be in the scope of the EPC Contractor.

15.2.8 Operator Workstation/PC shall be of Industrial Grade for browser-based access to plant data from Plant or remote server. Plant control & SLDC/Utility related operations shall only be initiated through browser-based interface requiring no client software or database to be installed on the Workstation. All critical software and Plant Data shall be installed/stored on local and remote servers only with user access control for protecting the software and data assets from accidental deletion or corruption.

15.2.9 Internet/Intranet at Plant: Public or private network access shall be provided at the plant through any broadband/VSAT connectivity of 50 Mbps or higher bandwidth. In case no broadband/VSAT connectivity can be provided at the plant, a 3G/4G data card from any Internet Service Provider (ISP) may be provided. SCADA system shall

be capable of sending all plant data in real time to the Remote Server.

15.2.10 GPS based Time Synchronization System: The SCADA system shall have a Master/Slave Clock system along with antenna, receiver, cabinet and internal interconnection cables. All SCADA controllers, servers, OWS and communicating equipment shall be synchronized to the GPS clock.

15.3 Industrial IoT Controllers & Data Acquisition

The Plant SCADA and Monitoring System may use one or more IIoT Controllers at each Inverter Control Room and MCR for the purpose of data acquisition and data forwarding to the Local and Remote SCADA Servers. The IIoT Controllers shall meet the following minimum requirements:

15.3.1 The IIoT Controllers shall be distributed in nature and work independently of other IIoT Controllers or any central controller in the system.

15.3.2 Shall be capable of supporting wide range of field protocols to communicate with different field equipment (Modbus over RS485/Ethernet,/IEC 61850 etc.)

15.3.3 Shall have local storage for a minimum of 2 weeks (in case of network failure).

15.3.4 Provide web-based interface to configure the controller for various equipment in the field.

15.3.5 IO Functionality: Shall support status monitoring of VCBs & Trip relays on RMU/HT/BESS & Transformer panels through distributed DI/AI modules.

15.3.6 Controls: Shall be capable of Controlling breakers (ON/OFF). Both ON/OFF and Parameter control of inverters shall be supported.

15.3.7 Data Communication with Servers: Shall send the data collected, from all the equipment at Inverter Control Room and/or Main Control Room, to the Monitoring & Control Server.

15.3.8 Controllers shall be capable of sending data over Internet connections USB data cards.

15.3.9 Shall not require a static public IP address, at the plant for the purpose of remote access.

15.4 Functionalities

15.4.1 The SCADA system shall monitor instantaneous and cumulative electrical parameters from all DC& AC Equipment including inverters, string combiner boxes, weather station, MFM, Transformer, BESS, Switchgear (LT & HT Panels) and Plant EMS Controller at regular intervals not greater than one minute.

15.4.2 The SCADA system shall monitor Instantaneous and cumulative environment parameters from weather sensors or data loggers as well as BESS parameters at same interval as electrical parameters and provide PR, CUF, State of Charge (SoC) etc. on the fly.

15.4.3 The SCADA system shall provide Alarms and Alerts on equipment faults and failure in less than 5 seconds. Alarms on status change of hardwired DI shall also be provided.

15.4.4 The SCADA system shall provide configurable alerts on any parameter crossing settable thresholds. The list of such parameters shall be finalised in consultation with the Owner.

15.4.5 The SCADA system shall enable integration with other sub-systems at the plant for supporting O&M activities. The list shall include but not limited to:

(i) Surveillance Cameras,

(ii) Module Cleaning System – For monitoring of water usage and efficacy of cleaning process.

15.4.6 The SCADA system shall have user-friendly browser-based User Interface for secure access from anywhere, for minimum ten concurrent connections from the Operator PC or other securely connected laptop/mobile, for plant monitoring, O&M, daily reporting, and analysis. A dashboard providing summary details of total plant generation, day's export, irradiance, Inverter Control Room level generation and performance indicators like PR and CUF.

15.4.7 Reporting: The SCADA system shall provide downloadable reports in Excel/PDF, configurable for equipment parameters across the plant.

15.4.8 The system shall have Configurable Analysis page for self-configured as well as on demand Analytics charts.

15.4.9 The SCADA system shall be extensible to include maintenance of O&M schedules and related activities for plant equipment as per the O&M Manual.

15.4.10 Connectivity shall be provided to Owner's Data Monitoring Centre. Data collected by Plant SCADA shall be replicated in real-time, using industry standard interfaces such as Web Services, OPC-UA, data files, as required – with Owner's Central Monitoring System. The data recording intervals for different parameters from different devices in the solar plant shall be considered when creating schedules to "push" the data from Plant SCADA to Owner's Data Monitoring Centre.

15.4.11 Mobile User Interface: summary of plant performance and issues should be

accessible in a mobile Native UI or browser UI.

15.4.12 Data Communication to SLDC: SCADA system shall provide required interface to integrate with TRANSCO-SLDC, in compliance with grid code, to send any parameters specified by SLDC.

Note: The methodology and specification of SLDC interface will be provided separately by SLDC/TRANSCO and it shall be the responsibility of the Contractor to determine the same.

15.4.13 Power Plant Control: SCADA system shall provide required interface to the local SCADA operator to set various power control modes (active/reactive power/frequency/PF) through the inverters over industry standard communication protocols like Modbus over TCP/IP.

15.4.14 Forecasting and Scheduling: SCADA shall provide day ahead and week ahead forecasting and scheduling for power generation at the plant as per SLDC/Utility stipulations.

15.4.15 Predictive Maintenance: SCADA system shall have in-built or pluggable frameworks to support AI based Predictive Maintenance for all key equipment including inverters, transformers and switchgear at the plant.

15.4.16 All programming functionalities shall be password protected to avoid unauthorized modification.

15.4.17 The Contractor shall provide software locks and passwords to Employer for all operating & application software. Also, the Contractor shall provide sufficient documentation and program listing so that it is possible for the Employer to carry out modification at a later date.

15.5 Earthing

15.5.1 Two isolated electronic earth pits near to SCADA panel at every Inverter and Control Room with < 1 Ohm resistance shall be provided. One earth pit shall be used for protective/body earth and the other to be used for Signal Earth.

15.5.2 Apart from providing separate earth pits, manufacturer specified earthing recommendations shall be followed for all communicating equipment connected to SCADA. This includes but is not limited to SMBs, Inverters, WMS and Switchgear panels.

15.6 Communication Cable Laying

15.6.1 All RS485, IO and CAT6 cables shall be laid in separate conduits with a minimum

separation of 1.5ft from AC/DC power cables all along.

15.6.2 Power cables shall be laid deep in the trenches first. Data cables shall be laid in separate conduits after partially filling the trenches to ensure minimum 1.5 ft separation between power and communication cables all along the trench.

15.6.3 IO Cables between switch gear panels and SCADA panel shall be laid on separate cable trays, with a minimum of 1.5ft separation from trays carrying AC Power cables.

15.6.4 RS485 & CAT6 cables between switch gear panels or Inverters and SCADA panel shall be laid on separate cable trays, with a minimum of 1.5ft separation from trays carrying AC Power cables.

15.7 Control Cabinets / Panels / Desks at Main Control Room

15.7.1 The cabinets shall be IP-22 protection class. The Contractor shall ensure that the temperature rise is well within the safe limits for system components even under the worst condition and specification requirements for remote I/O cabinets.

15.7.2 The cabinets shall be totally enclosed, free standing type and shall be constructed with minimum 2 mm thick steel plate frame and 1.6 mm thick CRCA steel sheet or as per supplier's standard practice for similar applications.

15.8 Software Licences

The Contractor shall provide software license for all software being used in Contractor's System. The software licenses shall be provided for the project and shall not be hardware/ machine-specific.

15.9 Hardware at Main Control Room

15.9.1 The Hardware as specified shall be based on latest state of the art Workstations and Servers and technology suitable for industrial application & power plant environment.

15.9.2 The Local Monitoring & Control Server and the Operating Work station, to be deployed in the Plant Control Room, shall have the following server hardware and operating system along with accessories:

Plant Server	
Server Hardware	Hex/Octal Core Xeon, 32GB RAM (expandable to 64 GB RAM), 8 X 2TB SATA hard discs in RAID 5 configuration, 4 Nos. of 2TB external USB hard disc (for backup), dual power supplies, 2 LAN ports, LCD console, keyboard & mouse.

	The Server hardware shall be housed in a rugged fan-cooled, and rodent-proof Server Rack.
Operating System	Operating System and Database shall be of enterprise scale (RedHat Linux or equivalent Linux OS or Windows OS, Oracle/MySQL or equivalent DB), with required AMC for 5 years.
Accessories	1. Monitor: Min 22" LED Flat Monitor with non-interfaced refresh rate min. 75 Hz. 2. Keyboard: ASCII type 3. Pointing Device: Mouse 4. Intelligent UPS (on line): Minimum 2 hour battery backup.
Operator Workstation	
Hardware	i7 CPU running at 3.0 GHz or faster with 8GB RAM, 500GB hard disk, 32" LED monitor, keyboard and mouse, 4 USB ports, LAN port
Operating System	Windows operating system with necessary tools, anti-virus software.
Accessories	1. Screen Display Unit: Min 50" LED Flat Monitor with wall mounted arrangement for the display of SCADA screen 2. A4 size monochrome laser printer. 3. UPS of required capacity with 2 hour battery backup.

15.9.3 All network components of LAN and Workstations shall be compatible to the LAN, without degrading its performance.

15.10 Factory Acceptance Test (FAT)

FAT procedure shall be submitted by bidder for approval. SCADA shall communicate with all third devices which are part of solar plant and same shall be demonstrated during the FAT.

16 Power Transformer

16.1 Standards and Codes

Power Transformer shall comply with the latest edition of the following standards and codes including amendments.

Standard	Description
IS 2026, IEC 60076	Specification of Power Transformers
IS 2099, IEC 60137	Bushings for alternate voltage above 1000 V
IS 8468	On-load tap changers
IS 335, IEC 60296	Insulating oil
IS 3639	Fittings and Accessories for Power Transformers

16.2 Technical Requirements

Parameter	Specification
Rated Capacity	As per system design
Rated Voltage	33 kV / 132 kV
Duty & Service	Continuous duty & Outdoor
Number of phases	3
Frequency	50 Hz
Vector group	As per system requirement
Impedance at principal tap and 75°C	10%
Tap changer	On Load Tap Changer (OLTC) on HV side +5% to -15% with steps of 1.25%
Power frequency withstand voltage (winding & bushing)	LV – 70 kV (rms) HV – 275 kV (rms)
Lightning impulse withstand voltage (winding & bushing)	LV – 170 kVp HV – 650 kVp
Permissible temperature rise over an ambient of 50°C (irrespective of tap)	
Top oil	50°C
Winding	55°C
Fault level & duration	As per system requirement
Short-circuit withstand time (Thermal)	2 second
Bushing	HV – 145 kV oil filled condenser bushing LV – 36 kV porcelain bushing
Termination	As per system requirement

Noise level	As per NEMA TR-1
Loading capability	Continuous operation at rated MVA on any tap with voltage variation of +/-3%, also transformer shall be capable of being loaded in accordance with IEC 60076-7
Flux density	Not to exceed 1.9 Wb/sq.m. at any tap position with combined frequency and voltage variation from rated V/f ratio by 10% corresponding to the tap. Transformer shall also withstand following over fluxing conditions due to combined voltage and frequency fluctuations: a) 110% for continuous rating b) 125% for at least one minute c) 140% for at least five seconds The Contractor shall furnish over fluxing characteristic up to 150%
Air clearance	As per CBIP

16.3 Tank

16.3.1 The Transformer tank and cover shall be fabricated from high grade low carbon plate steel of adequate thickness. The tank and the tank cover shall be of welded construction. All seams and joints shall be welded and where practicable, they shall be double welded. The tank so welded shall be reinforced by stiffener of structural steel for general rigidity.

16.3.2 The transformer top shall be provided with a detachable tank cover with bolted flanged gasket joint. Lifting lugs shall be provided for removing the cover. The surface of the cover shall be suitably sloped so that it does not retain rain water.

16.3.3 The main tank body of the transformer, excluding tap changing compartments and radiators, shall be capable of withstanding pressure of 760mm of Hg.

16.3.4 Inspection hole(s) with welded flange(s) and bolted cover(s) shall be provided on the tank cover. The inspection hole(s) shall be of sufficient size to afford easy access to the lower ends of the bushings, terminals etc.

16.3.5 Suitable guides shall be provided for positioning the various parts during assembly or dismantling. Adequate space shall be provided between the cores and windings and the bottom of the tank for collection of any sediment.

16.3.6 All bolted connections to tank shall be fitted with suitable oil-tight gasket, which shall give satisfactory service under the operating conditions. All gaskets shall be closed design (without open ends) and shall be of one piece only. Gasket of nitrile rubber or

equivalent shall be used. Gaskets of neoprene and / or any kind of impregnated / bonded core or cork only which can easily be damaged by over-pressing are not acceptable. Use of hemp as gasket material is also not acceptable.

16.3.7 Lifting lugs shall be provided on all parts of the transformer requiring independent handling during assembly or dismantling. In addition, the transformer tank shall be provided with lifting lugs and bosses properly secured to the sides of the tank for lifting the complete transformer assembly with oil either by crane or by jacks.

16.3.8 The transformer tank shall be supported on a structural steel base equipped with forged steel single flanged wheels suitable for moving the transformer completely with oil. The wheels shall be bi-directional and mounted on swivels which may be turned through 90° when the tank is jacked up and capable of being locked in position parallel to and at right angles to the longitudinal axis.

16.4 Core

16.4.1 The transformer core shall be built up with high-grade non-ageing cold rolled grain oriented (CRGO) silicon steel laminations having high permeability and low hysteresis loss. The thickness of lamination shall be 0.27 mm or less.

16.4.2 The transformer shall be so designed that the flux density in the core shall not exceed 1.7 tesla at rated voltage and rated frequency. The maximum flux density in any part of core or yoke at 10% continuous over voltage condition shall not exceed 1.9 tesla.

16.4.3 The laminations shall be free of all burrs and sharp projections. Each sheet shall have an insulating coating resistant to the action of hot oil.

16.4.4 The core shall be rigidly clamped to ensure adequate mechanical strength and to prevent vibration during operation and transportation. The clamping structure shall be designed to minimize eddy current loss.

16.4.5 The design of magnetic circuit shall be such as to avoid static discharges, development of short circuit paths within itself or to the earthed clamping structure and production of flux components at right angles to the plane of the laminations which may cause local heating.

16.4.6 The core shall be provided with lugs suitable for lifting the complete CCA of the transformer. The CCA shall be fixed with the tank so that it does not shift when transformer is moved or during short circuit.

16.4.7 The insulation of core to bolts and core to clamp plates shall be able to withstand a voltage of 2 kV RMS for one minute.

16.4.8 The core shall not be earthed at multiple locations. Terminal shall be brought on top

of tank and earthed through link. Core and Frame terminals should be brought out on transformer top so as to enable megger.

16.5 Winding

16.5.1 The conductor for winding shall be made of electrolytic grade copper. The winding shall be so designed that all coil assemblies of identical voltage ratings shall be interchangeable and field repairs can be readily done without special equipment.

16.5.2 The coils shall be supported between adjacent sections by insulating spacers and barriers. Bracings and other insulation used in the assembly of the windings shall be arranged to ensure a free circulation of the oil and to reduce hot spots in the windings.

16.5.3 The insulation paper shall be of high quality and the value of degree of polymerization shall not be less than 1200 DPv.

16.5.4 Materials used for insulation and assembly of the windings shall be insoluble, non-catalytic and chemically inactive in the hot transformer oil and shall not soften or otherwise get affected under the operating conditions.

16.5.5 All threaded connections shall be provided with locking facilities. All leads from the winding to the terminal board and bushings shall be rigidly supported to prevent injury from vibration. Guide tubes shall be used where practicable.

16.5.6 The conductor shall be transposed at sufficient intervals in order to minimize eddy currents and equalize the distribution of currents and temperature along the windings.

16.5.7 Windings shall be subjected to a shrinkage treatment before final assembly, so that no further shrinkage occurs during service. Adjustable device shall be provided for taking up any possible shrinkage of coils in service if required.

16.5.8 The windings shall be clamped securely in place so that they will not be displaced or deformed during short circuits. The assembled core and windings shall be vacuum dried and suitably impregnated before removal from the treating tank. The copper conductors used in the coil structure shall be best suited to the requirements and all permanent current carrying joints in the windings and the locks shall be welded or brazed.

16.6 Insulating Oil

The oil for first filling together with 10% extra shall be supplied with the transformer. The oil shall comply in all respects with the provisions of the latest edition of IS 335 (as amended up to date). Particular attention shall be paid to deliver the oil free from moisture having uniform quality throughout in non-returnable steel drums.

16.7 On-Load Tap Changer

16.7.1 On-Load Tap Changer (OLTC) shall be designed for remote control operation from Remote Tap Change Control (RTCC) Panel in the control room in addition to being capable of local manual as well as local electrical operation. The OLTC shall include the following.

(i) An oil immersed tap selector and arcing switch or arc suppressing tap selector, provided with reactor or resistor for reduction of make and break arcing voltages and short circuits.

(ii) Motor driven mechanism

(iii) Control and protection devices

(iv) Local /Remote tap changer position indicator

(v) Manual/Electrical operating device

(vi) Pressure relief device

16.7.2 The OLTC shall be so designed that the contacts do not interrupt arc within the main tank of the transformer. The tap selector and arcing switch or arc suppressing selector switch shall be located in oil filled compartment. The compartment shall be provided with Oil Surge Relay. It shall be designed so as to prevent oil in the tap selector compartment from mixing with the oil in the transformer tank.

16.7.3 The contactors and associated gear for the driving motor shall be housed in a local kiosk mounted adjacent to or on the transformer. The degree of protection of the complete arrangement shall be IP 55 or better. The motor shall be suitable for operation with three phase, 415 V, 50 Hz external power supply.

16.7.4 RTCC Panel

Remote Tap Change Control (RTCC) Panel shall include, but not limited to, the following.

(i) Automatic Voltage Regulator with SCADA compatibility

(ii) Under voltage relay to monitor the taper changer control voltage

(iii) Raise and lower push button

(iv) Tap position indicator

(v) Indication lamp showing tap changing in progress

(vi) Alarms and Annunciation

(vii) Any other accessory required for satisfactory operation or required during detail engineering

16.8 Bushing

16.8.1 The bushings shall have high factor of safety against leakage to ground and shall be so located as to provide adequate electrical clearances between bushings and grounded parts. Bushings of identical voltage rating shall be interchangeable.

16.8.2 All bushings shall be equipped with terminals suitable for bimetallic connection. Each bushing shall be so coordinated with the transformer insulation that all flash over will occur outside the tank.

16.8.3 HV bushings shall be 145 kV voltage class, oil filled condenser type and hermetically sealed. The bushings shall have provision for measurement of capacitance and loss factor without dismantling of the bushing. The bushings shall be removable without disturbing the Bushing Current Transformers if any. LV bushings shall be 36 kV voltage class, porcelain type. The oil used for the oil filled type bushings shall be the same as that used in the transformer.

16.9 Radiators

16.9.1 Radiators provided shall have sufficient cooling surface to limit the temperature rise to the values as specified in the 'Technical Requirements'. The radiators shall be seamless and made of mild steel/CRCA with minimum thickness not less than 1.2 mm. It shall be suitably braced to protect them from mechanical shocks.

16.9.2 The radiators shall be connected to the tank by machined steel flanges with adequate gaskets to avoid oil leakage. Each radiator unit shall be provided with butterfly type or positive operated gate type oil leak proof shut-off valve which can be fastened in either closed or open position and separate oil tight flange for each tank connection for use when the radiator unit is detached. Each radiator unit shall have a lifting arrangement and oil drain at the bottom and a vent at the top.

16.9.3 It shall be possible to take out any of the radiator unit without disturbing the transformer. The radiators shall be so designed as to prevent any accumulation of water on the outer surface or formation of gas pockets when the tank is being filled.

16.10 Accessories

16.10.1 Conservator

The conservator shall have air cell type constant oil preservation system to prevent oxidation and contamination of oil due to contact with moisture. The conservator shall be provided with separate compartment for OLTC. No separate conservator tank shall be provided for OLTC. The conservator shall be fitted with oil filling hole, cap

and drain valve. Prismatic toughened glass oil level gauge and 150 mm Magnetic Oil Gauge (MOG) with low oil level alarm contact shall also be provided.

16.10.2 Silica gel breather

The top of the conservator shall be connected to the atmosphere through indicating type cobalt free silica gel dehydrating breather with transparent enclosure. Silica gel shall be isolated from atmosphere by an oil seal. The capacity of breather should be such that it can contain minimum 5 kg silica gel for main conservator compartment and minimum 1 kg silica gel for OLTC conservator compartment. The GI pipe connecting breather with conservator should be seamless and no joint is permitted.

16.10.3 Buchholz relay

Buchholz relay, double float type with alarm and trip contacts, along with suitable gas collecting arrangement shall be provided. The relay shall be provided with a test cock suitable for a flexible pipe connection for checking its operation and taking gas sample. A copper or stainless-steel tube shall be connected from the gas collector to a valve located about 1200 mm above ground level to facilitate sampling when the transformer in service. The relay shall be provided with shut off valve on the conservator side as well as on the tank side.

16.10.4 Pressure Relief Device

Pressure Relief Device shall be provided on main tank and OLTC for rapid release of any pressure in transformer which may endanger the equipment. The device shall operate at a static pressure of less than hydraulic test pressure of transformer tank/OLTC chamber. The terminal box of the PRD shall be water tight with protection class IP 56 or better as per IEC 60529. Electrically insulated contact shall be provided for trip signal.

16.10.5 Temperature Indicators

16.10.5.1 Oil Temperature Indicator (OTI)

150 mm dial type temperature indicator with ‘Maximum’ reading pointer and resetting device shall be provided. The indicator shall have adjustable, electrically independent, potential free alarm and trip contacts. A temperature sensing element suitably located in a pocket on top oil shall be provided. Accuracy class of OTI shall be 1.5% or better.

16.10.5.2 Winding Temperature Indicator (WTI)

A device for measuring the hot spot temperature of each of the winding shall be provided. It shall comprise the following.

(i) Temperature sensing elements, one each on HV and LV winding.

(ii) Image coil.

(iii) Auxiliary CTs, if required to match the image coil.

(iv) 150 mm dial type temperature indicator with 'Maximum' reading pointer and resetting device with adjustable, electrically independent, potential free alarm and trip contacts.

(v) Calibration device.

The winding temperature indicator shall be responsive to the combination of top oil temperature and winding current, calibrated to follow the hottest spot temperature of the transformer winding. Accuracy class of WTI shall be 1.5% or better.

16.10.6 Marshalling Box

Marshalling Box shall be of sheet steel, dust and vermin proof provided with proper lighting and thermostatically controlled space heaters. The degree of protection shall be IP 55. One dummy terminal block in between each trip wire terminal shall be provided. At least 10% spare terminals shall be provided on each panel. The gasket used shall be of neoprene or synthetic rubber. Wiring scheme (TB details) shall be engraved in a stainless-steel plate with viewable font size and the same shall be fixed inside the marshalling box door.

16.10.7 Valves

The transformer shall be provided with the following (but not limited to) valves.

(i) Two nos. of filter valves, one at top and another at bottom on diagonally opposite corners

(ii) Two nos. of sampling valves at top and bottom of the tank

(iii) Drain valve on main tank

(iv) Drain valves on main and OLTC compartment of conservator

(v) Valves (for nitrogen injection and oil drain) as required by firefighting system

All valves shall be constructed of stainless steel, brass or gun metal except of shutoff valve for radiator and cooler. For radiator and cooler, valve shall be made up of gun metal or cast iron.

16.11 Painting

16.11.1 Before painting or filling with oil, un-galvanized parts shall be completely cleaned and

free from rust, scale and grease. All external rough surfaces on casting shall be filled by metal deposition. The interior of transformer tank and other filled chambers and internal structural steel work shall be cleaned of all scale and rust by send blasting or other approved method. These surfaces shall be painted with an oil resisting varnish or paint.

16.11.2 Except for nuts, bolts and washers, all external surfaces shall receive a minimum of three coats of paint. The primary coat shall be applied immediately after cleaning. The second coat shall be of oil paint of weather resisting nature. The final coat shall be of a glossy, oil and weather resisting non-fading paint. The paint shade shall be as provided by the Employer during detailed engineering.

16.11.3 All internal surfaces of mechanism chambers and kiosk except those which have received anticorrosion treatment, shall receive three coats of paint applied to the thoroughly cleaned metal surface. The final coat shall be of light coloured anti-condensation mixture.

16.11.4 Any damage to paint work incurred during transport and erection shall be made good by thoroughly cleaning the damaged portion and by applying full number of coats of paints.

16.12 Transportation

16.12.1 Transformer tank is filled with oil or pure dry nitrogen/ air depending upon the transport weight limitations. Necessary arrangement shall be ensured to take care of pressure drop of nitrogen or dry air during transit and storage till completion of oil filling during erection. A gas pressure testing valve with necessary pressure gauge and adaptor valve shall be provided.

16.12.2 Bushings shall be crated, packed and transported as per standard guide lines of the Bushing Manufacturer. All care should be taken to avoid any damage of the porcelain due to vibration during transport.

16.12.3 Special attention shall be paid in packing the accessories & spares to avoid moisture ingress. All parts shall be adequately marked to facilitate field erection.

16.13 Warranty

The power transformer shall be warranted for minimum of 5 (five) years against all material/ manufacturing defects and workmanship.

16.14 Testing and Inspection

16.14.1 Type Tests and Special Tests

The following type test and special test reports shall be submitted during detailed engineering. The tests should have been conducted on the similar transformer by NABL accredited laboratory.

16.14.1.1 Type Tests

(i) Lightning impulse (Full & Chopped Wave) test on windings as per IS 2026-3/IEC 60076-3

(ii) Temperature Rise test at a tap corresponding to maximum losses as per IS 2026-2/IEC 60076-2. Dissolved Gas Analysis (DGA) shall be conducted on oil sample taken before and immediately after temperature rise test. Gas analysis shall be as per IS 9434/IEC 60567 and results will be interpreted as per IS 10593/IEC 60599.

16.14.1.2 Special Tests

(i) Short circuit withstand test as per IS 2026-5/IEC 60076-5

(ii) Measurement of zero-sequence impedance as per IS 2026-1/IEC 60076-1

(iii) Measurement of harmonics of no-load current as per IS IEC 60076-1

(iv) Measurement of acoustic noise level as per NEMA TR-1

In case the contractor is not able to submit the test reports during detailed engineering, the contractor shall submit the reports of type/special tests either conducted by NABL accredited laboratory or witnessed by Employer.

16.14.2 Routine Tests

Each completed transformer shall be subjected to following routine tests as per the latest edition of IEC 60076 unless specified otherwise.

(i) Measurement of winding resistance at each tap

(ii) Measurement of voltage ratio between HV and LV windings at each tap

(iii) Check of vector group

(iv) Measurement of no-load loss and no-load current at 90%, 100% & 110% of rated voltage

(v) Measurement of short-circuit impedance and load loss at principal and extreme taps

(vi) Magnetic balance test & magnetizing current test as per CBIP manual publication no. 295

(vii) Separate source voltage withstand test

(viii) Induced over voltage withstand test

(ix) Measurement of insulation resistance and polarization index

(x) Measurement of tan delta and capacitance of winding

(xi) Core isolation test

(xii) Marshalling box functional test

(xiii) IR Measurement on wiring of marshalling box

(xiv) Test on on-load tap changer

(xv) Breakdown voltage test on transformer oil as per IS 335

(xvi) Jacking test followed by D.P. test

(xvii) Oil leakage test on completely assembled transformer along with radiators

17 Nitrogen Injection Fire Protection System

Nitrogen Injection Fire Protection System (NIFPS) shall use nitrogen as fire quenching medium. The protection system shall prevent transformer oil tank explosion and possible fire in case of internal faults. In the event of fire by external causes such as bushing fire, OLTC fire, fire from surrounding equipment etc., it shall act as a fast and effective fire extinguisher without any manual intervention.

17.1 Standards and Codes

All the equipment of NIFPS shall comply with the latest edition of the following standards and codes including amendments.

Standard	**Description**
IS 10028-2	Code of practice for selection, installation and maintenance of transformers; Part 2: Installation
IS 7285-2	Refillable Seamless Steel Gas Cylinders - Specification Part 2: Quenched and Tempered Steel Cylinders With Tensile Strength Less Than 1100 MPa (112 kgf/mm^2)
CEA Technical Standards for Construction of Electrical Plants and Electric Lines Regulations, 2010 with 2015 amendment	
CEA Measures relating to Safety and Electric Supply Regulations, 2010 with 2015 amendment	
CBIP Manual on Transformers, Publication No. 317	

17.2 Technical Requirements

Parameter	**Specification**
Fire extinction period from commencement of nitrogen injection	30 second (maximum)

Total time duration to bring oil temperature below flash point	30 minute (maximum)
Fire detector heat sensing temperature	141°C
TCIV setting for normal operation to ensure no obstacle for transformer breathing	40 litre per minute
TCIV setting for operation during abnormal flow of oil	60 litre per minute
Capacity of nitrogen gas cylinder	10 m^3 gas at pressure of 150 kg/cm^2 for up to 60,000 litre of oil 20 m^3 gas at pressure of 150 kg/cm^2 for above 60,000 litre of oil

17.3 System Components

NIFPS shall broadly consists of the following components. However, all other components which are necessary for fast, reliable and effective working of the fire protection system shall be deemed to be included in the scope of supply. The NIFPS shall have provision for SCADA connectivity.

17.3.1 Fire Extinguishing Cubicle

The Fire Extinguishing Cubicle (FEC) shall be made of CRCA sheet of minimum 3 mm thick with Polyurethane painting. The degree of protection shall be IP55 or better. It shall have hinged split doors fitted with high quality tamper proof lock. The following components shall be provided in the FEC.

(i) Nitrogen gas cylinder with regulator and falling pressure electrical contact manometer. The nitrogen gas cylinder should have been certified by Bureau of Indian Standards and approved by Chief Controller of Explosives, Government of India.
(ii) Oil drain pipe with mechanical quick drain valve
(iii) Control equipment for draining of oil and injecting nitrogen gas
(iv) Pressure monitoring switch for backup protection for nitrogen release
(v) Limit switches for monitoring of the system
(vi) Butterfly valve with flanges on top of the cubicle for connecting oil drain pipe and nitrogen injection pipe
(vii) Panel lighting
(viii) Oil drain pipe extension of suitable sizes for connecting pipes to oil pit

17.3.2 Control Box

Control box shall be placed in the Master Control Room (MCR) for monitoring, automatic control and remote control. The rated control voltage of the control box shall be 110 VDC. The control box shall have suitable indications, alarms, switches and push buttons for complete monitoring and control of the system.

17.3.3 Transformer Conservator Isolation Valve

Transformer conservator isolation valve (TCIV) shall be fitted in the conservator pipe line between conservator and buchholz relay which shall operate for isolating the conservator during abnormal flow of oil due to rupture / explosion of tank or bursting of bushing. The valve shall not isolate conservator during normal flow of oil during filtration or filling or refilling. Locking plates shall be provided with handle for pad locking. It shall have proximity switch for remote alarm and indication glass window for visual inspection for physical checking of the status of valve. The TCIV shall be of the best quality and proven design as malfunctioning of TCIV could lead to serious consequences.

17.3.4 Fire Detector

Adequate number of fire detectors shall be fitted on top cover of the transformer and OLTC with brackets. Heat sensing temperature of the fire detectors shall be 141°C.

17.3.5 Signal Box

Signal box shall be mounted way from the transformer preferably near the marshalling box for terminating the cables from TCIV & fire detectors and to further connection to control box at the MCR. The degree of protection of the signal box shall be IP 55 or better.

17.3.6 Cables

The interconnecting cables shall be Fire Retardant Low Smoke (FRLS) type. Cables passing along the top of the transformer shall be Fire Survival type.

17.3.7 Pipes

Heavy duty pipe connecting the transformer tank for oil drain and for nitrogen injection shall be provided. Pipes, complete with supports, connections, flanges, bends and tees etc. shall be supplied along with the system.

17.3.8 Other Items

(i) Doors and covers of all the panels (FEC, Control box, Signal box, etc.) shall be provided with neoprene gaskets.

(ii) All the panels and piping system shall be painted with enamelled paint.

17.4 Protection Philosophy

17.4.1 The NIFPS shall have the operating modes and operate on receipt of corresponding activation signals.

17.4.1.1 Auto Mode

A. Fire Prevention

The system shall operate on receipt of all the following three signals.

(i) Differential relay trip

(ii) Operation of Buchholz relay (OR) Pressure Relief Device (OR) Rapid Pressure Rise Relay

(iii) Master trip (OR) Tripping of LV / HV circuit breaker in series

B. Fire Extinction

The system shall operate on receipt of all the following three signals.

(i) Operation of fire detector

(ii) Operation of Buchholz relay (OR) Pressure Relief Device (OR) Rapid Pressure Rise Relay (OR) Oil Surge Relay

(iii) Master trip (OR) Tripping of LV / HV circuit breaker in series

17.4.1.2 Remote Manual Mode

The system shall operate on receipt of both the following signals.

(i) Master trip (OR) Tripping of LV / HV circuit breaker in series

(ii) Operation of emergency operating switch on the control box

17.4.1.3 Local Manual Mode

In case the system fails in Auto Mode / Local Remote Mode (OR) Power Failure, the system can be operated manually from the Fire Extinguisher Cubicle.

17.4.2 On receipt of all required activating signals, the system shall drain pre-determined volume of oil from top of the tank through outlet valve to reduce tank pressure and simultaneously inject nitrogen gas at high pressure through inlet valves for stirring the oil and thus bringing the temperature of oil below flash point to extinguish the fire. Transformer conservator isolation valve shall block the flow of oil from conservator tank.

18 Control and Relay Panel

18.1 Standards and Codes

All equipment provided under Control and Relay Panel shall comply with latest editions and amendments of the relevant IEC standards and IS codes. In particular, the C&R Panel shall comply with the following standards and codes.

Standard/Code	Description
IS 3231	Electrical relays for power systems protection
IEC 60255	Measuring relays and protection equipment
IEC 61850	Communication networks and systems for power utility automation
IEC 61131-3	Programmable controllers - Part 3: Programming languages
IS 9385	High voltage fuses
IS 9431	Indoor post insulators of organic material for systems with nominal voltages greater than 1000 V up to and including 300 kV
IEC 60099-4	Surge arresters - Part 4: Metal-oxide surge arresters without gaps for A.C. systems
IS 3070-3	Lightning Arresters for Alternating Current Systems - Part 3: Metal Oxide Lightning Arresters Without Gaps
IEC 62052-11	Electricity metering equipment (A.C.) - General requirements, tests and test conditions - Part 11: Metering equipment
IEC 62053	Electricity metering equipment (A.C.) - Particular requirements
IS 14697	AC Static Transformer Operated Watthour and Var-hour Meters, Class 0.2S and 0.5S

18.2 Construction

18.2.1 The control and relay panel shall be free standing, floor mounted, simplex type, metal enclosed construction. The panel enclosure shall be made of CRCA steel sheet. The thickness of load bearing members shall be minimum 3 mm and that of non-load bearing members shall be minimum 2 mm.

18.2.2 All external surface shall be painted with two coats of epoxy-based paint of colour shade RAL 7032. Internal surface shall be painted with epoxy enamel white paint. The minimum dry film thickness (DFT) shall be 100 micron.

18.2.3 Controls, indications, relays, meters and other instruments shall be flush mounted on the front of the panel. Door shall be provided at the rear of the panel. All doors and

removable covers shall be provided with neoprene or synthetic rubber gasket.

18.2.4 The panel shall be dust, moisture and vermin proof with degree of protection not less than IP 4X as per IEC 60529.

18.2.5 Cable entry shall be through the bottom of the panel. Gland plate of thickness not less than 3 mm shall be provided.

18.3 Relays

18.3.1 All relays shall be microprocessor based numerical type. However, auxiliary relays can be static or electromechanical type. The relays shall be flush mounted on panel front with connections from the inside.

18.3.2 All relays shall be capable of operating continuously between 80 – 120% of auxiliary voltage.

18.3.3 All numerical relays shall have adequate number of freely configurable, optically isolated, Binary Inputs (BI) and potential free Binary Outputs (BO). All I/O's shall have galvanic isolation. Analog inputs shall be protected against switching surges and harmonics.

18.3.4 All numerical relays shall have sufficient number of current and voltage inputs required for all the required protection functions.

18.3.5 The numerical relay shall provide choice of ANSI/IEC/IEEE relay characteristic curves with wide protection setting ranges through a minimum of two protection setting groups.

18.3.6 Making, breaking and continuous capacity of the relay contacts shall be adequate enough for the circuits in which they are used.

18.3.7 All numerical relays shall have provision for measurement and storage of electrical parameters such as voltage, current, frequency, active power, reactive power etc.

18.3.8 The numerical relay shall be able to record faults and events in non-volatile memory.

(i) Fault record – At least 5 recent faults including the protection function operated, operating phase(s), voltages and currents along with date and time stamp.

(ii) Event record – At least 200 events with date and time stamp.

18.3.9 The numerical relay shall have trip circuit supervision facility to monitor the circuit breaker trip circuit both in pre-trip and post-trip conditions. The relay shall also be able to provide circuit breaker monitoring, CT and VT supervision.

18.3.10 The numerical relay shall have self-diagnostic feature with separate output contact for indication of any internal relay failure.

18.3.11 The numerical relay shall have two serial communication ports, one on front side for

local communication with PC and another on rear side for remote communication with SCADA system as per IEC 61850.

18.3.12 The numerical relay shall have feature for time synchronization through the SCADA System / networking.

18.3.13 The numerical relay shall be provided with backlit alphanumeric LCD or LED to access protection settings, measurement parameters, fault and event records. Read and write access to protection settings shall be password protected.

18.3.14 Necessary software and hardware to up/down load the data to/from the relay from/to the PC shall also be provided.

18.4 Protection Scheme

The following protection schemes shall be implemented for the protection of power transformer and its feeder.

(i) Biased Differential Protection with Second Harmonic Restraint
(ii) Non-directional Over Current and Earth Fault Protection
(iii) Restricted Earth Fault Protection
(iv) Under Voltage and Over Voltage Protection
(v) Buchholz Alarm and Trip
(vi) OTI Alarm and Trip
(vii) WTI Alarm and Trip
(viii) PRV Trip
(ix) MOG Alarm
(x) OSR Trip

The above-mentioned protection schemes are indicative only. All the protection schemes required for safe and reliable operation of power transformer and the feeder shall be provided.

18.5 Measuring Instruments

18.5.1 All measuring instruments shall be enclosed in dust proof, moisture resistant cases and flush mounted on the panel.

18.5.2 Analog Ammeter and Voltmeter with selector switch shall be provided. Accuracy class shall be 0.5 or better. Instrument dial shall be with white scale, black pointer and black numerals.

18.5.3 Digital Multi Function Meter (MFM) of accuracy class 0.2 or better shall be provided. It shall have communication capability for integration with SCADA. MFM shall be able

to measure line & phase voltages, line & phase currents, active power, reactive power, apparent power, power factor and frequency.

18.6 Control Switches

All control switches shall be rotary operated type with adequate making, carrying and breaking current ratings. The control switches shall be pistol grip type, lockable with spring return to normal position. They shall be flush mounted on the panel with shrouded terminals.

18.7 Indications

All indicating lamps shall be flush mounted LED type with supply voltage of 110 VDC. Lamp covers shall preferably be screwed type and moulded from heat resisting material. Indicating lamps shall be provided for R, Y, B PT supply, Breaker ON & OFF, Auto trip, Spring charged, Trip circuit healthy, etc.

18.8 Annunciation

Flush mounted static type annunciator with sufficient number of windows to accommodate all trip and alarm signals shall be provided. Separate audible annunciation for alarm and trip shall be provided by means of buzzer and hooter. Visual annunciation shall be by flickering of facia. Push buttons for test, accept and reset shall also be provided.

18.9 Earthing

18.9.1 An earth bus made of copper or aluminium shall be provided throughout the length of the panel and bolted to the framework of the panel. The earth bus shall have sufficient cross section to carry maximum fault current without exceeding the allowable temperature rise.

18.9.2 All non-current carrying conductors of the panel shall be connected to the earth bus. All joints to the earth bus shall be made through at least two bolts. Hinged doors shall be earthed through flexible earthing braid of adequate cross section. Suitable provision shall be provided at each end of the earth bus for connection with earth grid.

18.9.3 All metallic cases of relays, instruments and other panel mounted equipment shall be connected to earth bus by independent copper wires of size not less than 2.5 sq. mm with green colour insulation.

18.9.4 Instrument transformer secondary neutral point shall be earthed at one place only on the terminal block. Such earthing shall be made through links so that earthing of one

circuit may be removed without disturbing the earthing of other circuits.

18.10 Mimic Diagram

Coloured mimic diagram made of metal or plastic with symbols to facilitate exact representation of the system shall be fixed on the front of control panel. Semaphore indicators shall be incorporated in the mimic diagram for indicating position of circuit breakers, isolators and earthing switches. The rated control voltage of semaphore indicator shall be 110 / 220 VDC.

18.11 Wiring and Terminal Blocks

18.11.1 All internal wiring shall be done with 1100 V grade, 2.5 sq.mm. PVC insulated stranded flexible copper wire. For CT secondary circuits, 4 sq.mm copper wire shall be used.

18.11.2 Wire terminations shall be made with solderless crimping type tinned copper lugs, which shall firmly grip the conductor. Insulation sleeves shall be provided at all the wire terminations.

18.11.3 Printed identification ferrules, marked to correspond with panel wiring diagram shall be provided at both ends of each wire. The ferrules shall be firmly located on each wire so that they cannot move or turn freely on the wire. Wire identification shall be done in accordance with IS 11353.

18.11.4 The Contractor shall be solely responsible for the completeness and correctness of the internal wiring and for the proper functioning of the connected equipment.

18.11.5 All internal wiring to be connected to the external equipment shall terminate on terminal blocks. Terminal blocks shall be rated for 1100 V, 10 A and made of non-inflammable material.

18.11.6 CT and VT secondary circuits shall be terminated on stud type, non-disconnecting terminal blocks.

18.11.7 At least 10% spare terminals shall be provided on each panel and these spare terminals shall be distributed on all terminal blocks.

18.11.8 Screw driver operated stud type test terminal block shall be provided.

18.12 Accessories

(i) Thermostatically controlled space heater with switch for isolation

(ii) 240 V, 15 A industrial socket with ON/OFF switch

(iii) LED lamp controlled by door switch

18.13 Warranty

The control and relay panel unit shall be warranted for minimum of 5 (five) years against all material/ manufacturing defects and workmanship.

18.14 Testing and Inspection

18.14.1 Type Tests

The Contractor shall submit type test report of the panel for degree of protection as required by the Technical Specifications as per IEC 60529. The test should have been conducted by NABL accredited laboratory.

18.14.2 Routine Tests

Routine tests and acceptance tests shall be as per the Quality Assurance Plan (QAP) approved by the Employer.

19 132 kV Switchyard Equipment

19.1 Standards and Codes

All equipment provided shall comply with latest editions and amendments of the relevant IEC standards and IS codes. In particular, the switchyard equipment shall comply with the following standards and codes.

Standard/Code	Description
IS/IEC 62271-100	High Voltage Switchgear and Control gear - Part 100: AC Circuit Breakers
IEC 60376, IS 13072	Specification of technical grade sulfur hexafluoride (SF6) for use in electrical equipment
IS/IEC 62271-102	High Voltage Switchgear and Control gear - Part 102: AC Disconnectors and Earthing Switches
IEC 61869	Instrument Transformers
IS 2099	Bushings for alternating voltages above 1000 Volts
IS 2544	Porcelain post insulators for systems with nominal voltage greater than 1000 Volts
IS 335, IEC 60296	Insulating oil
IS/IEC 60034	Rotating electrical machines
IS 996	Single-phase AC industrial motors for general purpose
IS 3070, IEC 60099-4	Surge arresters - Part 4: Metal-oxide surge arresters without gaps for A.C. systems
Indian Electricity Act, CBIP manual, CEA rules and guidelines	

19.2 General Technical Parameters

System Parameters	Specification
Highest system voltage	145 kV
Rated system voltage	132 kV
Rated frequency	50 Hz
Number of phases	3
Power frequency withstand voltage I. To earth II. Across Isolating distance	 275 kV (rms) 315 kV (rms)
Lightning impulse withstand voltage I. To earth II. Across Isolating distance	 650 kV (peak) 750 kV (peak)
System fault current	As per system requirement
Minimum Creepage distance	25 mm/kV of highest system voltage
System neutral earthing	Effectively earthed

19.3 Circuit breaker

19.3.1 Technical parameters

Parameters	Specification
Type	Outdoor SF6
Operating duty cycle	O – 0.3sec – CO – 3min – CO
Short circuit breaking current	As per system requirement
Short circuit making current	2.5 times of Short circuit breaking current
Rated break time	100ms
Re-strike performance class	C2
Mechanical endurance class	M1
First pole to clear factor	1.5 (As per IEC 62271 – 100)
Reclosing	Three phase high speed auto reclosing
Auxiliary contacts	As required plus 4NO and 4NC contacts per pole as spare. The contacts shall have continuous rating of 10A and breaking capacity of 2A with circuit time constant of minimum 20 milliseconds at 220V DC

19.3.2 Circuit breakers shall be of SF6 type. It shall comprise of three separate identical single pole units operated through the common shaft and shall be fully interchangeable both electrically and mechanically.

19.3.3 The circuit breaker operating mechanism shall be based on motor operated spring charging and it shall be re-strike free, trip free both electrically and mechanically, with anti-pumping feature.

19.3.4 Circuit breaker shall be provided with two independent set of trip circuit connected to separate fuse or MCB controlled DC supplies for greater reliability.

19.3.5 The rated control voltage of the spring charging motor shall be 110 VDC/230 VAC. Closing coil shall operate at all values of voltages between 85% and 110% of rated voltage. Opening coil shall operate correctly under all operating conditions of the circuit breaker up to the rated breaking capacity and at all values of supply voltage between 70% and 110% of rated voltage.

19.3.6 The spring charging motor shall have adequate thermal rating such that continuous sequence of the closing and opening operations is possible as long as power supply is available to the motor. It shall also be possible to charge the spring manually and close the breaker in the event of failure of motor / control supply to motor. Operating handle shall be provided for charging the operating mechanism. After failure of control supply to the motor, one open-close-open operation shall be possible with the energy contained in the operating mechanism.

19.3.7 The motor rating shall be such that it requires not more than 30 seconds for full charging of the closing spring. Closing action of the circuit breaker shall compress the opening spring ready for tripping. When closing springs are discharged after closing the breaker, they shall be automatically charged for the next operation.

19.3.8 Temperature compensated SF6 gas density monitor and pressure switches along with pressure indicator shall be provided to monitor and regulate the density of SF6 gas in breaker respectively in each pole. It shall be possible to dismantle the monitor without any seepage of SF6 gas.

19.3.9 Interrupter assembly shall be provided with an absorbing product box to eliminate moisture and SF6 decomposition products.

19.3.10 10% of total SF6 gas requirement shall be supplied in separate container as spare in addition to the required SF6 gas to fill the breaker installed at site.

19.3.11 Mechanical indicators shall be provided to indicate OPEN/CLOSED positions of the circuit breaker and CHARGED/ DISCHARGED positions of the closing spring. An operation analyzer shall be provided to record contact travel against time and measure opening time. These indicators and counter shall be visible from the panel front door without opening it.

19.3.12 Control cabinet shall be free standing, floor mounted, single front, metal enclosed construction. It shall be constructed with CRCA steel/Aluzinc sheet. The thickness of load bearing members shall be minimum 3 mm and that of non-load bearing members shall be minimum 2 mm. All external surface shall be painted with two coats of epoxy-based paint of color shade RAL 7032. Internal surface shall be painted with epoxy enamel white paint. The minimum dry film thickness (DFT) shall be 100 microns. Degree of protection shall not be less than IP5X.

19.3.13 Control cabinet shall be provided with thermostatically controlled space heaters to prevent condensation within the compartment. The space heater shall be connected to 240 V, 50 Hz, single phase AC supply through suitable switch and fuse. It shall also be provided with LED lamp rated for 240 V, 50 Hz, single phase AC supply for interior illumination controlled by door switch and a 240 V, 15 A, SPN industrial socket-outlet with ON/OFF switch.

19.3.14 The bidder shall furnish complete literature regarding assembly, maintenance and charging procedures as applicable to SF6 breakers.

19.4 Isolator

19.4.1 Technical parameters

System Parameters	**Specification**
Service	Outdoor
Type of Isolator	Mechanically gang operated, Double break or centre break with earthing switch
Operating Mechanism a) Isolator b) Earth switch	 Motor Manual
Auxiliary contacts	As required plus 4NO and 4NC contacts per pole as spare for isolator and earth switch each.
Short time current	As per system requirement
Safe duration of over load a) 150% of rated current b) 120% of rated current	 5 minutes 30 minutes

19.4.2 Isolators shall be outdoor type with blades rotating in horizontal plane, suitable for electrical as well as manual operation and local/remote operation.

19.4.3 Isolator and earth switch shall be capable of withstanding dynamic and thermal effects of system fault current in closed position and should not open under influence of fault current and wind pressure together.

19.4.4 Isolator shall be provided with heavy duty, self-aligning, high pressure current

carrying contacts and moving blades made up of highly conductive, corrosion resistant, hard drawing electrolytic copper alloy. Copper contacts shall be silver-plated with minimum 25-micron thickness.

19.4.5 Arcing horns on the fixed and moving contacts, if required shall be of 'make before and break after' type.

19.4.6 Each single pole of isolator shall be provided with suitable galvanized steel base channels with holes and designed for mounting on a lattice supporting structure. The bas shall be rigid and self-supporting.

19.4.7 Operating mechanism for isolator and earth switch shall provide quick, simple and effective operation and shall be provide on opposite ends.

19.4.8 Control cabinet/operating mechanism box shall be constructed with CRCA steel/Aluzinc sheet of minimum 3 mm thickness. All external surface shall be painted with two coats of epoxy-based paint of colour shade RAL 7032. Internal surface shall be painted with epoxy enamel white paint. The minimum dry film thickness (DFT) shall be 100 microns. Degree of protection shall not be less than IP5X. It shall be provided with thermostatically controlled space heaters to prevent condensation within the compartment, LED lamp for interior illumination controlled by door switch and an industrial socket-outlet with ON/OFF switch.

19.4.9 Support insulators for Isolator and earth switch shall be solid core type made up of homogenous and vitreous porcelain.

19.4.10 Mechanical indicators shall be provided to indicate OPEN/CLOSED position of the isolator.

19.4.11 Following fail safe type electrical and mechanical interlocks are required between Isolator & earthing switch and Isolator & circuit breaker:

(i) Prevention of opening of isolators on load.

(ii) Prevention of closing of earth switch, when line isolator is closed.

(iii) Prevention of closing of line isolator, when earth-switch is closed.

(iv) Prevention of opening of isolator, when circuit breaker is closed and vice versa.

(v) Provision shall be made for pad locking the mechanism of isolator and earthing switches in both, the 'close' and 'open' position.

19.5 <u>Instrument transformer</u>

19.5.1 Technical parameters

Parameter	Specification
Current Transformer	

Accuracy class	0.2S for metering 5P20 for protection
Rated VA burden	As per requirement
Insulation class	Class E
Rated Short time thermal rating	As per system requirement
Rated short time dynamic rating	80kA
Partial discharge level	10 Pico Coulomb maximum
No. of terminals in Terminal box	As required plus 10 terminals as spare
Voltage Transformer	
Accuracy class	0.2 for metering 3P for protection
Rated VA burden	As per requirement
Insulation class	Class E
Standard reference range of frequencies for which the accuracies are valid	96% to 102% for protection and 99% to 101% for measurement
Partial discharge level	10 Pico Coulomb maximum
Rated voltage factor	1.2 continuous and 1.5 for 30 sec.
No. of terminals in Terminal box	As required plus 10 terminals as spare

19.5.2 Instrument transformers shall be dead tank type, hermetically sealed single-phase units, oil immersed, self-cooled suitable for outdoor installations and shall be supplied with common marshalling box for a set of three single phase units.

19.5.3 Polarity marks shall indelibly be marked on each instrument transformer and at the lead terminals at the associated terminal block.

19.5.4 The insulators shall have cantilever strength of more than 600 kgf.

19.5.5 Secondary terminals of instrument transformer shall be brought outside in a terminal box constructed with CRCA steel/Aluzinc sheet of minimum 3 mm thickness. All external surface shall be painted with two coats of epoxy-based paint of colour shade RAL 7032. Internal surface shall be painted with epoxy enamel white paint. The minimum dry film thickness (DFT) shall be 100 microns. Degree of protection shall not be less than IP5X. It shall be provided with thermostatically controlled space heaters to prevent condensation within the compartment, LED lamp for interior illumination controlled by door switch and an industrial socket-outlet with ON/OFF switch.

19.5.6 CTs shall be suitable for high speed auto reclosing.

19.5.7 HRC fuses of suitable rating shall be provided on primary side of voltage transformers. For secondary side, four pole Miniature Circuit Breakers (MCB) shall be provided.

19.5.8 Wiring and Terminal blocks of instrument transformers

19.5.8.1 All internal wiring shall be done with 650 V grade, 1.5 sq.mm. PVC insulated stranded flexible copper wire. For CT secondary circuits, 2.5 sq.mm copper wire shall be used.

19.5.8.2 Wire terminations shall be made with solderless crimping type tinned copper lugs, which shall firmly grip the conductor. Insulation sleeves shall be provided at all the wire terminations.

19.5.8.3 Printed identification ferrules, marked to correspond with panel wiring diagram shall be provided at both ends of each wire. The ferrules shall be firmly located on each wire so that they cannot move or turn freely on the wire. Wire identification shall be done in accordance with IS 11353.

19.5.8.4 The Contractor shall be solely responsible for the completeness and correctness of the internal wiring and for the proper functioning of the connected equipment.

19.5.8.5 All internal wiring to be connected to the external equipment shall terminate on terminal blocks. Terminal blocks shall be rated for 650 V, 10 A and made of non-inflammable material.

19.5.8.6 CT and VT secondary circuits shall be terminated on stud type, non-disconnecting terminal blocks.

19.5.8.7 At least 10% spare terminals shall be provided on each panel and these spare terminals shall be distributed on all terminal blocks.

19.6 Warranty

All switchyard equipment shall be warranted for minimum of 5 (five) years against all material/ manufacturing defects and workmanship.

19.7 Testing and Inspection

19.7.1 Type Tests

All switchyard equipment shall be of type tested design. Type test reports as per the relevant IEC/IS standards shall be submitted during detailed engineering. The tests should have been conducted on the similar equipment by NABL accredited laboratory. In case the contractor is not able to submit the test reports during detailed engineering, the contractor shall submit the reports of type/special tests either conducted by NABL accredited laboratory or witnessed by Employer.

19.7.2 Routine Tests

Routine tests and acceptance tests shall be as per the Quality Assurance Plan (QAP) approved by the Employer.

20 Illumination

20.1 Standards and Codes

LED luminaires shall be tested at independent laboratory as per the following test standards.

Standard/Code	Description
LM79-08	Electrical and Photometric Measurements of Solid-State Lighting Products
LM 80-15	Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays and Modules

20.2 General specification

20.2.1 This specification covers design, supply and installation of uniformly Illumination system along the peripheral & internal roads, main control room & inverter rooms, switchyard and other facilities including entry points/gate(s) inside the plant area.

20.2.2 The Contractor shall furnish Guaranteed Technical Particulars of the LED luminaires, from renowned brands available in the market for approval of Employer.

20.2.3 Lighting system shall work on the auxiliary supply and same shall be incorporated in auxiliary loads. The Contractor shall provide minimum 20% of total lighting points as emergency lighting points, fed from UPS DB or DCDB as per scheme adopted by the Contractor. Indoor and outdoor emergency lights shall be provided at each inverter room, main control room, security room and main gate.

20.3 Lighting Levels

20.3.1 The average LUX level of 10 lm is to be maintained in switchyard. However, a lux level of 20 lm ((10+10) additional switchable on requirement only) is to be maintained in switchyard on transformer.

20.3.2 The lighting system for outdoor and indoor areas of solar power plant shall be designed in such a way that uniform illumination is achieved. Average LUX level to be maintained in different areas shall be as under:

Area	LUX
Control Room and equipment rooms	300

Office	300
Battery & other rooms	150
Internal/Periphery Roads	4
Transformer yard/Switchyard	20
H – pole and metering point	10

20.3.3 The lighting level shall take into account appropriate light output ratio of luminaires, coefficient of utilization maintenance factor (of 0.7 or less) to take into account deterioration with time and dust deposition and illuminance uniformity [Uo] shall be min 0.3.

20.4 LED Luminaire for Outdoor Applications

20.4.1 LED luminaires shall meet the following parameters.

Parameter	**Specified Value**
Input voltage	170 - 260 V
Input Frequency	50 Hz +/-1 Hz
Power Factor	0.90 (Minimum)
Luminaire efficacy	> 90 lumens per watt
Beam Angle	Minimum 120°
Total Harmonic Distortion	< 10 %
Working Humidity	10% - 90% RH (Preferably Hermetically sealed unit)
Degree of Protection	Minimum IP 65 (for Outdoor fixtures)
Luminaire Casing	Powder coated metal / Aluminium.
Colour Temperature	5700 K (cool day light)
Colour Rendering Index	> 65
Moisture protection in case of casing damage	IP 65 (driver unit shall preferably be totally encapsulated)

20.4.2 The LED luminaire (outdoor) housing, heat sink, pole mounting bracket, individual LED reflectors and front heat resistant tempered glass should be provided.

20.4.3 The LED luminaire (outdoor) housing should be made of non-corrosive, high-pressure, die-cast aluminium and the housing should be power coated grey, so as to ensure good weatherability. Each individual LED source should be provided with an asymmetrical distribution high reflectance aluminized reflector, which should ensure that the light distribution of the luminaire is suitable for road lighting applications (wide beam distribution) and should ensure high pole to pole spacing.

20.4.4 The luminaire should be provided with in-built power unit and electronic driver.

20.4.5 The luminaire should be suitable for standard street light poles and should be suitable for side entry and bottom entry (post top).

20.4.6 GI Lighting pole of suitable diameter capable of withstanding system and wind load, shall be provided with average Zn coating thickness of 80micron. The street light poles shall have loop in loop out arrangement for cable entry and light fixture / wiring protected with suitably rated MCB.

20.4.7 All outdoor lighting system shall be automatically controlled by synchronous timer or photocell. Provision to bypass the timer or photocell shall be provided in the panel.

20.4.8 Lighting panels shall be earthed by two separate and distinct connections with earthing system. Switch boxes, junction boxes, lighting fixtures, etc. shall be earthed by means of separate earth continuity conductor. Cable armour shall be connected to earthing system at both the ends. Proper earthing of street light poles shall be ensured.

20.4.9 Junction box for lighting shall be made of fire retardant material. The degree of protection shall be IP55 for outdoor JB.

20.4.10 Lighting cables, wherever exposed to direct sunlight, shall be laid through Double Wall Corrugated (DWC) HDPE conduits.

20.5 LED Luminaire/Lamps for Indoor Applications

20.5.1 LED luminaire/lamps shall have minimum 3-star BEE rating.

20.5.2 All indoor LED luminaire/lamps shall be supplied with proper diffuser to avoid direct visibility of LED and suitable heat sink for longer life.

20.6 Warranty

All luminaires shall be warranted against all material/ manufacturing defects and workmanship for minimum of 2 (two) years from the date of supply.

21 Weather Monitoring System

As a part of weather monitoring system, the Contractor shall provide the following measuring instruments with all necessary software and hardware required to integrate with SCADA.

21.1 Pyranometer

21.1.1 The Contractor shall provide minimum 6 (six) number of secondary standard pyranometers (ISO 9060 classification) along with necessary accessories, two numbers each for measuring the incidental solar radiation at horizontal, inclined plane of array and albedo at each site.

21.1.2 Specification of the pyranometer shall be as follows.

Parameter	Specification
Spectral Response	0.31 to 2.8 micron
Time response (95%)	Maximum 15s
Nonlinearity	±0.5%
Temperature Response	±2%
Tilt error	<±0.5%
Zero offset thermal radiation	±7 W/m^2
Zero offset temperature change	±2 W/m^2
Operating temperature range	0°C to +80°C
Non-stability	Maximum ±0.8%
Resolution	Minimum +/- 1W/m^2
Output	Analog output: 4 – 20 mA Serial output: RS485

21.1.3 Each instrument shall be supplied with necessary cables. Calibration certificate with calibration traceability to World Radiation Reference (WRR) or World Radiation Centre (WRC) shall be furnished along with the equipment. The signal cable length shall not exceed 20m. The Contractor shall provide instrument manual in hard and soft form.

21.1.4 Downward facing pyranometer to measure albedo shall be mounted at least 2 m above uniform surface. To avoid reflections, masts/mounting pole shall be painted with black, non-reflective paint. To minimize shading, the pyranometer shall be mounted on boom (minimum length 1 m) extending towards the equator.

21.2 Temperature Sensor

The Contractor shall provide minimum 3 (three) temperature sensors (1 (one) for ambient temperature measurement with shielding case and 2 (two) for module temperature measurement) at each site. The temperature sensor shall be Resistance Temperature Detector (RTD)/ Semiconductor type with measurement range of 0°C to 80°C. The instrument shall have valid calibration certificate.

21.3 Anemometer

Contractor shall provide minimum one no. ultrasonic wind sensor (no moving parts) for wind speed and direction monitoring.

Parameter	Specification

Velocity range with accuracy limit	0-60m/s with +/-2% accuracy @12 m/s; Resolution: 0.01m/s
Wind direction range with accuracy limit	0 to 360° (No dead band) with +/-2° accuracy @12 m/s; Resolution: 1°
Mounting Bracket	Anodized Aluminium bracket to reduce corrosion, all mounting bolts of SS
Protection Class	IP66
Output	RS232 and RS485

21.4 Data logger and Data Acquisition System

Data logger for the weather monitoring station should have the following features:

21.4.1 Provision for analog, digital and counter type inputs for interfacing with various type of sensors

(i) Analog Input

- Adequate nos. for all analog sensors with redundancy
- Provision for operation in different current and voltage ranges as per connected sensors
- Accuracy of +/-0.1% of FS

(ii) Digital Inputs

- Adequate no. of Digital inputs and outputs for the application

(iii) Provision for RS232 and RS485 serial outputs

(iv) Built-in battery backup

(v) Connectivity and Data transmission:

- RS485 MODBUS interface for data collection and storage on SCADA
- Web interface with provision for user login to enable viewing and downloading of weather data in XLS/ CSV format
- Communication protocol should support fast data transmission rates, enable operation in different Frequency bands and have an encryption-based data security layer for secure data transmission

(vi) Display Settings: Graphic LCD screen which should be easily accessible and should display relevant details like all sensor values, battery strength, network strength etc.

(vii) Provision of Time synchronization from telecom time or server time

(viii) Data Storage: Provision for at least 2 MB internal Flash Memory and at least 8 GB Micro SD card (expandable)

(ix) Protection level: IP65

22 CCTV Camera

22.1 CCTV Cameras along with monitoring stations (sufficient numbers) and all other accessories required for its proper operation must be installed to have complete coverage of following areas for 24 hours.

(i) Main entry: Covering all the entry/exit

(ii) Along the Plant Perimeter: Covering complete perimeter of Plant Area to capture all possible intrusion

(iii) Control Rooms: Covering Entry/Exit and Equipment Rooms

(iv) Switchyard

22.2 Monitoring stations of the CCTV Network shall be installed in Main Control Room.

22.3 The CCTV system shall be designed as a standalone IP based network architecture. System shall use video signals from different cameras at defined locations, process the video signals for viewing on monitors at control room and simultaneously record all video streams using latest compression techniques.

22.4 Camera shall be colour, suitable for day and night surveillance (even under complete darkness) and network compatible.

22.5 It shall be possible to control all cameras i.e., PTZ auto/ manual focus, selection of pre-sets, video tour selection etc. The software shall support flexible 1/2/4 windows split screen display mode or scroll mode on the display monitor for live video.

22.6 The system shall support video analytics in respect of the following:

(i) Video motion detection

(ii) Object tracking

(iii) Object classification

(iv) Camera server shall be provided with sufficient storage space to storage recordings of all cameras at HD mode for a period of 15 days. All recordings shall have camera ID, location, date and time of recording.

23 Fire Alarm System

23.1 Standards and Codes

Standard/Code	Description

IS 2189	Selection, Installation and Maintenance of Automatic Fire Detection and Alarm System Code of Practice
IS 2171	Portable Fire Extinguishers, Dry Powder (Cartridge Type)
IS 8149	Functional requirements for twin CO_2 fire extinguishers (trolley mounted)
IS 2546	Galvanized mild steel fire bucket
National Building code 2016	

23.2 Contractor shall ensure the compliance of fire detection and alarm system as per relevant standards and regulations. The installation shall meet all applicable statutory requirements and safety regulations of state/central fire department/body or any other competent authority in terms of fire protection.

23.3 Firefighting system for the proposed power plant for fire protection shall be consisting of but not limited to:

(i) Sand buckets
(ii) Portable fire extinguishers (CO_2 and dry powder type)
(iii) Microprocessor based fire alarm panel
(iv) Multi sensor smoke detectors
(v) Hooter cum strobe
(vi) Manual call points
(vii) Cables from sensor to fire Panel.

23.4 Minimum two numbers of fire extinguishers (CO_2 and Foam type each, of capacity 10 kg having BIS certification marking as per IS: 2171) shall be provided at every building/ encloser, transformer yard and switchyard. However, contractor must comply with existing building code for fire protection and relevant IS codes.

23.5 Four numbers of stand with four sand buckets on each stand shall be provided in the Transformer Yard. Sand buckets inside the building shall be provided at strategic locations as decided during detailed engineering.

23.6 Digital output from the fire detection system shall be integrated with SCADA

23.7 Contractor shall submit the plan for fire and smoke detection system for the Employer's approval.

24 Testing Instruments

The Contractor shall provide the following set of instruments for on-site testing.

24.1 Earth resistance tester

Parameter	Specification
Display	Backlit LCD or LED display
Range	Earth Resistance: up to 2000 Ω Earth Voltage: 200 V
Accuracy	± (2% + 5)
Safety Ratings	IP 56
Programmable Limits setting	Enabled
Accessories	
Earth Ground Stakes (4 Nos)	
Three cable reels with cable length up to 20 m	
Carry Case-1 (capable of handling tester along with accessories)	
1 set of spare battery	

24.2 Array tester

Parameter	Specification
Display	Backlit LCD or LED display
Functionality	All electrical tests required by IEC 62446-1:2016
Memory	Up to 200 records & USB downloadable to Computer
Accessories	
A set of two, 4mm fused leads for extra protection during installation tests.	
Leads which enable the array tester to connect directly to PV arrays	
1 set of spare battery	

24.3 Insulation tester

Parameter	Specification
Display	Backlit LCD or LED display
Insulation Test Range	0.1 MΩ to 10 GΩ
Test Voltage	250V, 500V, 1000V, 5000V
Test Voltage accuracy	+20% on positive side only no negative variation is allowed
Insulation Test Current	1 mA nominal
Auto Discharge	Discharge time< 0.5 Second for C = 1

Open Circuit test Voltage	>4 V, <8 V
Accessories	
Heavy duty Test Lead Set – 4 Nos.	
Carry Case with sufficient space for accommodating accessories.	

24.4 Digital Multimeter

Parameter	**Specification**
Display	Backlit LCD or LED display; Minimum resolution: 5 ¾ places for DC, 4 ¾ places for AC
Measuring Category	1000V CAT III as per IEC Standard 61010-1; wave shape independent RMS measurement (True RMS) suitable for operation in the site conditions.
Additional Functions	Resistance (Ω), Temperature (°C), Continuity, Diode, Capacitance, Frequency, Duty cycle measurement
Accessories	
Temperature Probe	
Silicon Test Lead	
Alligator Clip	
Carry Case with sufficient space for accommodating accessories.	

24.5 Clamp meter

Parameter	**Specification**
Display	Backlit LCD or LED display
Measuring Category	1000V CAT III as per IEC Standard 61010-1; wave shape independent RMS measurement (True RMS) suitable for operation in the site conditions.
Current Range	AC&DC Current up to 1000A/400 A
Voltage range	AC&DC Voltage upto 1000V
Additional Functions	Resistance, continuity, diode and non-contact voltage detection, Active, Reactive and Apparent Power, THD, PF
Accessories	
Test leads	

Electrical test leads
Probe light & extender
Carry Case with sufficient space for accommodating accessories.

24.6 Infra-red thermal imaging camera

Parameter	Specification
Spectral response	8 µm to 14 µm (LW)
Temperature-sensitivity and calibration range	–20 °C to +120 °C
Atmospheric air temperature	-10 °C to +40 °C
Thermal sensitivity	NETD ≤ 0.1 K at 30 °C
Geometric resolution	640 x 480 pixels
Photo camera resolution	Approx. 30 times of IR camera resolution
Absolute error of measurement	< ± 2 K
Adjustable parameters	Emissivity, ambient temperature
Adjustable functions	Focus, temperature level and span
Measurement functions	Measuring spot, measuring area with average and maximum temperature
Calibration	The measuring system (Camera, lens, aperture and filter): The camera has to be traceably calibrated at least every two years. The calibration has to be documented. If the camera is not compliant, it has to be readjusted by the manufacturer.
Documentation	Storing of the infrared picture with the radiometric data

24.7 Digital lux meter

Parameter	Specification
Range	0 – 1000 lux
Accuracy	± (2% + 5)
Resolution	1 lux
Display	3½ digits, Backlit LCD/LED

24.8 All testing equipment shall possess valid calibration certificate issued from approved NABL labs.

24.9 Instruments of superior rating is allowed after seeking consent of the Employer.

24.10 Maintenance, calibration, up keeping, repair & replacement of these tools will be in the scope of the Contractor under the O&M Contract.

24.11 It is Contractor's responsibility to arrange for tools, tackles, logistics, test kits, manpower, experts etc. required for trouble free operation of Plant.

25 Power evacuation system

25.1 The contractor has to do the power evacuation and integration to and with the designated substation via either overhead transmission line or underground cables at specified grid voltage with all necessary infrastructure such as protection switchgears and metering systems as per the requirement of the STU/Employer.

25.2 The power evacuation system for the plant shall be as per the local DISCOM requirement and appropriate approval. The contractor shall get the route approval from the Employer and TSTRANSCO/TSNPDCL as the case may be prior to start of the construction. Any changes in the route or scheme introduced by DISCOM at any point of the time prior to commissioning shall be complied without any additional cost to the Employer.

25.3 The ROW for the TL/UG cable shall be obtained prior to the construction of the line from the concerned authorities.

25.4 Overhead Transmission Line

In case the power evacuation is planned with overhead transmission line for plant internal and external evacuation, the design of tower and its accessories shall be as per the DISCOM's requirement and the design shall be submitted to Employer for approval/ accord.

25.5 Underground cable

In case the power evacuation is planned with underground cable for plant internal evacuation, the cable shall be approved by the Employer. However, in case of external power evacuation, the evacuation plan shall be as per DISCOM's requirement and the same shall be submitted to Employer for approval/ accord.

C Civil, Mechanical and Plumbing Works

1 General Requirement

1.1 This section of Technical Specifications describes detailed technical and functional requirements of all civil, structural, mechanical & plumbing works included in the scope.

1.2 This excludes design, supply and installation of Galvanised 220 kV and 132 kV

Transmission Line towers, Tower extensions & accessories and 11 kV, 22 kV & 33 kV transmission poles & accessories which shall be designed following latest guidelines of respective SEB (State electricity board) and got approved from SEB/STU before execution. In absence of SEB/ STU guidelines REC (Rural electrification corporation) standards shall be followed. Poles at corner with angle > 100 shall be provided with 4-pole structure or lattice tower. Use of Pre-stressed cement concrete spun poles is not acceptable. Approved copies of these designs & drawings shall be submitted to the employer for reference and record.

1.3 Standards & Codes

1.3.1 All design and construction of civil works shall conform to relevant Indian standards such as BIS, IRC, MORTH, NBC etc.

1.3.2 Design of steel structures shall conform to IS: 800, 801 or 802 as applicable. Design of concrete structures shall conform to IS: 456. For design of liquid retaining structure IS: 3370 shall be followed. Only in case of non-availability of Indian standard, equivalent American or British standard may be used for design with prior approval of the Engineer and the contractor shall submit proper justification for the same along with his request to the Engineer for review and approval, and the decision of the Engineer shall be final and binding.

1.3.3 All the design/ drawings shall be prepared/ approved either by in-house Engineering Team of the contractor (or by his Engineering Consultant) with qualified engineering staff with relevant experience in successful design of solar SPV plants.

1.3.4 The design calculations for MMS, RCC structure, Steel structure, Foundation system including piling, Road work, Drainage work, etc. shall be submitted for prior approval of Engineer before commencement of construction.

1.3.5 As per project requirements, the Employer may ask for approval of all civil designs and drawings by a Chartered Civil/ Structural Engineer.

1.4 The design calculations shall be supplemented with a neat sketch showing the structure geometry, node and member nos., lengths of various typical members, support points and type of supports, types of materials & type of sections with properties considered in analysis & design. The report shall also include back-up calculations for various loads adopted in design, brief write-up on primary load cases and design load combinations considered and conclusions on design results (with supporting sketches) for easy reference and clarity. Where a computer program (other than STAAD) is used for analysis and design, the contractor shall include a write-up on

the computer program used along with examples for validation check. Design Input (format suitable to the programme used and also in STAAD format) and output file shall also be given in the design report and in soft copy to facilitate its review and approval by the Engineer.

1.5 The methodology for construction of MMS and its foundations, Road & drainage works and Procedure for pile load test shall also be submitted for prior approval of Engineer before start of these works.

2 Topographical Survey

2.1 The contractor shall be responsible for detailed Topographical Survey of the proposed project site. The work shall be carried out through an agency with relevant experience and qualified survey team.

2.2 The Topographical survey shall be conducted at 20m x 20m grid, or as directed by the Engineer, only with the help of digital surveying instruments like Total Station/ Auto level.

2.3 The Contractor shall carry the Bench Mark from nearest GTS Bench mark or any other established source like Railway station, Permanent PWD/ WRD structure etc. as approved by the Engineer, by fly-levelling and establish two permanent bench marks (PBM) at site. All subsequent transfer of levels shall be carried out with respect to these PBMs. The work shall also include constructing permanent reference pillars (RP) at suitable locations as directed by the Engineer. These reference pillars shall be labelled permanently with their respective coordinates and reduced levels for future use. The Permanent Bench Marks (PBM) and reference pillars (RP) shall be shown on the survey drawings.

2.4 While carrying bench mark to the project site, levels shall also be established on the permanent objects like culverts etc. at least on one object in every 1 (one) km if available along with route with adequate description about the objects. These levels shall be maintained at site & also mentioned in the survey report to facilitate locating these objects later on.

2.5 The survey work shall be carried out in UTM grid system. The contractor shall also establish the latitudes and longitudes and UTM coordinates of all the corners of the project site. At least 50m width of the adjoining plots and surrounding areas shall also be covered in the survey for correlation with adjoining plots and facilities. The grids for the survey work shall be established in N-S & E-W direction (corresponding to Geographical North or Plant North) as directed by the Engineer.

2.6 Positions, both in plan and elevation, of all natural and artificial features in the area like waterways, railway tracks, trees, cultivation, houses, fences, pucca and kutcha roads including culverts and crossings, foot tracks, other permanent objects like telephone posts and transmission towers etc. are to be established and subsequently shown on survey maps by means of conventional symbols (preferably symbols of survey of India Maps). All hills and valleys within the area/areas are to be surveyed and plotted on maps by contours. Any unusual condition or formation on the ground, locations of rock outcrops (if visible on the surface) and springs/falls, sand heap/dune, possible aggregate deposits etc. shall also be noted and plotted on contour maps. The C/L coordinates of existing road & cross drainage (CD) works (culverts etc.) at intermediate points & at corners/ intersections and width of carriage way of the road shall be recorded with their position on the contour maps.

2.7 The record of measurement of all Reduced Levels (RL) shall be submitted in digital format, (in x, y z coordinate system) along with preliminary contour plan of the site, for Engineer's review before submission of final contour map. The contour interval shall be as required for proper representation of the topography however it shall not be more than 0.5m. The Contractor shall submit survey maps of the site in 1:10,000 scale indicating grid lines and contour lines, demarcating all permanent features like roads, railways, waterways, buildings, power lines, natural streams, trees, sand dunes etc. Present use of the site i.e. mining, quarrying, agriculture etc., existing drainage pattern of the site, possibility of water logging and high flood level of the area shall also be captured in the document. The project plot boundary with coordinates of all corner points along with coordinate grid of 50m x 50m interval shall be marked on the contour map.

3 Geotechnical Investigations

3.1 The contractor shall be responsible for detailed Geotechnical investigations at the proposed project site for the purpose of foundation design for various buildings, structures, HT lines, MMS etc. and other design/ planning requirements. The investigation work shall be carried out through any Govt. approved/ NABL accredited agency. The contractor shall submit the credentials of the proposed agency along with relevant certificates in support thereof for verification/ approval of the Investigation Agency by the Engineer.

3.2 The scope of work includes execution of complete soil exploration including boring and drilling with rotary drilling rig, standard penetration test (SPT), collecting disturbed (DS)

and undisturbed samples (UDS), collecting ground water samples, trial pits, electrical resistivity tests (ERT), field & laboratory CBR tests, conducting laboratory tests on collected samples of soil & ground water and preparation and submission of report. SPT shall be carried out in all types of soil deposits and in all rock formations with core recovery up to 20% met within a borehole (BH). SPT test shall be conducted at every 1.5m interval or at change of strata. The starting depth of SPT shall be 0.5m from ground level. UDS shall be collected at every 1.5m interval or at change of strata. The min. size of trial pit shall be 2.0mx2.0mx2.5m deep.

3.3 The field investigations shall mainly include drilling of min. 5m deep BHs (50% of total No. of boreholes shall be 10m deep), conducting SPT and collecting Disturbed (DS) and Undisturbed samples (UDS), conducting in-situ CBR test for approach road to the plant, internal roads & peripheral road; Trial pits(TP) and Electrical resistivity tests (ERT). Number and location of BHs, California bearing ratio (CBR) tests, ERTs and TPs shall be decided as per the project layout, site topography and soil conditions in consultation with the Employer. The proposed locations shall fairly represent the total project site to get the complete required geotechnical information. The BH near MCR and ICR shall be 10m deep. There shall be minimum 1 nos. of BH per 5 acres of the area (However, total number of boreholes shall not be less than 5), 3 nos. of Trial pits, 5 nos. of CBR test & ERT, 5 nos. of Ground water samples for laboratory investigations. The soil/ rock samples for laboratory investigations shall be collected from each borehole and trial pit in sufficient nos. (Note- In case the project plot is divided in to number of discrete blocks separated from each other, min. 3 nos. of bore holes, 2 trial pits, 2 ERT and 2 CBR tests shall be taken per such block with at least 1 No. of BHs per 5 acres as specified above).

3.4 The proposed Geotechnical investigation plan indicating proposed locations of TPs, BHs, water sample collection points, CBR test & ERT shall be submitted to the Employer for review and approval before start of work.

3.5 Laboratory tests shall be conducted on DS & UDS samples and ground water samples in sufficient no. & shall include, Soil classification, Grain size analysis including Hydrometer analysis, determination of Bulk and dry density, Specific gravity, Natural moisture content, Atterberg limits, Tri-axial shear tests (Unconsolidated Undrained – UU) on UDS, Undrained shear test, Consolidation tests, Unconfined compression tests (UCS), Free swell index, chemical analysis of soil and water samples to determine the carbonates, sulphates, chlorides, nitrates, pH, Organic matter and any other chemicals

harmful to concrete and reinforcement/ steel. Laboratory tests on rock samples shall be carried out for Hardness, Specific Gravity, Unit Weight, Uniaxial Compressive Strength (in-situ & saturated), Slake Durability etc. Laboratory CBR test on soaked samples shall also be conducted on min. 5 no. of soil samples to ascertain the suitability of soil for sub-grade and requirement of any treatment of subgrade soil in case of CBR <2% as per IRC requirements.

3.6 After completion of field and laboratory work, the contractor shall submit a Geotechnical Investigation Report for Engineer's approval. All bore log details and lab test results shall be presented in the report as per provisions of relevant BIS standards indicating BH coordinates, Existing GL, Depth of water table, Method of drilling etc. The report shall include a Map showing the locations of various field tests including coordinates, calculations and recommendations for foundation type and safe bearing capacity (SBC) for various Plant buildings (ICR, MCR etc.) and Open installations, Switch Yard structures & Sub-Station (as applicable), Transformer foundation, HT lines (as applicable), MMS foundation etc. corresponding to settlement of 25mm.

3.7 The report shall include the study for "Liquefaction potential assessment of the ground and suggestions for any ground improvement measures" as required.

3.8 The report shall also include ground water analysis (water sample collected from bore well) to ascertain its suitability for construction purposes, recommendations for type of cement, grade of concrete & minimum cement content as per prevalent soil characteristics with respect to presence of aggressive chemicals and environment exposure conditions as per relevant BIS specifications. However, minimum grade of concrete shall be as specified under Cl.13.0 'Concrete Works'.

3.9 In case the contractor wishes to adopt concrete pile foundation for MMS supports the Geo-tech. report shall also include the calculations, based on soil properties, for safe pile capacity under direct compression, lateral load and pull out as per IS:2911. For single pile, Lateral load capacity shall be min. of the values obtained as per IS:2911 & Brom's method corresponding to free pile head. The report shall also include recommendations about type of pile, its depth and dia. to be used.

3.9.1 In coastal areas and in marshy or swelling type soil, under reamed or driven precast concrete pile shall be used. In case contractor wishes to use helical piles the design, fabrication and installation shall conform to IBC (International building code).

3.9.2 The contractor shall carry out field trials for initial load test on pile to verify the pile design to confirm the safe load carrying capacity under direct compression, Lateral

load and Pull out. The min. of the two values (design value as per soil characteristics & field test results) shall be adopted.

3.9.3 The nos. of piles to be tested under each category shall be finalized corresponding to geotechnical characteristics at site, plot area etc. However, minimum 5 nos. of piles shall be tested {min. 3 nos. in each block (block size < 25 acre) and min. 5 nos. in each block (block size.25 acres) if the plant site is divided in discrete blocks separated from each other} under each category of load.

3.9.4 The locations of test piles shall be distributed over the plant site and to be finalized in consultation with Engineer. In case the MMS column is fixed using base plate-anchor bolt assembly, the adequacy of provided pile reinforcement in job (working) pile corresponding to the set of test loads shall be reviewed by the contractor for any additional requirement of reinforcement and the same shall be provided in the pile to be cast for initial load test.

3.9.5 In case the Contractor proposes to embed the Column leg in the pile for fixing, the test pile shall be provided with embedded column leg as per approved design and any dowels as required for application of test load. The drawing for the Test pile shall be submitted to Engineer for his approval before casting the test pile. The load test on pile shall be conducted after min. of 28 days from the date of casting. In case the contractor desires to conduct the test earlier than 28 days, he may use suitable higher-grade concrete or if there is substantial evidence from earlier cube test results on design grade concrete to demonstrate the early gain of required compressive strength prior to application of the test load.

3.9.6 However, under no circumstances the test shall be conducted before 15 days of the date of casting the pile. All the dial gauges and hydraulic jack assembly shall be properly calibrated as per the requirements of relevant BIS standards and valid calibration certificate to this effect from Govt. / NABL accredited Test agency shall be submitted to the Engineer before use.

3.9.7 The contractor shall submit detailed methodology for conducting the tests in line with IS: 2911 (Part 4) for Engineer's approval before commencement of any test. After completion of these tests the contractor shall compile the test results and submit the report in a proper format as specified in the BIS standard with recommendations/ conclusions for Engineer's approval. The pile work shall start only after approval of the final pile design duly verified/ confirmed with initial load test results.

3.10 All buildings and Plinth for Open installations (MCR, ICR etc.), Transformer yard,

Switchyard and Sub-station area shall have levelled ground as detailed under Cl. No. 5 below.

4 Other Investigations

4.1 The contractor shall also obtain and study other input data at proposed project site for design of the project from metrological department/ local govt. authorities. This shall include data related to Rainfall, Maximum & Minimum ambient Temperature, Humidity, HFL etc.

4.2 The contractor shall carry out Shadow Analysis at proposed site and accordingly design strings and array layout with optimum use of space, material and man power. In case of large variations in topography (3° to the horizontal) the study shall also include the effect of topographical variations on array layout and MMS structure design adequacy and stability. The contractor shall submit all the details/ design to the Engineer for review/ approval.

4.3 The contractor shall also identify potential quarry areas for coarse and fine aggregates to be used for concrete and shall carry out the concrete mix design for concrete grades to be used in construction of all concrete works (M25 and above) before start of construction. However, for piling M25 concrete with nominal mix of (1:1:2) may be used. For grades of concrete less than M25 to be used in PPC works, nominal mix as specified in IS:456 may be used. The concrete mix shall be designed for each source of cement and aggregates as per provisions of IS:10262 Standard and confirmed through 28 days compressive strength of concrete trial mix samples. Target mean strength of concrete for mix design shall be based on σ (standard deviation) = 5.. The concrete mix design shall be carried out through NABL accredited Laboratory or any Govt. agency approved by the Engineer. In case the contractor proposes to use RMC, the same shall conform to IS: 4926. The Contractor shall submit the Concrete mix design proposed to be used by the RMC for review and approval by the Employer. (Reports of periodic quality tests for the supply concrete batch shall be maintained by the RMC supplier as per approved Quality Plan and the same shall be submitted to the Employer for review and record).

5 Area Grading and Land Development

5.1 The Finished Grade Level (FGL) of the proposed plant shall be fixed with reference to the highest flood level (HFL) and surrounding ground profile at proposed site to avoid flooding of plant site. The data regarding HFL at proposed site shall be obtained from

the metrological department by the contractor. In case of absence of this data, the contractor shall assess the required information through local site reconnaissance. The area at and around (up to 25m beyond external wall/ area including access road & parking whichever is minimum) all buildings/ plinth for open installations (ICR, MCR etc.), transformer yard and switch-yard shall be uniformly levelled at suitable RL (i.e. FGL) to be finalized considering topography and HFL at site. The minimum plinth level of all buildings/ open installations shall be 450mm above FGL. Module mounting structure foundation/ Pile cap or any other pedestal shall be min. 200mm above FGL. Top of transformer foundation pedestal shall be min, 500mm above the FGL.

5.2 A detailed drawing for site levelling and grading (if necessary) shall be submitted by the contractor before commencement of construction of all buildings,plinth for open installation and transformer/switchyard works. The estimated volume of cutting and filling shall also be marked on the Grading drawings for reference. The final grade levels to be adopted for different blocks shall be clearly marked on the Plant Layout/ Array Layout drawing.

5.3 It is envisaged that the MMS are installed on natural/ existing ground without any levelling or grading of the area. Contractor shall accordingly consider the effect of the existing ground slope on the design of MMS structure as specified elsewhere in the specifications. If any ground undulations at column locations are observed the same shall be filled up with PCC (1:3:6) up to surrounding ground level immediately after pile installation before start of erection of other MMS members. In case of pile, the PCC fill shall extend min. 500mm outside pile cap all around and remaining area may be filled up with local soil properly compacted.

5.4 The contractor is responsible for making the site ready and easily approachable by clearing bushes, felling of trees (mandatory permissions/ licenses/ statutory clearances from competent authorities if required for cutting of trees, blasting or mining operations, disposal of waste material etc. shall be obtained by the contractor), cutting, filling with selected excavated earth or borrowed earth including identifying borrow areas. Except in exceptional cases (with approval of the Engineer), filling shall be made up of cohesive non-swelling material. The filling for levelling/ reclaiming the ground/ area shall be done in layers not more than 150mm of compacted thickness in case of cohesive (clayey) soils and 250mm compacted thickness in case of granular (sandy) soils with compaction up to 95% (of modified proctor density) and 80% (of relative density) respectively. The slope at edge of graded areas shall not be steeper than 1:1.5

(1 Vertical: 1.5 Horizontal) in cutting and 1:2 (1 Vertical: 2 Horizontal) in filling. In case of filling with rock material, the edges shall be provided in line with provisions of relevant BIS standard.

5.5 It shall be ensured that the land is grading and levelling is done properly to ensure for free flow of surface run-off and the grade levels shall be fixed with respect to high flood level at site, drainage pattern and system requirements. It shall be ensured that the land is used optimally to have maximum solar power generation considering full utilization of the plot areas. It is advisable to follow the natural flow of water at the ground as far as possible for drainage design.

5.6 In case the filled up earth is brought from outside the plant or borrow areas (when the material inside plant area is not found suitable for grading work or if directed by the Engineer), the contractor shall carry out all required soil investigations to ascertain the suitability of the borrowed soil for land development and filling purposes. Contractor's scope shall also include arranging land lease, getting all necessary statutory approvals for mining, payment of necessary challan etc. Excess earth, if any, shall be disposed of properly at location as directed by the Engineer.

6 Roads

6.1 Suitable approach road (as applicable) from nearest public road up to plant Main gate, Access road from Main gate to Main control cum office room (MCR), Internal roads connecting MCR and other facilities/ buildings/ open installations like Local control room(s) (LCR)/ Inverter control room(s) (ICR), Sub-station & Switch yard (as applicable) etc. and peripheral road along inside of the boundary fence/ wall shall be provided for safe and easy transportation of men, material and equipment during construction and maintenance.

6.2 The Approach road connecting nearest public road and the Main gate shall be of 4.5m wide carriage way with 0.5m wide shoulders on either side. The access road connecting Main gate and MCR and internal access road(s) connecting MCR to various facilities/ buildings/ open Installations shall be of 3.75m wide carriage way with 0.5m wide shoulders on either side while the peripheral road shall be of 2.5m wide carriage way with 0.5m shoulders on either side. The top of road (TOR) elevation shall be minimum 150 mm above FGL to avoid flooding of roads during rains. The roads shall be provided with alongside drains as per design requirements of drainage system for effective disposal of storm water and to avoid cross flow of storm water over the road. The roads shall be designed as per IRC SP-72 corresponding to traffic category T3 and critical

field CBR value of the subgrade. Shoulder shall be of min. 150mm thickness.

6.3 However, following minimum road section details shall be followed:

(i) Topping: Surface dressing with gravel or gravel-soil mixture conforming to Cl. 402 of MORD specifications for rural roads published by IRC (MORD specs). However, for sites with average annual rainfall > 1500mm, either 2 course surface bituminous dressing conforming to Cl. 505 of MORD specs or 20 mm thick open graded pre-mix carpet + Type – B or Type –C seal coat conforming to Cl. 506 of MORD specs. shall be provided.

(ii) Base course WBM (CBR>100%) conforming to Cl. 405 of MORD specs: 75mm compacted thick, Grade III

(iii) Base course WBM (CBR>100%) conforming to Cl. 405 of MORD specs: 75 mm compacted thick, Grade II

(iv) Granular/ gravel sub-base course (CBR>20%), conforming to Cl. 401 of MORD specs: 175 mm compacted thick, compacted to 100% of max dry density

(v) Compacted subgrade: 300mm thick below sub-base (non-expansive soil with max. dry density > 1.65 kN/m3) conforming to Cl 303 of MORD specs, compacted up to 98% of standard proctor density in layers of 150mm thickness. In case of expansive soils like black cotton soil suitable treatment as per Cl. 403 of MORD specs shall be provided before laying sub-base course.

(vi) Gravel Shoulders conforming to Cl 407 of MORD specs: 150mm compacted thick, compacted to 100 % of max. dry density

6.4 Soaked CBR value of sub-grade shall not be less than 2%. Where the CBR of the subgrade is less than 2 % a capping layer of 100 mm thickness of material with a minimum CBR of 10 % is to be provided in addition to the sub-base required for CBR of 2 %. When the subgrade is silty or clayey soil and the annual rainfall of the area is more than 1000 mm, a drainage layer of 100 mm over the entire formation width should be provided conforming to the gradation given in Chapter 6 of IRC SP-20. This layer will form a part of the designed thickness of sub-base.

6.5 In case of no-availability of murrum in the nearby areas of the project site, suitable other screening/ blending material for WBM construction may be used conforming to provisions of IRC SP 20.

6.6 The construction of road shall conform to MORD specifications for Rural roads published by IRC..

6.7 Drain, cable or any other crossing shall be provided with RCC box or precast concrete

pipe culvert. The culvert design shall conform to relevant IRC standard. The pipes for road culverts shall be of minimum class NP3 conforming to IS 458 with min. soil cover of 750mm above the pipe. In case of soil cushion less than 750mm the pipe shall be provided with 100 mm thick M20 reinforced concrete encasement with 10 dia. reinforcement rods @ 150mm c/c both ways. However, the water supply pipe for module cleaning and service/ drinking water shall be routed through Medium class GI steel pipe of required dia. conforming to IS: 1161.

6.8 Minimum dia. of casing pipe to be used at any facility like electric cable, water pipe line etc. shall be 150mm.

6.9 Maintenance pathways of min. 1.0m width shall be provided between SPV arrays for easy movement of maintenance staff, tools, equipment and machinery, washing of modules etc. The pathway area shall be generally levelled and well compacted manually/ mechanically. Areas of depression, valley zones or wherever there is noticeable change in topography, shall be levelled by laying min. 100mm thick PCC M10 or precast concrete paver blocks (min. 60mm thick, Grade M60) matching the top finished surface with ground topography/ grade to avoid accumulation of water in the region and allowing its free flow to keep the area devoid of mud/ sludge.

6.10 The design and drawings for approach road, all internal roads and culverts shall be submitted to the Engineer for approval before execution.

7 Surface/ Area drainage

7.1 The contractor shall design and construct storm water drainage network for smooth disposal of storm water from the plant to the nearest available drainage outlet.

7.2 The storm water drainage system shall be designed and planned to ensure no water stagnation in the plant.

7.3 The plant drainage system shall be designed for maximum hourly rainfall intensity and relevant time of concentration.

7.4 The design shall conform to the provisions of IRC SP 42 and best Industry practices. (The design rainfall shall be taken as max. hourly rainfall at 25 years return period at project site as provided in the Isopluvial map of the relevant subzone annexed with Flood Estimation Reports of Central Water Commission (CWC).

7.5 The coefficient of run-off for estimation of design discharge shall be considered as per catchment characteristics, however it shall not be less than 0.6.

7.6 The drainage scheme shall be designed considering the plant plot area and the surrounding catchment area contributing to the plant area drainage as per the

topography.

7.7 The storm water drainage system shall be a network of open surface drains (with rectangular or trapezoidal cross section) and shall generally be designed to follow the natural flow of water and ground contours.

7.8 Suitable size plant peripheral drain as per design (min. 500mm wide x 500mm deep) along inside of plant boundary wall/ fence shall be provided for smooth channelization of outside storm water and to avoid flooding in the plant. The size of all internal and road side drains shall not be less than 450mm (bottom width) x 500mm (depth).

7.9 All trapezoidal drains shall have side slopes not steeper than 1:1 and shall be lined with either brick or RR masonry/ concrete or stone slabs as suitable to the site conditions. The min. Thickness of the lining shall be 115mm for brick masonry, 75mm for concrete slabs, 150mm for RR masonry and 100mm for stone slabs. The lining shall be in CM (1:4) and the joints shall be raked and pointed with CM (1:3), however, the joints in lining of plant peripheral drain may be left without pointing.

7.10 In case of rectangular drain, the thickness of the wall shall be checked against structural stability under action of the design loads as specified in Cl. No. 10.0 'Design Loads'. However, Min. thickness shall be 230mm for brick masonry, 300mm for RR masonry and 125mm for RCC work, except for garland drain around buildings where the min. wall thickness can be 115mm, 200mm and 100mm respectively for brick masonry, RR masonry and RCC work.

7.11 The structural design of drains shall be as per provisions of relevant BIS standards and good industry practice.

7.12 The drain outfall shall be connected to the nearest existing natural drain(s)/ water body outside plant premises and it shall be ensured that the drainage water shall not re-enter the plant nor encroach/ flood in the adjacent property/ plot.

7.13 The proposed drainage scheme along with design calculations and drawings shall be submitted to the Engineer for review/ approval before start of construction.

7.14 The contractor shall also explore for providing rain water harvesting system for water conservation by constructing suitable collection wells along the drains or through provision of detention ponds etc. The scheme for rain water harvesting along with design calculations shall be submitted for approval.

8 Peripheral boundary Wall/Fence

8.1 The plant peripheral boundary shall be provided with either Chain link or barbed wire fencing or masonry boundary wall as specified.

8.2 The boundary fence/ wall shall be provided along the Solar PV plant boundary to demarcate the plant boundary and to keep away the unauthorised access to the plant. The fence/ wall shall be provided with Main entry gate. The fencing/ wall shall be with 2.5m height above grade level including 400mm dia. GI concertina wire along with 3 no. of barbed wires on either arm to be fixed on Y shape angle brackets. The main gate shall be min. 6.0m wide (clear) (4.5 m carriage way + 1.5m wicket gate).

8.3 Chain link fencing

8.3.1 The fencing shall be of Chain link (GI or poly coat GI as specified) mesh fabric with internal, corner and stay posts of RCC (min 200mm x 200mm size, M30 grade) or Hot dipped GI angle (min. ISA 75x75x6 mm), as applicable, along with 230 thick brick/ 300 thick RR masonry toe wall, with 100mm thick M15 PCC foundation (min. width 450mm and min. depth 450 mm below GL).

8.3.2 Intermediate, corner and stay posts shall be supported with min. 300 mm dia. and 850 mm deep (below GL) piles in cement concrete (nominal mix 1:1:2). The column posts shall be extended in to the pile up to 800mm with 50mm cover at the bottom. The pile shall project 150mm above GL. The toe wall shall project 150mm above GL. The intermediate, corner and stay posts shall be supported by angle struts that shall have the same foundation as that of the main posts.

8.3.3 The brick masonry toe wall shall be plastered with 15thick CM (1:4) plaster on both faces and shall have min. 50 thick PCC (1:2:4) coping finished smooth and projecting 35mm on either side of the wall with top sloping inwards..

8.3.4 Spacing of intermediate posts shall not be more than 2.5m. Every 10th intermediate post shall be provided with a stay post while every corner post shall be provided with two stay posts on either side.

8.3.5 Joints in RR masonry shall be properly raked and pointed with CM (1:3).

8.3.6 In case of pond/ drain crossing the fence, RCC beam of adequate size supported on RCC columns on either side and suitable grill of MS square rods (vertical spacing not more than 150mm) of min. Size 25x25 mm and min. 3 no. horizontal 20 SQ MS rods or 50 mm x 8 mm thick flats secured to RCC beam and columns; shall be provided in place of toe wall for smooth flow of water.

8.3.7 The GI chain link mesh fabric (40x40 mm with min. wire gauge 3.15mm, both ends twisted) and fencing shall conform to IS: 2721. Poly coat GI chain link mesh (50x50mm) shall conform to ASTM 668 and fencing shall conform to ASTM 668.

8.3.8 Each fence panel, in lieu of tie wire, shall be provided with 35x35x3mm GI edge angle

at top and bottom with mesh fabric firmly secured to them and to intermediate support angles.

8.3.9 All MS sections shall be painted with 2 coats of epoxy paint of approved make and shade over 2 coats of suitable primer.

8.4 Boundary wall

The boundary wall structure shall be a RCC beam-column structure with wall of either brick (min. 230mm thick), concrete block (min. 200mm thick) or of Pre-cast RCC columns and wall panels (min. 75mm thick). The top of the wall shall be provided with concrete coping (min. 50mm thick with 40mm projection on either side).

8.5 Barbed wire fencing

The details of barbed wire fencing shall be same as those for chain link fencing except providing barbed wires (4mm dia.) in place of chain-link mesh. There shall be 10 no. of barbed wires which shall be equally placed along the fence height. The Barbed wire shall be of type 'Iowa' and class designation 1 with chromate conversion coating and shall conform to IS: 278. Every bay of the fence shall also be provided with one GI diagonal line wire of 4mm dia. conforming to IS: 280..

8.6 Main Gate

8.6.1 The Main entry gate of size as specified under clause no. 8.0 (2.5m height) shall of rugged design with solid MS steel sections (25x25mm). The spacing of vertical members shall not be more than 150 mm.

8.6.2 The gate shall be complete with MS flat guide track, castor wheel(s), GI fittings & fixtures like hinges, aldrop, locking arrangement, posts etc.

8.6.3 The main gate shall be of 2.5m height and shall have 4.5m wide Gate for vehicular movement and an adjacent 1.5m wide wicket gate for pedestrian movement.

8.6.4 Area near the main gate extending from 500 mm (min) outside the gate to 2700 mm (min) inside the gate, shall be brought to Top of Road elevation with respect to the approach road at main gate for full width of the gate. This shall be achieved by providing 200 mm thick PCC (1:2:4) over 100 mm thick PCC (1:4:8) further underlain with 300 mm thick well compacted boulder soling with interstices filled with sand, resting over well compacted subgrade.

8.6.5 The gate shall be provided with the Project name plate (2.5mx 1m, 3mm thick MS plate). The gate shall be painted with 2 coats of epoxy paint over 2 coats of suitable primer.

8.6.6 The column posts of the gate shall be supported through RCC pedestal and footing. Min. depth of foundation shall be 1200mm below NGL.

8.7 All design and drawings for peripheral boundary fence/ Wall and Main gate shall be submitted for Engineer's approval before execution.

9 Plant Layout

9.1 The contractor shall submit drawing showing proposed Project Plant and SPV module Layout.

9.2 The Plant and SPV module layout shall be a comprehensive drawing showing various requirements of the project like, Reference coordinate grid, Geographical and Plant North, Layout of boundary fence including coordinates of all corner points, Location of main entrance gate and any other access gates as per project needs, Block wise FGL, Layout of main approach road to the plant, Internal and peripheral roads, Security Room/ cabin (s), all Buildings and Open installations with coordinates, Temporary Storage yard/ facility to be used by the contractor during construction, Proposed Array layout, Lightening arrester, UG/Over ground water Tank(s), Storm water drains, Corridor for buried cables etc.

9.3 The cable corridor shall be laid through clear gap between arrays and shall not be laid below modules for easy maintenance.

9.4 All the facilities and buildings shall be presented with suitable Legend.

9.5 The drawing shall be in suitable scale to have proper representation of the information.

9.6 The Plant & SPV module layout drawing shall be submitted by the contractor for review/ approval by the Engineer.

10 Design Loads

10.1 Unless otherwise specified elsewhere, Dead load, Live load, Wind load and Seismic load for buildings and structures shall be considered as per provisions of relevant BIS standards.

10.2 The following minimum imposed load as indicated for some of the important areas shall, however be considered for the design. If actual expected load is more than the specified minimum load, then actual load is to be considered.

S. No.	Area	Imposed (Live) Load
1	Roof	1.50 kN/ Sqm
2	Building floors (GF) & Grade Slab	10.00 kN/ Sqm

3	RCC Floors (General)	5.00 kN/ Sqm
4	Outdoor platforms, Stairs, Landing and Balconies, Walkway, Chequred plate & Grating (except cable trench cover)	5.00 kN/ Sqm
5	Road culverts & allied structures over drain & pipe crossings subjected to vehicular traffic	Design for Class – 'AA' loading (Wheeled & Tracked both) and check for Class – 'A' loading as per IRC Standard
6	Underground structures such as Sump, Pit, Trench, Drain, UG tank etc.	In addition to Earth pressure and Ground water table at FGL, a surcharge of 20kN /Sqm (10kN/Sqm for drains) shall also be considered. The structure shall be designed for following criteria – (a) Inside empty with outside fill+ surcharge and water table at GL & (b) Inside water with no fill & water table outside
7	Pre-cast and chequred plate cover over cable trench	4.00 kN/ Sqm
8	Main access & Internal Roads	As per IRC SP 20 corresponding to vehicular traffic of 150 commercial vehicles per day and critical in-field CBR

10.3 Primary Loads

(i) Dead Load (DL)

(ii) Live Load (LL)

(iii) Wind Load (WL) – Both along ±X & ±Z horizontal direction

(iv) Seismic Load (EL) – Both along ±X & ±Z horizontal direction

10.4 Basic wind speed (V_b) at project site shall be taken as per IS 875 (part-3) unless

otherwise specified elsewhere.

10.5 To calculate the design wind speed (V_z), the factors K_1 (probability factor or risk coefficient), K_2 (terrain roughness and height factor) and K3 (topography factor) shall be considered as per IS 875 (Part-3) (However, minimum values for K_1, K_2 and K_3 shall be 1.0, 1.05 and 1.0 respectively)

10.6 Topography factor 'k_3' shall be taken as 1.0 upto upwards slope of 3°. For topography with upward slope greater than 3°, the value of 'k_3' shall be calculated as per Annexure-C of IS 875 (Part-3).

10.7 In case of plant site within 60 km of sea coast, the importance factor for cyclonic region, 'k_4' shall be taken as 1.15. Provisions of IS: 15498 shall also be followed to ensure general safety of the structure.

10.8 To calculate the design wind pressure 'p_d', factors 'k_a' (area averaging factor) and 'k_c' (combination factor) shall be taken as 1.0. (The factor 'k_d' shall be taken as 1.0 in case of plant site within 60km of sea coast).

10.9 The Seismic Load shall be considered corresponding to Earth quake zone at site as per IS: 1893 (Part- 4) with Importance factor 1.5. Ductile detailing as per IS 13920 shall be followed in concrete structures except in case of concrete support structure upto plinth level supporting open installations of inverter transformers and control panels at ICR/LCR, wherein the detailing shall conform to IS 456 and SP 34.

10.10 <u>Notes for MMS Design</u>

10.10.1 WL shall be considered as detailed below for estimation of WL under primary loads:

(i) WLx (downward), WLz (downward): Load due to positive pressure on design tilt angles of MMS members for wind acting in both (±X, ±Z) directions.

(ii) WLx (upward), WLz (upward): Load due to negative pressure on design tilt angles of MMS members for wind acting in both (±X, ±Z) directions.

(iii) WLx (member load), WLz (member load): Load due to wind action on side (exposed) face of respective MMS members (drag force) for wind acting in both (±X, ±Z) directions.

- ±WLx (member load, transverse to MMS table): Load due to wind action of column, front and back bracing, longitudinal bracing
- ±WLz (member load, along length of MMS table): Load due to wind action of column, rafter front and back bracing, longitudinal bracing

10.10.2 For estimation of design wind loads on purlins (Table 8 of IS 875- Part 3), WL

(downward) and WL (upward) on modules (laid in the profile of mono slope canopy) shall be applied such that the center of pressure should be at (0.3 × length of canopy) from windward end (for simplicity, the wind load distribution may be taken as triangular with max. value at windward end). Solidity ratio (∅) shall be taken as 0.5.

10.10.3 In design of MMS (for height of structures less than 10 m from ground), 20% reduction in wind pressure as per Note under Cl. 6.3 of IS 875 – Part 3 is not permitted in case of purlins (members supporting modules), which shall be designed against action of WL corresponding to full wind pressure.

10.11 Design Load combinations

10.11.1 Appropriate Load factors in LSM design for concrete structures and appropriate Factor of safety in WSM design (ASD) for all steel structures including MMS shall be considered as per relevant BIS standard. No increase in permissible stress is permitted in design of MMS.

10.11.2 Following load combinations shall be considered in design:

- For MMS Design:
  - (i) DL+LL
  - (ii) DL+LL ± WLx (upward) ± WLx (member load)
  - (iii) DL+LL ± WLx (downward) ± WLx (member load)
  - (iv) DL+LL ± WLz (upward) ± WLz (member load)
  - (v) DL+LL ± WLz (downward) ± WLz (member load)
  - (vi) DL+LL ± ELx
  - (vii) DL+LL ± ELz
- For RCC and Steel structures except MMS:
  - (i) DL+LL
  - (ii) DL+LL ± WLx
  - (iii) DL+LL ± WLz
  - (iv) DL+LL ± ELx
  - (v) DL+LL ± ELz

10.11.3 All buildings, structures and foundations shall be designed to withstand loads corresponding to worst design load combination.

11 Foundations (General)

11.1 Contractor shall design all foundations for buildings, equipment, HT line Towers, Switch

yard structures, Transformer, MMS & other structures as per relevant BIS standards and recommendations of Geotechnical investigation report.

11.2 No foundation for MMS, buildings, switchyard equipment and structures, sub-stations, HT line towers, transformers, etc. shall rest on filled-up ground. However, minor structures like cable trench, cable rack, pipe pedestal, etc. may rest on filled-up soil with max. safe bearing capacity for design considerations not more than 3 T/Sqm.

11.3 Min. depth of foundation for all buildings and plinth for open installations shall be 1.5 m below NGL. For all other structures, min. depth of foundation shall be 1.0 m unless specified otherwise.

11.4 All foundations of a building shall be founded at same RL (Reduced level) with respect to foundation depth below lowest NGL (Natural ground level) in the building area. The Levels shall be obtained with reference to the already established TBM using digital survey instrument such as Total Station/ Auto Level.

11.5 All design & drawings shall be submitted to the Engineer for approval before execution.

12 MMS Foundation

12.1 Module mounting structure (MMS) may be supported on isolated/ strip footing or pile foundation.

12.2 <u>Bored cast-in situ, Driven precast or under reamed Concrete pile</u>

12.2.1 In case the contractor proposes to provide bored cast-in-situ concrete pile; the type, dia. and length of pile shall be as per recommendations of Geotechnical investigation report corresponding to prevalent soil characteristics at site. However, the min. dia. and depth of the pile shall be 300mm (Min 350 mm for column depth more than 175 mm) and 1800mm respectively except when very hard strata/ rock (N>100) is encountered at a higher level, the pile shall be extended in to the hard strata minimum 1.5 times the diameter of the pile with total depth of the pile not less than 1200mm below cut-off level.

12.2.2 As specified above, the MMS support shall project minimum 200mm above FGL (Finished grade level) to avoid any damage to the MMS column/sub support due to direct contact of rain water/ surface run-off. This shall be ensured through either single stage construction of entire pile length including portion above FGL or by providing a collar (to be cast in second stage) which shall project min. 75mm in plan beyond the pile face and shall extend min. 250mm below GL.

12.2.3 For proper bonding, the surface of first stage concrete shall be made rough by

trowelling and cleaning out laitance and cement slurry by using wire brush on the surface of joint immediately after initial setting of concrete. The prepared surface should be clean watered to get saturated dry condition when fresh concrete is placed against it. The prepared surface shall be applied with a suitable bonding agent before construction of pile cap/ collar as required.

12.2.4 In case the column post/stub is supported through base plate-anchor bolt assembly, the same shall only be provided through RCC pile cap to be designed as per provisions of relevant BIS standard with min. clear overhang of 75mm. The pile shall embedded min. 50mm in the pile cap and the pile reinforcement shall be extended in to the pile cap for proper anchorage.

12.2.5 In case of collapse of foundation strata during drilling of the pile bore, removable steel liner shall be used to maintain design depth and diameter of the pile for proper concreting.

12.2.6 The design & installation of piles shall conform to IS: 2911.

12.2.7 The bore shall be free from water before poring of pile concrete. For under water concreting tremie shall be used.

12.3 Helical/ Screw Pile

12.3.1 The design, manufacture, testing and installation of Helical/ Screw pile shall conform to ICB-2009 and Practice Note 28- "**Screw Piles: Guidelines for Design, Construction & Installation,** ISSN 1176-0907 October 2015 (IPENZ Engineers New Zealand)"

12.3.2 The design of pile shall be undertaken and verified by a suitably qualified geotechnical or structural Chartered Engineer with experience in the design of helical/screw piles.

12.3.3 The pile shall be designed and manufactured in accordance with accepted engineering practice to resist all stresses induced by installation into the ground and service loads.

12.3.4 The steel grade for pile shaft, helix plates and other accessories shall be with min. Fy 350 MPa. Min. thickness (BMT) of shaft and helix plate shall be 6 mm and 8 mm respectively in case of coastal installations and soils containing aggressive chemicals and at other project sites it shall be respectively 5 mm and 6 mm. Cap plate and col base plate shall be min. 12 mm thick and of min. grade E-250 conforming to IS:2062.

12.3.5 All materials shall be hot dip galvanized conforming to relevant BIS standard with min. thickness of galvanization 80 microns.

12.3.6 Wherever the pile shaft is required to be infilled with concrete grout, the same shall be of min. grade M30 (anti shrink).

12.3.7 The allowable axial design load (Direct compression & Pull out), Pa, of helical piles shall be the least of the following values:

(i) Sum of the areas of the helical bearing plates times the bearing capacity of the soil or rock comprising the bearing stratum.

(ii) Capacity determined from well-documented correlations with installation torque.

(iii) Load capacity determined from initial load tests.

(iv) Axial capacity of pile shaft.

(v) Axial capacity of pile shaft couplings.

(vi) Sum of the axial capacity of helical bearing plates affixed to pile.

12.3.8 The lateral allowable load capacity of the pile shall be calculated using P-Y analysis and shall be verified with field trials. The allowable design lateral load shall be equal to the min. of (i) the total lateral load producing max. lateral deflection of 5mm and (ii) 50% of the total lateral load at which the lateral displacement increases to 12mm.

12.3.9 Dimensions of the central shaft and the number, size and thickness of helical bearing plates shall be sufficient to support the design loads.

12.3.10 The Design Report shall include following details.

(i) Design loads

(ii) Geotechnical Strength Reduction Factors and supporting methodology

(iii) List of design standards

(iv) Design methodology and how specific loads such as seismic, lateral and settlement are addressed

(v) Founding stratum

(vi) Estimated length

(vii) Connection design and details between pile shaft & pile cap plate and Col base plate

(viii) Pre-production and production load testing to support design including acceptance criteria.

12.3.11 Helical piles shall be installed to specified embedment depth and torsional resistance criteria as per design. The torque applied during installation shall not exceed the maximum allowable installation torque of the helical pile

12.3.12 Special inspections shall be performed continuously during installation of helical pile foundations. The information recorded shall include installation equipment used, pile

dimensions, tip elevations, final depth, final installation torque and other pertinent installation data as required.

12.3.13 The installation of piles shall be done by an agency having adequate experience in helical pile construction.

12.3.14 The method statement for pre-production load testing (initial test) and construction of Helical Pile shall be submitted for review and approval. The method statement shall comply following requirements:

12.3.14.1 Helical pile pre-production load testing

The Piling Contractor shall provide a method statement for the pre-production load testing. The method statement shall be submitted 2 weeks prior to pile installation for testing and shall contain the following information (as a minimum):

- Programme of the testing, detailing the timing and sequence of each load test including any additional investigations proposed
- The general arrangement of the equipment
- A method for measuring the displacement at the head and toe of each test pile
- Template for the Pile load test report
- Confirming the criteria for determining the acceptability of the compression, tension and lateral load tests
- A contingency plan in the event that a load test is deemed not acceptable
- A procedure for verifying the capacity for each individual pile, this may include correlating the installation torque for each pre-production pile with the load test results
- All pile load tests shall be supervised by suitably experienced personnel, who are competent to operate, monitor and record each test throughout its duration. Each pile load test shall be continuously monitored throughout its duration.

12.3.14.2 Helical Pile Construction

The contractor shall provide a method statement for each piling operation to be undertaken in executing the Works. The method statement shall describe all proposed equipment and detail the construction sequence. The method statement shall be submitted with the tender and shall contain the following information (as a minimum):

- Programme of the works, detailing the timing and sequence of individual portions of the works

- Full details of the installation plant to be used, including manufacturer's information and proof of servicing/recent upkeep and calibration
- Proposed phasing of excavation/filling operations such that the design stresses in the piles (and any supporting frames) are not exceeded
- The contingency plan to be adopted, to minimize disruption and delay, in the event of encountering obstructions
- Anticipated noise levels (measured in dB) and vibration levels (measured in mm/sec) arising from piling operations (if applicable)

12.3.15 The Piling Contractor shall nominate a suitably experienced, professionally qualified engineer, as the "Piling Supervisor".

12.3.16 Unless specified else were, the field trials for initial load tests on concrete and helical/ screw pile shall conform to IS: 2911 (Part 4) & Practice Note-28 (IPENZ Engineers New Zealand) as applicable. The no. and location of such tests shall be as per the provisions stipulated under Cl. No. 26.8.

12.3.17 Contractor shall also carry out routine tests on 0.5 % of the total no. of working/ job piles as per provisions of IS: 2911 (Part 4). In case of unsatisfactory results, min. no. of routine tests may be increased up to 2% of the total no. of working/ job piles as per the directions of the Engineer.

13 Module Mounting Structure (MMS)

13.1 The module mounting structure design shall generally follow the existing land profile. The top of the table shall be in one plane.

13.2 In MMS analysis the column support shall be assumed at EGL/NGL.

13.3 In case of topographical variations more than 3°, the contractor shall carry out detailed study of its effect on array layout, shadow analysis and structural stability of MMS.

13.4 The structure shall be designed to allow easy replacement of any module and shall be in line with site requirements.

13.5 The MMS stub/ column, rafter, purlin, ties and bracing members shall conform to following Indian standards.

- IS: 2062 – Hot rolled Medium and High tensile structural steel
- IS: 811 – Cold formed light gauge structural steel sections
- IS: 1161 – Steel tubes for structural purposes
- IS: 4923 – Hollow steel sections for structural use

- Minimum grade of steel for sections conforming to IS: 811 & IS: 4923 shall be E350 conforming to IS: 2062 and Y_{St} 310 conforming to IS: 1608 respectively.

13.6 The contractor can also propose new light gauge structural steel or structural aluminum sections other than specified in IS: 811 subject to approval of the Engineer. In this case the contractor shall submit his proposal stating the technical advantages of the proposed sections for Engineer's review along with supporting literature and sample design calculations conforming to present specifications at the time of bidding.

13.7 The minimum thickness excluding anti corrosive treatment (BMT) of various elements of MMS structure shall be as following:

- Stub/ column – 3.15mm,
- Rafter – 2.5mm &
- Purlin & other members – 2.0mm

13.8 The primary loads and load combinations for design of MMS structure shall be as specified under Clause No. 10. The design shall be done by Working stress method and no increase in allowable stress shall be permitted.

13.9 The maximum permissible deflection/ side sway limits for various elements of MMS under serviceability conditions shall be as following:

- Lateral deflection/ side sway for Column – Span/ 240
- Vertical deflection for Rafter and Purlin – Span/ 180
- Lateral deflection for Purlin – Span/240

13.10 In case of natural frequency in first mode less than 5 Hz, the design of the MMS structure shall also be checked against dynamic effects of wind as per provisions of IS – 875 (Part-3) using gust factor method.

13.11 The purlins shall be provided with min. following tie/sag rods or angles or channels:

- 1 no., in the mid of each span and shall connect all the purlin members
- 1 no., diagonal, at each corner in end spans

13.12 Lateral restraint to compression flange if any due to PV panels is not permitted in purlin design.

13.13 The vertical diagonal bracing shall be provided in end spans and every alternate span of each unit (table) of MMS.

13.14 MMS shall support SPV modules at a given orientation & tilt and shall absorb and transfer the mechanical loads to the ground properly.

13.15 Welding of structure at site shall not be allowed and only bolted connections shall be

used.

13.16 The MMS structure shall be hot dip galvanized with minimum GSM 610 kg/ sqm and/or minimum coating thickness of 80 microns for protection against corrosion. Galvanization shall conform to IS-2629, 4759 & 4736 as applicable.

13.17 It is to ensure that before application of this coating, the steel surface shall be thoroughly cleaned of any paint, grease, rust, scale, acid or alkali or any foreign material likely to interfer with the coating process.

13.18 The bidder shall ensure that inner side is also provided with galvanization coating.

13.19 The galvanization shall be done after fabrication of members and cutting of holes to ensure galvanization of all cut/ exposed edges.

13.20 In case the proposed section is made up of Aluminum, anodized coating shall be Gr. AC25 and shall conform to IS: 1868.

13.21 The array structure shall be so designed that it will occupy minimum space without sacrificing the output from SPV panels at the same time.

13.22 Two numbers of anti-theft fasteners of stainless steel on two diagonally opposite corners for each module shall be provided. All fasteners both for MMS connections and fixing of PV Module shall be adequately protected from atmosphere and weather prevailing in the area.

13.23 Fasteners and washers to be used for erection of mounting structures and those for fixing Module over MMS shall be of stainless steel grade SS 304 & SS 316 with property class A2-70 conforming to relevant ISO standard and must sustain the adverse climatic conditions to ensure the life of the structure for 25 years.

13.24 Min. diameter of bolt for MMS connections shall be 10mm (12 mm in case of single bolt connection for seasonal tilt) except at column-rafter connection, where it shall not be less than 12mm (not less than 16mm in case of single bolt connection for seasonal tilt). In case of fixed tilt, min. two number of bolts shall be provided at each joint.

13.25 Modules shall be clamped or bolted with the structure properly. The material of clamps shall be Al / SS having weather resistant properties. Clamp/bolt shall have EPDM rubber washer and shall be designed in such a way so as not to cast any shadow on the active part of a module.

13.26 The MMS foundation shall be designed as per Cl. No. 12.

13.27 MMS column post supported with base plate secured to foundation shall be fixed with galvanized high strength “J” bolts conforming to specifications of IS: 4000/ IS: 1367 and relevant IS code Installation of foundation bolts and embedment of column leg in

foundation concrete shall be done by using template to ensure proper alignment. The underside of base plate shall be provided with anti- shrink grout.

13.28 In case the contractor proposes to extend the column leg to embed it in the pile/pedestal as an alternate fixing arrangement, the column member shall be extended for full depth of the pile (100mm cover at tip of the pile) with an end plate of min. 4mm thickness to be welded at the bottom of column leg. (However, for plants in coastal area or in case of marshy soil the column post shall be supported only with base secured to foundation through base plate and anchor bolt assembly and no embedment of column leg in foundation is permitted)

13.29 The array structure shall be grounded properly using maintenance free earthing kit.

13.30 The bidder/manufacturer shall specify installation details of the PV modules and the support structures with appropriate diagram and drawings.

13.31 The Bidder should design the structure height considering highest flood level at the site and the finished grade level. The minimum clearance between the lower edge of the module and the finished grade shall be the higher of (i) Highest flood level + 100mm and (ii) 500 mm, as applicable

13.32 The length of one unit (Table) of MMS shall not generally be more than 20m.

13.33 The contractor shall submit the foundation and structural design basis for MMS along with the list of reference standards in his Bid duly certified by a Chartered Engineer having adequate successful experience in similar works which shall be finalized with the prospective bidder during pre-award. The MMS shall be designed to optimise tilt angle and elevation to minimise self-shading and maximise the capture of diffuse light by Bifacial Modules. The Bifacial Module frames shall be rail-edge mounted in landscape configuration to minimise losses.

13.34 The contractor shall submit the detailed design calculations and drawings for MMS structure, bill of materials and their specifications/ standards to the Employer for approval before start of fabrication work as per the engineering work program (L2 schedule) as finalized during kick-off meeting.

13.35 The length of any cold formed section (CFS) shall not be more than 5.5 m.

13.36 In case of seasonal tilt, the front and back bracing members (subject to seasonal rotation) shall be connected to rafter or column through gusset plate and shall not be connected directly to the column or rafter.

13.37 The purlin splice shall be near the zone of contra-flexure, i.e. within a distance of 0.15L to 0.25L from the support, where L is the respective span within which splicing is

located.

13.38 The purlin splice shall comprise of flange and web splice plates and splice design shall conform to Annexure-F of BIS:800. For simplicity in fabrication, the splice member may be of CFS channel section without lips (CU). There shall be min. four number of bolts on either sides of joints in web zones and one number of bolt on either side of joint in flange zones.

13.39 For same member type, same section shall be used.

13.40 When any sag or tie member to the purlin (rod, angle or channel) is provided, it shall not be considered in modelling the structure for analysis except its effect as lateral support to the purlin members in strength design.

14 Concrete Works

14.1 Construction of all RCC works shall be done with approved design mix as per IS 456 and the materials used viz. Cement, coarse & fine aggregate, Reinforcement steel etc. shall conform to relevant BIS standards.

14.2 The min. grade of concrete shall be M25 (M30 in coastal areas/marshy soil) for all RCC works except liquid retaining structures like underground water tank, septic tank, etc. where minimum grade of concrete shall be M30 (M35 in coastal areas/marshy soil).

14.3 Cement higher than 43 Grade shall not be used in construction.

14.4 Unless otherwise specified elsewhere, PCC shall be of min. grade M10 (nominal mix 1:3:6) except for mud mat, back filling of ground pockets or leveling course which shall be of grade M7.5 (nominal mix 1:4:8).

14.5 Reinforcement steel shall be of high strength TMT bars of grade Fe500 D conforming to IS: 1786.

14.6 Unless specified otherwise for grouting works anti shrink ready mix grout of approved make or cement mortar (CM) grout with non-shrink compound shall be used. The grout shall be high strength grout having min. characteristic strength of 35 N/mm^2 at 28 days.

15 Miscellaneous Steel Works

15.1 Unless otherwise specified elsewhere, all structural steel work shall be designed as per provisions of IS: 800 with working stress method of design (WSD).

15.2 Structural steel hot rolled sections, flats and plates shall conform IS: 2062, structural Pipes shall be medium (M)/ high (H) grade conforming to IS: 1161, chequered plate shall conform to IS: 3502 and Hollow steel sections for structural purposes shall conform to IS: 4923.

16 Buildings and Plinth for Open Installations

16.1 General Requirement

16.1.1 Plant buildings and plinth for open installations are required to be constructed for housing the electrical equipment/ panel (Local Control Room Building - LCR) and Control room cum office cum store (Main Control Room Building - MCR) for operation and maintenance of Photovoltaic Solar Power Plant. Security room at main gate & Security cabin(s) (at strategic locations) shall also be provided to secure the plant from any theft/ burglary/unauthorized entry.

16.1.2 Unless otherwise specified elsewhere, all buildings and plinth for open installations except Security room/ cabin shall have RCC framed structure. Masonry partition walls shall be provided for Kitchen, Pantry, Battery room and Toilet units. For other rooms AL Glass partitions shall be provided. The plinth for open installations and equipment area shall be designed with OEM requirements. The security room/ cabin(s) shall be of prefabricated structure.

16.1.3 All buildings shall have provision of adequate windows for natural light & ventilation, fire safety provisions and shall be designed as per provisions of National building code (NBC).

16.1.4 The contractor shall submit the proposed equipment layout drawings to the Engineer for approval before development of Architectural drawings. The building layout, exterior elevations shall be aesthetically designed following good architectural practices to get a pleasant look. Horizontal/ vertical bands through projections/ groves in external plaster may be provided to break the monotony. Roof slab shall have projection of 450mm beyond external walls with RCC parapet wall of 450 mm clear height all-around which shall form a projected band at roof level. For weather protection all doors and windows shall be provided with 450mm wide RCC chajja. However, chajja for rolling shutter shall be 750mm wide.

16.2 Functional requirements

16.2.1 MCR Building

For operation & maintenance of SPV Plant, unless otherwise specified elsewhere, Control room cum office area of MCR building shall provide following facilities.

- Air-conditioned area (with provision of split A/C unit of adequate capacity) for SCADA room (min. carpet area 12m^2), Conference room (min. carpet area 20 m^2) & Supervisor cabin and office area (min. carpet area 20 m^2)
- Inverter/ Switchgear, equipment room(s) as per OEM requirements

- Store cum record room (min. carpet area 15 m^2)
- Battery room as per requirement
- Toilet block with separate gents and ladies wash room facilities (min. total carpet area 12 m^2)
- Pantry with service platform and utensil washing facilities (min. carpet area 5 m^2)
- Suitable provision for passage (for smooth movement of O & M personnel), cable trenches, operating area etc. (min. clear width 1500mm)

16.2.2 LCR/ ICR

- Inverter and associated equipment shall be installed on plinth as open installations. They shall generally comprise of data loggers, battery, inverter, electrical panels, etc. as per requirements and as per approved system drawings.
- There shall be suitable provision for easy/smooth passage of O&M personnel, cable trench, operating area, etc.
- The plinth supporting the ICR/LCR equipment shall have RCC framed structure with foundations, columns and beams up to plinth level (FFL).
- The size and clear head room (below soffit of beam) for LCR/ICR shall be provided as per system/O&M requirements.
- In case of indoor installation of inverters, MCR and LCR/ICR building shall not be clubbed together unless specified otherwise.
- However, when LCR/ICR and MCR building facilities are clubbed in one single building, the Equipment area (inverter room) and Office cum Control room area shall be separated by a brick wall with provision of internal entry door.
- MCR building shall have separate main entry to office area plus a provision of fire exit door.
- The size of inverter/HT panel room shall be provided as per system requirements.

16.2.3 Security Room/ Cabin

16.2.3.1 Contractor shall provide required number of pre-fabricated security cabins at strategic locations & at corners of the plot and 1 nos. security room at Main entry gate.

16.2.3.2 The Security room shall be of min. size 3m x 3m x 2.75m height. The Security cabin shall be of min. size 1.2 x 1.8m x 2.5m height.

16.2.3.3 Security room/ cabin shall be a pre-engineered & pre-fabricated structure. The walls and roof of the building shall be fabricated with double skin insulated sandwiched

Al-Zn alloy coated high tensile steel metal panels (BMT- 0.5mm, Al-Zn alloy coating -150 GSM total on both sides). The insulation shall be of PUF with min. density 40 kg/ cum and adequate thickness. Roof shall be provided with suitable slope, not less than 10° to the horizontal (approx. 1V:6H) for proper drainage of rain water and shall project 300mm beyond the walls. The make and (color) shade of pre- coated metal panels shall be subject to approval by the Engineer. Min. thickness of color coating shall be 20 micron (DFT) excluding prime coat 5 micron (DFT). The coating system shall confirm to IS: 15965.

16.2.3.4 The Main security room shall be provided with one Aluminum (AL) glazed door (0.75m wide x 2.1m height) on one face and AL glazed sliding windows (1.2m width x 1.0 m height) with AL grill on remaining three sides. Security cabin shall have one AL glazed door (0.75m widex2.1m height) and 1 no. AL sliding window (0.8m width x 1.0 m height) with AL (anodized) grill on one side. All glazing shall be of clear float glass with thickness of 4mm for window and 6 mm for door panel.

16.2.3.5 The door and windows shall be provided with all necessary fitting and fixtures like handles, tower bolts, mortise lock for door, stays, door stopper etc. All AL sections for doors and windows shall be anodized (min. average thickness 25 microns) or polyester powder coated (min. DFT 50 microns) with approved color shade for protection against weather.

16.2.3.6 Specially coated/ SS self-drilling screws/ fasteners conforming to class 3 as per ASTM: 3566.1 and 3566.2 shall only be used for all connections.

16.2.3.7 Anchor/ foundation bolts shall conform to IS: 5624 and IS 800.

16.2.3.8 The Security Cabin may be installed on concrete M20 skid platform (min. 250 mm thick, over 250 mm thick compacted rubble soling with interstices filled with sand). The top of skid shall be 200 mm above FGL. The concrete skid shall be provided with shrinkage reinforcement (8 dia @ 200 c/c both ways) near top surface. The concrete skid shall project 200mm beyond the walls.

16.2.3.9 The Security Room shall be supported on RCC framed structure with foundations, columns and plinth beams with 450 high plinth above FGL.

16.2.4 Portable Cabin

16.2.4.1 Portable cabin shall be of size 15 x 10 x 8.6 feet (clear dimensions i.e. available volume) for MCR and Store Room. For other buildings, appropriate sizes as per available space and design may be proposed.

16.2.4.2 The main fabrication of the structural frame work shall be integral and all welded (CO_2 welding) type to comprise of the bottom, top, side & overall frame work. Self-draining roof and desired door-window with Insulation & electrical fittings inside the cabin. The structure should be durable, fire proof, light, sturdy, termite and water proof.

16.2.4.3 The Portable cabin for MCR shall have provision for partition walls for a Supervisor Room and seating area for 4 O&M personnel.

16.2.4.4 Detailed Specifications

Component	Description	Reference Standard
Bottom/base frame	100 mm specially formed channel	IS 2062 for MS or IS 808 for Rolled section
Top frame	75 x 75 sq. mm pipes/tubes	IS 4923 (tube) IS 1239 (pipe)
Stiffeners Bottom	100 x 50 mm specially formed channels	IS 2062 or IS 808
Stiffeners Top	45 x 45 x 5 mm & 45 x 45 x 5 mm M.S Tee	IS 2062 or IS 808
Side Post	Specially formed 3.15 mm M.S post section	IS 2062
Side wall stiffeners	Specially formed 2.00 mm M.S channels	IS 2062 or IS 808
Panelling outside	M.S Corrugated sheet (10 gauge)	IS 2062
Internal wall panelling	8 mm Pre-laminated sheet for wall	
Roof outside	M.S Plain sheet (18 gauge) with efficient drain of rain water and to avoid collection of dust leaves etc on the roof	IS 2062
False ceiling	5 mm 100% water proof sheet	-
Bottom flooring	10 mm MS Chequered Plate	IS 2062
M.S door	50 mm insulated M.S Door of size- 3' x 6'6" with hydraulic door closer, locks, handles. Doors shall be fixed with heavy gauge	IS 2062 For Hinge – IS 1341/1992 For Hydraulic Door Closer – IS 3564/96 Type-2

	MS hinges Weather shed for door.	
Insulation	1.At four side walls by 50 mm Glass wool insulation covered with 8 mm pre-laminated sheet 2. At ceiling by 100 mm Glass wool insulation covered with 5 mm pre-laminated sheet (100% water proof) (All the Glass wool density-24)	Glass wool; IS 8183/93

16.2.4.5 Accessories

Wiring	Concealed wiring – PVC conduits using fire resistance wires
Electrical Fitting/cabin	1. Tube lights – 02 nos. 2. Door lights – 01 no. 3. Fans – 01 no. 4. Switches & sockets: 6 amps – 01 no. & 16 amps – 01 no.
Furniture (for MCR)	Office Chairs with swivel mechanism, wheels and adjustable height - 6 Nos., 4 seater Round Discussion Table –1 No., Supervisor Desk Table with Drawers for Supervisor – 1 No.,
Painting	Phosphating the cabin internally and painting with coat of epoxy primer (anti corrosive paint) & two coat of epoxy texture paint (corrosion resistant paint) of reputed make. The external surface of the cabin shall be painted with two coats of epoxy texture paint (corrosion resistant paint) of reputed make. The roof of the cabin painted with polyurethane paint.
M.S Racks with shutter OR Storage Cup board	M.S Storage Cupboard - 06 nos. Each Cup board made of M.S with full height door of size-4' 10" (width)x 2'6" (depth) x 6'(ht) comprising with 02 partitions at 2 ft height
Dummy plate	Size- 3'5" x 3'5"

16.2.4.6 The portable cabin for MCR shall be provided with adequate number of split type air conditioning units and fans.

16.2.5 Pre-Engineered Building (PEB)

16.2.5.1 General:

The PEB shall be made of structural steel construction with double skinned metal roofing and wall cladding of appropriate profile. PEB shall be complete with painting, metal fascia, metal gutter, rain water down comers, sun-shades, openings, etc., along with associated structural steel, cladding and roofing work insulation, Trims & Flashings. Each item of PEB like panels, masonry, plastering, flooring, foundation, fittings etc. shall be suitable for complete life of solar plant. The construction methodology for PEB shall also be submitted to the Employer/Owner for approval before start of works.

16.2.5.2 Structure and material specification

Component	**Description**	**Reference Standard**
Primary Structural Members: including the transverse rigid frames, columns, corner columns, end wall wind columns, beams, truss member, base pate.	Steel frame members with minimum thickness 4 mm with minimum yield strength of 345 MPa	IS2062 min Grade E250 Quality BR/ ASTM A572-12 Grade 50
Secondary Members: including the purlins, Girts, eave struts, bracing, flange bracing, base angles, clips, flashings and other miscellaneous	Minimum thickness 3.15 mm. Secondary members for purlins and Girts shall have minimum yield strength of 345 MPa. Miscellaneous secondary members shall have minimum yield strength of 250 MPa.	IS 811 or ASTM A1003-12 steel sheets conforming to ASTM A1011-12b Grade 50

structural parts. Suitable wind bracings sag rods to be reckoned while designing the structure.		
Wall Cladding	Insulated wall cladding or roofing shall consist of double skin metal cladding with Poly Urethane Foam (PUF). PUF must be made of continuous method PU foam and must be CFC free, self-extinguishing, fire retardant type with density 40 +/-2 kg/m3 and thermal conductivity 0.019-2.2 W/(m.K) at 10°C. The PUF panels shall be a factory made item ready for installation at site.	
Design Parameters and Design Loads:		
Dead Load:	Self-Weight of Structure including Purlins, Sheeting, Girts, Bracings, weight of turbo ventilators to be added as Dead load etc. Imposed Load (Live Loads) Live loads shall be as per IS – 875. For sloped roofs up to 10 deg. it shall be 0.75 KN/M².	
Wind Load:	Design wind speed factors shall be as per IS: 875-III, however the minimum value of these factors shall be considered as K1 = 1.0, K2 = 1.0 & K3 = 1.0 for the design of PEB.	
Earthquake Load:	All PEB structures shall be designed for Seismic forces. Vertical Deflection and Horizontal Sway	

	Limits: a) Limiting Deflection: The limiting permissible vertical deflection for structural steel members shall be as per IS 800 2007. b) The limiting permissible horizontal deflection for as per IS 800 2007 code where 'h' is height of building at eaves.	
Paint and Coating:	Steel shall be colour coated with total coating thickness of 25 microns (nominal) dry film thickness (DFT) comprising of silicon modified polyester (SMP with silicon content of 30% to 50 %) paint or Super Durable Polyester(XRW) paint of 20 microns (nominal) on one side (exposed face) on 5 micron (nominal) primer coat and 10 microns (nominal) SMP or Super Durable Polyester paint over 5 micron (nominal) primer coat on other side. SMP and polyester paints system shall conform to Product type 4 as per AS/ANZ 2728. The structural steel shall be hot-dipped galvanized, conform to IS: 4759 or relevant Indian standard	
Plinth Protection:	750mm wide plinth protection minimum 75 mm thick of cement concrete 1:3:6 (1cement : 3 coarse sand : 6 graded stone aggregate 20 mm nominal size) over 75 mm bed of dry brick ballast 40 mm nominal size well rammed and consolidated and grouted with fine sand including finishing the top smooth, shall be provided around the Pre-Engineered Building.	
Rolling shutter:	Rolling shutter (Hand operated) shall be fabricated from 18 gauge steel and machine rolled with 75 mm rolling centres with effective bridge depth of 12 mm lath sections, interlocked with each other and ends locked with malleable cast iron clips to IS:2108 and shall be designed to withstand a wind load without excessive deflection. Metal rolling shutters and rolling grills as IS: 6248.	

Windows Frame:	Aluminium black powder coated section, frame shall be of 92x31 mm, minimum 16G thick as per approved design. Tinted glass and aluminium grill shall be provided.
Roof Insulation and type	Both metal sheets shall have an under insulation of minimum 70 mm thick PUF with density 40 +/- kg/m3 and thermal conductivity 0.019-2.2 W/(m.K) at 10°C with gutters and down take pipes along with Flashing & Top cap of required size and colour complete with all necessary hardware. Roof shall be projected at-least 300 mm from the wall. Stiffening ribs / subtle fluting for effective water shedding and special male / female ends with full return legs on side laps for purlin support and anticapillary flute in side lap shall be provided. Both upper and lower sheets shall be separated through spacers and fastened through zinc /zinc-tin coated self-drilling screws. The fastener size shall be calculated as per the design or manufacturers recommendations. Contractor may also alternatively made the PEB roofing with composite slab (RCC slab with permanent formwork). The composite slab scheme, design and drawings shall be subject to approval from Employer/Owner before start of work.
Wall Insulation	All voids of external and internal metalled walls shall have an under insulation of minimum 60 mm thick PUF with density 40 +/- kg/m3 and thermal conductivity 0.019-2.2 W/(m.K) at 10°C with proper supports etc. as approved. Both the walls should be separated by spacers system made up of cold formed steel bars and fastened through zinc /zinc-tin coated self-drilling screws.

16.3 The Design and drawings shall be submitted for approval prior to fabrication and installation.

17 Flooring, Skirting and Dado

17.1 Store area, Equipment Area

40 mm thick Cement concrete (IPS) flooring (1:2:4), aggregate size 10 mm down, conforming to IS 2571 with 2mm thick Heavy-duty epoxy coating (Industrial grade) of approved make on top as per manufacturer specifications and 10mm thick matching skirting of 100mm height.

17.2 SCADA Room, Control cum Office Room, Supervisor Room and Lobby

1200 mm X 1200 mm thick Heavy duty vitrified tile (8mm thick or more) flooring with matching skirting of 100mm height.

17.3 Battery Area/Room

Acid/ Alkali resistant tile flooring and 2100 height dado, Floor and dado tiles - 20mm and 12 mm thick respectively. However, in case of maintenance free batteries, vitrified tile (8mm thick) flooring and dado shall be provided.

17.4 Toilet

- 40 mm thick Ceramic tile (8mm thick) flooring and glazed tile (6mm thick) 2100 height dado.
- 20mm thick Granite stone finish over platform for wash basin.

17.5 Pantry

40 mm thick heavy duty vitrified tile (8 mm thick) flooring and glazed tile (6mm thick) 2100 mm height dado, 20mm thick Granite stone finish over service platform.

17.6 Passage/ Corridor

40 mm thick Heavy duty vitrified tile (8mm thick) flooring with matching skirting of 100mm height.

17.7 Steps

Kota stone (20 thick) or 50 thick cement concrete (IPS) flooring conforming to IS 2571.

17.8 All items shall be of reputed make. Only Items with approved samples by the Engineer shall be used.

18 Doors and Windows

18.1 Doors, windows, louvers and ventilators shall be made of AL sections (minimum average thickness for windows and ventilators- 2.0mm, for partitions and doors- 2.5 mm), industrial grade, anodized (grade AC25, min. thickness 25 micron conforming to

IS: 1868) or with polyester powder coating (Total DFT 50 microns conforming to IS: 13871) and shall be of approved make & colour shade. All sections, fittings and fixtures shall be anodized (min. thickness of coating 20 micron). The window and door shutters shall be of clear float/ wired/ ground glass as per design/ functional requirements. The doors in toile area shall be of steel frame with solid core (MDF) flush shutter, 35mm thick, with laminated finish on both sides conforming to IS: 2202.

18.2 AL Louvers, duct/ ventilation openings shall be provided as per functional requirement.

18.3 All doors, windows and ventilators shall be provided with all necessary fittings and fixtures like handles, tower bolts, wind stays, hinges etc. of heavy duty anodized AL. All doors shall be provided with hydraulic door closure of required capacity.

18.4 All windows shall be provided with suitable AL grill of anodized sections with adequate thickness for security purposes.

18.5 Clear float glass for window and door shutter shall be of min 4mm and 6mm thickness respectively. Wired/ ground glass where provided shall be of min thickness 6mm.

18.6 Entrance door and door in passage shall be min. 1.5m wide (double leaf) x 2.1 m height while door for Conference room and Store room shall be min. 1.2m wide x 2.1m height. All other doors shall be min. 1.0m widex2.1m height except for WC which may be of 0.8m width.

18.7 Rolling shutters shall be of required size and shall be made of cold rolled steel strips with adequate gauge thickness (min. 18 gauge) and shall conform to IS 6248. Rolling shutter shall be provided with all fixture, accessories, paintings etc. all complete and shall be mechanically operated type.

19 Roofing

19.1 The roof of all buildings shall be provided with min. slope of 1:100 for effective drainage of rain water. The slope shall be achieved either by application of screed concrete of grade 1:2:4 (with 12.5mm down coarse aggregate) with min. 25mm thick CM 1:4 layer on top to achieve smooth surface to facilitate application of water proofing treatment.

19.2 The water proofing treatment shall be in situ five course water proofing treatment with APP (Atactic Polypropylene) modified Polymeric membrane over roof consisting of first coat of bitumen primer @ 0.40Kg per sqm, 2nd & 4th courses of bonding material @ 1.20 kg/sqm, which shall consist of blown type bitumen of grade 85/25 conforming to IS : 702, 3rd layer of roofing membrane APP modified Polymeric membrane 2.0 mm thick of 3.00 Kg/sqm weight consisting of five layers prefabricated with centre core as 100 micron HMHDPE film sandwiched on both sides with polymeric mix and the

polymeric mix is protected on both sides with 20 micron HMHDPE film. The top most layer (5th layer) shall be finished with brick tiles of class designation 10 grouted with cement mortar 1:3 (1 cement: 3 fine sand) mixed with 2% integral water proofing compound by weight of cement over a 12 mm layer of cement mortar 1:3 (1 cement: 3 fine sand) and finished neat. The water proofing treatment shall be extended over golla/ fillet and inner face of the parapet up to 450mm height.

19.3 The corners at parapet wall and slab shall be provided with 50 thick fillet/ golla in CM 1:3 with neat finish.

19.4 Required no. of rain water down take pipes min. 100mm dia. PVC pipes (UV resistant), with 450x450mmx15mm deep khurra and MS grill at inlet shall be provided for rain water disposal.

20 Plinth protection and drain

20.1 750mm wide plinth protection with min. 75mm thickness of PCC (1:3:6) over 75 mm thick bed of dry brick ballast, 40mm nominal size well rammed and consolidated and grouted with fine sand, shall be provided around all the buildings.

20.2 A peripheral drain (except for Security room/ cabin) of min. internal size 250mm x 250mm with brick walls in CM 1:6 over 75mm thick PCC (1:3:6) bedding with 12mm thick plaster in CM 1:5 and 25thk PCC (1:3:6) coping at top shall be provided along the periphery of the plinth protection for collection and disposal of rain water from building roof.

21 Plinth filling for buildings

Plinth beam, when provided, shall be taken minimum 200mm below FGL. The plinth filling below Ground floor (GF) for all buildings shall be provided with following specifications.

(i) Well compacted sub-grade
(ii) Well compacted boulder soling with interstices filled with sand over compacted sub-grade.
(iii) 75mm thick PCC 1:3:6 over (ii)
(iv) 100mm thick PCC 1:2:4 over (iii)
(v) 40mm thick floor finish over (iv)

22 Anti- termite Treatment

In case of presence of termites at the project site, an anti-termite treatment shall be provided for all foundation pits and building plinth in MCR building conforming to IS: 6313 to control entry of termites

23 Plumbing & Sanitary Works

23.1 Toilet block shall have following min. fittings:

- Wall mounted WC (Western type) 390 mm high with toilet paper roll holder, low height flushing tank and all fittings
- A set of 2 wall mounted Urinals (430 x 260 x 350 mm size) with flushing tank and all fittings (Gent's wash room only)
- Wash basin (550 x 400 mm) over concrete platform with all fittings including 2-pillar cocks
- Wall mirror (600 x 450 x 6 mm thick clear float glass) with hard board backing
- CP brass towel rail (600 x 20 mm) with C.P. brass brackets – one each in common area and bathroom (bathroom if applicable)
- Soap holder and liquid soap dispenser one each in common area and bathroom (bathroom if applicable)
- Shower and mixer for hot and cold water in bathroom (if applicable)
- Ventilators – Mechanical exhaust facility of adequate capacity
- Overhead PVC water storage tank – Capacity 1000 litres (common for both wash rooms) (2000 litres in case bathroom is to be provided)

23.2 Pantry room shall be provided with kitchen sink cum drain board and provision for installation of Water Cooler.

23.3 One toilet room with provision of WC and Wash basin shall be provided at Security Room near main gate.

23.4 Necessary plumbing lines for MCR building and Security Room near main gate.

23.5 All sanitary ware, fittings and fixtures shall be of reputed Make and Type and approved by the Engineer. All fittings, fastener, grating shall be of CP brass conforming to relevant BIS standards.

24 Painting & Other Finishes

Painting and white wash/ colour wash for the buildings shall conform to relevant BIS standards. The make and colour shade of the finish shall be as advised and approved by the Engineer.

Internal Walls except toilets & battery room	Acrylic emulsion (for MCR) & Oil bound distemper (for LCR/ Security Room)
Battery room	Acid/ Alkali resistant tiled dado of 2100 mm height & Acid resistant resin-based epoxy paint above dado (Vitrified tile flooring and dado with oil bound distemper in case of maintenance free batteries)
Toilet	Oil bound distemper
External Walls	All weather proof cement based acrylic emulsion paint, exterior grade
MMS foundations/ Earth pit Enclosure	Cement paint
Underside of roof slab	White wash
Air-conditioned areas	Underside of roof slab- Under deck insulation with 50mm thick mineral wool, min. density 45 kg/ m3 and Gypsum board false ceiling with GI grid/ Gypsum tile (600x600 mm x 12 thick) false ceiling with AL grid as per manufacturer's details
Structural steel work	2 coats of synthetic enamel paint over 2 coats of suitable primer

25 Air conditioning & Ventilation for MCR and Other Buildings

25.1 All buildings shall be equipped with appropriate numbers of fans for effective heat dissipation.

25.2 In MCR building, the supervisor room, Conference room and SCADA room shall have split type air conditioning units.

26 Fire Extinguishers

26.1 All buildings shall be installed with required no. of fire extinguishers as per relevant BIS standard and NBC. LiquefiedCO_2/ foam/ ABC type fire extinguisher shall be upright type of capacity 10kg conforming to IS: 2171, IS: 10658.

26.2 The fire extinguisher shall be suitable for fighting fire of Oils, Solvents, Gases, Paints, Varnishes, Electrical Wiring, Live Machinery Fires, and all Flammable Liquid &Gas.

27 Sand buckets

27.1 Sand buckets shall be wall mounted made from at least 24SWG sheet with bracket fixing on wall conforming to IS: 2546.

27.2 All buildings shall be provided with required no. of sand buckets as per relevant BIS

standard and NBC. 4 No. of Bucket stands with four buckets on each stand shall be provided in the Transformer Yard.

28 Sign Boards and Danger Boards

28.1 The sign board containing brief description of major components of the power plant as well as the complete power plant in general shall be installed at appropriate locations of the power plant as approved by Engineer

28.2 The Signboard shall be made of steel plate of not less than 3 mm. Letters on the board shall be with appropriate illumination arrangements.

28.3 Safety signs, building evacuation plan and direction signs, assembly points shall also be placed at strategic locations.

28.4 The Contractor shall provide to the Engineer, detailed specifications of the sign boards.

29 Masonry Work

29.1 The masonry work shall be of bricks, laterite blocks (as per site conditions) or concrete blocks.

29.2 All external walls of buildings shall be 230mm and internal walls shall be 230mm or 115mm as per requirements.

29.3 All concrete block masonry walls shall be min. 200mm thick.

29.4 Brick work shall be in cement mortar (CM) 1:6 & 1:4 for 230 mm and 115 mm thick brick wall respectively unless specified.

29.5 Unless otherwise specified elsewhere, Bricks shall be of class designation 7.5 conforming to IS: 1077, IS: 2212 & IS: 3495.

29.6 All concrete blocks shall be of min. compressive strength of 7.5 N/mm2 and shall be of Grade-A conforming to IS: 2185.

29.7 The laterite blocks shall conform to IS: 3620.

29.8 All buildings shall be provided with suitable damp-proof course (DPC). The DPC shall be with PCC (1:2:4) using 6 down coarse aggregate and water proofing admixture. The min. thickness of DPC shall be 40mm.

29.9 The construction of brick masonry shall conform to IS: 2212. Construction of Concrete block masonry shall conform to IS: 2572.

30 Plastering, Pointing & Coping Works

30.1 All brick masonry work shall be provided with plaster.

30.2 Wall and ceiling plaster shall be in cement mortar (CM) 1:6 and 1:3 respectively.

30.3 Thickness of plaster shall be 18mm and 12mm respectively for rough and smooth

surface of the masonry wall. The ceiling plaster shall be 6mm thick.

30.4 All joints in stone masonry shall be raked and pointed in cement mortar (CM) 1:3 except specified otherwise.

30.5 Exposed top surface of brick or stone masonry shall be provided with 25 mm thick plain cement concrete (PCC) coping (1:2:4) with trawl finish. All exposed coping shall be provided with suitable slope and projection for easy drainage of water.

30.6 All door and window chajja shall be provided with 10mm wide drip course.

31 Building Water Supply & Plumbing Works

31.1 C-PVC pipes shall be used for all internal building water supply works while all external water supply pipes shall be uPVC conforming to relevant BIS standard.

31.2 Rain water pipe shall be of PVC conforming to relevant BIS standard.

31.3 All sewerage, waste water and ventilation pipes shall be of HDPE conforming to relevant BIS standard.

31.4 MCR building and Security room shall be connected to Sewage treatment facility including all associated works like Manholes etc.

32 Sewage Treatment facility

32.1 The Contractor shall design & provide soak pit and RCC Septic tank for treatment of sewage and waste water from MCR building and Security room. The septic shall be designed as liquid retaining structure conforming to IS:3370 for design loads as specified under Cl. No. 35. However, in case of ground water within 1.5m of finished grade level or the soil strata being of low permeability (permeability ≤ 10^{-6} m/s) where septic tank and soak pit arrangement is not effective, suitable packaged sewage treatment plant of reputed make/manufacture shall be provided. The sewage treatment facility shall be of required capacity and of proven design suitable for total of 15 people.

32.2 The design and drawings shall be submitted for approval prior to execution.

33 Pipe & Cable Trenches

33.1 All trenches inside the building and transformer area shall be of RCC. The min. wall and base slab thickness shall be 100mm for depth ≤ 850mm and 150mm for depths > 850mm.

33.2 The trench shall be designed for loads as specified under 'Design Loads'. External trenches shall be kept min. 100mm above FGL to avoid entry of rain water. In case of straight length of the trench being more than 40m, suitable expansion joints with PVC water stop shall be provided.

33.3 Internal trenches (inside buildings) shall be provided with chequred plate (min. 8mm thick with stiffening angle ISA 50x50x6 @ 750 mm c/c for trench width greater than 800 mm) covers while external trench shall have precast concrete covers.

33.4 Min. thickness of precast cover shall be 50mm. Both bearing edges of the cable trench and all edges of pre-cast concrete covers shall be provided with min. 50x50x6 mm edge protection angle with lugs.

33.5 The trench cover (chequered or pre – cast both) shall be provided with suitable lifting hooks.

33.6 As required suitable MS insert plates shall be provided on trench wall to support the cable rack/ pipe.

33.7 The trench bed shall have a slope of approx. 1(V):250(H) along and 1(V):50(H) across the length of the trench. The cable trench shall have a dewatering sump (s) of size 450x450x450 mm depth at suitable location to facilitate collection & pumping out of rain water from the trench.

33.8 The external buried cables shall be laid in excavated trench as specified under specifications for Electrical works. The sand for filling shall be of Grade – IV conforming to IS: 383.

34 Transformer Yard Civil Works

34.1 Transformer and equipment foundations shall be founded on piles/isolated spread footings or block foundation depending on the final geotechnical investigation report and functional requirements.

34.2 In case of transformer oil tank capacity ≥ 2000 litres, the transformer foundation shall have its own soak pit which would cover the area of the transformer and cooler banks, so as to collect any spillage of oil in case of emergency. The retention capacity of the soak pit shall be equal to volume of the transformer oil (excluding free space above gravel) and it shall be filled with granite stone gravel of size 40mm, uniformly graded, with 200 mm free space above gravel fill.

34.3 In case of transformer oil tank capacity more ≥ 20000 litres, the soak pit shall be connected to a separate burnt oil pit through discharge pipe (300 mm dia) and shall be suitably sized to accommodate full oil volume (excluding free board above inlet pipe) of the transformer connected to it, without backflow. In this case the capacity of the soak pit may be reduced to min. 1/3rd of the total transformer oil volume. The burnt oil pit shall be further connected to oily water drainage system. The water shall be discharged into the nearest drain by gravity flow or pumping after suitable treatment as

per statutory and code provisions.

34.4 Both, the transformer soak including side walls and the burnt oil pit shall be of RCC and shall be provided with sump (min. 500 mm x 500 mm x 400mm deep) and slope of 1:50 in concrete screed of 1:1 – ½:3 to the floor slab towards the sump pit. The oil collection pit shall be provided with 20mm dia. MS rung ladder with 2 coats of epoxy paint over 2 coats of primer, a manhole & removable RCC cover. The inside of oil collection pit shall be plastered with 6 mm thick CM 1:6 and painted with 2 coats of epoxy paint over 2 coats of primer.

34.5 The area around the transformer and equipment shall be covered with uniformly graded granite stone gravel of size 40mm.

34.6 The area shall be provided with galvanized chain link fence of height min 1.8m with 3.5m wide gate. The specifications for fencing shall be similar to those specified under Cl. No. 31.3 except fence post which shall be of MS angle (ISA 65x65x6) spaced at 2.5 m c/c.

34.7 The Gate of size 3.5m shall be of MS pipe (medium class conforming to IS: 1161) frame with hard drawn steel wire fabric mesh (50x50mmx3mm thick conforming to IS: 1566) including all accessories and fittings. MS angle posts shall conform to IS 2062.

34.8 In addition to main gate a wicket gate of MS pipe (medium class conforming to IS: 1161) frame with 1.0 m width with hard drawn steel wire fabric (50x50x3mm thick conforming to IS: 1566) shall be provided for man entry for maintenance purpose.

34.9 The transformer yard fencing work shall conform to CEIG requirements.

34.10 The requirement of fire barrier wall between transformers shall be as per Electricity Rules and IS: 1646 recommendations. Minimum wall thickness shall be 230mm for RCC wall and 300mm for masonry wall.

35 Potable Water Supply & PV Module Cleaning System

35.1 The contractor shall design and install the effective module cleaning system.

35.2 A regular supply of suitable quantity of water shall be ensured by the contractor to cater day-to-day requirement of drinking water and for cleaning of PV modules during entire O&M period.

35.3 The Contractor shall estimate the water requirements for cleaning the photovoltaic modules at least once in two week or at closer frequency as per the soiling conditions prevailing at site, in order to operate the plant at its guaranteed plant performance. Also, the contractor is required to plan the water storage accordingly with provision of a tank of suitable capacity for this purpose. However, min. consumption of 2 Ltr / Sqm

of surface area of SPV module shall be considered in estimation of required quantity of water storage.

35.4 Water used for drinking & PV module cleaning purpose shall generally be of potable quality and fit for cleaning the modules with TDS generally not more than 75 PPM. In case of higher salt contents, the water shall be thoroughly squeezed off to prevent salt deposition over module surface. However, water with TDS more than 200 PPM shall not be used directly for module cleaning without suitable treatment to control the TDS within acceptable limits. The water must be free from any grit and any physical contaminants that could damage the panel surface.

35.5 If required, for settlement of any grit/ unacceptable suspended particles in the water a settling tank shall be installed before the inlet of the storage tank. Suitable arrangement for discharge/ disposal of sediment/ slush shall be provided in silting chamber by gravity disposal in surface drain or with provision of sludge sump and pump of adequate capacity.

35.6 The module cleaning system shall include construction of RCC tank or supply and installation of Ground mounted PVC tank (s) of required storage capacity, pumps (including 1 No. standby pump), water supply mains and flexible hose pipes, taps, valves (NRV, Butterfly valve, Ball valve, Gate valve, PRV, scour valve etc.), Water hammer arrester(s), pressure gauge, flow meter etc. as per the planning & design.

35.7 In case of over ground water storage tank, the contractor shall check its effect on plant performance through shadow analysis. The PVC storage tank shall conform to IS: 12701. The valves shall conform to IS: 778. A suitable metal sheet canopy for protection from direct sunlight shall be provided over the tank area.

35.8 The water supply mains could be either of GI, uPVC or HDPE, however, the vertical pipe connecting supply main to the discharge point shall be of GI.

35.9 Masonry chamber shall be provided for Main gate valve at pump end. Whereas, as per requirements, at other locations either a masonry or GI/ HDPE pipe chamber may be provided.

35.10 Module cleaning procedure and pressure requirement at discharge point shall be as per the recommendation of PV module manufacturer. However, discharge pressure at outlet shall not be less than 5 kgf/cm2(0.5 MPa)

35.11 All the pipes thus laid shall be buried in ground at least 150mm below FGL or laid above ground clamping on suitable concrete support blocks. In case of above ground piping only GI pipes shall be used.

36 Underground Water Tank

36.1 The top of the UG tank shall be 250 mm above FGL.

36.2 The tank shall have clear free board of 300mm above MWL.

36.3 The tank bottom shall have a slope of 1:100 towards drainage sump (500x500x500 mm deep). The slope shall be provided either in structural slab or in screed concrete (1:2:4) trawl finished. 1000x1000 mm size Manhole in roof slab and 20 mm MS rung ladder shall be provided for easy access to the storage tank and silting chamber for periodic cleaning. The manhole shall be covered with RCC precast cover. 50x50x6 mm MS angle with lugs shall be provided around precast cover and tank slab opening for edge protection. Rungs shall be painted with 2 coats of epoxy paint over 2 coats of primer.

36.4 The underground RCC tank shall be designed for following load conditions:

- External earth pressure + hydrostatic pressure due to ground water table (to be considered at FGL for design purposes) + Surcharge of 20 kN/ Sqm and Tank Empty.
- Tank full up to MWL and no external loads

36.5 The design shall conform to IS: 3370 with maximum crack width of 0.1mm for wall, bottom slab and roof slab. Min. grade of concrete shall be M30 (M35 in coastal areas, marshy and saturated soils) conforming to IS: 456. Suitable construction joints shall be provided as per provisions of IS: 3370 (Part 1). Water proofing admixture conforming to relevant BIS standard and of approved make shall be added to concrete as per manufacturer's recommendations.

36.6 The underground water tank shall be tested for water tightness as per the provisions of IS 3370 (Part-4). In case any leakage is noticed the same shall be repaired by injection of cement grout installing suitable nozzles around affected areas. Outside face of water tank in contact with water and soil and underside of roof slab shall be painted with 2 coats of epoxy paint.

37 Transmission Line Structures

37.1 Galvanized 220 kV and 132 kV Transmission Line towers, Tower extensions & accessories and 11 kV, 22kV, 22kV & 33 kV transmission poles, towers & accessories shall be designed following latest guidelines of respective SEB (State electricity board)/ STU (State transmission utility) and get approved from them before execution. In absence of SEB/ STU guidelines REC (Rural Electrification Corporation) standards may be followed. Support at corner with angle > 100 shall be provided with a 4-pole structure or a lattice tower structure. Use of PCC spun pole and RCC pole is not

acceptable.

37.2 Approved copies of these designs & drawings shall be submitted to the employer for reference and record.

38 Miscellaneous structures

38.1 Support structure for weather monitoring device

38.1.1 Weather monitoring device shall be mounted on tubular steel pole of required height. The pole shall conform to IS: 2713.

38.1.2 The pole shall be secured to an independent RCC foundation structure through Base plate and Anchor bolt assembly.

38.1.3 200 long 20 dia. rods shall be welded to the pole at 300 mm C/c for access to the device for maintenance purpose.

38.1.4 The support structure shall be hot dip galvanized.

38.2 Support structures for SMU

38.2.1 SMU shall not be supported from MMS and shall have an independent structural steel supporting frame of galvanized ISMC 75 with transverse diagonal bracings of ISA 65x65x6 to each column post.

38.2.2 Column post and bracings shall be supported with 300 mm (min.) diameter and 850 mm (min.) deep below GL piles in cement concrete (nominal mix 1:1:2). The column post and bracings shall be extended into the piles upto 800 mm with 50mm cover at the bottom.

38.2.3 The pile shall project 200 mm above GL.

38.2.4 The support structure shall hot-dip galvanized and of adequate height to ensure min. ground clearance of 1.0 m to SMU unit.

38.3 LA Mast and Foundation

38.3.1 The LA mast shall be a self-supporting structure with GI tubular pole of required height. The pole shall confirm to IS: 2713.

38.3.2 The pole shall be supported on RCC pedestal and foundation structure through Base plate & Anchor bolt assembly.

38.3.3 200 mm long, 20 dia rods shall be welded to the pole at 300 mm c/c for access to the device for maintenance purposes.

38.3.4 The support structure shall be hot-dip galvanized. Min depth of foundations shall be 1200 mm below GL.

D Quality Assurance and Inspection of Civil Works

1 Introduction

1.1 This part of the specification covers the sampling, testing and quality assurance requirement (including construction tolerances and acceptance criteria) for all civil and structural works covered in this specification.

1.2 This part of the technical specification shall be read in conjunction with other parts of the technical specifications, general technical requirements & erection conditions of the contract which covers common QA requirements. Wherever IS code or standards have been referred they shall be the latest revisions.

1.3 The rate for respective items of work or price shall include the cost for all works, activities, equipment, instrument, personnel, material etc. whatsoever associated to comply with sampling, testing and quality assurance requirement including construction tolerances and acceptance criteria and as specified in subsequent clauses of this part of the technical specifications.

1.4 The QA and QC activities in all respects as specified in the technical specifications/ drawings / data sheets / quality plans / contract documents shall be carried out at no extra cost.

1.5 The contractor shall prepare detailed construction and erection methodology scheme which shall be compatible to the requirements of the desired progress of work execution, quality measures, prior approvals from statutory authorities etc. if any and the same shall be got approved from the Engineer.

1.6 If required, work methodology may be revised/ reviewed at every stage of execution of work at site, to suit the site conditions, work progress commensurate with project schedule by the contractor at no extra cost to the Engineer

2 QA and QC Manpower

2.1 The contractor shall nominate one overall QA coordinator for the contract detailing the name, designation, contact details and address at the time of post bid discussions.

2.2 All correspondence related to Quality Assurance shall be addressed by the contractor's QA coordinator to the Engineer.

2.3 Employer/ Consultant shall address all correspondence related to Quality issues to the contractor's QA coordinator. The contractor's QA coordinator shall be responsible for co-ordination of Quality activities between various divisions of the contractor and their sub-vendors on one hand & with Engineer on the other hand.

2.4 The contractor shall appoint a dedicated, experienced and competent QA & QC in-

charge at site, preferably directly reporting to the Project Manager, supported as necessary by experienced personnel, to ensure the effective implementation of the approved QAP.

2.5 The contractor shall finalize and submit a deployment schedule of QA & QC personnel along with their details to Engineer for approval/ acceptance and further shall ensure their availability well before the start of the concern activity.

3 Laboratory and Field Testing

3.1 The contractor shall make necessary provisions to provide all facilities required for QA & QC activities by setting up a field laboratory for QA and QC activities in line with the indicative field QA & QC laboratory set-up.

3.2 The Laboratory building shall be constructed and installed with adequate facilities to meet the requirement of envisaged test setup. Temperature and humidity controls shall be available wherever necessary during testing of samples.

3.3 The quality plan shall identify the testing equipment/ instrument, which the contractor shall deploy and equip the field quality laboratory for meeting the field quality plan requirements.

3.4 The contractor shall furnish a comprehensive list of testing equipment/ instrument required to meet the planned/scheduled tests for the execution of works for Engineer's acceptance/ approval.

3.5 The contractor shall mobilize the requisite laboratory equipment and QA & QC manpower at least 15 days prior to the planned test activity as per the schedule of tests.

3.6 In case contractor desires to hire the services of any established laboratory nearby for any field tests then he shall ensure that the subject laboratory is well equipped with all requisite testing facilities and qualified QA & QC staff and this shall not affect in anyway the work progress.

3.7 All equipment and instruments in the laboratory/ field shall be calibrated before the commencement of tests and then at regular intervals, as per the manufacturer's recommendation and as directed by the Engineer. The calibration certificates shall specify the fitness of the equipment and instruments within the limit of tolerance for use. Contractor shall arrange for calibration of equipment and instruments by an NABL / NPL accredited agency and the calibration report shall be submitted to Engineer.

3.8 The tests which cannot be carried out in the field laboratory shall be done at a laboratory of repute. This includes selected IITs, NCB, CSMRS, reputed government / autonomous laboratories / organizations, NITs and other reputed testing laboratories.

The test samples for such test shall be jointly selected and sealed by the engineer and thereafter these shall be sent to the concerned laboratory through the covering letter signed by Engineer. Test report along with the recommendations shall be obtained from the laboratories without delay and submitted to Engineer.

3.9 Based on the schedule of work agreed with the Engineer and the approved FQP, the contractor shall prepare a schedule of tests and submit them to the Engineer and organize to carry out the tests as scheduled/agreed.

4 Sampling and Testing of Construction Materials

4.1 The method of sampling for testing of construction materials and work / job samples shall be as per the relevant BIS / standards / codes and in line with the requirements of the technical specifications / quality plans.

4.2 All samples shall be jointly drawn, signed and sealed wherever required, by the contractor and the engineer or his authorized representative.

4.3 The contractor shall carry out testing in accordance with the relevant IS standards/ codes and in line with the requirements of the technical specifications / quality plans. Where no specific testing procedure is mentioned, the tests shall be carried out as per the best prevalent engineering practices and to the directions of the Engineer.

4.4 All testing shall be done in the presence of Engineer or his authorized representative in a NABL accredited / Govt. Laboratory acceptable to Engineer.

4.5 The test samples shall be jointly selected and sealed and signed by the Site-in-charge and thereafter these shall be sent to the concerned laboratory.

4.6 The test report along with the recommendations shall be obtained from the laboratory without delay and submitted to Engineer.

5 Purchase and Service

5.1 All structural steel shall be procured only from main steel producers In case of non-availability of some of the sections with main steel producers, the contractor may propose to procure the sections from the re-rollers of the main steel producers, the name of such re-rollers will have to be cleared by the Engineer for which details such as BIS approval, main steel producer's approval, past experience for production of sections of specified material, details of machines, plant, testing facilities etc.

5.2 Confirmation that the process control and manufacturing of steel sections by re-rollers shall be same as that of main steel producers, that billets for re-rolling will only be sourced from main steel producers shall be furnished with regard to re-roller.

5.3 For Module Mounting Structures (MMS), sources of steel other than those specified under this clause may also be used subject to the condition that they otherwise meet the requirements of the Technical Specifications / Bid documents. Even after clearance of re-rollers, induction of billets with identified and correlated Mill test certificates (MTC) in the process of re-rolling, sampling of steel, quality checks thereof and stamping of final product for further identification and correlation with MTC prior to dispatch shall be the responsibility of the contractor and these shall be performed in presence of the authorized representative of the main Contractor.

5.4 Reinforcement steel shall be procured only from main steel producers and Mill test certificates (MTC) shall be obtained and submitted to the Engineer for correlation.

6 Field Quality Plan

6.1 Well before the start of the work, the contractor shall prepare and submit the Field Quality Plans to Employer for approval, which shall detail out for all the works, equipment, services, quality practices and procedures etc. in line with the requirement of the technical specifications to be followed by the contractor at site.

6.2 This FQP shall cover all the items / activities covered in the contract / schedule of items required, right from material procurement to completion of the work at site.

6.3 An Indicative Field & Manufacturing Quality Plan for civil, structural and MMS works is enclosed with this specification for reference as Annexure-B.

7 General QA Requirements

7.1 The contractor shall ensure that the works, BOIs and services under the scope of Contract, whether manufactured or performed within contractor's works or at his subcontractor's premises or at the project site or at any other place of work, are in accordance with Technical specification, applicable standards / codes, approved drawings / data sheets / quality plans and BOQ. All the works, BOIs and services shall be carried out as per the best prevalent engineering practices and to the directions of the Engineer.

Equipment	UOM	Approx. Qty.
Cube moulds for cement testing	nos.	4
Sieve shaker	nos.	1
Sieve for sand, coarse and fine aggregate	set	1
Sieve for coarse aggregate	set	1

Slump testing equipment	nos.	6
Oven	nos.	2
Physical balance	nos.	1
Thermometer	nos.	4
Burret	nos.	2
Measuring cylinder	nos.	9
Measuring flask	nos.	3
Compression testing machine	set	1
Cube mould for concrete	nos.	10
Mechanical weighing machine	nos.	1 (100kg capacity)
Drum type concrete mixer (for trial mixes)	nos.	1
Proctor testing equipment	set	1

7.2 Notes

7.3 The equipment listed above is indicative and minimum required. Additional equipment, if any, required for successful completion of work shall be provided /arranged by the contractor.

7.4 All test reports/ inspection reports shall be submitted in soft copy also and shall be available at site for easy access to the Engineer.

7.5 Based on the schedule (L2/L3 Network), Quality control & Quality Assurance Work plan shall be finalized by the contractor and the same shall be submitted to Engineer for acceptance/approval.

E Battery Energy Storage System

1 Scope of Works

The Scope of Work covered under this specification shall be but not limited to the following.

1.1 Initial Design and Fabrication

For the initial design and fabrication of the equipment, the Contractor shall

- Design, fabricate, and assemble a fully functional, containerized BESS that meets the requirements delineated herein. This shall include a control system that provides standard input/output channels and appropriate control actions for all

required operational and protective features.

- Fully document the design and expected performance of the BESS by means of documents, drawings, reports, data, and other submittals, as required herein.
- Perform factory acceptance testing of the BESS.
- Conduct design review meetings during initial design and fabrication, in Consultation with the Employer with special reference to the geographical/climatic conditions of the Project site.
- Obtain site-specific data in preparation for developing installation implementation plans.
- Develop site installation/construction drawings, specifications, and calculations.
- Supply any special equipment and tools required for maintenance of the BESS.
- Supply an initial complement of spare parts (as specified in Annexure F: Mandatory Spares) including spare racks for future installation
- Provide warranty for the entire BESS and its constituent equipment.

1.2 Transportation and Site Setup

Interconnection of the BESS with the grid is at the point of common connection (PCC). The Contractor shall be responsible for all equipment and installation activities up to the system side of the PCC. The Contractor will be responsible for completing the necessary work for interconnection point.

1.3 Installation/Interconnection

For installation/interconnection, the Contractor shall

- Develop drawings, specifications, and calculations for Contractor's scope of installation equipment and services (that is, up to the BESS side of the PCC).
- Develop detailed start-up and site acceptance test (SAT) plans.
- Obtain all permits necessary to transport the BESS to the site.
- Ship the BESS to the project site.
- Assemble BESS components on site to produce a functional system (as required).
- Perform start-up testing and SAT of the BESS.
- Provide on-site Contractor representative during installation and/or interconnection activities by the Employer and during start-up and SAT of the BESS by Contractor.
- Obtain permits necessary to prepare the site and to install and interconnect the BESS to the grid.

- Provide a complete set of as-built drawings.
- Provide a training class for the Employer's technicians and maintenance personnel.

1.4 Operation and Maintenance

Employer intends to entrust the operation and maintenance (O&M) of the BESS,as part of the Plant Facilities, on comprehensive basis to the Contractor on turnkey for the O&M Period as specified in this Document. The rates quoted by bidder for Comprehensive O&M of the Plant Facilities on yearly basis for the O&M Period shall be inclusive of the replacement costs if any.

1.5 Definitions

- **PCC** – Point of common connection, the electrical boundary between the Solar PV Power Plant and the electrical network of the utility.
- **Unit battery** – A unit battery is the minimum field-replaceable stored energy component or assembly. It may consist of one or more electrochemical cells, electrically interconnected in any series and/or series–parallel configuration. A unit battery has one (and not more than one) set of positive and negative terminals, by which it is interconnected with the rest of the storage system.
- **PCS** – Power Conditioning System - A switching power supply unit that enables bidirectional power conversion between AC and DC. It is the interface between the DC battery system and the AC system and provides for charging and discharging of the battery.
- **FAT** – Factory Acceptance Test
- **BESS** – Transportable, containerized energy storage system based on commercially available electrochemical storage solutions, capable of receiving, storing and delivering electrical energy at specified rate(s) suitable for the application laid out in the specifications herein. It comprises of unit batteries, battery management system (BMS), PCS, auxiliaries, such as HVAC and fire suppression systems, step-up transformers to match utility grid, ac switchgear, Control Systems etc.
- **BMS** - or Battery Management System, is any electronic system that manages a rechargeable battery (cell or battery pack), including protecting the battery from operating outside its Safe Operating Area, monitoring its state, calculating secondary data, reporting that data, controlling its environment, authenticating it and / or balancing it.

- **Available or Dispatchable or throughput energy** is the sum total of energy (kWh) delivered at the Point of Interconnection of the BESS with the Solar PV array fields when operating at the rated output power.

2 Site-Specific Implementation Requirements

2.1 Procurement-Specific Location and Site Characteristics for Design

Table-1 below lists supply-specific location and site characteristics.

Table 1: Procurement-Specific Location and Site Characteristics

Item	**Characteristic**
Location	Rajnadgaon, Chhattisgarh
Site characteristics:	
Climate Conditions (General)	Tropical type Climate, hot all year round, with a dry season from December to April, and a rainy season from May to November
Precipitation	1500-2000 mm per year
Seismic Zone (Geological Survey of India, 2014)	Seismic zone III
Electrical infrastructure: AC system interconnection requirement at Point of Connection (PCC)	33 kV/415, 50 Hz, 3 phase The BESS will be coupled with the PV System at the AC Bus on the LV (415 V) or the MV (33 kV) side of the Inverter Transformers. The BESS shall be designed for maximum flexibility with regard to site-specific voltages, frequency, phase imbalance, and protection requirements.

2.2 Grid Characteristics

The BESS shall be capable of continuous operation under variable voltage, frequency and phase imbalance conditions at the PCC, as described in Table-1. Information on available fault current and other characteristics of the Utility grid will be provided by the Transmission/Distribution Utility. The Contractor shall confirm, for each Host Utility site, that this information has been received and understood during the site-specific

engineering phase.

2.3 Codes and Standards

The BESS shall comply with the following Codes and Standards or equivalent Indian Standards, as applicable:

Standard/ Code	Description
IEC 61427-2/IS 16270 / UL 1973	Secondary cells and batteries for renewable energy storage for On-grid applications - General requirements and methods of test
IEC 62485-2	Safety requirements for secondary batteries and battery installations - to meet requirements on safety aspects associated with the erection, use, inspection, maintenance and disposal: Applicable for Lead Acid and NiCd / NiMH batteries
IEC 61508	Functional Safety of Electrical/Electronic/Programmable Electronic Safety-related Systems: Applicable for all Battery Energy Storage Systems
IEC 62619:2017/ UL 1642	Secondary cells and batteries containing alkaline or other non-acid electrolytes - Safety requirements for secondary lithium cells and batteries, for use in industrial applications
IEC 62281 / UN 38.3	Safety of primary and secondary lithium cells and batteries during transport: Applicable for storage systems using Lithium Ion chemistries
IEC 61850/ DNP3	Communications networks and management systems. (BESS control system communication)
IEC TS 62933-5-1:2017	Electrical energy storage (EES) systems - Part 5-1: Safety considerations for grid-integrated EES systems - General specification
UL 9540	Standard for Energy Storage Systems and Equipment

3 Technical Specification of Battery Energy Storage System

3.1 Procurement-Specific Ratings and Requirements

Table-2 below specifies project-specific BESS capabilities and ratings for this Project.

Table 2: Supply-Specific Ratings and Requirements for each system

Item Description	**Requirement**
Battery Technology	Any battery technology with totally Maintenance Free characteristic suitable for operation in site-specific climatic conditions can be used.
Rated No of Cycles (Minimum)	4000 cycles at rated energy capacity at 80% Depth of Discharge (DoD) at 25°C and up to C/3 Rate of Discharge
Power Rating	50 MW
Watt-hour rating (dispatchable capacity)	150 MWh ,dispatchable at the beginning of life (i.e. at the time of Commissioning) and minimum throughput capacity at the beginning of each year as per below table: Year 1 – 147 MWh Year 2 – 144 MWh Year 3 – 141 MWh Year 4 – 138 MWh Year 5 – 135 MWh Year 6 – 132 MWh Year 7 – 129 MWh Year 8 – 126 MWh Year 9 – 123 MWh Year 10 – 120 MWh Dispatchable capacity shall not be less than 80% of Beginning of Life capacity at any point of time up to End of Battery Life.
Annual BESS Availability Guarantee	99%
System ac-dc-ac efficiency*:	>80%
Reactive Power Rating	NA

Use case requirements	Peak Management
Peak Management	In the Peak Management Use Case scenario, power generated during the early and midday periods shall be stored in the BESS and discharged during peak demand, for 3 hours, after solar generation hours.
Charge-Discharge Cycles	One discharge cycle per day is envisaged.
Ventilation System inside the Container	Should be such as to maintain minimum and maximum Temperature as recommended by the manufacturer for optimum performance of the batteries on continuous basis.
Grid Charging	No
To be verified as per the procedure described in Annexure-F (Annexure-F: Plant Documentation, Commissioning and Test Procedure) to this Section for Performance Guarantee Tests and to be verified on annual basis as per Schedule. All measurement instruments for conducting the tests shall be maintained by the Contractor.	

3.1.1 The BESS Supplier/sub-Contractor must have experience of having successfully completed Design, Engineering, Procurement, Construction, Installation, Testing and Commissioning of Grid Connected Battery Energy Storage System (BESS) of at least 03 (Three) Grid connected BESS Plants, each having an individual capacity of 5 MWh (Five Mega Watt Hour) or above in last Five years. However, such BESS Plant capacity must have been in satisfactory operation for at least 12 (Twelve) months from the date of commissioning.

3.2 Nameplate Ratings

3.2.1 Overall System Real Power and Energy Ratings

During discharge, the BESS shall be rated to supply at the PCC the continuous net ac real power and ac energy output specified in *Table 2: Supply-Specific Ratings and Requirements* above. These ratings shall be referred to in all project documentation, including this specification, as the nameplate watt rating and the nameplate watt-hour rating. All nameplate ratings shall be achievable over the End of Battery life, as specified in Clause 4.5.1. The nameplate watt-hour rating shall be achievable during discharge for the full range of stated environmental conditions, provided that the

battery is fully charged and the HVAC system (if incorporated in the BESS) has stabilized. In any case, the BESS shall be capable of being discharged at reduced power levels from that specified above. However, in no case will the energy discharged from the battery be greater than the nameplate watt-hour rating.

The Contractor shall clearly state in its O&M manual as well as during design review the expected efficiencies of the major subsystems (battery, PCS) as well as the expected losses from auxiliaries.

Note: The real power level attainable during charging shall be at the Contractor's discretion, so long as the other charging/discharging requirements in this specification are met.

3.2.2 Overall System Reactive Power Rating

In accordance with the VAR-related control modes identified in this specification, if any, the BESS shall be capable of dispatching both leading and lagging reactive power at the PCC, up to the rated VAR capacity specified in Table-2, regardless of whether the battery is being simultaneously discharged or charged. This rating shall be referred to in all project documentation, including this specification, as the nameplate VAR rating. The BESS shall be capable of simultaneously producing real and reactive power as long as no nameplate rating is exceeded. That is, the combination of operation at full nameplate watt rating and full nameplate VAR rating shall not exceed the nameplate VA rating.

4 Design, Fabrication, and Construction Requirements of BESS

4.1 General

The methods and materials specified in this technical specification are intended to represent minimum requirements. Reliance thereon shall not diminish the responsibility for meeting performance and other requirements stated in this technical specification. The design of the BESS shall incorporate the principle of modularity, with a view to reducing life-cycle costs and ease of replenishment of storage capacity while facilitating ease of maintenance, space requirements, and reliability. The design should also facilitate rapid and easy replacement of the unit batteries without significant downtime. Overall, the design philosophy shall be to minimize and optimize all costs to the Employer, not simply initial capital costs or low maintenance costs.

Life-cycle costs include the following: initial system cost, unit battery replacement cost,

periodic equipment upgrades, maintenance costs, auxiliary system energy consumption, charging energy costs (that is, costs due to overall battery and PCS losses), and any other contributors to life-cycle energy cost.

4.2 System-Level Design and Performance Requirements

4.2.1 The major equipment items shall include a battery, battery management system (BMS), PCS, output/isolation transformer, and SCADA which is to be integrated with the solar plant SCADA system defined elsewhere in this document. Additional equipment shall include HVAC, wiring, connectors, protective devices, grounding, junction boxes and enclosures, instrumentation, enclosures, and all other items needed for a fully functional, grid-interactive BESS to meet the requirements set forth in this specification. All systems and components of systems—including electrical storage unit, switching devices in the PCS, components of monitoring and control systems, and components of auxiliary systems— must use proven and previously demonstrated technology. Electrochemical cells, PCS switching devices, and control system hardware and software must be commercially available and in use for other markets. Electrochemical cells must be replaceable (in small orders) with a maximum six-week lead time under normal business conditions. Designs using experimental or otherwise undocumented components are not permitted.

4.2.2 The BESS shall be IEEE 1547 (Standard for Interconnecting Distributed Resources with Electric Power Systems)–compliant, where possible.

4.2.3 The prudent design of the BESS should include careful consideration of resonance and Ferro-resonance.

4.3 Containerization and Transportability

4.3.1 The BESS shall be containerized, using either standard International Organization for Standardization (ISO) 668 shipping containers or custom-designed power equipment centres. The container or containers shall be designed to be drop-shipped onto a properly prepared pad or foundation (such as compacted soil, concrete pad or platform, and so on). When fully installed, all BESS components—including battery racks all auxiliaries, such as HVAC and fire suppression systems, step-up transformers to match grid, ac switchgear, and so on—and tools shall be enclosed in (or on) the containers, even if certain components must be separately shipped and installed at the site.

4.3.2 Containers shall be designed and constructed to meet IP54 requirements. The design and installation of Containers shall meet relevant regulatory requirements for

occupational safety and health under national and state legislations.

4.3.3 All containers and packaging of separately shipped components shall be suitable for land or sea transport, including offering suitable protection of the equipment inside against damage from weather and vibration or shock from transportation.

4.3.4 The containers and their contents shall be designed to be easily prepared for transport, shipped, connected and operated at site. The Contractor shall ensure that all required bracing and shipping stabilization equipment to enable transport is either kept at hand or brought to the site in a timely manner before transport.

4.4 Additional transportability requirements and/or clarifications

4.4.1 In designing for transportability of the lithium-ion batteries, the Contractor shall follow the relevant guidelines (Sub-section 38.3) set forth in the United Nations document "Recommendations on the Transport of Dangerous Goods—Manual of Tests and Criteria" (ST/SG/AC.10/11/Rev.5), with specific reference to obtaining UN38.3 and UN3480 certifications at the battery module and/or container level.

4.4.2 The BESS container or containers shall be of a size and weight to be capable of being transported to project sites with due consideration for the load bearing restrictions imposed by bridges, if any, and climatic conditions in the region.

4.4.3 Containers shall incorporate standard lugs or other means for lifting by crane or shall be properly palletized for movement with forklift trucks, or both.

4.5 Design Life and Life-Cycle Costs

4.5.1 End of battery life – End of battery life is that point in time when the BESS can no longer meet the power and/or energy discharge requirements of this Specification due to age or non-repairable malfunction of the battery subsystem, and/or non-replaceable components. When the system is no longer able to provide these requirements, the system has reached its end of life. Battery End of life shall not be less than 10 years from the date of Commissioning.

4.5.2 It shall be the responsibility of the Contractor to make periodic replacements/replenishments of unit batteries, if and when required, up to the End of Battery Life as described above. Outage time as a result of replacement will also be counted as an "Accountable BESS Outage" for the purpose of computing BESS Availability.

4.6 Reliability, Availability, and Operability of the BESS

The BESS shall be designed for high reliability, defined in the following terms:

Starting reliability: (99% starting reliability means that the unit shall start in 99 of 100 attempts)

Mean-time-to-repair- The time taken from the time of notification of a need for repair to the time of completion of repairs (that is, inclusive of time for arrival of spare parts and repair personnel at the location of the BESS)

Availability

Availability is the percentage of hours that the BESS is available during the year. The availability guarantee shall begin upon facility commissioning. Annual availability shall be calculated as follows:

$$[1 - \left(\frac{\sum Accountable\ BESS\ Outage\ duration\ in\ hours\ x\ We}{8760}\right)\ ] \times 100$$

Where:

- W_e, Weightage is $\frac{Outage\ Capacity}{Rated\ Capacity}$, where Outage and Rated Capacity shall be in Energy terms i.e. MWh. Rated Capacity in a given year shall correspond to the daily throughput capacity guarantee for the beginning of the year as per Clause 3.1.
- *Accountable BESS outages* are outages caused or necessitated by the BESS equipment that result in reduced capacity or loss of essential function of the BESS. These outages may be initiated by failure of components, loss of battery capacity, operation of protective devices, alarms, or manual action. Such outages include both forced outages due to equipment problems and scheduled outages for BESS maintenance.
- *Accountable BESS outage duration* is the elapsed time of accountable BESS outages from the instant the BESS experiences reduced capacity or is out of service to the instant it is returned to service or full capacity. If the BESS experiences reduced capacity but is determined by the Employer to be available for service even if the Employer elects not to immediately return the equipment to full capacity, such time will be discounted from the outage duration.
- The Procurement specific nameplate ratings shall be as defined in Clause 3.1 above. The BESS shall be considered to be under an accountable outage if any of those ratings cannot be met. The BESS shall also be considered to be under an accountable outage if a scheduled (or required) charge cycle cannot be

completed.

- The data required for assessment of the availability of the BESS shall be collected through the Plant's integrated SCADA system.
- Grid outage hours shall be subtracted from total no. of hours in the year.
- If the Plane of Array solar irradiation/insolation is less than 2kWh/m^2 on a day, the day (i.e. 24 hours) shall be excluded.

4.6.1 It shall be possible to fully remove, repair, and replace in the field any failed or poorly performing component, assuming that spare parts, test equipment, and maintenance personnel are on the site. This capability shall be demonstrated in the factory acceptance test (FAT) for unit batteries and other key components.

4.6.2 The BESS shall be capable of unattended operation, with provision of remote monitoring and control.

4.7 Planned Maintenance Outage

The Contractor shall provide a guarantee for the maximum length of time required for this type of maintenance operation.

4.8 Battery Subsystem Design Requirements

4.8.1 Electrochemical Cells

Only cells that are commercially available or for which suitable (not necessarily identical) replacement cells can be supplied on short notice will be allowed. *For both premature cell failures and end-of-battery-life replacement, the Contractor shall guarantee cell availability and the length of down time (hours or days) required to replace cells.* The cells may be supplied as separate, individual units or as group of cells combined into modules. The cells shall meet the seismic requirements for the planned location of the BESS. Cell and module design shall accommodate the anticipated vibrations and shocks associated with the transportation of the BESS and shall resist deterioration due to vibrations resulting from the same. Associated hardware and paraphernalia should also be able to withstand the rigors of transportation. The transport plan shall be shared with the Employer and approved prior to dispatch.

4.8.2 Labelling of the cells or unit batteries shall include manufacturer's name, cell type, nameplate rating, and date of manufacture, in fully legible characters. All cells shall be traceable to the point of origin for purpose of addressing safety issues.

4.8.3 Electrochemical Storage System

4.8.3.1 The storage system may consist of one or more unit batteries. If the storage system consists of more than one unit battery, these may be electrically interconnected in any desirable series and parallel configuration to achieve the overall system storage and power rating requirements.

4.8.3.2 Each electrically series-connected string of unit batteries shall include a means of disconnecting the string from the rest of the system and of providing over-current protection (during a fault). The means of disconnect shall provide for a physical interruption of the string electrical circuit, which shall be visible to anyone servicing the individual unit batteries in the string and shall be capable of being locked or secured in an open position.

4.8.3.3 If the disconnect means consists of removal of a unit battery, the storage system shall be designed to allow maintenance personnel to determine that there is no current flowing in the string and provisions to ensure that the PCS is off before the unit battery is removed. Procedures for maintenance and/or field replacement of unit batteries shall neither require nor recommend removal of the unit battery without first ensuring that no current is flowing in the string circuit.

4.8.3.4 Over-current protection, whether on the ac or dc side, in paralleled unit battery strings shall be sized and coordinated so that currents from other strings do not contribute to a fault in any unit battery string.

4.8.3.5 Where appropriate, dc wiring shall be braced for available fault currents. Protection shall include a dc breaker, fuse, or other current-limiting device on the battery bus. This protection shall be coordinated with the PCS capabilities and battery string protection. The Contractor shall produce a fault analysis and protection coordination study for the battery dc subsystem during final design. *The Employer reserves the right to withhold permission to ship the BESS until the fault analysis has been satisfactorily completed.*

4.8.3.6 Cells, wiring, switch gear, and all dc electrical components shall be insulated for the maximum expected voltages plus a suitable factor of safety.

4.8.3.7 The battery system shall include a system to detect and alarm excessive ground leakage current levels. Ground fault detection shall be enabled for the container or, if more than one electrical series string is installed in the container, for each series string. The detection/trip level shall be field adjustable. The Contractor shall have overall responsibility for the safety of the electrical design and installation of the battery, as well as all aspects of the BESS.

4.8.3.8 The battery system shall include a monitoring/alarm system and/or prescribed maintenance procedures to detect abnormal unit battery conditions and notify proper personnel of their occurrence.

4.8.3.9 Abnormal conditions shall include but not be limited to (1) weak unit batteries that could reasonably be expected to fail to provide rated capacity upon full discharge, (2) high-resistance or open-unit batteries, (3) high-resistance or open external unit battery connections, (4) unit batteries with temperatures exceeding operating thresholds, and (5) internally shorted unit batteries. Unit battery monitoring, whether automatic or manual, should be specified to alert the proper personnel in a timely manner that an abnormal unit battery condition exists or may exist. All alarms shall be part of the control system and shall include remote display or annunciation capability.

4.8.3.10 The unit batteries shall be racked or shall be housed in stackable modules. The unit batteries or cells shall be arranged and installed to permit easy access for equipment and personnel. The moveable units shall be arranged and installed to permit easy access for equipment and personnel to carry out unit removal and replacement activities. For all systems, it shall be possible to remove and replace a prematurely failed unit battery or cell (as appropriate), when system performance specifications cannot be met. The lengths and widths of all aisles and spaces into which personnel may enter in the field for operations and/or routine or unscheduled maintenance purposes, as well as egress routes from these aisles and spaces, shall conform to applicable codes and standards. All racks and metallic conductive members of stackable modules shall be grounded to earth. Racks shall meet the seismic load and road vibration requirements and shall include means to restrain cell movement during seismic events and transport.

4.8.3.11 Provision shall be made for future Augmentation/Replacement by keeping Spare Racks for accommodating Battery Stack Modules capacity as per Annexure F: Mandatory Spares.

4.8.3.12 The design of all modules and racks shall specifically account for the anticipated vibrations and shocks associated with the transportation of the BESS.

4.8.4 Cell/Battery Auxiliary Systems

The cells and battery system shall be supplied with all required and/or recommended accessories. This includes inter-cell connectors and monitoring devices for cell temperature and cell voltage, if required.

4.9 Power Conditioning System Design Requirements

4.9.1 General

4.9.1.1 Standards and Codes

Power Conditioning Unit (PCU) shall comply with the specified edition of the following standards and codes.

Standard	Description
IEC 61683 Ed. 1	Photovoltaic systems - Power conditioners - Procedure for measuring efficiency
IEC 62109-1 Ed. 1	Safety of power converters for use in photovoltaic power systems - Part 1: General requirements
IEC 62109-2 Ed. 1	Safety of power converters for use in photovoltaic power systems - Part 2: Particular requirements for inverters
IEC 61000-6-2 Ed. 2	Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity standard for industrial environments
IEC 61000-6-4 Ed. 2.1	Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Emission standard for industrial environments
IEEE 1547/IEC 62116/UL 1741	Utility-interconnected photovoltaic inverters - Test procedure of islanding prevention measures
IEC 61727 Ed. 2	Photovoltaic (PV) systems - Characteristics of the utility interface
IEC 60068-2-1:2007	Environmental testing - Part 2-1: Tests - Test A: Cold
IEC 60068-2-2:2007	Environmental testing - Part 2-2: Tests - Test B: Dry heat
IEC 60068-2-14:2009	Environmental testing - Part 2-14: Tests - Test N: Change of temperature
IEC 60068-2-30:2005	Environmental testing - Part 2-30: Tests - Test Db: Damp heat, cyclic (12 h + 12 h cycle)

4.9.1.2 The PCS may consist of one or more parallel units. Paralleling may be at the DC or AC terminals. The PCS circuit topology shall be voltage source (that is, the PCS at its AC terminals shall appear to the grid as a voltage source rather than as a current source and, at its DC terminals, shall be capable of reversing current flow in the battery without reversing the polarity of the DC bus).

4.9.1.3 All load-carrying cables within the PCS subsystem shall have a suitable load factor of safety.

4.9.1.4 The PCS shall be housed within one or more appropriate weatherproof and dustproof enclosures, with provisions to prevent moisture condensation and to prevent the entrance of water, airborne salt or dust, rodents, insects, and/or similar materials or pests into air intake/exhaust ports.

4.9.2 Power Conditioning System Rating

The PCS shall be capable of delivering Real power as specified in Table-2. This rating shall be referred to in all project documentation, including this specification, as the nameplate VA rating. To account for losses in the PCS, the DC input power to the PCS will be higher than the rated PCS output power. The available DC input power will be the BESS nameplate watt rating divided by the PCS full load efficiency (as specified in the datasheet) during discharge.

4.9.3 Power Conditioning System Protection and Control

The PCS, in conjunction with the control system, shall be capable of completely automatic, unattended operation, including self-protection, synchronizing and paralleling with the grid, and disconnect. The control of the PCS shall be integrated with the overall BESS controls.

The PCS shall include all necessary self-protective and self-diagnostic features to protect itself from damage in the event of component failure or the excursion of operating parameters beyond a safe or expected range. This includes excursions due to internal or external causes. The self-protective features shall prevent the PCS from being operated in a manner that may be unsafe or damaging. Faults due to malfunctions within the PCS, including commutation failures, shall be cleared by the PCS over-current protection device(s).

4.9.4 Power Conditioning System AC Interface with AC bus

4.9.4.1 The BESS must meet applicable harmonic current and voltage specifications in accordance with applicable standards. Harmonic suppression may be included with the PCS or at the BESS AC system level. However, the Contractor shall design the BESS electrical system to preclude unacceptable harmonic levels in the BESS auxiliary power system.

4.9.4.2 In addition to interconnection standards specified in this document, there may be specific requirements for interconnection, which need to be ascertained by the Contractor in co-ordination with the distribution/transmission utility at site.

4.9.4.3 The PCS transformer may be used to aid in harmonic cancellation and may include

tertiary windings to supply BESS auxiliary power requirements. The transformer must be dry type. The PCS shall include provisions for disconnect on both its AC and DC terminals for maintenance work. Conductor separation must be clearly visible. The detailed maintenance procedure shall be addressed in the O&M manual.

4.9.4.4 Electromagnetic Interference

The PCS shall not produce electromagnetic interference (EMI) that will cause mis-operation of instrumentation, communications, or similar electronic equipment within the BESS.

4.9.4.5 Islanding

The PCS design shall include provisions to limit run-on and islanding as per applicable standards upon the loss of grid. This capability shall be demonstrated to the Employer's satisfaction during the FAT.

4.10 AC System

The BESS AC system includes all switch gear, bus work, cable, connectors, transformers, and protective relaying required for connecting the BESS at the PCC. The Contractor shall design, procure, ship, and assemble on-site all ac interconnection equipment on the BESS side of the PCC. The Contractor shall design, fabricate, ship and install all cabling required for connecting the BESS to the PCC. The BESS AC system shall include potential transformers, current transformers, and any other metering equipment so that the performance monitoring and documentation requirements of this specification can be met. Metering accuracy shall meet applicable standards.

4.11 Protection and Control

4.11.1 The power system (PCS), AC and DC switchgear/protective devices) shall be designed to provide safe, reliable operation with minimum interruption. Reliable operation shall be supported by a sensitive and properly coordinated protection system. The protection system shall be capable of monitoring significant operating parameters and sensing all abnormal operations or fault conditions. It shall isolate the faulted circuits or components without causing damage to other circuits and components of the system. The protection system shall also provide adequate indications and/or alarms for identification of the faulted circuits, components, and abnormal conditions, allowing preventive action and rapid restoration of service.

4.11.2 The BESS shall have at least following protection mechanisms for battery:

- Reverse Polarity
- Over/ Under Voltage
- Over Temp
- Over Charge

4.11.3 The grid may have its own protective schemes at the point of common connection (PCC) that will be the responsibility of the Contractor to fulfil.

4.11.4 Protection shall not be interlocked with the position of any isolating/interrupting devices.

4.11.5 The BESS shall be capable of interrupting line-to-line fault currents and line-to-ground fault currents available at the PCC and flowing in the equipment in either direction for faults on either side of the PCC. Faults due to malfunctions within the BESS shall be cleared by the BESS protective devices.

4.11.6 The BESS must have low-voltage ride-through capabilities according to extant Technical guidelines on connectivity.

4.11.7 BESS should be disconnected from the system and the system operators must be notified if any of the following occur:

- The BESS local interconnection protection system fails
- The interrupting device fails.
- The dc supply is lost

4.11.8 The BESS shall include provisions to protect against transient voltage surges from switching, lightning, and similar causes, in accordance with applicable standards. The overall PCS design shall also limit surges on the dc bus to twice the normal maximum DC bus voltage.

4.12 Auxiliary Power

The BESS shall include an auxiliary power system (separate or same as the Solar Plant auxiliary system) derived from the utility AC bus, the PCS transformer low-side bus, PCS transformer tertiary winding, or similar means with metering. The auxiliary power system shall include all step-down transformers, breakers, fuses, motor starters, relaying, panels, enclosures, junction boxes, conduits, raceways, wiring, and similar equipment, as required for the BESS operation. The auxiliary power system shall include separate potential transformers and current transformers, so that auxiliary power consumption can be measured and electronically recorded in real time, independently of operation of the PCS or of net power flows to and from the battery. The auxiliary power system and/or control system design shall provide for whatever

emergency power is necessary for an orderly system shutdown during abnormal conditions such as a loss of grid power. The auxiliary power system and/or control system design shall also provide for the capability to restart automatically after BESS shutdowns of several days.

5 Control and Communication

5.1 Control System General Requirements

The control system shall be designed to provide for automatic, unattended operation. The control system design shall provide for local manual operation and remote operation or dispatch from a remotely located computer. The control system shall be programmable for establishing or adjusting all parameters, set points, algorithms, limits, and so on that are required for effective operation as described in this specification. The control system shall be designed to prevent externally supplied, control panel or local signals from causing the BESS to operate in an unsafe manner or in a manner that may damage the BESS.

5.2 Control Functions and Protocols

5.2.1 To the extent possible, all BESS control functions and operating modes shall be in accordance with standard functionalities for smart distributed resources, as documented in the IEC 61850-90-7.

5.2.2 The communication protocol for the BESS shall be according to IEEE 1815-2010-Standard for Electric Power Communications—Distributed Network Protocol (DNP3) or IEC 61850.

5.2.3 If data points and/or control functions outside the standard point definitions in DNP3 AN2011-001/IEC 61850 are created by the Contractor, the Contractor shall maintain a systematic log of the same for the purpose of maintaining/facilitating interoperability with future standards/protocols for distributed energy resources

5.3 Additional Control System Functions

5.3.1 Shutdown/Startup/Standby

The start and stop controls shall be as per DNP3 AN2011-001 standard specifications or IEC 61850. The control system shall use these controls for an orderly and safe shutdown, even in the absence of grid power. The control system shall also use these controls for an orderly startup sequence, which shall provide for a safe system reset from any standby or operating condition so that the unit goes through a normal startup sequence in the same way it would when being powered up after loss of power or

being in a shutdown state. The control system shall include provisions for a standby state (that is, BESS available but not charging or discharging), which shall be the end result of a normal startup sequence. It shall also be possible to enter the standby state from any of the other operating states except connect/disconnect.

5.3.2 Initiation of Shutdown

The control system shall initiate shutdown under the following conditions and shall remain in the shutdown state until a reset signal, either local or remote, is initiated. An appropriate alarm shall be set.

- Emergency trip switch.
- Loss of the low-voltage AC or utility grid voltage.
- An AC circuit breaker trip (either side of transformer).
- Door interlock: Initiate shutdown when the door is opened (with appropriate provision for maintenance work). Interlocks shall be self-resetting.
- Smoke/fire alarm.
- Control logic trouble.
- A DC ground fault (field-adjustable setting).
- Remote disable (no reset required).
- grid system faults (balanced and unbalanced; line-to-ground, line-to-line, and three-phase).
- Abnormal frequency
- Abnormal voltage
- Islanding condition.
- Protection or control scheme failures, including the following:
  - Failure of local interconnection protection system
  - Failure of critical breaker trip coil or interrupting device
  - Loss of DC supply

5.3.3 Reset Alarms

For all system-generated alarms, the control system shall provide for the resetting of those alarms. This function is intended for alarms that, after they are set (for example, by a fault condition, as listed above and elsewhere in this specification), must be cleared by operator intervention to allow normal operation to be restored.

5.3.4 Modify Storage Settings

The control system shall provide for modification of various set points and fixed operation/control settings associated with the various control functions.

5.3.5 Event/History Logging

The control system shall provide for the automatic logging of the following information:

- All errors or failures
- All startup and shutdown actions
- All control actions
- All responses to control actions
- All limit violations, including returns within limits

5.3.6 Status Reporting

The control system shall provide for reading and reporting of various BESS- supplied status information in accordance with the data collection and reporting requirements specified in this technical specification.

5.3.7 Time Synchronization

The control system shall provide for synchronization of its real-time clock with a standard time source.

5.3.8 Change Operational Mode

The control system shall support activating/deactivating control functions. The control functions are expected to be executed by command from a remote host, but may also be scheduled.

5.3.9 Perform Self Diagnostics

The control system shall provide for self-diagnostic functions.

5.4 Control System Hardware Requirements

All local control and monitoring system components shall be housed in appropriate controlled environment enclosures either as separate arrangement or in conjunction with Solar Plant SCADA system.

5.5 Control System Self-Protection and Self-Diagnostic Features

5.5.1 The BESS shall include appropriate self-protective and self-diagnostic features to protect itself and the battery from damage in the event of BESS component failure or from parameters beyond the BESS's safe operating range due to internal or external

causes. The self-protective features shall not allow local or remote signals to cause the BESS to be operated in a manner that may be unsafe or damaging to the BESS. All protective operations resulting in a shutdown shall be carried out in an orderly and safe manner, even in the absence of utility power.

5.5.2 Temperature sensors shall be incorporated in critical components within the BESS. The BESS shall alarm and go to standby/fault mode when an over-temperature condition is detected.

5.5.3 The BESS shall alarm upon detection of a DC ground fault. The alarm trip level shall be field adjustable.

5.5.4 Door interlock switches shall be provided for all BESS container doors. The BESS shall alarm and go to shutdown mode when a BESS door is opened. Doors shall be fitted with provisions for external locks.

5.5.5 The BESS shall alarm and go to shutdown mode upon detection of smoke.

5.5.6 Surge-protection devices shall be provided at the input and output terminals of the BESS.

5.6 Control Panel

The BESS shall include a local control panel or console, which is easily accessible, on or within the BESS container. As a minimum, the following operator controls shall be located on the control panel:

- Trip/reset for the BESS AC circuit breaker or contactor.
- Trip/reset for DC circuit breaker(s)/contactor(s).
- PCS on/off.
- Reset toggle or push button. When reset is initiated, the control system shall resume control and proceed to the appropriate operating mode.
- Reset cut-out selector switch to disable remote or local reset signals.
- A selector switch to manually set the operating state (that is, the shutdown, disconnect, or operate state) and to have the control system set the operating state automatically.
- A selector switch to manually set the operating mode and to have the control system set the operating mode automatically.
- The control panel or console shall also include meters, indicators, and displays.

5.7 Performance Monitoring and Data Acquisition

5.7.1 The BESS shall include a (Data Acquisition System) DAS to provide continuous monitoring and display of key operational parameters, as well as permanent archival

of all measured parameters. The DAS shall include sensors, transducers, wiring, signal isolation and conditioning circuitry, and data acquisition and analysis hardware and software as required to perform the functions described in this section. The DAS shall be of standard commercial manufacture and shall use hardened components suitable for operation in the climatic conditions prevailing at site.

5.7.2 The DAS shall measure operational data, as described in this Clause, and shall record all data points to fixed and removable non-volatile memory. The DAS shall be capable of making all monitored data and events available through the DNP3 / IEC 61850 communication interface and shall permit display of current values and recent historical trends on a local screen for all recorded points. In addition, the DAS shall provide panel meter displays of certain operational parameters, as prescribed below.

5.7.3 Provision of monitoring and event data via the communication interface shall adhere to DNP3 AN2011-001 / IEC 61850 to the extent possible and capture at least the following data points:

- Frequency at the AC bus
- AC real power
- Power factor
- Real energy delivered
- Real energy received
- Auxiliary power
- Auxiliary energy
- DC power
- DC voltage
- DC current
- Phase A voltage
- Phase A angle
- Phase B voltage
- Phase B angle
- Phase C voltage
- Phase C angle
- Battery state of charge
- Battery string currents
- Battery temperature

5.7.4 Digital displays, on the BESS Control Panel, shall update at least once per second.

The DAS shall be integrated with the Solar PV SCADA described elsewhere in this Technical Specification either as addendum or within an overall Energy Management System Interface. The DAS shall, at a minimum, provide remote data inquiry from personal computer– based platforms and data file export capabilities in ASCII format on independent media (such as a universal serial bus drive) that are readable on personal computer-based systems.

5.7.5 The DAS shall continuously measure or calculate the data points identified in Clause 5.7.3 and shall make them available via the communication network as specified. All measured parameters shall also be permanently archived in all modes of operation. For continuously varying quantities, the Contractor shall propose for Employer's review and approval an approach to data archiving that is suitable for each quantity measured. The final approach will be decided during product design.

5.7.6 The DAS shall provide unsolicited message capability for reporting critical alarms. The Contractor and the Employer will agree on a list of alarms that are reported the instant they are detected. However, a minimum of following parameters shall be displayed on BESS local control panel, console, or SCADA computer:

- Main temperature Alarm (on system temperature exceeding a predetermined threshold)
- Smoke/fire Alarm (on system detection of smoke/fire)
- DC leakage current (battery leakage current to ground exceeding a predetermined threshold)
- Breaker status (connect/disconnect switch)
- AC voltage OK (system ac voltage exceeding a predetermined threshold)
- Battery temperature alarm (battery temperature exceeding a predetermined threshold)
- Synchronization error shutdown
- PCS fault
- Weak Unit Battery Alarm
- AC system fault
- Control logic problem (problem with the BESS control logic)
- DC fuse blown
- Container door open (BESS container door opening)

5.7.7 The BESS shall include provisions for determining and storing in non-volatile memory the sequence of abnormal events, trips, and/or alarms that cause the BESS to go to

disconnect or shutdown state. It is preferable that this function be implemented separately from the normal operations data acquisition function of the DAS so that failures in the latter (hardware/software failures or power interruptions) will not prevent the permanent logging of abnormal event sequences. The BESS shall include provisions to transmit, at a minimum, the data displayed on the panel meters and the alarm/status indicators to the remote computer.

6 Grounding

A suitable equipment grounding system shall be designed and installed for the BESS as per relevant Codes and Standards for grounding/earthing. This system shall be designed to be tied to an existing site grounding system. The system also shall be adequate for the detection and clearing of ground faults.

All exposed non-current-carrying metal parts shall be solidly grounded. Particular attention shall be given to prevention of corrosion at the connection of dissimilar materials such as aluminium and steel.

7 Wiring

7.1 All wiring shall be continuous for each wiring run; splices are not acceptable.

7.2 Wiring that may be exposed to mechanical damage shall be placed in conduit or armoured.

7.3 Wires shall have identifying labels or markings on both ends. The labels or markings shall be permanent and durable. Stick-on labels will not be allowed. All field wiring between separate equipment items supplied by the Contractor shall be color-coded according to appropriate standards.

7.4 In general and where practicable, control and instrumentation wiring shall be separated from power and high-voltage wiring by use of separate compartments or enclosures or by use of separate wireways and appropriate barrier strips within a common enclosure.

7.5 BESS and PCS control and instrumentation system wiring shall be bundled, laced, and otherwise laid in an orderly manner. Wires shall be of sufficient length to preclude mechanical stress on terminals. Wiring around hinged panels or doors shall be extra flexible and shall include loops to prevent mechanical stress or fatigue on the wires.

7.6 Insulation and jackets shall be flame retardant and self-extinguishing.

7.7 Wiring to terminal blocks shall be arranged as marked on wiring diagrams. Terminal groupings shall be in accordance with external circuit requirements.

7.8 Raceway and cable systems shall not block access to equipment by personnel. There

shall be no exposed current-carrying or voltage-bearing parts.

8 Civil/Structural

8.1 General Requirements

8.1.1 Soil bearing stresses shall not exceed the allowable stresses for the soil parameters, as determined by the Contractor. A minimum safety factor of 1.5 shall be provided against uplift, sliding, and overturning loads. Soil stresses shall be calculated using unfactored loads.

8.1.2 All structures and foundation designs must include suitable evidence to show that their design is commensurate with a minimum of 25-year life.

8.1.3 Unless specifically stated otherwise, the design of all structures, equipment, and foundations shall be based on applicable portions of IS codes, these specifications, and industry standards.

8.1.4 All components shall be painted, coated, or otherwise protected in a manner commensurate with at least 25-year design life. Particular attention shall be given to prevention of corrosion at the connections between dissimilar materials such as aluminium and steel, and steel and concrete.

8.1.5 All structures and foundations shall be designed to resist dead, live, wind, and seismic loads.

8.2 Requirements for Installation

8.2.1 The Contractor shall be responsible for obtaining all required permits and ensuring that all inspections by local authorities are completed as required.

8.2.2 Calculations based on applicable standards shall be supplied to show that the design of the entire BESS will withstand wind speed and/or gusts and other loads specific to the site and that the design meets all applicable structural and transportation codes.

8.2.3 Excavation spoils shall be disposed of as directed by the Employer.

8.2.4 All reinforced concrete work shall be in accordance with relevant Indian Standards. All other materials and installation requirements shall be subject to Employer approval.

9 Mechanical

9.1 All exposed surfaces of ferrous parts shall be thoroughly cleaned, primed, and painted or otherwise suitably protected to survive outdoor conditions for at least 25-year design life of the system.

9.2 Outdoor enclosures shall be weatherproof and capable of surviving intact under the

site environmental conditions specified. Outdoor enclosures shall be equipped to prevent condensation.

9.3 Components mounted inside enclosures shall be clearly identified with suitable permanent designations that also shall serve to identify the items on drawings provided.

9.4 The site temperatures and the effect of temperature on component life shall be considered in developing the thermal design for all components, including the battery and PCS. Irrespective of the heat-removal system design the final rejection of all waste heat from the BESS shall be to the ambient air. Air-handling systems shall include filters to prevent dust intrusion into the BESS.

9.5 The BESS shall include an HVAC or ventilation system designed to maintain battery temperatures at levels acceptable to the Contractor's normal battery warranty conditions, conducive to acceptable battery life, and as required to maintain battery capacity for all seasons/climatic conditions at the site. The air handling/distribution system shall be designed to promote temperature uniformity within the battery.

10 Other Design Requirements

10.1 Noise Levels

The Contractor shall provide for and maintain noise mitigation devices like Noise mufflers at site, if required.

10.2 Fire Protection

10.2.1 The Contractor shall design and install a fire protection system that conforms to good engineering practice, CEA guidelines and considering thermal runaway fire characteristics of the Battery Unit/ Packs provided by the OEM.

10.2.2 The fire protection system design and associated alarms shall take into account that the BESS will be unattended. If required by the type of fire protection system provided, the Contractor shall calculate and take into account the heat content of the battery cell materials in designing an appropriate fire protection system. Separate fire protection systems may be used in the battery, PCS, and control areas.

10.3 Toxic Materials

If any toxic substance can be emitted from the equipment during a failure, fire, or emergency or protective operation, description of the toxic nature of the substances as well as treatment for exposure to it shall be included in the O&M manual. Their treatment and disposal shall be in accordance with the New Hazardous Waste Management Rules 2016 notified by the Government of India.

10.4 Spare Parts and Equipment

The Contractor shall evaluate the design with regard to expected failure rates, modes, and effects; overall BESS reliability; and planned mode of servicing. Based on this evaluation, the Contractor shall recommend and furnish an initial complement of spare parts that are not readily available. For example, these spare parts may include spare unit batteries and a small rectifier to maintain the unit batteries, as well as fuses, printed circuit boards, and switching devices (gate turnoff thyristors [GTOs], silicon-controlled rectifiers [SCRs], insulated gate bipolar transistors [IGBTs], and so on).

11 Maintenance and Repair

11.1 The Contractor shall supply all labour, equipment, and materials needed to maintain the BESS performance and safe operation, including all maintenance required to satisfy the warranty terms and conditions.

11.2 The Contractor shall list all maintenance activities to be carried out under the maintenance contract. For each maintenance item, the list shall include a description of the item, the expected frequency (maintenance interval), the time required to perform the maintenance, any anticipated parts replacement, and any potential problems in carrying out the maintenance.

12 Factory Acceptance Testing of BESS

12.1 The Contractor shall develop and submit to the Employer for its review and approval a comprehensive FAT plan that shall demonstrate that the BESS will meet the requirements of the specification. The Employer shall have the right to request reasonable changes to the test plan.

12.2 Where full-scale testing of larger systems at the factory may be difficult or impossible due to the large system, the FAT shall be carried out at a subsystem or module level and shall consist of tests of 100% of the subsystems or modules that comprise the complete BESS, to the extent possible. In the FAT plan, the Contractor shall clearly state what is being tested and shall fully explain any features or functions of the fully assembled BESS that would not be fully tested in the reduced-scale testing proposed. In such a case, the SAT plan shall further describe how the tests that could not be carried out in the factory will instead be carried out at the site.

12.3 After the Contractor determines that the BESS is fully operational, the Contractor shall conduct a FAT, witnessed by the Employer and/or the Employer's representative. The FAT shall consist of the Contractor demonstrating to the Employer that the BESS is

fully operational and performs as specified. This includes but is not limited to the following:

- Visual inspection of all provided equipment, including dimensions and overall design.
- Verification of proper mechanical construction such as electrical connection torques.
- Verification of sensors, metering, and alarms.
- Verification of all control functions, including remote control and monitoring, and communications interfaces.
- Verification of BESS performance at full and partial power and energy ratings.
- Verification of maintenance and replacement features for unit batteries and other key components.
- Verification of compliance with specifications.

12.4 During the FAT, the BESS shall meet the following:

- Be operated and function as specified and designed in all the operating states, use cases, and duty cycles specified herein
- Meet the power and energy requirements specified herein
- Be demonstrated to meet the safety and response to catastrophic failure requirements specified herein
- Have the efficiencies, response capabilities, and other features specified herein and/or proposed by the Contractor

Note: *The methodology* for measurement of procurement specifications is provided in the Annexure-E to this Section.

12.5 Operation of all control, protective relaying, and instrumentation circuits shall be demonstrated by direct test, if feasible, or by simulating operating states for all parameters that cannot be directly tested. Automatic, local (control console), and remote operation of the controls shall be demonstrated.

12.6 Factory testing shall demonstrate operation at expected temperature extremes at the Employer's site. If this is not possible for the full BESS at the manufacturing facility, independent laboratory certification of operation of critical components and subsystems in the battery, PCS, and control systems shall be submitted at the time of the FAT. The Contractor shall submit to the Employer for approval, 90 days before the FAT, a list of components and subsystems for which independent lab testing certification will be

sought.

12.7 The Contractor shall perform any and all system modifications required during start-up and testing. The testing may be suspended as a result of a BESS malfunction and resumed only on rectification of problem items. Such suspension and resumption will occur at the sole discretion of the Employer.

12.8 The BESS will not be accepted for shipment until all FATs have been successfully completed. In addition, the Employer will verify that all provisions of the contract have been met, including verification of all required submittals, any spare parts delivery, and any required system modifications.

13 Commissioning and Functional Guarantee test procedure

13.1 The Contractor shall develop and submit to the Employer for its review and approval a comprehensive SAT plan that shall demonstrate to the Employer that the BESS will perform as specified at the Employer's site. The Employer shall have the right to request reasonable changes to the test plan.

13.2 The Contractor shall develop and perform SAT procedures to ensure that the BESS will perform as designed and that the system meets the performance criteria specified elsewhere in these specifications. The SAT plan shall include procedures to test operating scenarios described in the specification. These procedures may involve special requirements and/or witnessing by the local independent system operator. To the extent achievable, all use cases and operating modes described in the specification shall be tested.

13.3 After the Contractor has determined that the BESS is fully operational, the Contractor shall conduct the SAT, witnessed by the Employer and/or the Employer's representative. The tests shall include, as a minimum, the following:

- Verification of sensors, metering, and alarms
- Verification of all control functions, including automatic, local, and remote control
- Verification that the performance criteria in the specification can be met or exceeded
- Demonstration of all of the intended uses
- Demonstration of interface protection circuits and functions and control interfaces

13.4 Tests shall demonstrate that the BESS capabilities, efficiencies, response, and features are as proposed by the Contractor.

13.5 Testing shall include, as a minimum, measurement of harmonic content and power

factor at full and partial power levels for both charge and discharge.

13.6 Operation of all control, protective relaying, and instrumentation circuits shall be demonstrated by direct test, if feasible, or by simulating operating states for all parameters that cannot be directly tested. Automatic, local, and remote operation shall be demonstrated.

13.7 The SAT shall also specifically address discovery of problems or failures that may have occurred during or as a result of shipment.

13.8 The Contractor shall perform any required modifications and repairs identified by the testing, before acceptance by the Employer.

13.9 The Employer will not accept the BESS for commissioning until all acceptance tests have been successfully completed and all provisions of the contract have been met.

13.10 Functional Guarantee - Actual Operating Experience

Since it may not be possible, due to system constraints, to test all facets of the BESS function as part of the performance verification tests specified in the preceding sections the actual operating experience of the BESS during the performance guarantee period after initial startup shall be deemed an extension of the performance verification tests. The performance guarantee period shall not be construed as a substitute for the warranty requirements, as specified in the subsequent Clause. Actual operating experience will be documented through Contractor-furnished records, and other system monitoring equipment and associated BESS performance. Documented failure or malfunctions of any BESS component during the performance guarantee period shall be deemed a failure of the system commissioning test. The Contractor shall, at no cost to the Employer, make the necessary repairs, replacements, modifications, or adjustments to prevent the same failure or malfunction from occurring again. The replacement of certain BESS components in response to a system failure may necessitate, at the discretion of the Employer, the duplication of certain performance verification tests, which shall be performed at the Contractor's expense.

14 Warranty

14.1 The Contractor shall provide a warranty for the entire BESS and its constituent equipment.

14.2 At a minimum, the Contractor shall provide an unconditional, 5 (five) -year parts and labour warranty on all BESS equipment except battery (unit or racks). For the battery storage, the warranty shall cover parts warranty including battery nominal capacity ratings in order to meet the End of battery Life condition described in this specification.

14.3 Warranty replacement shall be required for individual unit batteries that degrade in performance to the point at which the BESS cannot meet the requirements specified in this specification up to the End of Battery Life and/or for unit batteries that materially degrade the availability, reliability, safety, or functionality of the BESS.

14.4 The warranty shall guarantee the availability of battery replacements delivered to the site during the battery warranty period. This period, shall, however, not be considered part of the Accountable Outage period for assessing BESS availability.

14.5 Additional warranty requirements are as follows:

- The warranty shall specify the terms and conditions of the warranty, including operating conditions requirements, procedures that must be followed, and all maintenance requirements. The warranty terms shall be easy to understand and shall be clearly stated.
- The warranty shall provide an explicit statement as to the warranted cycle life and the warranted calendar life of the battery.
- The warranty shall include a simple and easy to understand proration formula, if any, to be used in crediting the Employer for unused life or capacity of equipment replaced or repaired.
- The warranty shall specify the scope of service associated with software updates.
- The warranty shall specify the scope of service included in replacement or repair of the equipment.
- The warranty shall specify all labour, materials, shipping charges, and other Employer expenses not included in the warranty.
- The warranty shall specify the estimated time to complete the repairs/replacement required to restore the BESS to the warranted performance level. The time shall be given as the number of working days from the time of Employer's notice to the Contractor that the BESS has failed to meet the performance requirements.

15 Documentation and Submittals

15.1 The Contractor shall furnish complete documentation that will be used for determination of contract compliance, as well as O&M of the BESS.

15.2 Review and acceptance of submittals shall not encumber the Employer or the Host Utility with responsibility for the adequacy or safety of the Contractor's design.

15.3 Titles shall clearly indicate the function of the document, the Employer and location of the facility.

15.4 At a minimum, Contractor's documentation shall consist of the following:

- Construction and installation drawings
- Construction materials submittal
- Equipment drawings and specifications
- Operation and maintenance manual
- Maintenance schedule
- Critical path method project schedule
- Master test plan and procedures
- Quality assurance manual
- Software documentation
- Study reports
- Test reports
- Training manuals

F EMS (Energy Management System)

1 General Requirements

1.1 Energy Management System (EMS) system shall be a controller based system along with required accessories and communication links for integrated, real-time monitoring, efficient operation and control of active power, reactive power as well as voltage at the interconnection point of PV arrays and BESS.

1.2 EMS shall be integrated with the SCADA described under Part B: Electrical System to acquire/monitor real time data of various equipment of Plant facilities and have in built logic/programming to monitor, control, and optimize the performance of Plant facilities as per specification. Contractor shall provide complete EMS system with all accessories, auxiliaries and associated equipment and cables for the safe, efficient and reliable operation of entire Plant facilities and its auxiliary systems. Contractor shall include in his proposal all the Industrial Grade Hardware, Software, Panels, Power Supply, HMI, Gateway, Networking equipment and associated Cable etc. needed for the completeness even if the same are not specifically appearing in this specification.

2.1 EMS functionality for the BESS Control: -

The following operation modes of BESS can be set from the EMS system:-

- Automatic mode: This means that a part of the power quantity of the BESS behaves according to the selected operation mode.

- HMI mode or manual mode: in this mode, the operator has the possibility to:
  - Select the operation point
  - Direct control of active and reactive setpoints of the PCS.
  - Command of the balance of plants
- OFF-mode: A BESS is not producing any power. The system is disconnected form the grid.
- STANDBY-mode: the BESS is connected to the grid, but the IGBT's in the PCS system are in an off-state (i.e. open switching)

Also, the performance of every application mode will be controlled and adaptable by this system.

This energy management strategy will be operated by the SCADA in Main Control Room. Any failure in the process or the control system including instrumentation must be detected and logged. This means that the instrumentation, electronic and electrical equipment shall include those failure detections.

A communication with the SCADA system must be possible to receive set points and transmit set points for each application mode. The SCADA should be able to remotely control the BESS. The EMS should allow the SCADA at least the following:

- Change the operation mode of each BESS independently
- Start/Stop each application mode appointed to a BESS.
- Change the application mode of each BESS (multiple modes can be selected together)
- Select the amount of power dedicated to each selected application mode.
- Specifically, for following use cases considered for the Project:
  - Power ramp rate control
  - Power Curtailment
  - Deviation Settlement Mechanism(DSM)
  - Change the setpoints for the SOC management
  - Direct control of active and reactive setpoint of a PCS
- Adapt the parameters needed for the operation of every application mode

The Communication protocol may be IEC 61850 or MODBUS over a serial or Ethernet connection (Modbus RTU or MODBUS TCP). Other solutions can be proposed but are subjected to the approval of the client.

2 EMS functionality for the Plant Control: -

2.1 The EMS monitors grid and Plant facility variables and should be programmable for selecting the optimum-operating mode of the whole plant w.r.t. active and reactive power, grid voltage, grid frequency, etc. Additionally, it can receive external set points and automatically adapt the Plant Facility behaviour to the new settings.

The EMS shall perform following functionality to Control the Plant facilities: -

- Communication with grid or SCADA
- Communications with PV Inverters, BESS and other power units
- Measuring and processing of the electrical magnitudes at EMS (voltage, current, PF)
- Control capability of PV Inverters, BESS and other power units

The EMS shall allow following operation modes for the Plant facilities:

- Reactive Control (Q Control, setting point of reactive power Q at EMS)
- Power Factor Control (PF Control, setting point of cos(L) at EMS)
- Voltage Control (V closed loop control, setting point of V at EMS)
- Voltage Droop (Reactive power vs Voltage programmable curve or droop)
- Apparent Power Control (S Lim, setting point of S Lim at EMS)
- Active Power Limitation (P Lim, setting point of P Lim at EMS)
- Power Ramp Rate Control (setting point of maximum %Pn/min)
- Frequency Regulation (Power vs Frequency programmable curve or droop)

2.2 In addition to these operating modes, the EMS shall be prepared to work under voltage dips, allowing the inverters to inject the corresponding reactive power to provide the corresponding voltage support at the EMS. The EMS can receive the target values specified by grid operators using a standard protocol (i.e. Modbus TCP/IP) and over different communication media

3 Measurements

To perform the application modes described above, measurements are needed at the Point of Common Coupling (PCC). The measurements are (but not limited to):

- Voltage measurement: This is needed to perform voltage regulation and reactive power compensation
- Output power (Active and Reactive): This will be measured with an accuracy précised by the supplier. The measurement equipment should be class 0.2

2.2 Control & Power Supply Scheme

Contractor shall provide the UPS/ DC Power supply of suitable rating to cater all the load requirements of EMS system and its auxiliaries.

2.3 Software Documentation & Listings

All technical manuals, reference manuals, user's guide etc. in English required for modification/editing/addition/deletion of features in the software of the EMS System shall be furnished. The Contractor shall furnish a comprehensive list of all system/application software documentation after system organization for Employer's review and approval. All The software listings for application software, Project data files etc. shall be submitted by the Contractor. All the EMS Software with license Key shall be handed over to the Owner on the DVD/CD media. All the hardware and software shall be licensed to SECI.

G Performance Measurement Procedure

1 Performance Ratio (PR)

Performance Ratio (PR) test for Operational Acceptance of the plant shall be performed as per the procedure attached in Annexure-C.

2 Capacity Utilization Factor (CUF)

Capacity Utilization Factor of the plant shall be calculated as per the procedure attached in Annexure-C.

ANNEXURE A.3
SPECIAL TECHNICAL CONDITIONS

1. Based on preliminary site survey, Soil strata at top is composed of poorly graded sandy gravel followed by rocky strata. Presence of rock outcrops is also observed in some of the land patches. The Contractor is advised to inspect the site and study the nature of soil, topography and other conditions to decide the extent of scope of area grading, ground compaction, and foundation system to be provided before submission of the Bid. The Employer shall not be responsible for any variations in soil characteristics and other conditions, between those observed during preliminary site visit and detailed investigations to be carried out by the Contractor during contract execution and there shall be no compensation what so ever in the contract price on this account.
2. Topographical survey for the project site has been conducted by the employer and contour map prepared on its basis has been attached with this Annexure. This has been provided only for reference and general information of the Bidder. No warranty is expressed or implied that such information, given in good faith, will present the exact picture of the whole of the project site. The Bidder shall be responsible for any inference drawn from the attached details and is advised to inspect the site before submission of the Bid. The Employer shall not be responsible for any variations in site topography, if observed during detailed topographical survey to be carried out by the Contractor during contract execution and there shall be no compensation what so ever in the contract price on this account.
3. The Contractor is advised to ascertain the availability of good quality ground water at site for construction, drinking and module cleaning purpose. In case of non-availability of ground water source, the contractor shall explore the option of supply of water through water tankers. In case the water quality is not suitable for drinking or module cleaning purpose, the Contractor shall install suitable water treatment facilities.
4. **Power Conditioning Units (TS Part B Clause 4)**
   Power Conditioning Unit shall be outdoor type, installed on plinth comprising of RCC framed structure with foundations, columns and beams up to plinth level (FFL), with a suitable metal canopy on top.
5. **HT Switchgear (TS Part B Clause 6)**
   HT Switchgear shall be outdoor type, installed on plinth comprising of RCC framed structure with foundations, columns and beams up to plinth level (FFL), with a suitable metal canopy on top.
6. **Power Transformer (TS Part B, Clause 16)**
   The Power Transformer shall be designed for suitable duty cycle considering at least 4 hours of operation at 110% of full (rated) load.
7. The Design Parameters for all structural works are provided below:
   a. The basic wind speed ‘Vb’ = 39 m/sec (Moderate Damage Risk Wind zone B).

b. Seismic zone – II.
c. Design hourly rainfall intensity for storm water drainage – 80 mm/hr.
d. The average annual rainfall at project site is 1275 mm.

8. Plant fencing for each plot shall be of Chain Link Type as per the drawing provided in this section. The total perimeter of the fencing is approx. 22 km.
9. Main Entry gate for each plot shall be as per the drawing provided in this section.
10. MCR shall be RCC Type Building sand shall conform to the provisions as specified in Technical Specifications
11. SCADA Room shall be pre-engineered structures and shall conform to the provisions as specified in Technical Specifications.
12. All UG cables shall be laid in brick masonry trench (max. depth 450mm) to be covered with precast concrete covers.
13. Site Office for SECI (during construction) shall be as per specifications of Portable Cabin defined under Clause 16.2.4 for MCR.
14. Pyranometers (for measurement of GHI and albedo) and temperature sensors (for measurement of PV Module Temperatures) shall be installed at 2 locations to account for spatial variability over the project. The locations shall be finalised in consultation with the Owner at the time of detailed engineering. The data shall be averaged for the purpose of calculation of PR.
15. The BESS shall be distributed into at least 2 sub-systems (defined in terms of the Power Rating, Energy Capacity and point of interconnection with the PV arrays) with the objective of increasing system robustness.
16. For Plant internal lighting along internal roads, Solar LED type Garden/Landscape stake lights (Color Temperature 5700 K) shall be installed along with Solar Panels and rechargeable and replaceable battery units with minimum 8 hours of discharge.
17. **Part B: Electrical System, Clause 22 CCTV Camera:** CCTV Camera network covering complete perimeter of Plant Area is not required. However, shall include Main Entry, Control Rooms: Covering Entry/Exit and Equipment Rooms, Switchyard and BESS installation area.
18. **Part C: Civil, Mechanical and Plumbing Works, Clause 6: Roads:** Peripheral road along inside of the boundary fence/ wall of land patch is not required. However sufficient space may be left with cleared and flat surface.
19. Guest House shall be RCC Type Building as per the specifications in ANNEXURE A.2 - The Plan of the Guest House shall be as per the drawing in this section. The location shall be finalised in consultation with the Owner.
20. Security cabins shall be provided in every patch as per specifications provided in ANNEXURE A.2.

21. The Plant Equipment Maintenance Schedule shall include Spare Power and Inverter Duty Transformers.

ANNEXURES TO ANNEXURE A: Employer's Requirements

Annexure – A

Pre-dispatch Inspection Protocol for Crystalline PV Modules by Employer or Employer Deputed Agency

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Pre-dispatch inspection procedure

1. Objective:

The objective of this document is to establish General inspection protocol with objectivity for verification of Quality Parameters of Solar Modules by the customer (or its authorised inspection agency) prior to dispatch. The decision rules and procedure specified herein seek to uphold quality standards based on industry best practices and technical specifications laid out in tender documents as well as to control risks associated with item procurement.

2. Standards and Codes:

1. Sampling for determining Acceptance Quality Level (AQL) shall follow ISO 2859-1: 1999.
2. IEC TS 60904-1-2:2019 - Photovoltaic devices - Part 1-2: Measurement of current-voltage characteristics of bifacial photovoltaic (PV) devices

3. Definitions:

1. Lot: All products/items manufactured in one batch.
   Notwithstanding the aforementioned definition, the customer or authorized inspection agency can lay down alternate/additional criteria for determining a lot.
2. Major Defect: A defect that reduces the usability or causes the product to fail to fulfil its nominal characteristic function.
3. Minor Defect: A defect that does not reduce the usability of the product, but does not meet the quality standard.

4. Inspection Schedule:

Customer representative shall propose the schedule for Pre-despatch Inspection of Finished Goods to the Customer well in advance, and in no case less than 3 working days prior to commencement of Inspection at a location within India and 7 days in case of a foreign country.

5. Scope of Inspection:

Supplier representative will accompany the Inspector while doing the inspection which shall typically consist of 2 steps for clearance of each Lot:

BOM verification: To be conducted prior to the commencement of production.

The details of materials used will be verified from the ERP/Manufacturing data and corroborated with the Construction Data Form (CDF). This shall include verification of following:

Item	Method of Verification
Shelf life of the following BOM items: • EVA • PV Module Back sheet • Sealant and potting material (Silicone)	Verify the expiry date/shelf life and storage conditions *The PV Module manufacturer shall submit all required information to prove that materials being used are within their shelf life.*

Note: Supplier shall provide the necessary documents for approval of BOM as per IEC standards and tender Technical Specifications.

Witness Tests:

Manufacturer shall assist the Inspecting agency to witness following checks, the details of which are provided elsewhere in this document:

I. Flash test- As per sampling Plan

For Bifacial Modules, Measurement of current-voltage characteristics shall be done as per IEC TS 60904-1-2:2019 - Photovoltaic devices - Part 1-2:

II. Visual Inspection- As per sampling Plan

III. EL Inspection-As per Sampling Plan

IV. Electrical Characteristics (Other than Flash Test)- As per Sampling Plan

Note: The Supplier shall furnish soft and hard copy of the Production Quality Plan prior to commencement of the Inspection.

6. Sampling Process:

a. Supplier shall provide the list of modules in a lot ready for despatch, along with flash test data (Measured Electrical Data, P_{max}) prior to commencement of Inspection tests. **Note**: Smallest lot size for Inspection: 20% of the capacity as per the PO.

b. Supplier will arrange to move the PV Modules from FG to Inspection area.

c. Same samples shall be used for all Witness Tests stated at 5.2 above.

d. Inspector shall commence Inspection process by randomly selecting samples from the list of serial nos. (pallet-wise) provided by Supplier as per ISO 2859: Single Sampling Plan for Normal Inspection, General Inspection plan level-II. However, the

Inspector shall reserve the right to switch to tightened or reduced level of Inspection as per the lot quality.

7. Decision Rules for Acceptance/Rejection

Following is a summary of Decision Rules for Acceptance/Rejection of a given Sample in a lot offered for Inspection:

Table 1: AQL Levels

Defect Type	AQL (%)
Major (Ma)	2.5
Minor (Mi)	4

Table 2: Inspection Levels

Inspection steps	Inspection item	Inspection level
1	Flash Test	General inspection level I
2	Visual	General inspection level I
3	EL	General inspection level I
4	EC (Other than Flash Test)	10 Nos. per lot

8. Inspection Process

a. Electrical Inspection – Flash Tests

For Electrical inspection following preparation will be done:

- Module Temp Stabilisation: Modules will be kept in controlled environmental condition till it reaches 25 ±2ºC
- Calibration of Sun-simulator: Sun-simulator will be calibrated as per Calibration Reference. Reference should calibrated against Calibration Reference tested from reputed testing lab TUV / Fraunhofer etc. Testing of modules will be done at STC condition, AM=1.5

Note:

(i) All modules selected for sampling inspection will be re-tested in the sun-simulator. A P_{max} retest (repeatability test) variation of ± 2 % on actual flash P_{max} value will be acceptable.

(ii) The Supplier shall provide a valid calibration certificate of the apparatus used.

b. Visual Inspection:

- Customer representative will verify the module visual characteristics as per the Visual Acceptance norms.
- The Visual Inspection shall be carried out in a well-lit room. It shall be the responsibility of the Supplier to ensure adequate brightness in the room.

c. Electroluminescence (EL) Inspection:

- The EL image shall have sufficient resolution for analysis of defects.
- Hi-pot test shall be done as per IEC procedure. The Supplier shall provide a valid calibration certificate of the apparatus used.

9. Re-inspection and review

In case of minor non-conformities like cleaning issues, label mismatch, etc. which can be easily reworked, Supplier shall rework/replace the modules and offer them for re-inspection to Inspector.

10. Inspection Summary:

Once the inspection is completed Customer Representative will compile his Inspection Summary Report and share with Supplier and give necessary recommendation on despatch depending upon the audit findings based on the observations made. This report shall be provided within same day of inspection (Format Attached).

11. Disclaimer:

Inspection by SECI/ Employer does not absolve the responsibility of the Supplier/vendor to ensure quality during production of the material and its transport to site. Any damages during transport/ handling shall be replaced before erection at site as directed by Engineer-in-charge without any extra cost to the purchaser.

Sampling Plan

(Sampling Plan as Per ISO 2859) -1

Table 1 - Sample size code letters (see 10.1 and 10.2)

Lot size	Special inspection levels				General inspection levels		
	S-1	S-2	S-3	S-4	I	II	III
2 to 8	A	A	A	A	A	A	B
9 to 15	A	A	A	A	A	B	C
16 to 25	A	A	B	B	B	C	D
26 to 50	A	B	B	C	C	D	E
51 to 90	B	B	C	C	C	E	F
91 to 150	B	B	C	D	D	F	G
151 to 280	B	C	D	E	E	G	H
281 to 500	B	C	D	E	F	H	J
501 to 1 200	C	C	E	F	G	J	K
1 201 to 3 200	C	D	E	G	H	K	L
3 201 to 10 000	C	D	F	G	J	L	M
10 001 to 35 000	C	D	F	H	K	M	N
35 001 to 150 000	D	E	G	J	L	N	P
150 001 to 500 000	D	E	G	J	M	P	Q
500 001 and over	D	E	H	K	N	Q	R

(Sampling Plan as Per ISO 2859) – 2 – Normal, Tightened and Reduced)

Table 2-A — Single sampling plans for normal inspection (Master table)

Sample size code letter	Sample size	Acceptance quality limit, AQL, in percent nonconforming items and nonconformities per 100 items (normal inspection)																									
		0,010	0,015	0,025	0,040	0,065	0,10	0,15	0,25	0,40	0,65	1,0	1,5	2,5	4,0	6,5	10	15	25	40	65	100	150	250	400	650	1 000
		Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re
A	2	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↓	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	30 31
B	3	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	30 31	44 45
C	5	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	30 31	44 45	↑
D	8	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	30 31	44 45	↑	↑
E	13	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	30 31	44 45	↑	↑	↑
F	20	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	↑	↑	↑	↑	↑	↑
G	32	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	↑	↑	↑	↑	↑	↑	↑
H	50	↓	↓	↓	↓	↓	↓	↓	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	↑	↑	↑	↑	↑	↑	↑	↑
J	80	↓	↓	↓	↓	↓	↓	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	↑	↑	↑	↑	↑	↑	↑	↑	↑
K	125	↓	↓	↓	↓	↓	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
L	200	↓	↓	↓	↓	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
M	315	↓	↓	↓	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
N	500	↓	↓	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
P	800	↓	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
Q	1 250	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
R	2 000	↑	↑	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑

↓ = Use the first sampling plan below the arrow. If sample size equals, or exceeds, lot size, carry out 100 % inspection.

↑ = Use the first sampling plan above the arrow.

Ac = Acceptance number

Re = Rejection number

Table 2-B — Single sampling plans for tightened inspection (Master table)

Sample size code letter	Sample size	Acceptance quality limit, AQL, in percent nonconforming items and nonconformities per 100 items (tightened inspection)																										
		0,010	0,015	0,025	0,040	0,065	0,10	0,15	0,25	0,40	0,65	1,0	1,5	2,5	4,0	6,5	10	15	25	40	65	100	150	250	400	650	1 000
		Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re
A	2	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇧	0 1	⇩	⇧	1 2	2 3	3 4	5 6	8 9	12 13	18 19	27 28
B	3	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	0 1	⇩	⇩	1 2	2 3	3 4	5 6	8 9	12 13	18 19	27 28	41 42
C	5	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	0 1	⇩	⇩	1 2	2 3	3 4	5 6	8 9	12 13	18 19	27 28	41 42	⇧
D	8	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	0 1	⇩	⇧	1 2	2 3	3 4	5 6	8 9	12 13	18 19	27 28	41 42	⇧	
E	13	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	0 1	⇩	⇩	1 2	2 3	3 4	5 6	8 9	12 13	18 19	27 28	41 42	⇧		
F	20	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	0 1	⇩	⇩	1 2	2 3	3 4	5 6	8 9	12 13	18 19	⇧	⇧	⇧			
G	32	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	0 1	⇩	⇩	1 2	2 3	3 4	5 6	8 9	12 13	18 19	⇧						
H	50	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	0 1	⇩	⇩	1 2	2 3	3 4	5 6	8 9	12 13	18 19	⇧							
J	80	⇩	⇩	⇩	⇩	⇩	⇩	⇩	0 1	⇩	⇩	1 2	2 3	3 4	5 6	8 9	12 13	18 19	⇧								
K	125	⇩	⇩	⇩	⇩	⇩	⇩	0 1	⇩	⇩	1 2	2 3	3 4	5 6	8 9	12 13	18 19	⇧									
L	200	⇩	⇩	⇩	⇩	⇩	0 1	⇩	⇩	1 2	2 3	3 4	5 6	8 9	12 13	18 19	⇧										
M	315	⇩	⇩	⇩	⇩	0 1	⇩	⇩	1 2	2 3	3 4	5 6	8 9	12 13	18 19	⇧											
N	500	⇩	⇩	⇩	0 1	⇩	⇩	1 2	2 3	3 4	5 6	8 9	12 13	18 19	⇧												
P	800	⇩	⇩	0 1	⇩	⇩	1 2	2 3	3 4	5 6	8 9	12 13	18 19	⇧													
Q	1 250	⇩	0 1	⇩	⇩	1 2	2 3	3 4	5 6	8 9	12 13	18 19	⇧														
R	2 000	0 1	⇧	⇩	1 2	2 3	3 4	5 6	8 9	12 13	18 19	⇧															
S	3 150			1 2																							

⇩ = Use the first sampling plan below the arrow. If sample size equals, or exceeds, lot size, carry out 100 % inspection.

⇧ = Use the first sampling plan above the arrow.

Ac = Acceptance number

Re = Rejection number

Table 2-C — Single sampling plans for reduced inspection (Master table)

Sample size code letter	Sample size	Acceptance quality limit, AQL, in percent nonconforming items and nonconformities per 100 items (reduced inspection)																										
		0,010	0,015	0,025	0,040	0,065	0,10	0,15	0,25	0,40	0,65	1,0	1,5	2,5	4,0	6,5	10	15	25	40	65	100	150	250	400	650	1 000
		Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re
A	2	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇧	0 1	⇩	⇩	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	30 31
B	2	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	0 1	⇧	⇩	⇩	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	30 31
C	2	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	0 1	⇧	⇩	⇩	1 2	2 3	3 4	5 6	6 7	8 9	10 11	14 15	21 22	⇧
D	3	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	0 1	⇧	⇩	⇩	1 2	2 3	3 4	5 6	6 7	8 9	10 11	14 15	21 22	⇧	⇩
E	5	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	0 1	⇧	⇩	⇩	1 2	2 3	3 4	5 6	6 7	8 9	10 11	14 15	21 22	⇧	⇩	⇩
F	8	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	0 1	⇧	⇩	⇩	1 2	2 3	3 4	5 6	6 7	8 9	10 11	⇧	⇧	⇧	⇩	⇩	⇩
G	13	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	0 1	⇧	⇩	⇩	1 2	2 3	3 4	5 6	6 7	8 9	10 11	⇧	⇩	⇩	⇩	⇩	⇩	⇩
H	20	⇩	⇩	⇩	⇩	⇩	⇩	⇩	0 1	⇧	⇩	⇩	1 2	2 3	3 4	5 6	6 7	8 9	10 11	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩
J	32	⇩	⇩	⇩	⇩	⇩	⇩	0 1	⇧	⇩	⇩	1 2	2 3	3 4	5 6	6 7	8 9	10 11	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩
K	50	⇩	⇩	⇩	⇩	⇩	0 1	⇧	⇩	⇩	1 2	2 3	3 4	5 6	6 7	8 9	10 11	⇧	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩
L	80	⇩	⇩	⇩	⇩	0 1	⇧	⇩	⇩	1 2	2 3	3 4	5 6	6 7	8 9	10 11	⇧	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩
M	125	⇩	⇩	⇩	0 1	⇧	⇩	⇩	1 2	2 3	3 4	5 6	6 7	8 9	10 11	⇧	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩
N	200	⇩	⇩	0 1	⇧	⇩	⇩	1 2	2 3	3 4	5 6	6 7	8 9	10 11	⇧	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩
P	315	⇩	0 1	⇧	⇩	⇩	1 2	2 3	3 4	5 6	6 7	8 9	10 11	⇧	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩
Q	500	0 1	⇧	⇧	⇩	1 2	2 3	3 4	5 6	6 7	8 9	10 11	⇧	⇧	⇧	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩
R	800	⇧	⇧	⇧	1 2	2 3	3 4	5 6	6 7	8 9	10 11	⇧	⇧	⇧	⇧	⇧	⇧	⇧	⇧	⇧	⇧	⇧	⇧	⇧	⇧	⇧	⇧

⇩ = Use the first sampling plan below the arrow. If sample size equals, or exceeds, lot size, carry out 100 % inspection.

⇧ = Use the first sampling plan above the arrow.

Ac = Acceptance number

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Customer inspection Report

CUSTOMER INSPECTION REPORT			
Ref. No. & Date:			
Client:	**PMC**: SECI	**EPC Contractor**: PO Ref. No.:	
Place of Inspection:	**Date of inspection:**	**Lot Size**	**Sample Quantity**
Problem Quantity: **Detail:** **Inspection Result (OK/Not OK):**			
Visual Inspection **Problem Quantity:** **Detail:**			
Flash Test **Problem Quantity:** **Detail:**			
EL Inspection: **Problem Quantity:** **Detail:**			
EC Inspection (Hipot,DC Continuity,IR): **Problem Quantity:** **Detail:**			
Any Other Criteria/Remarks:			
Is the shipment qualified to be released? ☐ ☐ **Yes** **No**			
From Client	From EPC Contractor	Solar Energy Corporation of India Limited	

Enclosed: Test Details, Flash Test Report, EL test (images- soft copy), EC Test Report

Disclaimer: *This Inspection by SECI/ Employer does not absolve the responsibility of the vendor to ensure quality during production of the material and its transport to site. Any damages during transport/ handling shall be replaced before erection at site as directed by Engineer-in-charge without any extra cost to the purchaser.*

Details:

Lot :				**Date**
S.No.	**Defect**	**Module Id**	**Type (Ma/Mi)**	**Details**
1				
2				
….				

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	**Sr.No.**	**Activity & Operation**	**Instruments**	**Class of Check**	**Type of Check**	**Quantum of Check**	**Reference Documents & Acceptance Standard**	**Format of Record**	**D*** (Records identified with (√) shall be issentially included by EPC vender in QA documentation)	**Cheking Agency**			**Remarks**
2								SR - Site Register SECI-SPV-QA-F-XXX SECI-SPV-QA-T-XXX (XXX - Inspection record form No. or Test report format no.)		**M'fr/ Supplier or Sub-Contractor**	**EPC Contractor**	**SECI or Owner**	
3	**1**	**General Requirements**											
4	a	Availability of requisite test set-up and equipment in good working condition with valid calibration at site well before commencement of concerned activity	As required/ agreed	Critical	Physical	Once prior to start of work & Monthly there after	Tech. Specs, Construction Drawings	SR	√		**x**	**x**	**Min. list of equipment** - CTM, Set of Seives for CA & FA, Elcometer (digital), Micrometer, Multimeter, Meggar, Torque Wrench, Moulds for casting of concrete/ mortar test samples, Curing tank of adequate size, SS measuring tape - 50m, Theodolite, leveling staff and associated equipment etc. for day to day work with proper storrage racks. The equipment shall be in adequate no. matching the site progress requirements. Functioning of laboratory equipment in proper working condition to be verified on monthly basis
5	b	Submission of QA & QC manpower deployment schedule based on agreed L-2 network	As required/ agreed	Critical	Verification	Before start of work	Tech. Specs, Construction Drawings	SR	√		**x**	**x**	
6	c	Availability of QA & QC manpower deployment based on agreed deployment schedule, Periodic review for augmentation as per actual progress	As required/ agreed	Critical	Physical	Once prior to start of work & Monthly there after	Tech. Specs, Construction Drawings	SR	√		**x**	**x**	
7	d	Submission of schedule/ programme of tests and inspection of civil works (survey, excavation, concreting, backfilling, brickwork, finishing works, roads, drains etc.) to be done monthly and quarterly based on agreed schedule	As required/ agreed	Critical	Physical	Once prior to start of work & Monthly/ Quarterly there after	Tech. Specs, Construction Drawings	SR	√	**x**	**x**	**x**	
8	e	Submission of actual work programme min. 3 days (72 hours) in advance to facilitate planning for quality checks as per approved QP	As required/ agreed	Critical	Physical	48 hours before start of actual work	Master programme/ schedule	SR	√	**x**	**x**	**x**	
9	f	Stacking and storage of construction materials and components at site	IS: 4062	Critical	Physical	Random	Tech. Specs, Construction Drawings & IS: 4062	SR	√	**x**	**x**	**x**	
11	**2**	**Surveying (Execution phase)**											
12	a	Availability of Calibrated Instruments, qualified & experieced staff at site	As required/ agreed	Critical	Physical	100%	Tech. Specs, Construction Drawings, Agreed deployment schedule	Calibration Report	√	x	x	x	
13	b	Ensure correct Boundary Layout and Latitude-Longitude Coordinates,True North	construction Drawings	Critical	Measurement	100%	Tech. Specs, Construction Drawings	SR	√	x	x	x	
14	c	GL (ground level), FGL (finished ground level) and Plinth Level, Check PBM(permanent bench mark) with Total Station/ Theodolite and after conformation carryout Peg marking	As required/ agreed	Critical	Measurement	100%	Construction Drawings	SR	√	x	x	x	
16	**3**	**Materials**											
17	A	*Cement*											
18	i	Fineness	As per IS: 4031	Critical	Review of MTC/ Physical	One test at Lab to corelate with MTC	IS:456,IS:269,IS:8112, IS:12269,IS:1489, Tech. Specs	Manufacturers Test Certificate (MTC's) and Laboratory Test results	√	**x**	**x**	**x**	Each consignment/ lot of cement shall be duly correlated with MTC If cement stored is more than 60 days in godown the same shall be re-tested for conformation with MTC
19	ii	Compressive Strength											
20	iii	Initial & final setting time											
21	iv	Chemical composition of Cement											
22	B	*Coarse Aggregates (CA)*											

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	**Sr.No.**	**Activity & Operation**	**Instruments**	**Class of Check**	**Type of Check**	**Quantum of Check**	**Reference Documents & Acceptance Standard**	**Format of Record**	**D*** (Records identified with (√) shall be issentially included by EPC vender in QA documentation)	**Cheking Agency**			**Remarks**
2								SR - Site Register SECI-SPV-QA-F-XXX SECI-SPV-QA-T-XXX (XXX - Inspection record form No. or Test report format no.)		**M'fr/ Supplier or Sub-Contractor**	**EPC Contractor**	**SECI or Owner**	
23	i	Determination of Particle size (Sieve Analysis), Flakiness index, Elongation index	As per IS: 2386	Major	Visual	Once per 100 cum or part thereof (During monsoon moisture content to be checked every day)	IS:383,IS:2386, Tech. Specs	Lab Test results	√	x	x	x	Water content of concrete to be corrected as per results of moisture content
24	ii	Moisture content											
25	iii	Crushing Value, Impact value, Abrasion value		Critical		One test at Lab for each source/ on every change of source			√	x	x	x	These tests shall be carried out while establishing design mix. In case of change of source the design mix shall be re-validated for new source
26	iv	Specific Gravity, water absorption											
27	v	Bulk Density											
28	vi	Soundness											
29	vii	Presence of deleterious materials											
30	C	*Fine Aggregate (FA)*											
31	i	Gradation/Determination of Particle size (Sieve Analysis)	Balance, Oven etc. As per IS: 2386, 383	Major	Visual	Gradation - Once per 1000 cum or part there of Mosture content - Every day	IS:383,IS:2386,IS:456 , Tech. Specs	Lab Test results	√	x	x	x	Water content of concrete to be corrected as per results of moisture content
32		Moisture Content											
33	ii	Specific Gravity and density (for design mix concretes only)	As per IS: 2386, 383	Major	Visual	One test at Lab for each source/ on every change of source							
34	iii	Water absorption (for design mix concretes only)											
35	iv	Presence of deleterious materials											
36	D	*Concrete Admixture*											
37	i	Type of admixture			Review of MTC		IS: 9103, Approved design mix		√	x	x	x	Admixture shall be of brand and type as per approved design mix.
38	ii	Physical & Chemical properties			Review of MTC		IS: 9103, Manufacturer's Brochure						Each lot/ batch of admixurture shall acompany the Manufacturer's Brochure and shall be correlated with MTC
39	iii	Suitability											
40	E	*Bricks*											
41	i	Dimensional Tolerance, shape			Measurement/ Physical	As per relevant IS code/ one sample for 30,000 nos. or part there of	IS: 1077, IS: 13757, IS: 12894, Tech. Specs, Construction Drawings	Lab Test results	√	x	x	x	Efflorescence shall be checked at each source
42	ii	Compressive Strength											
43	iii	Water Absorption											
44	iv	Efflorescence			Visual								
45	E	*Water*											
46	i	Cleanliness - Test for ascertaining limit of solids		Major		One per 3 months for each source	IS:456,IS:3025 (part 18), Tech. Specs, Construction Drawings specification	Lab Test reports	√	x	x	x	Water to be used for concrete shall be of potable quality and shall meet requirements specifed in IS: 456
47	ii	Chemical Tests to ascertain the suitability for construction purposes - pH Value, Sulphate & Chloride content					IS:456,IS:3025 (part 22, 23), Tech. Specs, Construction Drawings	Lab Test reports	√	x	x	x	
48	F	*Reinforcement Steel*											
49	i	Identification & Size		Major	Visual	Each batch of delivery	IS:432,IS:1786,IS:1852, Tech Specs	SR	√	x	x	x	Reinforcement steel shall be stored properly at site to avoid rusting
50	ii	Freedom from cracks, surface flaws, lamination				Random in each shift			√	x	x	x	
51	iii	Tensile Test		Critical	Review of MTC	Each batch of delivery	IS:432,IS:1566,IS:1786, Tech Specs	Manufacturers Test Certificate (MTC's)	√	x	x	x	
52	iv	Yield stress/proof stress											
53	v	Percentage Elongation							√	x	x	x	
54	vi	Bend/Rebend Test											
55	vii	Reverse Bend Test for HDS wire					IS:432, Tec. Specs		√	x	x	x	
57	**3**	**Structural Steel Work {Example: Chequered plate cover, Panel supports, Rungs, Cat lader, Inserts, Fencing gate (MS) etc.}**											
58	i	Strutural Steel (Raw material)-Chemical Properties, Ultimate Tensile Strength(UTS), Yield Strength (YS), Percentage Elongation, Bend test		Critical	Review of MTC	For each batch of each section	IS: 2062, IS: 8500, Tech. Specs, Construction Drawings	Manufacturers Test Certificate (MTC's)	√	x	x	x	MTC to be correlated
59	ii	Dimensional Check - Secition dimensions, thickness		Critical	Measurement	10% of total quanity at Random			√	x	x	x	For Fencing gate - dimensional check 100%

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	**Sr.No.**	**Activity & Operation**	**Instruments**	**Class of Check**	**Type of Check**	**Quantum of Check**	**Reference Documents & Acceptance Standard**	**Format of Record**	**D*** (Records identified with (√) shall be issentially included by EPC vender in QA documentation)	**Cheking Agency**			**Remarks**
2								SR - Site Register SECI-SPV-QA-F-XXX SECI-SPV-QA-T-XXX (XXX - Inspection record form No. or Test report format no.)		**M'fr/ Supplier or Sub-Contractor**	**EPC Contractor**	**SECI or Owner**	
60	iii	Visual checks for damages, rusting, pitting, scaling etc.		Major	Visual	100%	IS: 822, Tech. Specs, Construction Drawings, MTC, relevant BIS standards for painting	Manufacturers Test Certificate (MTC's)/ SR	√	x	x	x	
61	iv	Visual checks for welding defects, painting (surface preparation, primer coat, and Finishing coat - make and shade of paint, DFT) as applicable.		Major	Visual/ Measurement/ Review of MTC	10% of total quanity at Random			√	x	x	x	MTC to be correlated
62	v	Acceptance ofStructural steel works		Major	Physical/ Acceptance	Random	Tech. Specs, Construction Drawings	SR	√	x	x	x	
64	**4**	**Foundation System**											
65	**A**	**Bored Cast in-situ Concrete Piling (for MMS support)**											
66	**a**	**Execution**											
67	i	Ensuring correctness of layout		Critical	Physical	100%	Tech. Specs, Construction Drawings	SR	√	x	x	x	
68	ii	Checking of pile making as per drawing	Total Station	Major	Vsual								
69	iii	Checking of Centre line of Pile Group	Total Station	Critical	Physical			IS 2911, Tech Specs, Construction Drawings	√	x	x	x	1. During boring of pile, record SPT/ core recovery to ensure socketing length in the hard strata equivalent in terms of pile diameter in hard rock zone as per tech Specs and approved construction drawings. 2. In case of collapse of pile bore during drilling temporary MS lining shall be used. 3. Lines and levels to be checked 4. Each bore shall be cleaned of any loose materail by pressure jet washing/ cleaning by air jet 5.The column section shall pe placed and held in position in true vertical alignment using template/ tripod till initial setting of concrete 6. Concrete garde - as per Construction Drawing
70	iv	Check Pile Location	Total Station										
71	v	GL, Pile depth, diameter and alignment	As required		Measurement								
72	vi	Cleaning/ flushing of pile bore	As required	Major	Visual								
73	vii	Insertion & positioning of Column post in the bore hole (in case of embeded col. Leg) Placement of reinforcement and foundation bolts with template (inacse of fixing of col. with base plate & foundation bolt assembly)	As required	Critical	Visual/ Measurement								
74	viii	Acceptance of Pile casting - Shape, reinforcement or col. leg embedment (as aplicable), concreting, compacting with use of needle vibrator etc.	As required/ Agreed	Major	Visual								
75	ix	Grouting u/s of base plate	As required/ Agreed	Critical	Visual	100%	Tech. Specs & Construction drawings	SR	√	x	x	x	The type, grade and thickness of grout shall be as per approved drawing
76	**b**	**Testing**											
77	i	Initial pile load test - Compression (Vertical), Lateral (Horizontal), & Pull out (Tension)	Calibrated dial gauges, jack of required capacity, datum bars etc.	Critical	Physical	100% for 3 no. for each type of test or as specified in Tech Specs, Approved test pile layout	IS 2911, Tech Specs, Construction Drawings	Test Report	√	x	x	x	1. The R/F details shall be as per approved drawing for test plie (if applicable), 2. The test load shall be up to 2.5 times of required pile capacity in case of Compression and Lateral load and 2 times in case of Pull out test as per IS: 2911 (Pt. 4), 3. The location shall be as per approved pile test programme/ layout drawing 4. The test shall be carried out as per approved methodology 5. Test report along with test records shall be submitted in standard format as per IS:2911
78	ii	Routine pile tests - Pull out and Lateral		Critical	Physical	100% for 0.5% of total no. of working piles for each type of test	IS 2911, Tech Specs, Construction Drawings	Test Report					1. The piles for routine tests shall be selected at Random to represent total no. of job piles insalled 2. The test load for vertical and pull out shall be 1.5 times the required pile capacity 3. The test shall be carried out as per approved methodology. 4. The Test report along with test records shall be submitted in standard format as per IS:2971 (Pt. 4)

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80	**B**	**Cable Trench/ Building & Equipment Foundations**											
81	**a**	Before Excavation											
82	i	Ensuring correctness of layout		Critical	Physical	100%	Tech. Specs, Construction Drawings	SR	√	x	x	x	
83	ii	Checking of trench marking & alignment		Major	Visual		Tech Specs, Construction Drawings						
84	**b**	Excavation											
85	i	Dimensional conformity including diagonal check		Ctitical	Visual / Measurement	100%	IS:3764, Tech Specs, Construction Drawings	SR	√	x	x	x	
86	ii	Excavated earth kept away from edges		Minor	Visual	Random		SR	√	x	x	x	
87	**c**	Acceptance of Trench/ Foundation casting - Shape, reinforcement, shuttering, concreting, etc.		Minor	Physical	100%	Tech. Specs, Construction Drawings	SR	√	x	x	x	
89	**5**	**Foundation Bolts / Inserts/ Concrete embedments**											
90	i	Visual check of mechanical damage and galvanising painting if applicable on inserts			Visual / Measurement	100%	As per Tech Specs, Construction Drawings	SR	√	x	x	x	
91	ii	Bolt and assecories, inserts - Dimensions (total & threaded length & dia of bolt, size & thk of embedment and lugs etc.), Nos											
92	iii	Verticality, alignment, levels, pitch distance, embeded and projected length of bolt											
93	iii	Use of template for Alignment and Level checking											
94	iv	Acceptance of foundation bolt assembly / inserts in postion											
96	**6**	**Formwork**											
97	i	Materials & Accessories	As agreed/ required	Major	Visual	Once before start of work	IS :456 , Other relevant BIS Standard, Tech. Specs, Construction Drawings	SR	√	x	x	x	
98	ii	Soundness of staging, shuttering and scaffolding including application of mould oil/ release agent	As agreed/ required	Major	Visual	Once before start of work	Manufacturer's specs, IS :3096, IS:4014, IS: 4990, Tech. Specs, Construction Drawings	SR	√	x	x	x	
99	iii	Dimensional Check, alignment & levels as per drawing and tolerences		Major	Visual/ Measurement	100%	Tech. Specs, Construction Drawings	SR	√	x	x	x	
100	iv	Proper sealing of joints, Acceptance of formwork before concreting		Major	Physical/ Visual	Before start of concreting	As per provisions, tolerences, Tech. Specs, Construction drawings		√	x	x	x	
102	**7**	**Placement of Reienforcement Steel**											
103	i	Check whether Bar bending schedule (BBS) with necessary lap, spacers & chairs is available before start of cutting & bending of bars	As agreed/ required	Major	Visual/ physical	Random in each shift at each work site	Tech. Specs, Construction Drawings, IS: 2502	SR	√	x	x	x	
104	ii	Check whether cutting and bending of bars is as per BBS and placement conforms construction drawings			Visual/ measurement								
105	iii	Check whether all joints and crossing of bars are tied properly with right gauge and annealed wire			Visual								

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106	iv	Check for proper cover,spacing of bars, spacers & chairs after the reinforcement cage has been put inside the foundation			Visual								
107	v	Check whether lapping of bars are tied properly with right gauge and annealed wire			Visual								
109	**8**	**Concrete**											
110	i	Availability of approved Design Mix (for all specified grades)		Critical	Physical	For each specified grade of concrete	IS :456, Tech Specs, Construction Drawings	Approved mix design	√		x	x	The concrete shall be as per approved design mix and the materials (cement, coarse and fine aggregate shall be from the same source considered during mix trials. The mix design shall be verified and approved in case of change of source of any of the matearials
111	ii	Minimum cement content (as applicable in MMS piling and foundation/ below ground works)		Critical	Physical	For piling and foundation works	IS: 456, Tech. specs, Construction drawings	SR	√		x	x	The minimum cement content shall correspond to exposure conditions and/ or, suplphate contents in ground water/ soil
112	iii	Trial mixes to ascertain the workability and cube strength	As per recommended mix design from specialist agency	Critical	Physical/ Testing	One for each mix proportion	Tech. Specs, IS: 456	Lab Test Reports	√	x	x	x	Necessary correction for moisture content and water absoption according to mix design recommendations may be carried out during trial mix
113	iv	Mixing of concrete- check for quanities of cement, CA, FA and water used, Concrete shall be homogenous	Mixing shall be done in a approved mixer/ batching plant (conforming to IS: 4926/ 4925)	Major	Physical	Mixer/ Batcher to be calibrated at the time of starting and subsequently once in tree months	IS: 4925, IS: 4926	Calibration Report/ Certificate	√	x	x	x	Review of calibration chart/ Certificate as per IS: 4926 Qty. of materials including cement consumptionshall be available through on line printer
114	v	Handling & trasportation	As required	Major	Physical	100%	As per approved/ agreed construction methodology	SR		x	x	x	Concrete shall be placed within 30 minutes of its removal from mixer
115	vi	Placement of concrete	As required	Major	Visual/ Physical	100%			√	x	x	x	
116	vii	Compacting	As required	Major	Physical	At Random			√	x	x	x	
117	viii	Curing	As required	major	Physical	At Random	IS: 456	SR		x	x	x	
119	**9**	**Concrete Testing & Acceptance**											
120	i	Workability - Slump Test		Critical	Physical	At the time of concrete pouring at site every 2 hrs	IS:456, IS:516,IS:1199, Tech Specs, Construction Drawings	Test Results / SR	√	x	x	x	
121	ii	Crushing strength - (Works test cubes)		Critical	Physical	Testing	IS:456, IS:516,IS:1199, Tech Specs, Construction Drawings	Test Results/ SR	√	x	x	x	**MMS Pile** - 6 cubes (3 for 7 day test & 3 for 28 day strength) per sample for each 5 cum or part there off **Building work and Equipment/ Misc foundations etc.** - 6 cubes (3 for 7 day test & 3 for 28 day strength) per sample for each 25 cum or part there off
122	iii	Acceptance of concrete work - Dimensional check (dimensions, levels etc), placement of bolts, inserts, pockets, pitch distance for bolts etc.	As required & dimensional tolerences	Major	Visual/ Measurement	100%		Joint Protocol between Civil Conractor, EPC Vendor and SECI/ Owner where applicable/ SR	√	x	x	x	
124	**10**	**Acceptance of Hardened Concrete**											
125	i	Dimensional check (dimensions, levels etc), workmanship, finsishing after removal of shuttering	As required & dimensional tolerences	Major	Visual/ Measurement	At Random			√	x	x	x	

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126	ii	Water tightness test for liquid retaining structures/ tanks	As required	Critical	Physical/ Testing	100%	IS: 3370 (Pt.4), Tech Specs, Construction Drawings	SR/ Test Records	√	x	x	x	Water tightness test shall be performed for Under ground (UG) water tank, Septic tank
128	**11**	**Excavation & filling in foundations, trenches, plinth & grading works**											
129		**Excavation**											
130		Nature, Type of soil/ rock before and during excavation		Major	Visual	Random in each shift	Tech. Specs., Construction Drawings	SR		x	x	x	
131		Initial GL before start of excavation		Major	Measurement	100%		SR	√	x	x	x	
132		Final shape/ size & dimensions of excavation		Major	Measurement	100%		SR	√	x	x	x	
133		Final excavation levels		Major	Measurement	100%		SR	√	x	x	x	
134		Side slope of final excavation		Major	Measurement	Random in each shift		SR		x	x	x	
135	**12**	**Fill / Backfill**											
136	i	Suitability of borrowed earth for filling (if applicable) - Grain size analysis, Atterberg limits, Free swell index, Organic matter		Major	Physical	One in every 2000 cum or part there of for each type and source of fill material subject to min. 2 samples	IS: 2720 (Pt. IV), IS: 2720 (Pt. XI), Tech Specs, Construction Drawings	Lab Test Results/ SR	√	x	x	x	The parameter should not be worse than the parameter of the existing soil in plant area
137	ii	Optimum moisture content (OMC), Max. dry density (MDD) before fill		Critical	Visual	At Random	IS: 2720 (Pt. I), IS: 2720 (Pt.VII), Tech Specs, Construction Drawings	Lab Test Results/ SR	√	x	x	x	
138	iii	Layer thickness, Compaction procedure		Major	Visual	At Random	Approved Methodology, Tech. Specs, Construction Drawings	SR	√	x	x	x	The layer thickness, Type & Capacity of roller, No. of passes shall be as per approved methodology, Construction Drawing, Tech. Specs
139	iv	Degree of compaction - 1. Dry density by proctor needle penetration 2. Earth filling - In-situ Dry density (core cutter or sand replacement method) or Sand Filling - In-situ Relative density (Density Index)		Critical	Physical	(i) For foundation fill/ backfill - One for every 10 foundations at Random for each compacted layer (ii) For area grading/ filling - one every 1000 sqm area for each compacted layer	IS: 2720 (Pt. XXIX), IS: 2720 (Pt. XXVIII), IS: 2720 (Pt. XIV), Tech Specs, Construction Drawings	Test Results/ SR	√	x	x	x	
141	**13**	**Brick masonry work**											
142	i	Soaking of Bricks before use		Major	Physical	100%	IS: 2250	SR		x	x	x	
143	ii	Grading of sand, Mortar mix / proportion, Compressive strength, Consistency		Major	Physical/ Test	At Random	IS: 2250, IS: 2116, Tech Specs, Construction Drawings / As per Design Specification	Lab Test Results/ SR		x	x	x	The sand grading shall conform to IS: 2116
144	iii	Workmanship, Verticality (Plumb) / Alignment		Major	Physical/ Measurement	100%	IS: 2212, IS: 1905, Tech Specs, Construction Drawings	SR	√	x	x	x	
145	iv	Check for Bond/closers, joints		Major	Visual	At Random	IS: 2250	SR		x	x	x	
146	v	Curing		Major	Visual	100%	IS: 2250 / As perTech. Specification	SR		x	x	x	
148	**12**	**Cement Plaster**											

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149	i	Quality & Grading of sand, Check for mix proportion, wetting the surface etc		Major	Physical	At Random	IS: 2116, IS: 2386 (Pt. I & II), IS: 1542, Tech Specs	Lab Test Results/ SR		x	x	x	Sand to be used shall be free from deleteriousmaterials, Grading shall conform to Table-I of IS: 2116
150	ii	Plaster & grooves - Thickness, Evenness & Finishing, Trueness os palstering system		Major	Visual/ Measurement	At Random in each shift	Tech Specifications, Construction Drawings	SR	√	x	x	x	Trueness - Deviation not more than 4mm when checked with straight edge of 2m length
151	iii	Hacking, Raking of joints, Cleaning the surface, Removing all loose particles, Wetting the surface etc		Major	Visual	At Random in each shift	IS 1661, Tech Specs	SR		x	x	x	
152	iv	Curing		Minor	Physical	100%	IS 1661, Tech Specs	SR		x	x	x	
154	14	**Painting System - Plastered Masonry & Concrete surface**											
155	i	Materials & accessories - Approval for Paint, Color shade and Brand- Dry distemper, Oil Bound Distemeper, Acrylic Emulsion, Chemical resistant, Oil resistant Paint, Weather proof acrylic exterior paint, water proof cement paint etc.	As approved by SECI/ Owner	Critical	Review of MTC	Each batch of delivery	Tech Specs, Construction Drawings	MTC/ SR	√	x	x	x	MTC shall be correlated with the material received
156	ii	Surface preparation	As required	Minor	Physical	Random in each shift	IS: 2935 (Pt.1), Tech Specs, Construction Drawings	SR	x	x	x	x	
157	iii	Number of coats	As required	Major	Physical	Random in each shift	Tech Specs, Construction Drawings	SR	x	x	x	x	
158	iv	Application and Acceptance of painted surface	As required	Major	Physical	Each surface at Random							
160	15	**Floor finishes & Alied works**											
161	i	Preperation of Sub-grade			Physical	At Random for each building	Tech. Specs, Construction Drawings	SR	√	x	x	x	
162	ii	Plinth filling in layers (stone agrregates/ rubble with interstices filled with sand), ramming & compaction			Physical	At Random for each building	IS: 2720, Tech. Specs, Construction Drawings		√	x	x	x	Quality Checks as aplicable to Fill/ Back fill
163	iii	Check providing shuttering, reinforcement (if applicable)			Physical	At Random for each building	Tech. Specs, Construcion Drawings			x	x	x	Quality Checks as aplicable to Shuttering/ Reinforcement placement
164	iv	Checking the Panel size (as applicable)			Physical	At Random for each building	IS: 5491, Tech. Specs, Construcion Drawings			x	x	x	The concrete shall be cast in alternate panels in chess board fashion, panel size as specified in Construction Drawing or 25 sqm
165	v	Availability of Design mix (if applicable)			Visual	At Random for each building	Tech. Specs, Construcion Drawings	Mix Design Report/ SR		x	x	x	
166	vi	Clearance for concreting (as applicable)			Physical	100%	Tech. Specs, Construction Drawings	Joint Protocol between Civil Contractor, Eqpt. Supplier/ EPC Vendor & SECI/ Owner SR		x	x	x	
167	viii	Performing concreting ensuring Grade/Mix Proportions, Compaction, Thickness and Finish			Physical	At Random per shift	IS; 456, Tech. Specs, Construction Drawings	SR	√	x	x	x	Quality Checks as aplicabel to Concrete Work
168	viii	Curing			Visual	100%	IS: 456, Tech. Specs	SR		x	x	x	Minimum up to 10 days from date of casting
169	ix	Testing of Concrete Cubes for Flooring			Physical	One sample for every 20 Cum of concreting or part thereof for each days concreting (one sample consists of min 3 test cubes for 28 days strength)	IS:456, IS:516,IS:1199 and Design specification	Lab Test Reports					
170	x	Tiled flooring/ dado											

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171	a	Material - Glazed ceramic Tiles, Vitrified Ceramic Tiles, Mosaic Tailes, Acid alkali Tiles, Heavy duty cement concrete tiles	As agreed/ required	Critical	Review of MTC & Test Reports	Each lot of material received	IS:13755, IS:1237, IS:8042, Tech Specs, Construction Drawings	MTC/ SR	√	x	x	x	MTC shall be correlated for all the parameters specified in Tech. Specs, BIS Standard
172	b	Finishing & Acceptance		Major	Physical	100%	IS: 1443, Tech Specs, Construction Drawings						
173	xi	IPS with or without IRONITE (as aplicable)		Major	Physical	At Random per shift	IS: 5491, Tech. Specs, Construction Drawings	SR	√	x	x	x	
174	xi	Fixing of Panel Dividers for finishing course (3 mm Thk Glass/ 2mm Thk Aluminium strip) (if applicable)		Major	Physical	At Random per shift	Tech Specs, Construction Drawings	SR	√	x	x	x	
175	xii	Anti abrasion/ anti wearing epoxy coating (if aplicable)											
176	a	Material	As agreed/ required	Critical	Approved Make and Type	Each lot of material received	Tech Specs, Construction Drawings, Manufacturer's Brochure/ Recommendations	manufacturer's Brochure/ SR	√	x	x	x	Material specifications to be correlated with Manufacturer's Brochure
177	b	Finishing & Acceptance		Major	Physical	100%	Tech Specs, Construction Drawings	SR	√	x	x	x	
178	xiv	Kota stone flooring and skirting (as aplicable)											
179	a	Material	Quality, Texture, Thickness, Colour fro approved source	Major	Physical	Each batch of delivery	Tech Specs, Construction Drawings	SR	√	x	x	x	
180	b	Finishing & Acceptance		Major	Physical	100%	Tech Specs, Cosntruction Drawings	SR	√	x	x	x	
181	xv	Acid/ Alkali resistant tile flooring/ dado											
182	a	Material -Tiles, Mortar, Sealing, Fillers etc.	Thickness, Quality,	Critical	Approved source, Review of MTC/ Test Report	Each batch of delivery	Tech Specs, Construction Drawings	SR	√	x	x	x	The acid alkali resistant tile flooring nd dado shall be provided in battery room as per approved Arch finishing details
183	b	Finishing & Acceptance	Workmanship	Major	Physical	100%	Tech Specs, Construction Drawings	SR	√	x	x	x	
184	xvi	Interlocking Blocks											
185	a	Materials	Size/ Shape, colour shade, Grade of Concrete	Critical	Approved source, Review of MTC/ Test Report	Each batch of delivery	BS: 6717, Tech Specs, Construction Drawings	SR	√	x	x	x	
186	b	Final finishing & Acceptance	As agreed/ required	Major	Physical	100%	BS: 7533 (Pt.3), Tech Specs, Construction Drawings	SR	√	x	x	x	
188	**16**	**Damp Proof Course**											
189	i	Material - Hot bitumen & water proofing materials etc.	As agreed/ required	Critical	Review of MTC	Each batch of delivery	IS: 702, Tech. Specs, Cosntruction Drawings	SR	√	x	x	x	
190	ii	Acceptance of Damp Proof Course - Thickness, Grade of PCC, Application of Bitumen layer etc.	As agreed/ required	Major		100%	Tech Specs, Construction Drawings	SR	√	x	x	x	
192	**17**	**Grouting of pockets/ underside of base plate**											
193	i	Material	As required/ Agreed	Critical	Review of MTC/ Physical	Each batch of delivery	Tech. specs, Construction Drawings, Manufacturerr's catelogue	SR	√	x	x	x	In case of ready mixed grout MTC to be correlated with Manufacturerr's catelogue
194	ii	Type of Mix	Anti shrink cement grout/ Ready mixed - Fluid mix, stiff mix as required	Major	Physical	At Random prr shift of grout application	Tech. specs, Construction Drawings	SR	√	x	x	x	In case of cement grout anti shrink compound shall be added as per provisions of relevant IS/ Cosntruction Drawing
195	iii	Mixing, placement, application	As required	Major	Visual	At Random prr shift of grout application	Tech. Specs, Construction Drawings	SR	√	x	x	x	
196	iv	Crushing Strength - Test cubes	As required	Major	Physical/ Testing	3 cubes for entire grouting work	IS: 4031 (Pt.6), Tech Specs, Construction Drawings	SR/ Lab Test Report	√	x	x	x	

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197	v	Acceptance of Grouting	Thickness, Finished level etc.	Major	Physical	!00% of 20 % of grout work at Random	Tech. Specs, Construction Drawings	SR	√	x	x	x	
199	**18**	**Precast Concrete**											
200	**a**	**Bought Out Units (Precast boundary wall units - Slab Panels, Column etc., Trench Covers , Manhole Covers, Paver Blocks etc.)**											
201	i	Crushing strength	As required	Critical	Review of MTC/ Test Reports	100% for Each batch of delivery	IS: 456, IS:516, IS: 1199, Tech Specs, Construction Drawings	MTC	√	x	x	x	Sampling as per IS: 456, Vendor record review
202	ii	Workmanship, dimentions, R/F	As require/ agreed	Major	Review of MTC/ Physical	Each batch of delivery at Random	Tech Specs, Construction Drawings	MTC/ SR	√	x	x	x	Vendor record review, Physical check at Random
203	**b**	**Cast at site (if applicable)**											
204	i	Crushing strength - Test Cubes	As required	Critical	Testing		IS: 456, IS:516, IS: 1199, Tech Specs, Construction Drawings	SR	√	x	x	x	1 sample of 6 cubes (3 for 7 days strength, 3 for 28 days strength) for each 5 cum of concrete with minimum 1 sample per shift of concrete work
205	ii	Workmanship, dimentions, R/F	As required/ agreed	Major	Physical	At Random	Tech Specs, Construction Drawings	SR		x	x	x	
206	**c**	**Acceptance of pre-cast concrete units**											
207	i	Bought Out Units - Check for any breakage, damage during handing & trasport, erection at site (levels) etc.	As required/ Agreed	Major	Visual	At Random	Tech Specs, Construction Drawings	SR	√	x	x	x	
208	ii	Cast at site (if applicable) - Check for curing, damage during handling, erection at site (level) etc.	As required/ Agreed	Major	Visual	100% of 10% at Random	Tech Specs, Construction Drawings	SR	√	x	x	x	
210	**19**	**Joints In concrete**											
211	i	Joint Material - Bitumen inpregnataed fiber board, PVC water stop, Sealing compound - Bitumastic/ polysulphide, Hydrophilic strip, Expanded polysterene (thermocol) board etc.	As per manufacturer's standards	Critical	Review of MTC	Each batch of delivery	Tech. Specs, Construction Drawings, IS: 1838, IS:1834, IS:2200	MTC	√	x	x	x	
212	ii	Acceptance of installation	As agreed/ required	Major	Physical	Each installation at Random	Tech. Specs and Construction Drawings	SR	√	x	x	x	
214	**20**	**Underdeck Insulation Works**											
215	i	Insulation material - Mineral/ Glass wool, galvanized wire neting, Aluminium foil, fasteners etc.	As agreed/ required	Critical	Review of MTC/ Test Reports	Each lot received at site	Tech. Specs and Construction Drawings	MTC/ Test Reports/ SR	√	x	x	x	All tests as per Tech. Specifications
216	ii	Acceptance of installation	As agreed/ required	Major	Physical	Each installation	Tech. Specs and Construction Drawings	SR	√	x	x	x	
218	**21**	**False Ceiling**											
219	i	Materials - Gypsum board/ Tiles, Particle board tiles, Al tiles/ Strips, GI hangers, AL/ GI Tee support, AL/ GI Edge angle, Fasteners etc.	As agreed/ required	Critical	Visual/ Physical, Review of MTC	Each lot received at site	IS:2095, IS:8183, Tech. Specs and Construction Drawings	MTC/ SR	√	x	x	x	Compare MTC with Tech. Specifications and requirements
220	ii	Acceptance of Installation	As agreed/ required	Major	Visual/ Physical	Random	Tech. Specs and Construction Drawings	SR		x	x	x	
222	**22**	**Doors, Windows, Ventilators, Glass/ Glazing and Grill**											

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223	i	Door Frame (Hollow steel metal, Aluminium, Wooden etc. including fittings such as hold fasts etc.)	As agreed/ required	Critical	Visual, Physical, Reviewof MTC/ Test Reports	Each lot received at site	Tech. Specs and Construction Drawings	MTC/ Lab Test Reports/ SR	√	x	x	x	
224	**a**	**Steel Doors**											
225	i	Materials (MS sheet & Stiffeners, fasteners,hinges, jambs, lock strike plate, hydraulic door closer, fittings and fixtures etc)	As agreed/ required	Critical	Visual/ Physical/ Review of MTC, Test Report	Each lot received at site	IS:2062, Tech. Specs and Construction Drawings	MTC/ Lab Test Report/ SR	√	x	x	x	Review of MTC/ Test Report
226	ii	Finishing & Acceptance - Surface preperation for painting, primer & finishing coat, DFT	As agreed/ required	Major	Visual/ Physical	Random	Tech. Specs and Construction Drawings	SR	√	x	x	x	
227	**b**	**Flush Doors**											
228	i	Shutters, Teak beading	As agreed/ required	Critical	Review of MTC/ Test Report	Each lot received at site	IS:2202, Tech. Specs and Cosnstruction Drawings	MTC/ Lab Test Report/ SR	√	x	x	x	
229	ii	Acceptance	As agreed/ required	Major	Visual/ Physical	Random	Tech. Specs and Construction Drawings	SR		x	x	x	
230	**c**	**Aluminium doors and Partition works**											
231	i	Materials- Aluminium sections (average thickness, alkali resistant, anodisation, power coating and colour shade etc.), fittings and fixtures. floor spring, hydraulic door closer, hinges, etc.	As agreed/ required	Critical	Visual/ Physical/ Review of Test Report	Each lot received at site	IS:1948, IS;1949, IS:733, IS:1285, IS:1868, IS:11857, Tech. Specs and Construction Drawings	SR/ Lab Test Reports	√	x	x	x	Review of Test Report For anodization check as per Tech. Specs and Construction Drawings Power coating, colour shade as applicable as per Tech. Specs and Construction Drawings
232	ii	Finishing & Acceptance - fabrication & erection, fitting etc..	As agreed/ required	Major	Visual/ Physical	Random	Tech. Specs and Construction Drawings	SR		x	x	x	
233	**d**	**Grill**											
234	i	Materials - Aluminium, MS, Anodization in case of aluminium	As agreed/ required	Critical	Visual/Physical/ Review of Test Report	Each lot received at site	Tech. Specs and Construction Drawings	SR/ Lab Test Reports	√	x	x	x	Review of Test Reports
235	ii	Finishing & Acceptance - erection, fitting, painting in case of MS grill etc.	As agreed/ required	Major	Visual/ Physical	Random	Tech. Specs and Construction Drawings	SR		x	x	x	
236	**e**	**Rolling Shutters**											
237	i	Surface finish, Thickness of plate, mechanically operated	As agreed/ required	Critical	Visual/ Physical/ review of MTC	Random for each lot of delivery	IS:8248, Tech. Specs & Construction Drawings	SR	√	x	x	x	
238	ii	Finishing and Acceptance -Painting , DFT	As agreed/ required	Major	Visual/ Physical	Random	Tech. Specs and Construction Drawings	SR		x	x	x	
239	**f**	**Glass and Glazing**											
240	i	Material - Clear float glass, wired glass, tinted glass, ground glass, figured glass, thickness	As agreed/ required	Major	Review of MTC/ test reports	For each lot received at site	IS: 14900, IS:1081, IS: 3548, IS:5437 Tech Specs and Construction Drawings	SR	√	x	x	x	
241	ii	Installation, finishing and acceptance	As agreed/ required	Major	Visual/ Physical	Random	Tech Specs and Construction Drawings	SR	√	x	x	x	
243	**23**	**Precast Concrete Boundary Wall**											
244		Acceptance of boundary wall- Finising, Alignment Dimensions etc.	As agreed/ required	Major	Physical		Tech Specs and Construction Drawings	SR		x	x	x	For inspection of precast concrte units -refer S.No. 18
246	**24**	**Roof Water Proofing**											
247	i	Methodology for the application of water proofing system	As required	Critical	Review	for each type of treatment	Tech Specs and Const. Drawings						
248	**a**	Materials											

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249	i	Polyurethene based coating, polyester scrim cloth, extruded HD dimpled polyurethene	As agreed / required	Critical	Review of MTC/ test reports	For each lot received at site	ASTM C-836, ASTM C898 and Tech Specs /Const. Drawings	MTC/ SR	√				
250	**b**	Roof											
251	i	Graded under bed - Slope/ Level	As agreed / required	Major	Physical	100%	Tech Specs and Construction Drawings	SR		**x**	**x**	**x**	
252	ii	Elastomaric coatings -Primer coat, Finishing coat	As agreed / required	Major	Review of MTC/ test reports	Each lot of delivery	Tech Specs and Construction Drawings	MTC/ Test Reports/ SR	√	**x**	**x**	**x**	
253	iii	Wearing Course - PCC-Grade, chicken wire mesh, elastomeric sealant	As agreed / required	Major	Visual/ Review of MTC	Each lot of delivery of material/ Review of Test Report	Tech Specs and Construction Drawings	MTC/ Test Reports SR	√	**x**	**x**	**x**	2 samples of 3 no. of test cube each shall be taken for PPC work for testing of crushing strength of concrete mix, Review of MTC for Chicken wire mesh, waterproof sealant
254	c	Acceptance of Water proofing treatment	As agreed/ required	Major	Visual/ Physical	100%	Tech Specs and Construction Drawings	SR		**x**	**x**	**x**	
256	**25**	**Water Supply and Sanitary Installations**											
257	**a**	**Water Supply Fittings and Fixtures**											
258	i	Materials - GI/ MS/ C-PVC/ uPVC/PPR/HDPE pipes and fittings	As agreed / required	Critical	Review of MTC/ test reports	Each lot of delivery as per Specifications	IS:1239, IS:4736, IS:4985, IS:6745, IS: 4984, IS:2633, IS:2629, IS:15778, IS:15801, Tech Specs and Construction Drawings	MTC/ SR	√	**x**	**x**	**x**	
259	ii	Disinfection - Before use	As agreed / required	Major	Physical	Each installation	IS:2065, Tech specs and construction Drawings	SR		**x**	**x**	**x**	
260	iii	Hydraulic test - Before use/ Leakage	As agreed / required	Critical	Physical	Each installation	Tech Specs and Construction Drawings	SR		**x**	**x**	**x**	
261	iv	Acceptance & Working	As agreed / required	Major	Physical	Random	Tech Specs and Construction Drawings	SR		**x**	**x**	**x**	
262	**b**	**Sand Cast Iron/ Cast iron Pipes**											
263	i	Material - SCI / CI pipes and fittings / joints	As agreed / required	Critical	Review of MTC/ test reports	Each lot of delivery (as applicable)	IS: 1729, IS:1536, IS:1538, Tech Specs and Construction Drawings	MTC/ SR	√	**x**	**x**	**x**	
264	ii	Acceptance and leakage	As agreed / required	Major	Physical	Random	Tech Specs and Construction Drawings	SR		**x**	**x**	**x**	
265	**c**	**HDPE Pipes for Sewerage**											
266	i	Material- HDPE pipes and fittings/ joints	As agreed/ required	Critical	Review of MTC/ test reports	Each lot of delivery (as applicable)	IS:14333, Tech. Specs	MTC/SR	√	**x**	**x**	**x**	
267	ii	Acceptance & leakage	As agreed / required	Major	Physical	Random	Tech Specs and Const. Drawings	SR		**x**	**x**	**x**	
268	**d**	**HDPE Pipes for Rain water Downcommer**											
269	i	HDPE pipes and fittings/ joints	As agreed/ required	Critical	Review of MTC/ test reports		IS:4984, Tech. Specs	MTC/SR	√	**x**	**x**	**x**	
270	ii	Acceptance & leakage	As agreed / required	Major	Physical	Random	Tech Specs and Const. Drawings	SR		**x**	**x**	**x**	
271	**e**	**Sanitary fitting and fixtures**											
272	i	Sanitory items and fixtures i.e. water closets, urinals, wash basins, sinks, mirrors, shelves, towel rail, soap containers, geyser, water cooler, etc, water supply / sanitation pipes, manhole cover and frames etc	As agreed / required	Major	Review of MTC/ Test reports	Each lot of delivery as per Specifications	Tech Specs and Const. Drawings	MTC/Test Reports/ SR	√	**x**	**x**	**x**	

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273	ii	Acceptance of installations of all sanitory items and fixtures	As agreed / required	Major	Acceptance	100%	Tech Specs and Const. Drawings	SR		x	x	x	
274	f	**RCC Pipes**											
275	i	Material - RCC pipes	As agreed / required	Major	Review of MTC/ test reports	Each lot of delivery as per Specifications	IS: 458, Tech Specs and Const. Drawings	MTC/Test Reports/ SR	√	x	x	x	
276	ii	Acceptance and leakage	As agreed / required	Major	Physical	Random	Tech Specs and Const. Drawings	SR		x	x	x	
277	g	**Water Storage Tank**											
278	i	Over head / loft type	As agreed / required	Critical	Physical, review of MTC/ test reports	Each lot of delivery as per Specifications	IS:12701, Tech Specs and Const. Drawings	MTC/Test Reports/ SR	√	x	x	x	
279	ii	Aceptance and leakage	As agreed / required	Major	Acceptance	Random	IS:12701, Tech Specs and Const. Drawings	SR		x	x	x	
281	26	**Special Items (Switch Yard)**											
282	a	**Earthing Mat (Grounding System)**											
283	i	Earthing mat	As agreed / required	Critical	Physical, review of MTC/ test reports	Each lot of delivery as per Specifications	As per relevant IS and Tech. Specs / Manufacturer's, IS 3043	SR/MTC	√	x	x	x	
284	ii	Weld sizes & length	Visual/Tape	Major	Visual/ Measurement	100%	Tech Specs and Const. Drawings	SR		x	x	x	Low hydrogen electrode as per approval shall be used.
285	iii	D P test	DP test Kit	Critical	Physical	10% at random	Tech Specs and Const. Drawings	TR	√	x	x	x	
286	iv	Earth test	Earthing test kit	Critical	Physical	100%	IS:3043, Tech Specs and Const. Drawings, Relevant IS 3043	SR/ Test Report	√	x	x	x	
287	b	**Anti Weed Treatment**											
288	i	Anti-weed treatment materials	As agreed / required	Critical	Physical, review of MTC	Each batch of delivery	Tech Specs and Const. Drawings	SR/ MTC	√	x	x	x	
289	ii	Execution of treatment	As agreed / required	Major	Physical	Random check for each treatment	Tech Specs and Const. Drawings	SR		x	x	x	
291	27	**Road Work**											
292	a	**Construction of Sub-Grade and earthen/hard soulders**											
293	i	Standard proctor Test	As per IS: 2720	Critical	Physical	One in every 2000 cum for each type and source of fill materials	As per Tech Specs and Const. Drawings,Section 900 of MORTH specification, IS 2720 (Pt.VII)	SR	√	x	x	x	In cutting or existing levelled ground - quantum of check shall be one per 1000 SQM
294	ii	Moisture content of fill before compaction	As per IS: 2720	Major	Physical	One in every 2000 cum for each type and source of fill materials	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification, IS 2720 (Pt.II)	SR		x	x	x	In cutting or existing levelled ground - quantum of check shall be one per 1000 SQM
295	iii	Dry density by core cutter method ---- OR---- Dry density in place by sand displacement method	As per IS: 2720	Critical	Physical	One in every 500 SQM area for each compacted layer.	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification, IS 2720 (Pt. XXIX)/ IS 2720 (Pt. XXVIII)	SR	√	x	x	x	Both for embankment and cut formation quantum of check - One in every 1000 SQM area for each compacted layer.
296	iv	Lines, grade and cross section	As required / agreed	Major	Physical	One in every 500 SQM area	As per Tech Specs and Const. Drawings	SR	√	x	x	x	Template, straight edge

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297	**b**	**Water Bound Macadam (Non-Bituminous) for base course and sub-base course**											
298	i	Aggregate Impact value	Agrregate Impact value Test Apparatus	Critical	Physical	One test per 200 cum of Test aggregate	As perTech Specs and Const. Drawings, Section 900 of MORTH specification	SR	√	x	x	x	
299	ii	Grading	Set of IS Sieves	Major	Physical	One test per 100 cum of aggregate	As perTech Specs and Const. Drawings, Section 900 of MORTH specification	SR		x	x	x	
300	iii	Flakiness index and elongation index	Flakiness test gauge	Major	Physical	One test per 200cun of agregate	As perTech Specs and Const. Drawings, Section 900 of MORTH specification	SR		x	x	x	
301	iv	Atterberg Limits of binding material	Atterberg limits determination	Critical	Physical	One test per 25 cum of binding material	As perTech Specs and Const. Drawings, Section 900 of MORTH specification	SR	√	x	x	x	
302	v	Atterberg Limits of portion of agreggate passing 425 micron sieve	Atterberg limits determination	Critical	Physical	One test per 100cum of aggregate	As perTech Specs and Const. Drawings, Section 900 of MORTH specification	SR	√	x	x	x	
303	vi	Camber, surface, slope	As required / agreed	Major	Physical	One in every 500 SQM area	As per Tech Specs and Const. Drawings	SR	√	x	x	x	Template, straight edge
304	**c**	**Bituminous Macadam for base and binder course**											
305	i	Quality of binder	Penetrometre with St. needle	Critical	Physical	No. of samples per Lot & tests as per IS:73, IS:217, IS:8887 as applicable	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification, IS 73	SR	√	x	x	x	
306	ii	Aggregate Impact Value / Los angeles abrasion value	Aggregate Impact ValueTest apparatus	Major	Physical	Once per source	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR	√	x	x	x	
307	iii	Flakiness Index and elongation index of aggregates	Flakiness test gauge	Major	Physical	One test per 50 cum of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR		x	x	x	
308	iv	Stripping value of aggregate (Immersion tray test)	As required / agreed	Major	Physical	Initialy one set of 3 representative specimen per source, and on every change of source.	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR		x	x	x	
309	v	Water sensitivity of mix	As required / agreed	Critical	Physical	Initialy one set of 3 representative specimen per source, and on every change of source.	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR	√	x	x	x	
310	vi	Grading of aggregates	Set of Sieves	Major	Physical	Two test per day per plant both on individual constituents and mixed aggregate from dryer	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR		x	x	x	
311	vii	Water absorption of aggregate	As required / agreed	Major		Initially one set of 3 representative specimen per source, and on every change of source.	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR		x	x	x	

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312	viii	Soundness (Magnesium and Sodium Sulphate)	As required as per IS:2386	Critical	Physical	Once per source by each method and on every change of source	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR	√	x	x	x	
313	ix	Percentage of fractured faces	As required / agreed	Major	Physical	When gravel is used one test per 50cum of aggregates	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR		x	x	x	
314	x	Binder content and aggregate grading	Bitumen extractor	Critical	Physical	Periodic, subject to a min of two tests per day per plant	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR	√	x	x	x	
315	xi	Control of Temperature of binder and aggregate for mixing and of the mix at the time of laying and rolling	Thermometer	Major	Physical	At regular close intervals	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR		x	x	x	
316	xii	Rate of spread of mixed materials	As required / agreed	Major	Physical	Regular control through checks of layer thickness	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR		x	x	x	
317	xii	Density of compacted Layer	As required / agreed	Critical	Physical	One test per 250 sqm of area	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR	√	x	x	x	
318	**c**	**Bituminous Surfacing - Open graded premix carpet and Seal coat**											
319	i	Quality of binder	Penetrometre with St. needle	Critical	Physical	No. of samples per Lot & tests as per IS:73, IS:217, IS:8887 as applicable	IS 73,Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR	√	x	x	x	
320	ii	Aggregate Impact Value / Los angeles abrasion value	Aggregate Impact ValueTest apparatus	Major	Physical	One test per 50 cum of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR	√	x	x	x	
321	iii	Flakiness Index and elongation indexof aggregates	Flakiness test gauge	Major	Physical	One test per 50 cum of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR		x	x	x	
322	iv	Stripping value of aggregate (Immersion tray test)	As required / agreed	Major	Physical	Initialy one set of 3 representative specimen per source, and on every change of source.	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR	√	x	x	x	
323	v	Water absorption test		Critical	Physical	Initialy one set of 3 representative specimen per source, and on every change of source.	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR	√	x	x	x	
324	vi	Water sensitivity of mix	As required / agreed	Critical	Physical	Initialy one set of 3 representative specimen per source, and on every change of source.	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR	√	x	x	x	
325	vii	Grading of aggregates	Set of Sieves	Major	Physical	One test per 25 cum of aggregates	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR	√	x	x	x	

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326	viii	Soundness (Magnesium and Sodium Sulphate)	As required as per IS:2386	Critical	Physical	Once per source by each method and on every change of source	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR	√	x	x	x	
327	ix	Polished stone value	As required as per BS:812(Part 114)	Major	Physical	As required	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR		x	x	x	
328	x	Temperature of binder at application	Thermometer	Major	Physical	At regular close intervals	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR		x	x	x	
329	xi	Binder content	Bitumen extractor	Critical	Physical	One test per 500 cum& not less than two tests per day	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR	√	x	x	x	
330	xii	Rate of spread of materials	As required / agreed	Major	Physical	One test per 500 cum and not less than 2 tests per day	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR		x	x	x	
331	xiii	Percentage of fractured faces	Bitumen extractor	Critical	Physical	When gravel is used one test per 50cum of aggregates	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR	√	x	x	x	
332	**d**	**Tack Coat/ Prime coat/ fog coat**											
333	i	Quality of binder	Penetrometre with Standard needle	Critical	Physical	No. of samples per Lot & tests as per IS:73, IS:217, IS:8887 as applicable	IS 73,Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR	√	x	x	x	
334	ii	Temperature of binder at application	Thermometer	Major	Physical	At regular close intervals	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR		x	x	x	
335	iii	Rate of spread of binder	As required / agreed	Major	Physical	One test per 500 cum and not less than 2 tests per day	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR		x	x	x	
336	**e**	**Alignment, Level, Surface regularity and rectification**											
337	i	Horizontal alignment, Surface levels and Surface regularity	As required / agreed	Major	Physical	At Random	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR	√	x	x	x	
338	ii	Rectification	As required / agreed	Major	Physical	Each rectification	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR		x	x	x	
340	**28**	**Geotechnical Investigations**											
341	i	Deployment of approved Geotechnical Investigation Agency - Equipments, Manpower etc	As required / agreed	Critical	Physical	Once before commencement of work	As per technical specifications and relevant IS Codes	SR	√	x	x	x	
342	ii	Execution of Geotechnical Investigation - locations, type etc as per scheme	As required / agreed	Major	Physical	Each Location	As per technical specifications and relevant IS Codes	SR		x	x	x	
343	iii	Collection of disturbed and undisturbed samples , their packing and storage	As required / agreed	Major	Physical	each sampling	As per technical specifications and relevant IS Codes	SR		x	x	x	
344	iv	Conducting filed tests as per investigation scheme- such as, SPT/ERT/SCPT/PLT/PMT etc	As required / agreed	Major	Physical	each field test	As per technical specifications and relevant IS Codes	SR		x	x	x	

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345	v	Submittion of Field Borelogs in approved format	As required / agreed	Major	Review	Within 24 hours after completion of each BH	As per technical specifications and relevant IS Codes	SR		x	x	x	
346	vi	Submittion of laboratory test schedule and selection of samples for laboratory testing	As required / agreed	Critical	Review and acceptance	as per consultation with engineer during dispatch of samples to approved laboratory	As per technical specifications and relevant IS Codes	SR	√	x	x	x	
347	vii	Submission of Final Geotechnical investigation report along with recommendations	As required / agreed	Critical	Physical	After completion of investigation work and review of draft reports	As per technical specifications and relevant IS Codes	SR		x	x	x	
349	**29**	**Topographical Survey Works**											
350	i	Deployment of approved Topographical Surveying Agency - Equipments, Manpower etc	As required / agreed	Critical	Physical	Once before commencement of work	As per technical specifications and relevant IS Codes	SR	√	x	x	x	
351	ii	Transfer of Permanent Bench mark to site from known location	As required / agreed	Major	Physical	Before commencement of work	As per technical specifications and relevant IS Codes	SR		x	x	x	
352	iii	Establishment of boundary pillers and survey grid, Temporary bench Marks, Measurement & recording spot levels	As required / agreed	Major	Physical		As per technical specifications and relevant IS Codes	SR		x	x	x	
353	iv	Recording features like trees, roads, transmission lines, lake, nala, river, temple, house, culverts etc. with coordinate locations	As required / agreed	Major	Physical		As per technical specifications and relevant IS Codes	SR		x	x	x	
354	vi	Submission of final Counter map showing all topographical features, record of spot levels	As required / agreed	Critical	Physical	After completion of investigation work and review of draft reports	As per technical specifications and relevant IS Codes	SR	√	x	x	x	
356	**30**	**Internal Switchyard - Site Leveling & Grading**											
357	i	Leveling Switchyard area	As required / agreed	Major	Visual / Physical	100%	As perTech. Specification and Approved Drawing	SR		x	x	x	
358	ii	Grading of 20/40mm stone / Gravel Spreading in sitchyard area	As required / agreed	Major	Physical	100%	As per Tech. Specification & Approved Drawing	SR		x	x	x	
360	**31**	**Plant Boundary Fencing (if applicable) & Gate (Also refer S.No. 3 for Steel works as applicable)**											
361	i	Fence posts (Intermediate, Stay & Corner Posts etc.) - Section size, Length, Galvanization - Grade/ Thickness, Tensile strength etc.	As agreed/ Required	Critical	Physical/ Measurement/ Review of MTC	Each lot received at site Random	IS:226; IS:2721; IS:278; IS:480; IS:4826 , Tech. Specs & Construction Drawings	MTC/ SR	√	x	x	x	For Structural steel checks refer S.No. 3
362	ii	Barbed wire - Dia. of line wire and barb wire, Grade of galvanization etc, Tensile strength etc.	As agreed/ Required	Critical	Physical/ Measurement/ Review of MTC				√	x	x	x	
363	iii	Tie wire - Diameter, Galvanization- Grade, tensile strength etc.	As agreed/ Required	Critical	Physical/ Measurement/				√	x	x	x	
364	iv	Blade barbed/ Concertina Wire - Thickness/ Diameter, galvanization, Diameter of concertina coil, Tensile strength etc.	As agreed/ Required	Critical	Physical/ Measurement/ Review of MTC				√	x	x	x	

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	**Sr.No.**	**Activity & Operation**	**Instruments**	**Class of Check**	**Type of Check**	**Quantum of Check**	**Reference Documents & Acceptance Standard**	**Format of Record**	**D*** (Records identified with (√) shall be issentially included by EPC vender in QA documentation)	**Cheking Agency**			**Remarks**
2								SR - Site Register SECI-SPV-QA-F-XXX SECI-SPV-QA-T-XXX (XXX - Inspection record form No. or Test report format no.)		**M'fr/ Supplier or Sub-Contractor**	**EPC Contractor**	**SECI or Owner**	
365	v	Fence Fabric- Mesh size, Wire Diameter, Galvanization-Grade, Selvage, Knuckling, Tensile strength etc.	As agreed/ Required	Critical	Physical/ Measurement/ Review of MTC				√	x	x	x	
366	vi	MS Gate - Caster weels, ball & bearings, Fixtures & fasteners etc.	As agreed/ Required	Major	Visual	100%	Tech. Specs & Construction Drawings	SR		x	x	x	
367	vi	Acceptance of Boundary Fence and gate	As agreed/ Required	Major	Physical	100%	Tech. Specs & Construction Drawings	SR		x	x	x	
369	**32**	**Tranformer Yard Fencing & Gate (Also refer S.No. 3 for Steel Works as applicable)**											
370	i	Fence posts (Intermediate, Stay & Corner Posts), Concertina Wire Support Angles - Section size, Length, Galvanization, Tensile strength etc.	As agreed/ Required	Critical	Physical/ Measurement/ Review of MTC	Each lot received at site Random	IS-226; IS 2721; IS-4948 , IS:480; IS:4826 Tech. Specification and Approved Drawing	MTC/ SR	√	x	x	x	For structural steel checks refer S.No. 3
371	ii	Tie wire (as aplicable) - Diameter, Galvanization, Tensile strength etc.	As agreed/ Required	Critical	Physical/ Measurement/ Review of MTC				√	x	x	x	
372	iii	Fence Fabric (chain link/ welded wire as aplicable)- Mesh size, Wire Diameter, Galvanization, Selvage, Knuckling, Tensile strength etc.	As agreed/ Required	Critical	Physical/ Measurement/ Review of MTC				√	x	x	x	
373	iv	MS Gate - Fixtures and fasteners	As agreed/ Required	Major	Visual	100%	Tech Specs andAproved Drawings	SR		x	x	x	
374	v	Acceptance of Fence & Gate	As agreed/ Required	Major	Physical	100%	Tech Specs and Approved Drawings	SR		x	x	x	
376	**33**	**Installation of Pre Engineered Building (PEB) - Security Cabin**											
377	**a**	**Receipt**											
378	i	Receipt of materials and Checking as per packing list	As agreed/ Required	Major	Visual	100%	As per Approved Drawings & Method Statement, Relevant BIS standards	SR	√	x	x	x	
379	iii	Dimensional Check	As agreed/ Required	Major	Measurement	100%			√	x	x	x	
380	iv	Visual checks for damages, rusting, pitting etc.	As agreed/ Required	Major	Visual	100%				x	x	x	
381	v	Visual checks for defects, primer coating and painting/galvanising as applicable.	As agreed/ Required	Major	Visual	100%				x	x	x	
382	vi	Nut/Bolt/Washers Checks	As agreed/ Required	Major	Visual	100%				x	x	x	
383	**b**	**Pre-Installation**											
384	i	Check that the work area is ready and safe to start installation	As agreed/ Required	Major	Visual / Dimension					x	x	x	
385	ii	Check readiness of Foundations	As agreed/ Required	Major		100%				x	x	x	
386	**c**	**Installation (as aplicable)**											
387	i	Readyness of concrete platform, foundations for installation- Size, Location, Level etc.	As agreed/ Required	Major	Visual					x	x	x	
388	ii	Check PUF side walls/ roof are installed properly	As agreed/ Required	Major	Physical					x	x	x	
389	iii	Check tightening of all Nut/Washers/Bolts	As agreed/ Required	Major	Physical					x	x	x	
391	**34**	**Structural Work for Module Mounting Structure (MMS)**					Tech. Specification, Approved Drawing & Method Statement						
437	a	**Manufacturing**											

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438		**Strucural Steel (Raw Material)** Hot rolled & cold formed sections - Angle, Channel, Z-section, Box section, Plate, rod & bar											
439	i	Ultimate Tensile Strength (UTS), Yield Strength (YS), Percentage Elongation, Bend Test, Chemical Composition, Section dimensions	As agreed/ Required	Critical	Chemical composition, Mechanical, Measurement	1 Sample per 50 MT or part thereoff/ for every heat no.	IS 2062, IS 513, IS 811, IS 1079, IS 808, IS 1852, IS 1730 -Part I	MTC	√				Raw material to be procured from reputed manufacturers - like SAIL, RINL, JSPL, JSW, TISCO, ISSAR
440	ii	Visual Examination - Cracks, Scaling, Rust, Pitting, Lamination etc.	As agreed/ Required	Major	Visual	10% IS 2500, Level II, AQL 1.5	IS 2062, IS 513, IS 811, IS 1079, IS 808, IS 1852, IS 1730-Part I	SR	√	x	x	x	Material shall be free from surface defects like cracks, lamination,roughness, imperfect edges, rust, pitting & other harmful defects. Removal of minor surface defects as per IS;2062 is acceptable. Witness for 10% sample. Record review for every material
441		**Boughtout Items (Hardware - Nuts, Bolts and Washers - plain, spring)**											
442	i	Mechanical & Chemical Properties	As agreed/ Required	Critical	Chemical composition, Mechanical	1 sample per 5 MT or part thereoff	IS 1327 (Part 17) eq./ ASTM standard	MTC/ Lab test Report	√	x	x	x	
443	ii	Dimensional check (Dia., Thickness, Total stem length & Threaded length etc.)	As agreed/ Required	Major	Measurement	IS 1327 (part 17) eq 10 pieces per lot per member type	IS 6639, IS 2016,IS 6610 & IS 3063 / ASTM standard	Vendor Records	√	x	x	x	Witness for sample. Record review for every material
444	iii	Galvanizing - Mass per Sqm, Thickness (DFT)	As agreed/ Required Alcometer	Major	Visual, Measurement	IS 1327 (part 17) eq 10 pieces per lot per member type	For Hot dip galvanizing should be maintained 43 microns (min) and average 54 microns as per IS 1367 (part XIII) eq.	Vendor Records	√	x	x	x	Record review Random sample inspection/ measurement
445	b	**In Process Inspection**											
446		**Structural Item Fabrication**											
447	i	Straightening	As agreed/ Required	Major	Visual	100%	0.2% of total length	Vendor Records	√	x	x	x	Record review
448	ii	Cropping (Cutting)	As agreed/ Required	Major	Visual	100%	Approved drawing	Vendor Records	√	x	x	x	Record review
449	iii	Identification/ Marking	As agreed/ Required	Major	Visual	100%	Approved drawing Marking Shall be done with the help of permanent paint marker using stencil as per Drawing	Vendor Records	√	x	x	x	Record review Random sample inspection
450	iv	Punching/ Drilling of Holes	As agreed/ Required	Critical	Measurement	1 piece per 25 pieces	IS 802/ Approved drawing	Vendor Records	√	x	x	x	Record review
451		Edge Security							√	x	x	x	
452	v	Overall Length	As agreed/ Required	Major	Measurement	1 piece per 25 pieces	IS 802/ Approved drawing	Vendor Records	√	x	x	x	Record review Random sample measureemnt
453	vi	Bending	As agreed/ Required	Critical	Measurement	100%	IS 801, 811/ Approved drawing	Vendor Records	√	x	x	x	
454		Cross Section Dimensions							√	x	x	x	Record review
455	vii	Welding	As agreed/ Required	Major	Visual	100%	Approved Welding Procedure & Welder Qualification	Vendor Records	√	x	x	x	Record review Random sample ispection
456	viii	Visual Examination - Black spots, Porosity, Spatter, Rust bleed points, Weld dimensions	As agreed/ Required	major	Visual	100%	Tech. Specification, Approved Drawing	Vendor Records	√	x	x	x	Record review Raddom sample inspection (The fabricated material shall be free from
457	ix	DP Test (as necessary)	As agreed/ Required	Major	Chemical	Shift wise/ random	As and when required	Vendor Records	√	x	x	x	
458	x	Final Inspection of Fabricated Parts - Cross section dimensions, Thickness (before galvanization)	As agreed/ Required	Critical		10 % in lot size of 100 nos.	IS- 802, IS 807, IS 811 and relevant applicable eq. standards , approved drawings, Tech spec	Vendor Records	√	x	x	x	
459		**Galvanizing**											
460	i	Zinc - Ingot, Molten metal in galvanizing bath	As agreed/ Required	Critical	Chemical	1 sample from each batch of ingot supply	IS 2629	MTC Lab test report	√	x	x	x	Purity of Zn 98.5%, MTC to be correlated. Molten metal in the galvanizing bath ≥ 98.5 % by mass of zinc.
461		**Pre Galvanizing**											

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462	i	Degreasing	Acid base cold degreaser	Major	Chemical	One sample daily	Sp. Gravity 1.1 to 1.2, ph Value 2 to 3	Vendor Records	√	x	x	x	Record review
463	ii	Pickling - Acid & Iron content	Lab test	Major	Chemical	One sample daily	Acid Content-Concentration 18% to 4% min, Sp. Gravity 1 to 1.3 Iron Content -120g/litre (max)	Vendor Records	√	x	x	x	Record review
464	iii	Rinsing	pH meter	Major	Chemical	One sample daily	Rinsing water ph value 5 to 7	Vendor Records	√	x	x	x	Record review
465	iv	Pre-fluxing in ZnCl solution - Specific gravity, pH	pH meter	Major	Measurement	One sample daily	Sp Gr - 1.10 to 1.26 pH - 3 to 5	Vendor Records	√	x	x	x	Record review
466	v	Pre-heating	Pyrometer	Major	Measurement	One sample daily	Above 50^0 C	Vendor Records	√	x	x	x	Record review
467	vi	Dipping - Zinc bath temperature, Imersion & withdrawl time	Continuous recording & verification by Pyrometer	Major	Measurement	Hourly check	Zn bath temp - 440^0 C to 460^0 C Article to be immersed till reaction	Vendor Records	√	x	x	x	Record review
468	vii	Quenching	Plain water	Minor			Bath in plain water for cooling & Cleaning. Temp. Below 65°	Vendor Records	√	x	x	x	Record review
469	viii	Di-chromating	Di-chromate solution	Major	Chemical	One sample daily	strength of the solution to be maintained as 0.7 to 1% of sodium dichromate, temperature of solution should be less than 65°	Vendor Records	√	x	x	x	Record review
470		**Post Galvanizing**											
471	i	Surface Defects/Finish - Dross, Pimples, Black marks, Ash deposition	As agreed/ Required	Major	Visual	100%	IS 2633	Vendor Records	√	x	x	x	Record review Random samples to be inspected during
472	ii	Thickness of Zinc Coating	Alcometer	Critical	Measurement	3 samples per dip	As Per IS 4759 , 6745 , Minimum 80micron or as per spec.	Vendor Records	√	x	x	x	Record review Random samples to be measured during factory visit by Owner/PMC
473	iii	Mass of Zinc Coating		Critical	Chemical	1 sample per shift	As Per IS 6745	Vendor Records	√	x	x	x	Record review
474	iv	Uniformity of Zinc Coating (Preece Test)		Major	Chemical	1 sample per shift	No red stains after 4 dippings	Vendor Records	√	x	x	x	Record review/ Sample test if deemed necessary
475	v	Adhesion of Zinc Coating (Pivote Hammer Test/ Knife Test)		Major	Physical	1 sample per hour	No Removal or lifting in areas between hammer impression/coating should not peel off. As per IS 2629	Vendor Records	√	x	x	x	Record review Random samples to be inspected during factory visit by Owner/PMC. Sample test if deemed necessary
476		**Proto Assembly**											
477	i	Proto Assembly check - Fitment, Dimensions, Alignment, Overall Stability	Prototype of one mounting table with	Critical	Physical/ Measureemnt	100%	Cut lengths of all members, Fitment (dia. of holes, end security, c/c distance between holes etc. shall be checked for correctness wrt permissible tolerence through in postion ispection of assembled proto), Fasteners (bolts, nuts and washers), Cleats, Gussete plates shall be as per Approved drawing/ specifications. The proto assembly shall be checked for overall stability for design verification of various conenctions and col. support system.	IR	√	x	x	x	The general quality of fabrication and galvanization of members, straightness of members, overall stability of prototype etc. shall be checked for design verification. Any suggestions for design changes etc. shall be properly recorded in the inspection report for implimentation in mass production of MMS members
478		**Marking/ Packaging**											
479	i	Marking	As agreed/ Required	Major	Visual	100%	Aprroved drawing/ marking scheme	IR	√	x	x	x	Record review Random sample shall be checked during facroty visit by Vendor and SECI/ Owner representative

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480	ii	Packaging, Storing, Bundling, Handling	As agreed/ Required	Major	Visual	100%	As per IS-802. Packing of Column. Bracing, Rafters and Purlins shall be done by strapping. Packing of smaller items by wires or in gunny bags/ or as per approved procedure	IR	√	x	x	x	Separate packaging for different type of members like Col, Purlin, Rafter, Front/ rear/ diagonal bracings, fasteners, cleats etc. Small members shall be bundled with wire. Damage to galvanization and form (shape) of the member during handling and trasporting shall be controlled
481		**Site Installation**								x	x	x	
482	i	Receipt of materials and Checking as per packing list	As agreed/ Required	Critical	Visual	Random	Tech. Specification, Approved Drawing & Method Statement.		√	x	x	x	
483	ii	Fabricated members - Dimensional Check	As agreed/ Required	Major	Visual	100%				x	x	x	
484	iii	Visual checks for defects/damages, rusting, pitting, galvanising etc.	As agreed/ Required	Major	Visual	Random				x	x	x	
485	iv	Nut/Bolt/Washers	As agreed/ Required	Major	Measurement	100%				x	x	x	
486	v	Mounting of structures & Accessories - Coordinates, Levels, Fitment, Alignment etc.	As agreed/ Required	Critical	Visual /Measurement	100%			√	x	x	x	
487	vi	Torque Checking - Daily calibration check, Bolt installation	As agreed/ Required	Major	Measurement	100%				x	x	x	
489	**35**	**Module Mouting - Pre Installation Check**			Visual	100%							
490	i	Check for site physical layout as per drawing / Design Specification		Major	Physical	100%				x	x	x	
491	ii	Check for Structure, Mounting readiness		Major	Physical					x	x	x	
493	**36**	**String Combiner Boxes (SCB) - Mouting - Pre Installation Check**											
494	i	Check for foundation readyness - location & coordinates, dimensions & levels, foundation bolts etc.		Major	Physical	100%				x	x	x	
496	**37**	**Inverter Panel**					Design Specification, Drawings, Manufacturer Manual Method Statement	SR					
497		**Pre Installation**											
498	i	Check for site physical layout as per drawing.		Major	Visual	100%			√	x	x	x	
499	ii	Ensure that no fouling with civil/structural		Major	Physical	Random				x	x	x	
500	iii	Check for Foundation readiness and level of foundation.		Major	Physical	100%				x	x	x	
502	**38**	**Burried Cables**					Design Specification, Drawings, Manufacturer Catalogue Method Statement (SW-SEPC-MS-CAB-006)						
503	i	Cable Trench - Dimensions, alignment		Critical	Physical	100%	Design Specification, Drawings, Manufacturer Catalogue Method Statement	SR		x	x	x	
504	ii	Sand filling before cable laying, sand filling after cable laying, placing of precast concrete slabs/ bricks, backfilling with soil		Major	Visual	100%				x	x	x	
586													
587													
588													
589													
590													
591													

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2								SR - Site Register SECI-SPV-QA-F-XXX SECI-SPV-QA-T-XXX (XXX - Inspection record form No. or Test report format no.)		**M'fr/ Supplier or Sub-Contractor**	**EPC Contractor**	**SECI or Owner**	
592			**LEGEND**: D * Records, indentified with "Tick" (√) shall be essentially included by supplier in QA documentation.							**DOC. NO.**: SECI - XXX - XXX -XXX - FQP & MQP - 001		**REV**: 0	
593			**Legend to be used:**										
594			**Class # : A** = Critical, **B**=Major, **C**=Minor										
595			**Format of Record #** : **SR**=Site Register, **TR**=Lab Test Report, **IR**=Inspection Report, **MTC**=Manufacturer's Test Certificate										
596			All **MTC'**s shall be correlated with batch of material supply, Tech specs and drawings										
597			**Category 'A'** - Sub-contractor/ sub-vendor, EPC Vendor, SECI/ Owner										
598			**Category 'B'** - Sub-Contractor/ Sub-Vendor, EPC Vendor, SECI										
599			**Category 'C'** - Sub-Contractor/ Sub-Vendor										
600										**Reviewed By**	**Approved By**		**Approval Seal**
601			This document shall be read in conjunction with Tech. Specifications and Drawings										

Annexure – C

PG Test Procedure

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1 INTRODUCTION

This document lays down the procedures and requirements for conducting Functional Guarantee tests including scope of the tests, procedures for the tests, reporting formats and process for determining test results in accordance with the Tender Specifications, applicable standards and industry best practices.

2 FUNCTIONAL GUARANTEE TESTS FOR SOLAR PV PLANT

Functional Guarantee for Solar PV Plant shall comprise of following Guarantees:

(1) Performance Ratio Guarantee test for operational acceptance.

(2) BESS Performance Assessment as per Annexure G.

2.1 PERFORMANCE RATIO GUARANTEE TEST

A Performance Ratio Guarantee test shall be commenced within 60 days of the commissioning of Plant Facilities to demonstrate that the plant has achieved the Guaranteed Performance Ratio in line with requirements under ANNEXURE A of the bidding document. This will be one of the pre-conditions for the Plant Operational Acceptance. Performance Ratio (PR) test period would be continuous measurement of 30 consecutive days. The test shall be conducted in accordance with the IEC-61724 as per the methodology described in Technical Specifications under ANNEXURE A of the bidding document. The procedure of PR test is described further in Section 2.4. The report shall contain all the measured energy and Met data values, calculations, results and conclusions.

2.1.1 Performance Ratio

The Performance Ratio (PR) of the PV Plant is calculated as follows (according to IEC 61724 Ed.2).

$$PR = \frac{E_{out}}{\sum_k \left(\frac{(C_k \times P_o) \times (G_{i,k} \times \tau_k)}{G_{i,ref}} \right)}$$

where

PR Temperature Corrected Performance Ratio

E_{out} Cumulative AC energy measured at the Plant End (ABT meter) over the duration of reporting period (kWh)

τ_k Duration of the kth recording interval, i.e. (1/60) hour

$\sum_k$ Summation over all recording intervals in the reporting period, (1/4) hour

C_k Power rating temperature adjustment factor and can be calculated as below

$Ck = 1 + \gamma \times (T_{avg\_mod,k} - T_{ref})$

γ Temperature coefficient of power with negative sign ($°C^{-1}$)

$T_{avg\_mod,k}$ Average PV Module temperature measured at the commencement of time interval 'τ_k' (°C)

T_{ref} PV Module temperature at which P_o is determined, i.e. 25°C

P_o Installed nominal peak power of PV modules, i.e. Nameplate rating at STC (kW_p)

$G_{i,k}$ Average irradiance measured at the Plane of Array (POA) at the commencement of time interval τ_k (kW/m^2) (average of all Pyranometres in various sites)

$G_{i,ref}$ Irradiance value at which P_o is determined, i.e. 1 kW/m^2

2.1.2 **General Requirement**

- The Functional Guarantee shall comprise of a set of visual/mechanical/Electrical checks followed by a Performance Ratio (PR) test of the Plant Facilities.
- The PR test shall be carried out for a period of 30 consecutive days at site by the Contractor in presence of the Employer/ Employer's Representative/ Owner's Engineer.
- These tests shall be binding on both the parties to the contract to determine compliance of the equipment with the guaranteed performance parameters.
- The test will consist of guaranteeing the correct operation of the Plant Facilities, by way of the performance ratio based on the reading of the energy produced and delivered to the grid (ABT meter) and the Plane of Array incident solar radiation.
- PR is calculated as per the formula given in Clause no. 2.1 and recorded as per the format provided at ***Annexure 1***.
- The filled-in format shall be signed by both the parties (EPC Contractor and SECI) and each party will keep one copy for record. **The same will be recorded for 30 consecutive days.**
- The Functional Guarantee condition for the purpose of Provisional Acceptance of the Plant Facilities shall be considered to have been met if the guaranteed Performance Ratio (PR) is achieved on a daily basis for 30 *consecutive days** as per Clause 2.1.5 of this document.
- During this PR test, equipment failure/interruption of any kind, except for SCADA communication failures, will not be accountable. In case of a breakdown, the test may be resumed once the complete system is rectified and working properly.

  ***** Interruptions due to communication breakdown only may be exempted based on specific approval to the effect that generation is not affected and equipment failure (Refer Clause 2.1.5) is not attributable. In such case, the test shall be extended for affected no. of days (up to 5 days)

2.2 PRE-PR TEST

2.2.1 The EPC Contractor shall perform start-up tests after completion of Commissioning and Test Procedure as per Annexure F: Plant Documentation, Commissioning and Test Procedure and recording of punch points.

2.2.2 Functional Guarantee Test shall commence immediately after all issues arising from the functional/ start-up test have been rectified.

Note:

(a) All measurement(s) procedure should be carried out taking proper safety precaution.

(b) Also it should be ensured that to avoid any loose connection at the terminal points for which measurement procedure is conducted.

(c) Ensure proper functioning (e.g. Multimeters shall be calibrated) of all measuring instruments before conducting above measurement procedure.

(d) The above test procedure shall be conducted in presence of site in-charge.

2.3 PR TEST PROCEDURE

The date of commencement of the PR Test shall be communicated in advance and agreed upon by both parties i.e. SECI and EPC Contractor. Any consecutive 30 days period (excluding interruptions that last entire day on account of grid outage or as per hindrance record maintained at site only) for the purpose of conducting PR test shall be mutually discussed and agreed between SECI and EPC Contractor. It shall comprise of the following procedures.

2.3.1 Pre-test Procedure

(1) Before the commencement of Performance Ratio (PR) test, the plant shall have achieved visual/mechanical/Electrical completion as per Clause 2.2 above and SCADA system and WMS shall be fully commissioned and functional.

(2) Trial Run: The PG Test for Plant Facilities shall commence with a trial run for 7 consecutive days. The EPC Contractor shall provide the data in requisite formats (specified elsewhere in the document) to SECI. SECI shall vet the data for any discrepancies and systemic errors and revert within 3 working days. Post the trial run period, the 30 days PR test will commence after communication from SECI in this regard.

(3) Pyranometer Tilt Angle & Cleanness: The pyranometers & Tilt Angle shall be verified before the test commences and **then visually inspected at regular intervals for cleanliness during the tests**.

(4) The average POA radiation of all the Pyranometers ($G_{i,k}$) shall be considered for the calculation of PR. The average of module temperatures recorded by all the temperature sensors shall be used for calculation of PR. The Pyranometers and Temperature sensors

used for the purpose of the PR Test shall have valid calibration certificates.

2.3.2 Following the completion of the pre-test procedures, Performance Ratio Test of plant shall commence in accordance with the procedures, conditions and requirements provided in the next section.

2.3.3 General Procedure for the PR Test

The PR Test Procedure shall include the following components:

(1) Data Collection: PV Power Plant test related parameters are collected in one-minute and 15 intervals for the 30 (Thirty) days (consecutive) reference period. The data shall consist of the following at a minimum:

- Irradiance at Collector's (i.e. PV Module) POA; (Source: SCADA, Temporal Resolution: 1 minute) Average values form all the sites will be considered
- Other Met Data received from installed WMS; (Source: SCADA, Temporal Resolution: 1 minute)
- Energy generated at Plant (kWh) (Source: Plant TVM Meter from SCADA, Temporal Resolution: 1 minute)
- Energy injected into grid (kWh) (Source: Plant End ABT Meter, Temporal Resolution: 15 minute)
- PV Module Temperature recorded from the temperature Sensors (^{o}C) (Source: SCADA, Temporal Resolution: 1 minute)

(2) **Data Filtering:** The data shall be filtered so that the data set is free of nuisance data points and bad data that exhibit a high degree of error (such as errors caused by faulty instrumentation). The EPC Contractor shall document data which is to be eliminated along with reasons. The following criteria shall be excluded from the dataset used for this test:

- **Nuisance or bad data** – Nuisance data points or bad data that clearly exhibit a high degree of error including required meteorological measurement equipment that is identified as being out of calibration or requiring adjustment. A 15-minute time-block shall be *explicitly* flagged through a flag parameter on account of this factor after recording reasons thereof (**Note**: no filtration shall be done at site level). The same shall be corroborated/verified by SECI.
- Time blocks with insufficient (less than equal to 10) 1-minute records.
- **Grid Interruptions** – Time periods (in 15-minute time blocks) of the grid interruptions at the utility substation, recorded manually jointly by EPC Contractor and SECI representatives shall be eliminated. Grid outage period, if any, shall be verified from SCADA.
- Any Force majeure conditions

- **Radiation Criteria –** Radiation on Plane of Array (POA) less than 200 W/m^2
- Shutdown explicitly demanded by the Owner/DISCOM/STU.
- As per the hindrance record maintained at site.

Note: Minimum 24 Nos of 15-minute time blocks shall be considered to account the day for PR measurement. Otherwise the PR test shall be extended to another day.

2.3.4 **Determination of PR Test**

Daily PR shall be calculated as the average of the PR calculated for valid 15-minute time blocks (Refer Clause 2.3.3) for the 30-day duration. If the ABT Meter data is not available on daily basis, PR shall be calculated based on the MFM data and shared for record. However, at the end of the PR test period, the daily PR shall be re-calculated with the ABT Meter data for sign-off.

If the If the EPC Contractor is not able to demonstrate guaranteed PR during this period, two more chances shall be given to demonstrate the same after incorporation of suitable corrective measures. In case the contractor fails to achieve guaranteed PR even after the two more chances, further action shall be taken as per the provisions of contract.

The test shall be repeated for 30 days in case of any outage of following equipment (as applicable) for more than 7 days.

- Power Transformer/Inverter Duty Transformer
- Power Conditioning Unit
- HT Switchgear Panel
- SCADA and data logger combined
- Tilted pyranometer
- Other WMS sensors.

2.3.5 **Raw Data Formats and Reports**

The EPC Contractor shall submit to SECI the raw data from the Plant SCADA on daily basis in the following format.

Temporal Resolution: 1 Minute

Date & Time dd/mm/yyyy hh:mm:ss format	Wind Speed (m/s)	Module Temp. (°C)	Ambient Temp. (°C)	Horizontal Irradiance (W/m²)	POA Irradiance (W/m²)	POA Radiation (kWh/m²)	Humidity (%)	Wind Direction (°)	Generation (kWh) (Source: TVM)

Temporal Resolution: 15 Minute (Every 15th Min record from the 1 Min Data)

Date & Time Dd/mm/yyyy hh:mm:ss	Wind Speed (m/s)	Module Temp. (° C)	Ambient Temp. (° C)	Horizontal Irradiance (W/m²)	POA Irradiance (W/m²)	POA Radiation (kWh/m²)	Humidity (%)	Wind Direction (°)	Generation (kWh) (Source:	Explicit Removal Flag*	Remarks

format									TVM)	(0 or1)	

* Explicit Removal Flag: 0 indicates time block considered; 1 indicates time block not considered.

PR Test Report shall be generated from the Raw Data (Sample Report provided in the Annexure) after data filtering as per criteria laid out in (2). The Report shall contain the signature of both representatives (SECI/Employer & EPC Contractor).

Note: In case of multiple pyranomters/temperature sensors, the radiation and temperature data for the purpose of calculation of PR shall be derived from the average values from tilted pyranometer /temperature sensors.

2.4 CAPACITY UTILIZATION FACTOR (CUF)

Capacity Utilization Factor for Solar Plant shall be calculated as per the following formula.

$$\mathbf{CUF} = \frac{\mathbf{E_{ac}}}{\mathbf{8760 \times P_{ac} \times (1 - DF \times (N - 1))} \mathbf{x}\ \boldsymbol{RCF}}$$

where,

Eac is the number of units recorded in the plant end ABT meter excluding auxiliary consumption, kWh

8760 refers to the number of hours in non-leap year. It shall be replaced by 8784 hours during leap year

Pac is the plant AC capacity, kW

DF is module degradation factor, 0.55% per year

N is the number of years of operation after operational acceptance of the plant

RCF is the Radiation Correction Factor: RCF = $\frac{Measured\ Irradiation}{Reference\ Irradiation}$,

where Reference Irradiation = 1828 kWh/m^2 and Measured Irraditation (GHI_{mes}) shall be recorded from the Pyranometer installed in horizontal plane at the site location. The radiation data of the Pyranometer shall be compared with the Reference Irradiation mentioned above. The radiation data from the Plant Pyranometer shall be used for computation of CUF, except in case of any discrepancy (i.e. more than ± 10% variation from the Reference Radiation, GHI_{ref}), in which case the radiation data from the nearest available Solar Radiation Resource Assessment (SRRA) station data will be used for computation of CUF. Missing data (GHI_{mes}) from the Plant Pyranometer shall be substituted by average of GHI measured for the same period in the past three (3) days. The plant Pyranometer has to be under CCTV coverage.

CUF shall be calculated on annual basis from the date of operational acceptance of the plant till the

end of O&M period. Module degradation factor will not be considered for first year CUF calculation. It is the Contactor's responsibility to envisage and install extra DC capacity to accommodate any degradation during first year. Module degradation factor, as per above will be considered from second year of operation.

Grid outage hours shall be subtracted from total number of hours in a year. The Contractor shall submit grid outage certification from competent authority of STU/DISCOM.

Reports

Sample Report for PR Test

PR Guarantee Test Report

Day 20-Nov-2016 Criteria >200

No. of Timeblocks considered 36 /42 Tot Gen 53694

Plant PR for the day ABI 80.68%

Remarks: [to be recorded, if any]

Liquidated Damages for Shortfall in PR

For every 0.01 shortfall in PR below the committed PR value, a penalty of 1% of the total Contract Value (i.e., total sum of all the Supply, Service and absolute value of O & M Contract) shall be levied. In case the Contract Performance Security has already been encashed on account of any default/delays, the penalty amount will be recovered from any due payments to the contractor. In case the Plant PR Shortfall is more than 0.05 than the specified PR value, then the total plant will be accepted on as-is basis & the total Contract Performance. Security submitted by the contractor will be forfeited & payments linked to operational acceptance will not be made.

Annexure – F

Procedure for Plant Testing, Commissioning and Documentation

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1 INTRODUCTION

This document lays down the procedures, requirements and templates for conducting commissioning tests and inspection of the Plant Facilities after installation and for subsequent re-inspection, maintenance or modifications in accordance with the Tender Specifications, IEC 62446 standard (Part 1: Grid connected systems – Documentation, commissioning tests and inspection)- and industry best practices.

2 CODES AND STANDARDS

The Testing and Commissioning Procedures shall, in general, comply with the following standards:

1. IEC 62446 standard (Part 1: Grid connected systems – Documentation, commissioning tests and inspection).
2. IEC 60364-6:2016 - Low voltage electrical installations - Part 6: Verification.
3. IEC 61829:2015: Photovoltaic (PV) array - On-site measurement of current-voltage characteristics.
4. IEC 60904-4:2019 Photovoltaic devices - Part 4: Reference solar devices - Procedures for establishing calibration traceability
5. IEC TS 60904-1-2:2019 - Photovoltaic devices - Part 1-2: Measurement of current-voltage characteristics of bifacial photovoltaic (PV) devices
6. IEC 62305-3– Protection against lightning - Part 3: Physical damage to structures and life hazard
7. IS/IEC 61557 : Part 2 : 2007 - Electrical safety in low voltage distribution systems up to 1000 V ac and 1500 V dc - Equipment for testing, measuring or monitoring of protective measures: Part 2 insulation resistance

3 COMMISSIONING

3.1 GENERAL

3.1.1 Objective

The Commissioning Procedure defined in this document aims to:

- Verify that the power plant is structurally and electrically safe
- Verify that the power plant is structurally and electrically robust to operate for the specified lifetime of a project

- Verify that the power plant operates as designed and its performance is as expected

3.1.2 General Requirements before Starting the Commissioning Process

- The modules shall be stabilized (sufficiently exposed after 200 kWh/m² reaching the PV plane)
- The tests shall be conducted under stable weather conditions
- The process shall be witnessed by the Owner or their duly appointed representative.
- Soiling losses shall not be accounted for in the assessment of Results. Therefore, adequate Module cleaning exercise shall be undertaken prior to commencement of Commissioning process.

- The following equipment shall be used during the commissioning process (Refer Annexure A.2:Technical Specifications for testing instruments):
  - Earth resistance tester
  - IV curve tracer
  - Insulation tester
  - Digital multimeter
  - Clamp meter
  - Infrared camera
  - Digital lux meter
  - Electroluminescence camera, power supply and accessories
- All testing equipment shall possess valid calibration certificate issued from approved laboratories.

4 Cold Commissioning

4.1 DC COMMISSIONING

4.1.1 Visual Inspection

The visual inspection shall be conducted on 5% of the system split in subareas equally distributed in the field. Unless otherwise specified, Approved Cat I Drawings shall be referred for correctness/verification. At least following aspects shall be verified visually on the DC side:

- Sizing of the DC fuses for running conditions, for the maximum voltage and the maximum current.

- Sizing of the string cables including overcurrent protection considering the current carrying capacity under operating conditions
- Cables protected against mechanical damage
- Functionality of the main DC switch
- Fixation of the modules to the mounting structure
- Termination of the cables to the inverter
- Where the PV system includes functional earthing of one of the DC conductors, the functional earth connection shall be specified and installed to the requirements of IEC 62548.
- Laying and installation of cables
- Fixation of the grounding electrodes
- Grounding of all conductive parts and connected to the equipotential bonding system of the PV plant
- The torque values in the mounting structure, combiner boxes, bars and joints shall match the manufacturer specifications
- Where protective earthing and/or equipotential bonding conductors are installed, they shall be parallel to and bundled with the DC cables
- Electrical circuits and devices shall be labelled.
- The PV modules shall be in a good condition (no visible serial defects such as yellowing, delamination, scratches, etc.).
- Functioning of fire protection equipment.

Acceptance criteria

Each deviation from industrial best practices, norms, standards and good workmanship shall be documented in a punch list. All items shall be categorized as "critical", "important" or "minor".

4.1.2 Pre-Energizing Tests

4.1.2.1 Measuring instruments and monitoring equipment and methods shall be chosen in accordance with the relevant parts of IEC 61557 and IEC 61010. The following tests shall be carried out on the DC circuit forming the PV array in accordance with a Sampling Plan:

- Electrical Continuity test: This test shall be performed on the earthing and/or

equipotential bonding conductors, in the PV array field. Connection of such conductors to earthing pit shall also be verified .

- Polarity test: Polarity of DC cables shall be verified. After verifying the correctness of polarity, marking on cable shall be checked for correctness

  Note: Polarity test shall be performed before closing the switches or string overcurrent protective devices are inserted

- Combiner box test: The purpose of this test is to ensure all strings are connected correctly to the combiner box. The test procedure is as follows and shall be performed before any string fuses / connectors are inserted for the first time:

i) Select a volt meter with voltage range at least twice the maximum system voltage.

ii) Insert all negative fuses / connectors so strings share a common negative bus.

iii) Do not insert any positive fuses / connectors.

iv) Measure the open circuit voltage of the first string, positive to negative, and ensure it is an expected value.

v) Leave one lead on the positive pole of the first string tested, and put the other lead on the positive pole of the next string. Because the two strings share a common negative reference, the voltage measured should be near-zero, with an acceptable tolerance range of ±15 V.

vi) Continue measurements on subsequent strings, using the first positive circuit as the meter common connection.

vii) A reverse polarity condition will be very evident if it exists – the measured voltage will be twice the system voltage.

- String open circuit voltage test, V_{oc} (under stable weather conditions): The purpose of this test is check the modules connection in string as per the design. The V_{oc} of PV string should be measured using suitable measuring device before closing any switch or string overcurrent protective devices, where fitted.

  The measured string V_{oc} will be assessed to ensure it matches the expected value (typically within 5 %) in one of the following ways:

  a) Compare with the expected value derived from the module datasheet or from a detailed PV model that takes into account the type and number of modules and the module cell temperature.

  b) Measure V_{oc} on a single module, then use this value to calculate the expected value

for the string.

c) For systems with multiple identical strings, voltages between strings can be compared.

- String circuit current test, Isc (under stable weather conditions): The purpose of this test to check the correctness of system, operational characteristic and PV array wiring. These tests are not to be taken as a measure of module / array performance. The test procedure will be as follows:

i) Ensure that all switching devices and disconnecting means are open and that all PV strings are isolated from each other.

ii) Create a temporary short circuit into string under test by using any of the following method:

(a) use of a test instrument with a short circuit current measurement function (e.g. a specialized PV tester);

(b) a short circuit cable temporarily connected into a load break switching device already present in the string circuit;

(c) use of a "short circuit switch test box" – a load break rated device that can be temporarily introduced into the circuit to create a switched short circuit.

iii) Measure the short circuit current (Isc) using a suitably rated measuring instrument.

iv) After taking the reading, interrupt the short circuit using a suitable load break switching device and check the zero value of current before changing any other connections.

v) Compare the measure value of Isc with the expected value. For systems with multiple identical strings, measurements of currents in individual strings shall be compared. These values should be the same (typically within 5 % of the average string current).

Note: An I-V curve test can be performed as an alternative to this test (see 4.3).

- Functional tests: The following functional tests shall be performed:

i) Switchgear and other control apparatus shall be tested to ensure correct operation and that they are properly mounted and connected.

ii) All inverters forming part of the PV system shall be tested to ensure correct operation. The test procedure should be as defined by the inverter manufacturer.

Functional tests that require the AC supply to be present (e.g. inverter tests) shall only be performed once the AC side of the system has been tested.

- Insulation resistance of the DC circuits: Test procedure to conduct this test will be as

follows:

i) Before commencing the test adopt the following safety measure to avoid any potential shock hazard

(a) Isolate the testing area.

(b) Do not touch any metallic surface, module backsheet or the module terminals when performing the insulation test.

(c) Appropriate personal protective clothing / equipment should be worn for the duration of the test.

ii) Isolate the PV array from the inverter (typically at the array switch disconnector)

iii) Disconnect any piece of equipment that could have impact on the insulation measurement (i.e. overvoltage protection) in the junction or combiner boxes.

iv) The insulation resistance test device shall be connected between earth and the array cable(s) or combiner bus bar. Connections can be made between earth and array negative followed by a test between earth and array positive or between earth and short circuited array positive and negative.

v) Follow the IR test device instructions to ensure the test voltage and readings in megaohms. When the system voltage (Voc at STC X 1.25) is higher than 500V, the test voltage shall be 1,000V and the minimum insulation resistance 1 MΩ.

vi) Ensure the system is de-energized before removing test cables or touching any conductive parts.

4.1.2.2 Sampling Plan:

At least 2 strings from 2 SMUs shall be randomly chosen by the Owner connected to each Inverter.

Acceptance criteria

The DC commissioning will be passed when the aforementioned verifications are successfully passed in 100% of the sample according to the IEC 62446: 2016 – 5 and IEC 62446:2016 – 6.

4.2 AC COMMISSIONING

4.2.1 Visual Inspection

The visual inspection shall be conducted on 5% of the system. In general, the requirements

specified in the IEC 60364-6 -6.4.2 apply. At least following aspects shall be verified visually on the AC side:

4.2.1.1 General requirements

- Protective requirements against electric shock
- Protection against fire and heat
- Choice, setting, selectivity and coordination of protective and monitoring devices
- Sizing of cables regarding voltage drop and ampacity as per approved Drawings.
- Sizing of protective and monitoring devices as per approved Drawings
- The circuit breakers are correctly located
- Selection, location and installation of suitable isolating, overvoltage protective devices and switching
- The equipment and protective measures are appropriate for the external influences and mechanical stresses
- The diagrams, warning notices or similar information attached to the wall inside the inverter housing or the control room
- Proper fixation of the cables to the collector bars in the AC combiner box
- Proper labelling of all electrical circuits and devices including the neutral conductor and protective conductor as well as correct connection of single pole devices to the phase conductors
- Adequacy of termination and connection of cables and conductors
- The warning labels and technical documentation physically displayed
- Selection and installation of earthing arrangements, protective conductors and their connections
- The existence and correct use of protective conductors and protective equipotential bonding conductors (PEB)
- Measures against electromagnetic disturbances implemented
- Easy access to the operational devices for maintenance
- Any exposed conductive parts connected to the earthing system
- The RCD type has been selected according to the requirements of the IEC 62548
- The isolation means of the inverter on the AC side are functional and correctly sized
- The fire protection requirements according to the approved design shall be given

4.2.1.2 Requirements for the inverter

- Installation as per manufacturer's instructions and compliance with IEC 62548
- Inverters properly fastened to the ground
- Inverter properly earthed
- Inverter incoming/outgoing cables properly isolated, labelled and connected
- The connections for phase sequence L1, L2, L3 and N in the correct order
- All cable terminations properly done
- Nameplate data. The minimum requirements for the production of a name plate are –
    - name and origin of the manufacturer; –
    - model or type name;
    - serial number;
    - electrical parameters: Vdcmax, Vmppmin, Vmppmax, Idcmax, Pac,r, Vac,r, f r , Iacmax;
    - degree of protection;
    - overvoltage category;
    - safety class.
- The displays - check / readout show plausible results
- The filters are clean and properly maintained
- The cooling outputs of the inverters are free from obstruction
- The DC circuit breaker is functional
- The DC insulation monitoring correctly installed
- The fuses at the DC entrance correctly sized
- The location of the inverter(s) in the field matches the approved design
- Protection against self-loosening of clamps and screws
- The string inverter anchored to the mounting structure
- The mechanical assembly is robust
- The inverters are fixed to non-flammable mechanical elements

Acceptance criteria

Each deviation from industrial best practices, norms, standards and good workmanship shall be documented in a punch list. The punch list shall represent a maximum budget of 1% of the construction price and all items shall be categorized as "critical", "important" or "minor".

4.2.2 Pre-Energizing Tests

Measuring instruments and monitoring equipment and methods shall be chosen in accordance with the relevant parts of IEC 61557 and IEC 61010. The following tests shall be carried out on the AC circuit forming the PV array:

- Continuity of conductors. The requirements in IEC 60364-6:2016 – 6.4.3.2 apply
- Insulation resistance of the electrical installation. The requirements in IEC 60364-6:2016 – 6.4.3.3 apply
- Insulation resistance testing to confirm the effectiveness of protection by SELV, PELV or electrical separation. The requirements in IEC 60364-6:2016 – 6.4.3.4 apply
- Insulation resistance/impedance of floors and walls. The requirements in IEC 60364-6:2016 - 6.4.3.5 apply
- Polarity test. The requirements in IEC 60364-6:2016 - 6.4.3.6 apply
- Testing to confirm effectiveness of automatic disconnection of supply. The requirements of the IEC 60364-6:2016 – 6.4.3.7 apply
- Testing to confirm the effectiveness of additional protection. The requirements of the IEC 60364-6:2016 – 6.4.3.8 apply.
- Test of phase sequence. The requirements of the IEC 60364-6:2016 – 6.4.3.9 apply
- Functional tests. The requirements of the IEC 60364-6:2016 – 6.4.3.10 apply
- Voltage drop. The requirements of the IEC 60364-6:2016 – 6.4.3.11 apply

Acceptance criteria

The AC commissioning will be passed when the aforementioned verifications are successfully passed in 100% of the sample according to the IEC 62446: 2016 – 5 and IEC 60364 – 6.

4.2.3 Additional Pre-Energizing Tests

All of the below tests shall be conducted in accordance with the supplier's installation/commissioning manuals.

4.2.3.1 Distribution boards and combiner boxes

Site testing on distribution boards shall include:

- Mechanical functional test of all components including mechanical interlocks
- Electrical functional test of all control and protection wiring against the approved

switchgear schematics

- Power frequency overvoltage test (flash test) on the switchgear including circuit-breakers in the test circuit
- Low resistance ductor test on the switchgear including circuit-breakers in the test circuit
- Visual inspection
- Verification of earthing

4.2.3.2 Inverters

Site testing on inverters shall include:

- Full test procedure as defined by the inverter manufacturer
- A full mechanical functional test of all components including mechanical interlocks
- Verification that the inverter operational parameters have been programmed to local regulations
- Electrical functional test of all control and protection wiring against the approved switchgear schematics as per approved MQP/FQP
- Insulation resistance test and earth residual current monitoring test
- Anti-islanding functionality
- High Voltage overvoltage test
- SCADA and metering calibration & functionality test

4.2.3.3 HT Switchgear

Site testing on outdoor circuit-breakers shall include:

- Functional check of all wiring, interlocks, auxiliaries and pressure devices
- Timing test and travel curve
- Visual inspection

4.2.3.4 LV/MV transformers

Transformer commissioning shall include:

- Visual inspection, alignment, earthing and labeling
- Functional check of all wiring against the approved transformer schematics
- Testing and calibration of all transformer protection and monitoring devices
- Insulation resistance test
- Functional test of off-circuit/on Circuit tap changer and check of the continuity of all windings

4.2.3.5 Substation/Power Transformers

- Ratio measurement on all tap changer settings
- Winding resistance measurement on highest, lowest and nominal tap settings
- Insulation resistance between all windings, and each winding to earth
- Insulation resistance core-to-earth
- Oil sample tests: breakdown strength, moisture content, and dissolved-gas content
- Transformer differential protection scheme testing

Acceptance criteria

The test results shall be aligned with the manufacturer specifications stated in the installation manual.

4.3 IV CURVE TESTING

The requirements of the IEC 62446-1:2016 – 7.2 apply. Following normative references shall be considered while performing the IV curve test:

- IEC 61829:2015 Photovoltaic (PV) array - On-site measurement of current-voltage characteristics
- IEC 60891:2009 Photovoltaic devices - Procedures for temperature and irradiance corrections to measured I-V characteristics

2 % of the module strings shall be measured. If $\Delta P_{stringN}$>5%, all the modules within that string shall be I-V characterized. Modules with ΔP_N>5% shall be replaced. If more than 5% of the measured strings of the first sample show ΔP_N>5%, another 2% shall be inspected. If more than 5% of the measured strings in the second sample show ΔP_N>5%, another 5% shall be inspected. If more than 5% of the measured strings in the third sample show ΔP_N>5%, another 10% shall be inspected. If more than 5% of the measured strings in the fourth sample show ΔP_N>5%, another 10% shall be inspected. The reference power value is the flash list value minus the light induced degradation (LID) value in the datasheet/module warranty.

Acceptance criteria

The power determination analysis will be passed when less than 5% of the modules measured in the last sample show ΔP_N<5%.

5 Hot Commissioning

5.1 INFRARED INSPECTION

Following normative references apply:

- PV array infrared camera inspection procedure (IEC 62446-1:2016 - 7.3) and IEC 62446-3 TS Ed.1.0 - Photovoltaic (PV) systems - Requirements for testing, documentation and maintenance - Part 3: Outdoor infrared thermography of photovoltaic modules and plants (draft)
- The infrared inspection shall be applied both to the PV modules and the BOS components

The inspection sample will depend on the project size and shall be agreed with the OWNER. The following values serve as an orientation:

- Large scale ground mounted PV plants
  - PV modules: 100%
  - Inverters: 100%
  - Combiner boxes: 100%

Acceptance criteria

The following conditions shall be met simultaneously:

- 0.2% or less of the inspected modules show thermal gradients at the cell level of T > 10 K
- 0.2% or less of the inspected modules show thermal gradients at the junction box level of T > 10 K
- 0.2% or less of the inspected modules show inactive cell strings
- No PID is detected
- All module strings are connected and producing
- All inverters are connected and producing

5.2 INVERTER AVAILABILITY TEST

5.2.1 Calculation of the Operation Time

It shall be calculated on inverter level. The operation time starts as soon as the inverter switches on. Therefore only the logged irradiation values during the operation time of the inverter shall be considered. Irradiation values logged before or after the inverter running time shall be disregarded.

5.2.2 Calculation of the Downtime

The downtime relevant for the availability calculation is any time in which a part or a subpart of the system is not operational. The outage periods shall be considered again on inverter level. Only complete outages shall be taken into consideration. System black-out periods due to following reasons shall not flow into the calculation (i.e. excluded events):

- A failure in the distribution grid or the transformer substation, making it impossible to transmit the generated power
- Solar radiation below the level needed to obtain the minimum operating voltage to start the inverter operation
- Causes of Force Majeure.
- Occurrences of anomalies in the power supply system (frequency differences or voltage surges) that trigger the protective systems of the plant or the limit settings of the inverter

Any forced disconnection shall be documented and recorded.

Acceptance criteria

The system availability shall be at least 99% during the testing period.

5.3 SINGLE AXIS TRACKER AVAILABILITY TEST (IF APPLICABLE)

The tracker availability test shall be carried out in parallel to the inverter availability test and shall have the same duration. During the test, all trackers shall follow the sun according to the angles established in the tracking mechanism. A loss of availability shall be considered when the angle of inclination of one or more trackers deviates by more than 2° from the theoretical angle. The angles of inclination of each tracker shall be recorded with a resolution of 1min via the SCADA system.

Acceptance criteria

The tilt angle of each tracker shall lie within a ±2° range during 99.5% of the operational time.

5.4 SCADA AND WEATHER STATION RELIABILITY

5.4.1 Visual Inspection

- Installation of the communication system architecture diagram according to the

specifications

- Functional Tests conducted during FAT for Pre-Dispatch Inspection shall be repeated.
- SCADA shall be linked to all protection relays, disturbance recorders and other substation equipment using the communications protocol
- Visual check on the assembly of all joints and on the as-installed condition of all components, including:
    - The irradiation sensor is not shaded and is installed at the correct tilt angle and under CCTV coverage.
    - Ambient temperature and module temperature sensor are installed properly (Reference IEC 61724)
    - Mechanical anchorage of the sensors is robust
- Complete calibration certificates of all the instruments shall be provided

Acceptance criteria

Each deviation from industrial best practices, norms, standards and good workmanship shall be documented in a punch list. The punch list shall represent a maximum budget of 1% of the construction price and all items shall be categorized as "critical", "important" or "minor".

6 Battery Energy Storage System

6.1 VISUAL INSPECTION

Before energizing the BESS, following visual checks shall be made to check the required design compliance:

- Installation of protective cover for live, hot and cold parts, and the adequate distance from the person;
- Installation of fence, wall, locking system of doors and access panels, and notice boards
- Installation of ventilation system;
- Installation of firefighting system;
- Installation of lightning protections devices.
- Wiring
    - All wiring shall be continuous and without splices.

- Wiring that may be exposed to mechanical damage are placed in conduit or armoured.
- Wires have permanent and durable identifying labels or markings on both ends.
- Control and instrumentation wiring shall be separated from power and high-voltage wiring by use of separate compartments or enclosures or by use of separate wireways and appropriate barrier strips.
- BESS and PCS control and instrumentation system wiring shall be bundled, laced, and otherwise laid in an orderly manner.
- Cable systems do not block access to equipment by personnel. There are no exposed current-carrying or voltage-bearing parts.

6.2 CONTINUITY TEST

Continuity of power, control and auxiliary circuit in the system shall be verified through visual inspection, continuity tester and insulation resistance test.

Phase sequence and terminal marking shall also be verified with drawing and design documents.

6.3 EARTHING TEST

Following element to be check according to the design and applicable standards:

- Proper connection of the earthing busbar to the local earthing busbar;
- Individual earthing connection of main equipment to the earthing busbar;
- Connection of earthing cables to structures via proper connectors to prevent corrosion from dissimilar metals.

6.4 INSULATION TEST

For low-voltage EES systems, the insulation resistance test and withstand voltage test shall be performed according to IEC 60364-6.

For EES systems exceeding 1 kV AC or 1,5 kV DC, the withstand voltage test shall be performed according to IEC 61936-1.

6.5 FUNCTIONAL TEST

6.5.1 Start and stop test

Check start and stop operation of BESS system with the startup/shutdown command manually and automatically.

6.5.2 Alarms Functional Test

Alarms initiation from the BESS in case of following conditions:

- Emergency trip switch.

- Loss of the low-voltage AC or utility grid voltage.
- An AC circuit breaker trip (either side of transformer).
- Door interlock: Initiate shutdown when the door is opened (with appropriate provision for maintenance work). Interlocks shall be self-resetting.
- Smoke/fire alarm.
- Control logic trouble.
- A DC ground fault (simulated).
- Remote disable (no reset required).
- grid system faults (balanced and unbalanced; line-to-ground, line-to-line, and three-phase).
- Abnormal voltage
- Islanding condition.
- Protection or control scheme failures, including the following:
  - Failure of local interconnection protection system
  - Failure of critical breaker trip coil or interrupting device
  - Loss of DC supply

6.5.3 Load tripping test

Check the interlock of BESS with the main

6.5.4 Operating cycle test

Check for any abnormalities such as rise in temperature, noise level and vibration in ESS system during rated input and output power operation.

6.5.5 Storage Settings

Verification of settings/control points and provision for modification of various set points and fixed operation/control settings associated with the various control functions.

Operator Controls:

- Trip/reset for the BESS AC circuit breaker or contactor.
- Trip/reset for DC circuit breaker(s)/contactor(s).
- PCS on/off.
- Reset cut-out selector switch to disable remote or local reset signals.
- A selector switch to manually set the operating state (that is, the shutdown, disconnect, or operate state) and to have the control system set the operating state automatically.
- A selector switch to manually set the operating mode and to have the control system set the operating mode automatically.

6.5.6 Communication test

Verified that measuring, alarm, fault indication, message and control and monitoring system operations are correct transmitted and received by the SCADA system.

6.6 SYSTEM RATING VERIFICATION

BESS rating including rated power, energy available at rated power, and the performance of the BESS associated with different performance metrics mentioned herein taken at the beginning of life shall be based on a set of ambient operating conditions specified by the BESS Original Equipment Manufacturer (OEM) for the Project site. The Contractor shall also provide an indication of how the performance of the BESS with respect to the metrics is expected to change over time, to account for time and use of the system, and report the same periodically.

An energy capacity test shall be performed at the time of Commissioning, in accordance with procedure mentioned below and is intended to be used to determine the dispatchable energy capacity of the BESS at the time of commencement of Operation. In conducting the energy capacity test, the Contractor shall provide a detailed and documented charging procedure within the specifications of the BESS. The energy capacity tests conducted on the BESS shall be documented to allow for tracking performance degradation.

Available/Dispatchable/Throughput energy shall be tested in accordance with the following procedure under the standard testing conditions specified in IEC 62933-2-1 (Cl. 5.1.3):

Measurement:

System shall be charged to the full available energy level. Subsequently, the BESS (appropriate modular sub-unit thereof) shall be discharged and charged at rated power between the lower and upper SOC* limit (as recommended by the OEM for current application). Power during charge and discharge shall be recorded at regular intervals of time documented by the OEM to provide a statistically valid resolution. The associated energy input (Ei), including all BESS functional, parasitic and auxiliary consumption and energy output (Eo) of the BESS shall be calculated from the recorded power. Discharged energy should be recorded as per the readings in the ABT Meter(s) at the point of interconnection of the BESS with the Solar PV array,

** SOC recorded, shall be as reported by the Battery Management System.*

The above process shall be repeated multiple times, with minimum rest period between charging and discharging, if so recommended, so as to record data for a specified no. of cycles (n). The reference performance test value for stored energy shall be calculated as the mean of the values of Eo and Ei as measured for discharge and charge respectively.

The procedure shall be repeated (one cycle each) with power levels at 75%, 50%, and 25% of rated power and documented.

Criterion: BESS stored Energy capacity shall be at least total energy dispatchable as specified in the Section V: Technical Specifications at rated Power at the time of commissioning.

2. Round-trip energy efficiency (RtE, η) shall be determined as a function of the charge and discharge power and calculated using the following formula:

$$\eta_p = \frac{\sum Eo}{\sum Ei}$$

where,

∑Ei is the sum of Energy input to the BESS over n cycles

∑Eo is the sum of Energy output from the BESS over n cycles η_p is the Round Trip Efficiency at charge/discharge Power, P (expressed as a percentage of rated power)

Eo and Ei shall be determined as per point 1. above.

Criterion: η_p, as determined through the process described above shall be >80% at the time of commissioning.

Note: The tests are intended to be carried out over a continuous period. The value of n shall be at least 3 for 100% rated Power and 1 for 25%, 50% and 75% of rated power as per procedure laid down in Annexure B.

3. BESS Response time: shall be measured as the sum of the following two entities: 1-> The time elapsed between the instant when a command to change set point from rest to discharge is sent to the BESS (T_0) and the instant when the BESS starts responding to the discharge command signal (T_1), the BESS being in active standby state and 50% SOC at T_0 i.e., T_1- T_0

2-> Time elapsed in seconds between the instant the ESS output transitions from no discharge i.e. 0% (T_1) to discharge and the instant it attains rated power capacity(T_2) (or from no charge (T_1) to charge state and the instant it attains rated charge rate(T_2)) i.e. T_{2-} T_1

$$\mathbf{RT} = (T_{2-} T_1) + (T_{1-} T_0) = \mathbf{T_{2-} T_0}$$

Where T_0 , T_1 and T_2 are timestamps:

T_0 :	Instant when a command to change set point is received at BE boundary (to be identified in advance);
Data Format:	dd/mm/yyyy hh:mm:ss.00
T_1 :	Instant when the BESS starts responding to the Command signal;
Format:	dd/mm/yyyy hh:mm:ss.00
T_2 :	Instant when the BESS attains 100% of full discharge rate wl discharging or full charge rate;
Format:	dd/mm/yyyy hh:mm:ss.00

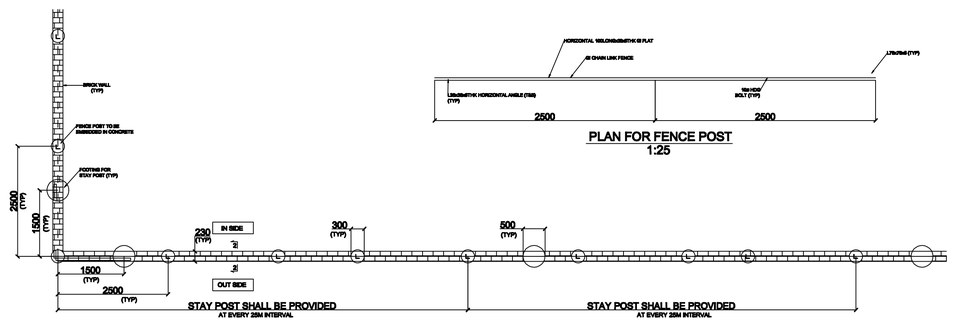
ANNEXURE – D

MANDATORY SPARES

S. No.	Equipment/Material	Quantity (for each type and rating)
1	PV Modules	0.25% of total supply
2	Power Conditioning Unit	Spares s per OEM recommendation in case of central inverter/ 0.5% of total capacity in case of string inverters.
3	MC4 connectors (including Y-connector if used)	1% of total supply
4	String Monitoring Unit	10 Nos
5	Inverter Transformer	1 Nos. of Each Rating
6.	Power Transformer	1 No. – 50 MVA
6	Inverter Transformer Spare	
	(i) HV bushing with metal parts and gaskets	2 set
	(ii) LV bushing with metal parts and gaskets	2 set
	(iii) WTI with contacts	2 set
6	HT Switchgear	
	(i) Vacuum pole	2 nos.
	(ii) Closing coil	2 nos.
	(iii) Tripping coil	2 nos.
	(iv) Spring charging motor	2 nos.
	(v) Relay	2 nos.
	(vi) Meter	2 nos.
	(vii) Current Transformer	2 nos.
	(viii) MCCB	2 nos.
	(ix) MCB	2 nos.
	(x) Fuse	10% of total supply
	(xi) Indicating lamp	10% of total supply
	(xii) Rotary switch	10% of total supply

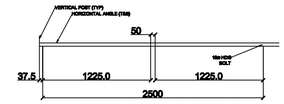
S. No.	Equipment/Material	Quantity (for each type and rating)
7	LT Switchgear	
	(i) MCCB	2 nos.
	(ii) MCB	2 nos.
	(iii) Fuse	10% of total supply
	(iv) Relay	2 nos.
	(v) Meter	2 nos.
	(vi) Current Transformer	2 nos.
	(vii) Voltage Transformer	2 nos.
	(viii) Indicating lamp	10% of total supply
	(ix) Rotary switch	10% of total supply
8	Battery	2% of total supply along with all Cell/ Battery Auxiliary Systems, interconnectors, monitoring devices

Spares, if used, during the O&M period shall be replenished by the Contractor. All the mandatory spares shall be handed over to the Employer in working condition at the end of O&M period.

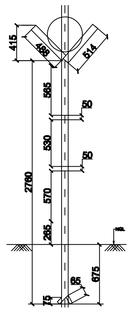


PLAN OF FOUNDATION
1 : 50

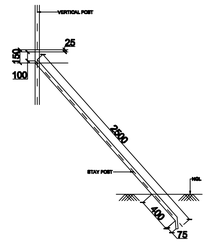
PLAN FOR FENCE POST
1:25



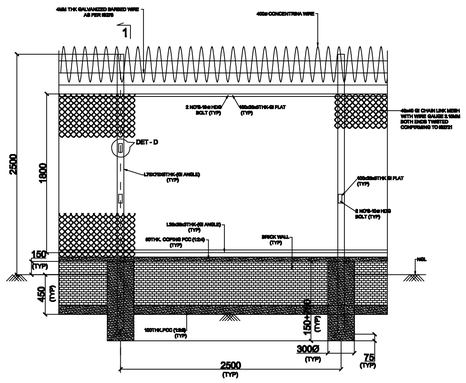
HORIZONTAL ANGLE DETAILS
1:25



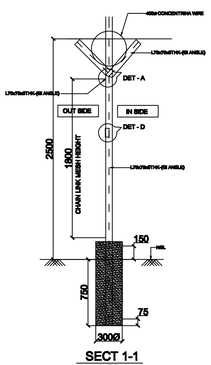
SECT 1-1
1:25



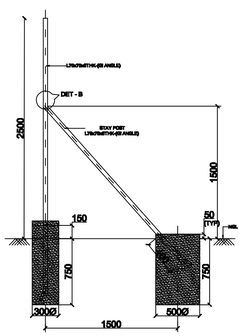
STAY POST DETAILS
1:25



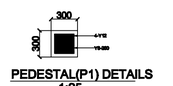
ELEVATION FOR BOUNDARY FENCING
1:25



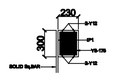
SECT 1-1
1:25



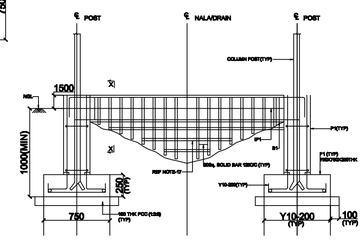
STAY POST DETAILS
1:25

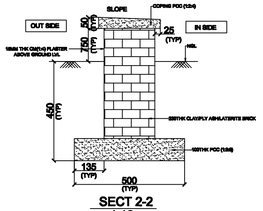


PEDESTAL(P1) DETAILS
1:25

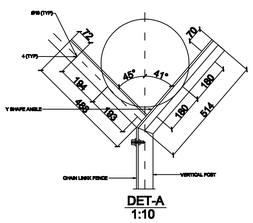


SECT X-X
(B1 230x300)
1:25

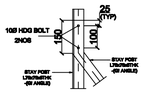




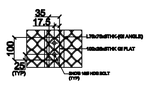
SECT 2-2
1:10



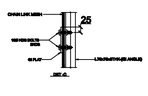
DET-A
1:10

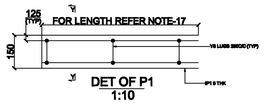


DET - B
1:10

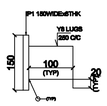


DET - D
1:10





DET OF P1
1:10



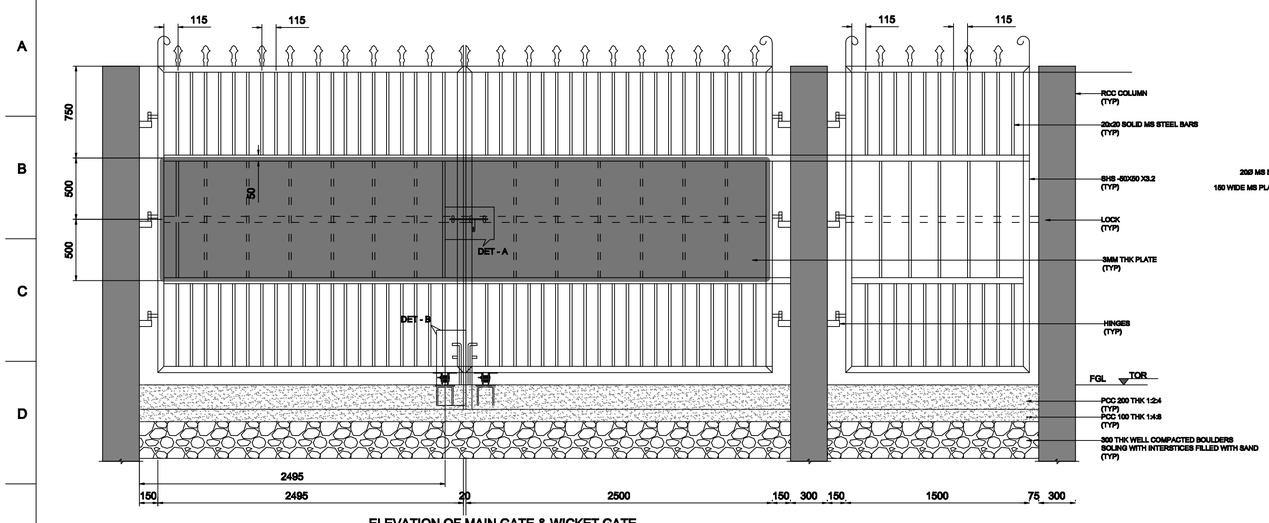
LEGEND

PCC	—	PLAIN CEMENT CONCRETE
NGL	—	NATURAL GROUND LEVEL
DET	—	DETAIL
TYP	—	TYPICAL
HDG	—	HOT DIP GALVANIZED
GI	—	GALVANIZED IRON
Eq	—	EQUAL
T&B	—	TOP & BOTTOM

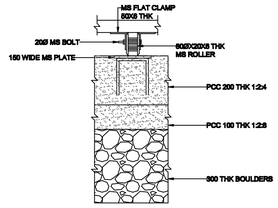
NOTES

1. ALL DIMENSIONS ARE IN MILLIMETER AND ELEVATION IN METER
2. ALL STRUCTURAL STEEL WORL SHALL CONFORM TO IS:2062 GRADE-E250
3. ALL DIMENSION TO BE CHECKED BEFORE FEBRICATION OF STEEL WORK.
4. GALVANIZATION ON WIRES SHALL CONFORM IS:4826 HEAVY DUTY.
5. GALVANIZATION THICKNESS SHALL BE 80 MICRONS MIN.
6. FENCING HEIGHT SHALL FOLLOW THE NATURAL CONTOUR OF LAND.
7. BARBED WIRE SHALL MINIMUM 4MM DIA APPROVED MAKE TATA OR EQUIVALENT. IT SHALL BE CONFORM TO IS 278.
8. THE BARBED WIRES SHALL BE INSERTED IN THE SLOTTED HOLE AND BINDED WITH BINDING WIRES.
9. TWO STAY POST SHALL BE PROVIDED AT EVERY CORNER COLUMN POST AND WHEREVER CHANGE IN ELEVATION/LEVEL.
10. CLEAR COVER TO STEEL COLUMN POST SHALL BE 75MM.
11. GRADE OF CONCRETE SHALL BE M25 WITH 20MM NOMINAL SIZE GRADED AGGREGATES AS PER IS:456.
12. ALL REINFORCEMENT SHALL BE HIGH YIEL STRENGTH DEFORMED BAR OF GRADE TMT FE500 CONFORMING TO IS:786.
13. CLEAR COVER TO REINFORCEMENT SHALL BE AS FOLLOWS:
    FOOTING = 50MM, COLUMN = 40MM & BEAM = 25MM.
14. WHOLE DIAMETER SHALL BE 2MM LARGER THAN BOLT DIA.
15. GRILL 20 Sq. SOLID MS BAR WELDED TO IP1 AT SPACING OF 125MM C/C. 20Sq HORZ. BARS OR 35MMX5MM THK FLAT WELDED TO VERTICAL Sq BARS AT SUITABLE INTERVALS (MIN. 3 NO OF THE BARS/FLATS).
16. HEIGHT OF THE VERTICAL Sq SOLID MS BAR WILL VERY BASED ON ACTUAL NALA/DRAIN DEPTH.
17. LENGTH OF THE INSERT PLATE WILL BE BASED ON ACTUAL NALA/DRAIN WIDTH.
18. ADJACENT POST SHALL BE SUITABLE RELOCATED AT SPACING <2.5M TO ACCOMMODATE THE NALA OR DRAIN WITHIN 2.5M FENCE SPAN AT NALA CROSSING. POST ON EITHER SIDE OF NALA SHALL BE SUPPORTED WITH PEDESTAL & FOOTING ARRANGEMENT AS SHOWN.

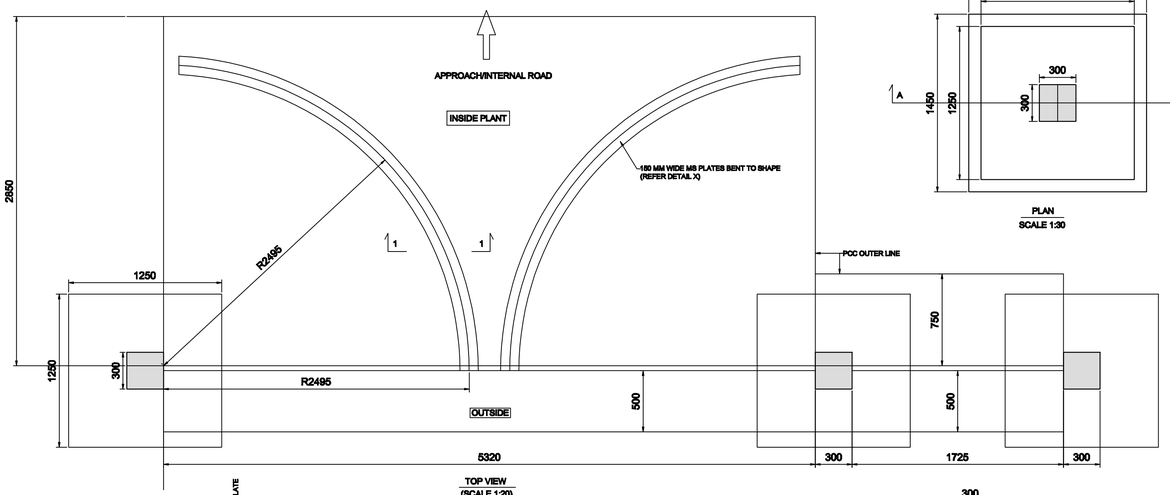
									THIRD ANGLE PROJECTION		PROJECT CODE:		TITEL	DRAWN	CHKD.	APPR.	SHEET
											PROJECT:			DATE	DATE	DATE	REV.
											UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN mm			PART/DWG NUMBER-			SHEET SIZE A1
											TOLERANCES						
											NO D.P. ± 1mm	ONE D.P. ± 0.5mm	TWO D.P. ± 0.25mm	ONE D.P. ± 0.5°	SCALE 1 : 25mm		



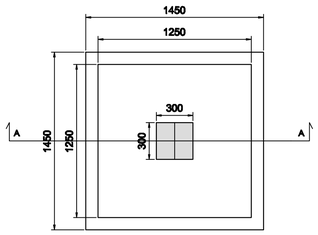
ELEVATION OF MAIN GATE & WICKET GATE
(SCALE 1:20)



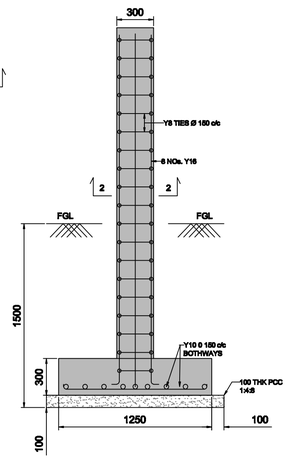
SECTION 1-1
(SCALE 1:10)

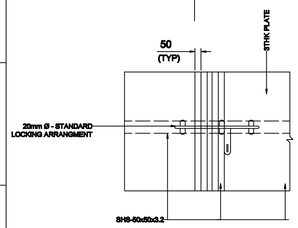


TOP VIEW
(SCALE 1:20)

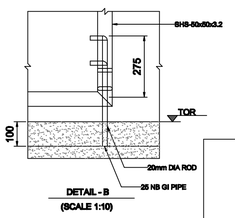


PLAN
SCALE 1:20

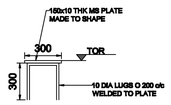




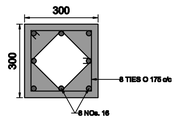
DETAIL - A
(LOCKING ARRANGMENT)
(SCALE 1:10)



DETAIL - B
(SCALE 1:10)



DETAIL - X
(SCALE 1:10)



SECTION 2-2
(SCALE 1:10)

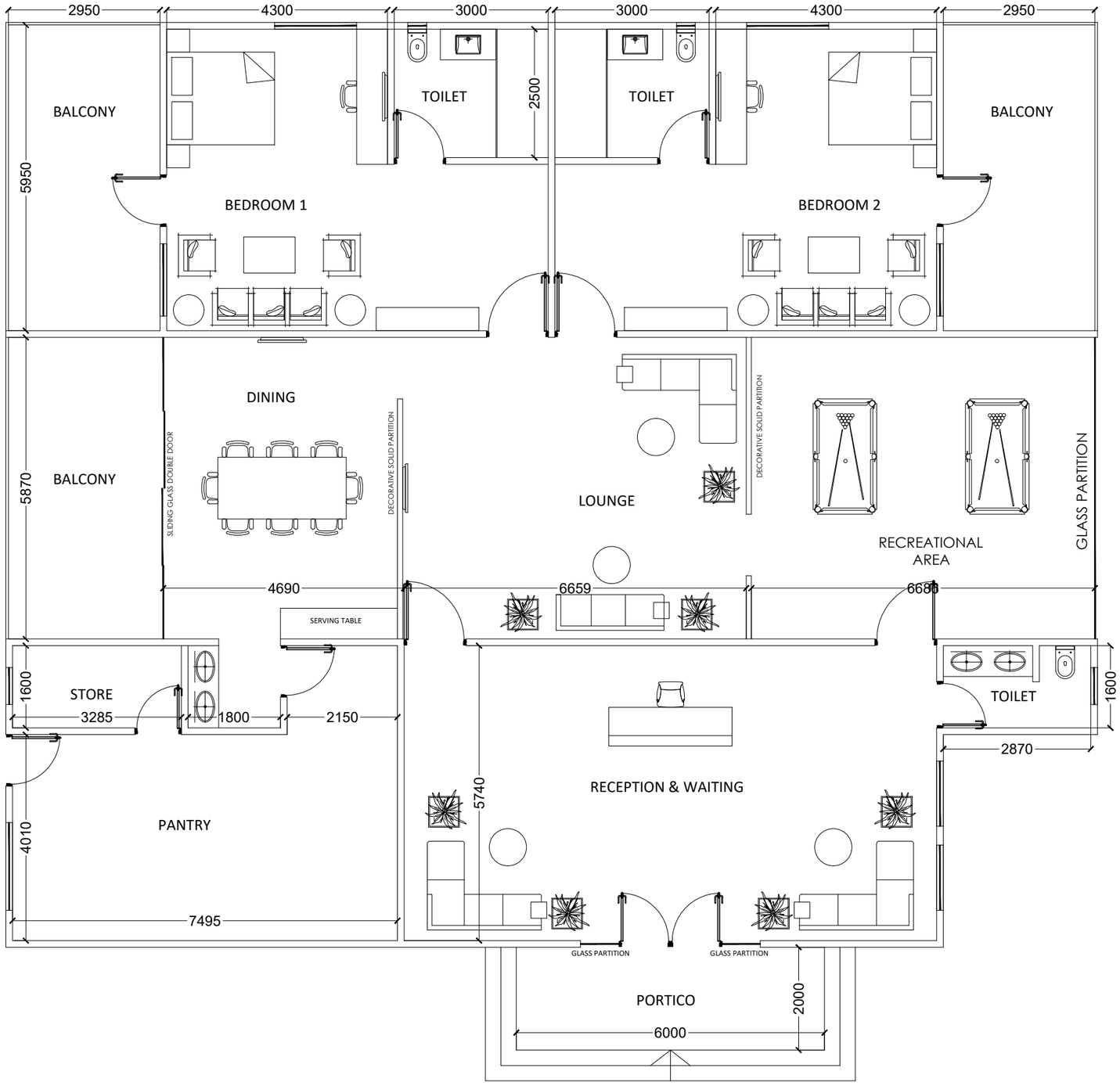
LEGEND

FGL — FINISHED GROUND LEVEL
TYP — TYPICAL
THK — THICK
NB — NOMINAL BORE
TOR — TOP OF ROAD

NOTES

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
2. DO NOT SCALE THE DRAWING. ONLYU WRITEN DIMENSIONS SHALL BE FOLLOWED.
3. COLUMN/GATE ORIENTATION SHALL BE AS PER LAYOUT.
4. CONCRETE SHALL BE OF M25 WITH 20MM NOMINAL SIZE GRADED AGGREGATES CONFORMING TO IS:456-2000.
5. REINFOCEMENT BARS SHALL BE OF HIGH YIELD STRENGTH TMT BARS OF GRADE FE500D CONFERMING TO IS:1786.
6. REINFOCEMENT BARS SHALL NOT BE COUNTED.
7. THE BARS SHALL BE BEND AS PER IS:2502.
8. LAP/LENGTH. DEVELOPMENT LENGTH. SHALL BE PROVIDED 50xDIA OF SMALL BAR.
9. ANY DISCREPANCY IN THE DRAWING SHALL BE BROUGHT TO THE NOTICE OF ENGINEER IN CHARGE BEFORE EXECUTE OF WORK
10. THE DRWAING SHALL BE READ IN CONJUNCTION WITH RELEVANT LAYOUT DRAWINGS.
11. CLEAR TO MAIN REINFORCEMENT:
    a) FOOTING - 50mm b) PEDESTAL - 40mm c) COLUMN - 40mm
12. HING. LOCKING ARRANGEMENT AND DROP RODS ARE INDICATIVE ONLY AND SHALL BE AS PER MANUFACTURER PROVISION.(SHALL BE HEAVY DUT).
13. ALL THE FITTINGS SHALL BE GI FITTINGS.
14. ALL STRUCTURAL STEEL WORK SHALL CONFIRM TO IS:2062 GRADE-A, E-250.
15. THICKNESS OF WELD SHALL BE 5MM THICK UNLESS OTHERWISE NOTED.
16. THE GATE/NAME PLATE SHALL BE PAINTED WITH 2COATS OF EPOXY TOTAL DFT 150 MICRONS PAINT OF APPROVED MAKE AND SHADE OVER 2COATS OF SUITABLE PRIMER.

COMPANY NAME	COMPANY NAME	COMPANY NAME	THIRD ANGLE PROJECTION	COMPANY NAME	PROJECT CODE:	TITEL	DRAWN	CHKD.	APPR.	SHEET
					PROJECT:		DATE	DATE	DATE	REV.
					UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN mm		PART/DWG NUMBER-			SHEET SIZE A1
					TOLERANCES: NO D.P. ± 1mm; ONE D.P. ± 0.5mm; TWO D.P. ± 0.25mm; ONE D.P. ± 0.5°; SCALE 1 : 25mm					


2950
4300
3000
3000
4300
2950
BALCONY
TOILET
2500
TOILET
BALCONY
5950
BEDROOM 1
BEDROOM 2
DINING
SLIDING GLASS DOUBLE DOOR
DECORATIVE SOLID PARTITION
DECORATIVE SOLID PARTITION
5870
BALCONY
LOUNGE
RECREATIONAL AREA
GLASS PARTITION
4690
6659
6680
SERVING TABLE
1600
STORE
3285
1800
2150
TOILET
1600
2870
5740
RECEPTION & WAITING
4010
PANTRY
7495
GLASS PARTITION
GLASS PARTITION
PORTICO
2000
6000

Annexure - C

10 Years Plant Operation & Maintenance of 100 MW (AC) Solar PV Project (200MWp DC capacity) along with 50MW/150 MWh Battery Energy Storage System at Rajnandgaon, Chhattisgarh, India

1. CONTRACTOR'S OBLIGATIONS

1.1. Services

During the Term of the Contract, the Contractor shall perform the services in accordance with the Operation and Maintenance Scope of work as described in Annexure 1 (Scope of Work for Operation and Maintenance) (hereafter the "Services"), and also in accordance with the other conditions as prescribed related to the operational performance under ANNEXURE A (Employer's Requirement) of the Bid Document:

1.2. The Contractor shall be deemed to have allowed correct and sufficient O&M Price to cover all its obligations under the Contract and to have allowed the necessary resources to enable it to perform the Services to the standards and in the manner required. The Contractor's failure to acquaint itself with or assess any applicable condition shall neither relieve it from the responsibility for performing its obligations under the Contract nor entitle the Contractor to any additional costs or any other relief.

1.3. To the extent the Contractor reasonably believes that it is necessary to enhance the overall performance or safety of the Plant, the Contractor may propose changes and improvements to the Plant [(including the software included with respect thereto)]. The Contractor shall ensure that no modification of any equipment, change of software settings or any other alteration of equipment shall:

(i) cause a negative impact on the performance of the safety and reliability of the Plant;
(ii) adversely impact the Warranties;
(iii) adversely affect the warranties provided by the Contractors under the Contract;
(iv) conflict with the requirements under the contract; or
(v) bypass any protective equipment.
(vi) Violates any National/International Trade & IPR laws.

1.4. Any proposed modifications/changes shall not be carried out without the approval of the original equipment manufacturer and the Employer and in accordance with Performance Standards, and Technical Specifications. The Employer shall be notified of the proposed modifications along with reasons and technical note for such

modifications, changes, alterations, etc., and after the modifications are carried out in accordance with the contract, an alterations activity report is to be shared with the Employer.

1.5 The Contractor shall, while rendering the Services, observe and comply with all the Applicable Laws, Good Solar, BESS Industry Practices, Ministry of New & Renewable Energy (MNRE), Ministry of Power (MoP), CEA, CERC, POSOCO, SLDC, Local DISCOM & TRANSCO guidelines and Performance Standards pursuant to the contract. The Employer shall have the right to, to the extent applicable to Services rendered by the Contractor, conduct monthly audit on Applicable Laws, health, safety and environment and all other relevant compliances. The Contractor shall provide all necessary access and supporting documents during audit which are applicable to the same. However, such audits will be planned well in advance in coordination with the Contractor, without affecting the site operation plan.

1.6 The Contractor shall provide and make available as necessary, all such skilled, experienced and qualified labour and other competent personnel as are required to perform the Services the Contractor shall ensure that its Personnel hold and continue to maintain all qualifications and licenses as required under Applicable Law to allow its Personnel to lawfully undertake performance of the Services and carry out the Contractor's other obligations under the contract. For works/services being performed on a continuous basis, the O&M Price shall be deemed to include and the Contractor shall obtain all required Government Approvals and bear any costs related thereto (including any shift or permitted overtime working, allowances, wage orders, night shift differentials, etc.).

1.7 The Contractor shall ensure that all its Personnel deployed for providing the Services have undergone adequate safety training and are appropriately skilled, qualified and experienced in performing the Services for solar farms of a similar size, scope and complexity as the Plant. The Contractor shall be responsible for all matters relating to labour relations, working conditions, training, employee benefits, safety programs and related matters pertaining to its Personnel. The Contractor shall at all times have full supervision and control over its Personnel and shall at all times maintain appropriate order and discipline among its Personnel.

1.8 Contractor shall be solely liable for and, at its sole cost and expense, arrange for the response, reporting, removal, transportation, disposal, investigation, cleanup or other

remedial action (in all cases by licensed, insured, competent and professional contractors in a safe manner and in accordance with Applicable Laws) for any hazardous substances/waste existing at, in, on or under the Project.

1.9 The Contractor shall ensure availability of such Consumable Parts, Spare Parts, and Contractor's Equipment as may be necessary for the performance of the Services. The Contractor shall ensure that such Contractor's Equipment does not interfere with the operational or structural integrity of the Plant

1.10 The Contractor shall make available to the Employer the Reference Documents set forth in the Reference Documents and shall also provide the Employer with updates and revisions to the Reference Documents to the extent such updates and revisions are necessary and applicable to the performance of the Services. The Contractor shall provide the Employer with a latest version of update available of all the Reference Documents at the time of termination of the contract.

1.11 The Contractor acknowledges and agrees that other contractors of the Employer may be present at the Plant and it shall cooperate with such other contractors to allow the performance of its and their respective obligations to occur concurrently.

1.12 The Contractor shall through relevant agencies, if applicable, promptly investigate all accidents, damage or destruction, diagnosis, assessment of any potential consequential effects, estimating cost of repair, arranging for any remedial action required, making of any claims under the insurance policies and co-operating with and making reports required by the Employer or insurers.

1.13 The Contractor shall ensure that any Warranties provided under the Project Contracts are not invalidated or adversely affected by any act or omission of the Contractor during the period of such warranties.

1.14 The EMS and SCADA system shall be connected with the Plant and the Contractor shall make arrangements to provide monthly reports from the SCADA system. The Contractor shall arrange to connect the Plant to the SCADA system operating at the Site enabling the remote operation of the Plant by the Contractor and to provide access to information pertaining to the Plant to the Employer's Representative at Site and SLDC. The Employer may collect the data generated by the SCADA system in respect of the Plant from the Contractor. And the Employer will facilitate such data transfer by installing an OPC server at site.

1.15 Upon the expiry or earlier termination of the contract, the Contractor shall arrange to provide and install an additionally extended terminal from the SCADA system at the Site to enable the Employer to continue to access data relating to the Plant, at no Additional Cost and upon such terms as may be mutually agreed between the Parties at such time of expiry or earlier termination of the contract as the case may be.

1.16 The Contractor shall further provide support for the operation and maintenance of any Employer installed scope including any third-party support as may be required by any relevant Government Authority.

1.17 The Contractor shall notify and communicate to the Employer about any condition which may cause any malfunction or failure in the Project.

1.18 The Owner, at its discretion, may carry out periodic Fire Safety Audits of the project including Battery Energy Storage Systems by qualified agencies after duly notifying the EPC Contractor in accordance with the extant guidelines for grid connected storage systems, OEM installation recommendations and thermal runaway characterization of the Battery Storage systems. The EPC Contractor shall be obligated to ensure compliances as per the recommendations in the Audit Report at no extra cost to the Employer.

2. FUNCTIONAL GUARANTEES/WARRANTIES

2.1. Technical and Functional Performance Guarantee

2.1.1 The Contractor shall be responsible for meeting the performance guarantee of the Plant Facility (Applicable Individual guarantees for Solar PV Plant and BESS) as described in the contract.

2.1.2 In case of failure to meet the functional guarantees as described in section 2.1.1 above, the Contractor shall be liable to pay applicable Liquidated damages as described in the Bid Document and represented in Annexure-2 of this Annexure C.

2.2. General Repair Warranty

2.2.1. All repairs and replacements performed by the Contractor pursuant to the contract, shall cover a warranty for defects in materials and workmanship for the entire terms of O&M contract.

2.2.2. The Contractor shall disassemble, repair or, replace and reinstall any defective Equipment parts and/or re-perform any defective work covered by this warranty, at no cost or expense to the Employer.

2.2.3. In the event that Contractor replaces Parts that failed during the final year of the Term in accordance with its obligations under the Contract, Contractor hereby warrants to Employer that the replacement Parts installed in the Plant Equipment during such period shall not fail due to a defect for one (1) year following the date of installation of such replacement Parts; provided that in no event shall any such warranty extend beyond earlier of (i) the period that is one (1) year following the expiration of the Term or (ii) the date of any termination of the contract for reasons other than attributable to Contractor. During such period, if the contract is not in effect for any reason other than being terminated by Employer for cause, Contractor's obligation will be limited to supplying all needed Parts on to the Site delivered basis. For the avoidance of doubt, this Clause may survive the termination or expiry (as the case may be) of the contract for a period of one (1) year.

2.2.4. During Defect Liability Period if any repair and replacement are done, then the warrantee of the equipment shall be extended from the data of such repair and replacement to the period of original equipment warrantee w.r.t. that replaced component.

2.2.5 Any latent defect which may not come to knowledge or discovered in the course of normal inspection/operation during two years from the operational acceptance but, may arise within a period of 5(five) years from expiry of warranty period of two years, shall be under warranty by free replacement/rectification.

2.2.6 The acceptance of the equipment by employer shall in no way relieve contractor of his obligations under the contract.

2.3. Guarantee of compliance in relation to Curtailment Plans (acoustic or other curtailment plans)

The Employer may communicate to the Contractor some curtailment plans either linked to acoustic requirements; load management, or Applicable Law, the ("**Curtailment Plans**").

The Contractor shall ensure compliance with all Curtailment Plans provided by the Employer in accordance with Performance Standards and Technical Specifications. If either the Contractor or the Employer detects a variation with respect to the Curtailment Plans or in noise emission the Contractor will, at its own expense, characterise the problem, isolate the source of the problem and propose solutions to solve the problem to Employer (at the Employer' expenses in all cases other than cases where it's ascertained that the deviation was caused by a non-respect of the obligations under the contract).

2.4. Grid Connection and balance of electricity commitments

The Contractor acknowledges that to allow the Employer to inject the energy generated by the Plant Facility to the Grid and be eligible for the full tariff under the PPA, the Plant and the Contractor must comply with the requirements prescribed by Applicable Law, Good Solar/BESS Industry Practices, Performance Standards and the Grid documents and that failure to comply with such requirements may cause the Employer to either: (i) not be able to collect the tariff energy injected; and/or (ii) be subject to penalties payable to the Grid operator and/or the Discom and/or the power purchaser and/or any Government body. The Contractor therefore undertakes to diligently comply the requirements referred to Grid Connection and balance of electricity commitments, as prescribed under the Grid documents as provided by or on behalf of the Employer from time to time (or of which the Contractor otherwise becomes aware), and/or with the reasonable requests of the Employer associated with the compliance therewith.

3. **PERFORMANCE STANDARDS**

3.1 Contractor shall perform its obligations under the contract in compliance with the contract and otherwise, as applicable, in accordance with the following order of precedence (collectively, the "Performance Standards") as from time to time in force:

3.1.1 the Applicable Laws, and the requirements from the Grid Operator/SLDC;

3.1.2 the Permits and all the related documents;

3.1.3 the terms of the contract;

3.1.4 the functional Guarantee;

3.1.5 the Reference Documents including the manufacturers recommendations;

3.1.6 Employer's health and safety manuals and procedures and ESMP;

3.1.7 the Site Regulations;

3.1.8 environmental Social management plan as attached in the bidding document, provided by the Employer, as updated from time to time through the Employer's written notice to the Contractor;

3.1.9 the Equator Principles and the Equator Principles Requirements;

3.1.10 Good Solar/BESS Industry Practice;

3.1.11 Any relevant and reasonable instructions issued by the Employer, relevant to the scope of the contract, to the Contractor at least 15 days before the implementation of such instructions without any cost to the Contractor.

3.1.12 [The terms of insurances directly relating to the Project] and

3.1.13 [Comply with all operation and maintenance obligations as set out under the PPA or do anything which results in a breach of the Employer's obligations under the PPA.]

3.1.14 The World Banks applicable operational policies and procedures Performance Standards on Environmental and Social Sustainability, as published by the following link to be implemented by the contractor,

https://www.ifc.org/wps/wcm/connect/554e8d80488658e4b76af76a6515bb18/Final%2B-%2BGeneral%2BEHS%2BGuidelines.pdf?MOD=AJPERES; https://www.ifc.org/wps/wcm/connect/66b56e00488657eeb36af36a6515bb18/Final%2B-%2BElectric%2BTransmission%2Band%2BDistribution.pdf?MOD=AJPERES&id=1323162154847 and

3.2 If there is any inconsistency between the Performance Standards, [it shall be interpreted in the order of precedence listed above provided that(i) the application of a Performance Standard does not derogate, breach, contradict, obstacle or circumvent the application of a Performance Standards appearing above such standard in the above order of precedence, and, in addition, (ii) provided that this

such application does not cause a breach of Performance Standards or the Parties shall discuss and agree upon the manner in which such conflict shall be resolved.

3.3 Notwithstanding any other provision in the contract, the Contractor shall have no responsibility or obligation:

(a) to save and to the extent that the Contractor is required to do so pursuant to the provisions of Additional Services, to ensure that the Plant complies with the requirements of Applicable Law, Permits, if and to the extent that the same are introduced or amended following the Commencement Date; or

(b) subject to Additional Services, to ensure that the Plant or the Plant (as a whole or in part) complies with any noise or acoustic emissions requirements under Applicable Laws Permits.

Without prejudice to the foregoing, the Contractor is required to comply with the quality of supply limits determined in accordance with the Applicable Law and the Contractor will be deemed to have knowledge of its content.

3.4 The Contractor shall not do or omit to do anything in the performance or discharge of its obligations or the exercise of its rights under the contract or in breach of the contract, which would cause any breach of any of the terms of the Supply Contract, Works Contract, the Applicable Law, the Permits or the terms of any Permits or the Direct Contract, and should the Contractor be in breach of the Performance Standards, it shall, on demand of the Employer, indemnify the Employer against any direct Losses arising from a breach of this Clause by the Contractor, always subject to the aggregate liability cap of the Contractor (except as otherwise agreed herein).

3.5 If the Contractor is aware of a conflict between any of the above requirements, it shall inform the Employer accordingly and the Parties shall discuss and agree upon the manner in which such conflict shall be resolved.

4. EXCLUSIONS

4.1. General

(a) Force Majeure events as per GCC clause 37 of the contract condition

4.2. The rights of the Contractor under Exclusions shall only apply to the extent that the Excluded Risk Event has caused actual delays or substantial interference to the performance of the Contractor's obligations under his Contract, which could not have

been mitigated by the Contractor's best efforts, and to such portions of Contractor's obligations directly affected by such delays or interference.

4.3. Notification of Excluded Risk Event

To the extent Contractor has actual knowledge of any loss or damage to the Plant caused by or arising from an Excluded Risk Event, it shall give Employer immediate notice of the same and provide a written report to Employer within five (5) Business Days; and the employer and Contractor shall be mutually agreed upon within (30) business day. However, that any failure of Contractor to provide such notice shall not waive, prejudice or otherwise affect the other provisions in Exclusions, except to the extent that the failure to timely notify Employer results in any additional damage or loss to the Plant. Notwithstanding the foregoing, in case of delay to provide the aforementioned notice, the Contractor shall be liable towards the Employer for any additional damage or loss caused by the delay to notify the Employer.

5. ADDITIONAL SERVICES

5.1. Employer may, with respect to the Plant, request that Contractor perform work, provide services, or supply other equipment or parts, not included within Services for the successful operation of the plant for 10-year duration. Any such requested service or supply that the Parties mutually agree to in writing shall, subject to any specific terms and conditions agreed with respect to such service or supply, be an "**Additional Service**".

6. SERVICE PERSONNEL

6.1. Contractor shall provide the Services and any Additional Services to be performed on Site using a sufficient number of suitably skilled, qualified and experienced (including any licensing, certifications or training required by Applicable Laws or the local transmission system operator) and adequately equipped and properly trained Personnel and/or Subcontractors, all appropriately skilled and experienced in their

respective trades or occupations as may be reasonably necessary to fulfil its obligations hereunder in relation to the Services and Additional Services

6.2. The Employer may request the Contractor to remove (or cause to be removed) any Person or Subcontractor employed on the operation of the Plant, including the Contractor's Representative if applicable, who:

(i) engages in material or persistent misconduct or lack of reasonable care;
(ii) carries out duties incompetently or negligently;
(iii) fails materially to conform with any provisions of the Contract;
(iv) engages in conduct which is prejudicial to safety, health or the protection of the environment or in violation of any related Performance Standards or Applicable Laws;
(v) engages in conduct which might reasonably result in a breach of any provision of the contract and threaten public health, safety or security.

6.3. The Employer shall give notice to the Contractor of the same giving reasons and request the Contractor to replace such Personnel with a suitable candidate. The Contractor shall then as soon as reasonably possible but no later than seven (7) days upon receiving such notice from the Employer, Contractor will look in to the facts and claims of the case in all sincerity and deploy the required actions with the notice to the Employer.

6.4. Contractor shall have full supervision and control over its Personnel at the Site and shall maintain appropriate order and discipline among such personnel and shall cause any Subcontractor to maintain similar standards with respect to such Subcontractor’s personnel at the Site.

6.5. The Contractor shall be responsible for all matters relating to labour relations, working conditions, training, employee benefits, employee drug testing in accordance with the Contractor’s standard drug testing policy, safety programs and related matters pertaining to its employees and other Personnel engaged by the Contractor. The Contractor shall at all times have full supervision and control over its employees and other personnel engaged by it and shall at all times maintain appropriate order and discipline among its Personnel and shall cause any Subcontractor (or any subcontractor appointed by such Subcontractor) to maintain similar standards with respect to such Subcontractor’s or any subcontractor appointed by such Subcontractor) employees and Personnel.

6.6. The Employer shall have the right, acting reasonably and following prior notification, to require the Contractor to remove from the Site any employee or Personnel of the Contractor or any of its Subcontractors (or any subcontractor appointed by such Subcontractor) engaged in activity which presents a risk of injury to persons or property at the Site.

7. SAFETY PRECAUTION

7.1 During performance of the Services, Contractor shall:

7.1.1 comply with the safety standards and any safety procedures established by Contractor and same shall be approved by employer after the Commencement Date;

7.1.2 take all precautions required by Applicable Laws or Site Regulations, or otherwise according to the Performance Standards, for the health and safety of Contractor, its Affiliates and Subcontractors in the performance of the Services and any other Persons with temporary or perpetual access to the Site; [provided that the foregoing shall not limit Employer's responsibility for the safety of the Site as provided in Safety Precautions.

8. CONSUMABLES, SPARE PARTS, TOOLS AND EQUIPMENT

8.1 During the Term, Contractor shall provide equipment Spare Parts and Consumables and Tools, all as part of the Services and without Additional Cost to the Employer in accordance with the contract. Unless otherwise specified in the contract, the Contractor shall provide the Employer with an initial Spare Parts inventory. At the end of the Term or upon termination of the contract, the Supplier will replenish the equal quantity of the Spare Parts and Consumables and Tools as provided during the start of Contract.

8.2 <u>Consumables and Tools</u>

Contractor shall supply Consumables and Tools to the extent required for performance of the Services. All Consumables provided by Contractor in the performance of its Services, shall be compatible with the applicable requirements of the Reference Documents and Applicable Laws.

8.3 <u>Equipment and Spare Parts</u>

Contractor shall supply Equipment and Spare Parts to the extent required for its performance of the Services and to maintain its obligations thereunder. The Contractor has the right to use renovated Equipment and Spare Parts. If the Contractor intends to use any refurbished Major Components, it will seek prior written approval from the Employer. Contractor's right to procure and use renovated / refurbished Spare Parts is subject to: (i) standards of good workmanship and Good Industry Practice; (ii) compliance with the applicable requirements of the Reference Documents; (iii) the Spare Part(s) are of the type being replaced or of another type insofar as same does not invalidate any applicable Type Certification of the Equipment (iv) the same warranty as equivalent new parts in terms of scope, nature and duration, (v) being renovated in conformity with the original equipment manufacturer's standards, and (v) being listed in the monthly maintenance report when used (track record of the Part).All such renovated/refurbished parts will be allowed by Employer only for any long lead items and also considering uninterrupted generation from the Project. However, the contractor shall immediately reinstate and order new items in order to replace the refurbished items provided for emergency purposes.

8.4 Inspection of Replaced Parts

Contractor shall give to the Employer seven (7) days' notice of the time when the Replaced Part is being transported to the Site. Contractor shall permit Employer to inspect, at Employer's sole cost and expense, any Part which is removed and replaced by a Spare Part pursuant to Consumables, Spare Parts, Tools and Equipment (such Part, a "Replaced Part"); provided however, any such inspection:

(i) must not include physical alteration or disassembly of such Replaced Part; and

(ii) must not result in any material increased costs to Contractor or delay Contractor in the performance of its obligations under the contract or any Contract with, or warranty from, its Subcontractors, unless Employer agrees to cover such material increased cost.

8.5 Tools and Equipment

Contractor shall furnish its service personnel with such tools, instruments, or materials tools and equipment and equipment as are necessary to perform the Services (the "**Contractor's Equipment**").

8.6 Prices of Consumables, Spare Parts and Contractor's Equipment

Subject to GST, Taxation & Import Duties, the O&M Price payable to Contractor under the contract shall include (in addition to other components included in such Price) the Costs of any and all Equipment, Consumables, Spare Parts and Contractor's Equipment required in connection with the performance of the Services.

8.7 Risk of Loss or Damage to Consumables, Spare Parts and Contractor's Equipment

Contractor shall:

(i) be responsible at its own cost for the safe transportation and delivery to Site and adequate storage; of all Consumables, Spare Parts, and Contractor's Equipment, in each case, required for the carrying out of the Services;

(ii) bear the risk of loss and damage to all such Consumables and Spare Parts during transportation to the Site and, thereafter up to the date of their incorporation by Contractor into the Plant; and

(iii) at all material times bear all risk in any and all Contractor's Equipment on or off the Site and whether remaining separate or temporarily attached to the Plant.

8.8 Title

Contractor shall retain title to any and all Contractor's Equipment on or off the Site and whether remaining separate or temporarily attached to the Plant until transfer of Title occurs. Title to any Spare Part (or other Part) or Consumables provided by Contractor pursuant to the contract shall pass to the Employer upon:

(i) incorporation by Contractor in the Plant free and clear of any Lien; or

(ii) in the case of Additional Services, the date (if later) on which payment is made in full for such Spare Part or Consumable.

Title to any Replaced Part shall vest in Contractor upon such replacement, except if the Parties agree differently from time to time. In case of Additional Services, Employer shall retain title to any Replaced Part.

9. COMMUNICATION AND REPORTING

During the Term, Contractor shall exchange information and reports on daily, weekly, monthly, quarterly and annual basis:

9.1 Monthly Reports

Contractor shall provide Employer with the Monthly Performance Report by no later than the fifth (5th) day from the end of each month.

9.2 Emergency Notices

Upon obtaining actual knowledge thereof, Contractor shall promptly notify Employer verbally (with written notice to follow within three (3) Days) of any emergency or other hazardous condition or occurrence that Contractor reasonable believes could cause an immediate threat to the safe operation of the Plant and/or the safety of Persons.

If, by reason of an emergency arising in the course of, as a result of or otherwise in connection with and during the performance of the Services, any protective or

remedial work is necessary as a matter of urgency to prevent damage to the Plant, the Contractor must immediately perform that work, provided that, Contractor shall have no obligation to perform such portions of the protective or remedial work which would be in violation with the Performance Standards, be a material breach of the contract or would cause a threat to the safety of Persons or property or would otherwise not be reasonably practicable or possible; and provided further, that Contractor shall have no obligation to retrofit or upgrade the Plant except if otherwise agreed.

Without prejudicing the liability attributable to the Contractor for failure to comply with the provisions of the paragraph above, it is clarified that if the Contractor does not perform the protective or remedial works referred to above immediately, the Employer may appoint a Replacement Contractor to perform such works. If the work (or parts thereof) which were performed or caused to be performed by the Employer is work which the Contractor was liable to do at its own expense under the contract, the costs incurred by the Employer as a result of appointing a Replacement Contractor shall be [substantiated to the Contractor on an open book basis and be] considered due and payable to the Employer and Invoices and Payment and Set Off shall apply. It is further clarified that the impact of Replacement Contractor's actions shall not be considered as an Excluded Risk Event.

9.3 Meetings

A representative of each of Contractor and Employer (the "**Representatives**") shall meet (either at the Site or alternatively at such other location as may be agreed between the Parties) at quarterly intervals or such other period as is agreed especially for the purposes set forth below:

(i) to discuss projected dates for performance of the Services and the Additional Services in the following quarter;
(ii) to discuss, the calculated Measured Average Availability of the Plant Facility (Solar and BESS) for the past quarter under Annexure 2 [Functional Guarantees]; and
(iii) to review the Services and Additional Services performed in the past quarter.

9.4 Visitors Log Book

Contractor shall provide Employer with a log book for the Plant to record the identity and activity of all visitors to site. Such log book will be kept at the entry Gate location

of Plant. The Contractor shall cause that all personnel and representatives of each Party or any third parties visiting the [site] shall be required to record their identity, the date, time and purpose of any visit to site, the nature of any work performed thereon and such other details for which log books may reasonably be used. It is clarified that the Contractor shall not permit unauthorised third party access to the Site unless such third parties have been authorised by the Employer, are required to inspect or access the Site in accordance with Applicable Law or for performance of Services. Copies of these logs shall be provided to the Employer within ten (10) Business Days following its written request. Contractor shall create a digital back up of such logs at least every month. The log book shall be in English only.

9.5 Annual Calendaring of Maintenance Services.

At the latest two (2) months after the beginning of commencement date, each year during the Term thereafter, the Contractor shall send to the Employer the projected dates and times for the immediately following period during which the Contractor shall perform the Maintenance/Preventive Services on the Plant, with the parties using reasonable efforts to minimize any Plant downtime during Operational Sunny periods (the "**Maintenance Services Calendar**". Such Maintenance Services Calendar may be postponed by the Employer for 5 business days); provided, that the Maintenance Services Calendar shall be developed in accordance with the Operating Manual and the terms of the contract. The dates and times in the Maintenance Services Calendar may be amended thereafter by mutual Contract of the Parties. For clarity, the Maintenance Service Calendar shall include a maintenance plan established in accordance with the Maintenance Manual.

9.6 Status Reviews

As reasonably required, or requested by the Employer, the Representatives shall meet to discuss and review (i) the information contained in the Monthly Performance Reports, (ii) the availability of the Plant, (iii) any technical issues which may have arisen with respect to the performance, availability or maintenance and servicing of the Plant Equipment, (iv) Maintenance Services and Repair Services performed during the preceding calendar month, (v) any and all failures by a Plant equipment, and (vi) Maintenance Services to occur during the next following a calendar month.

10. **Contractor's Permits**

Prior to the time in which such Permits are required in order to perform when the relevant Services and/or Additional Services, as applicable, are to be performed,

Contractor shall obtain and maintain, as applicable, throughout the Term of the Contract all Permits (the "Contractor Permits") required by the Applicable Law, Good Solar/BESS Industry Practices, Performance Standards and Technical Specifications which should be issued in the name of Contractor or are otherwise attributable or necessary to the provision of the Services and/or Additional Services, other than such Permits as are required to be obtained by Employer pursuant to *Employer Permits*.

11. **Contractor's Manager**

On or prior to the commencement of the Term, Contractor shall designate a duly qualified and experienced person to manage and administer the Contractor's activities and shall provide notice thereof to the Employer, to act as its manager and coordinator of the contract on Contractor's behalf (the "**Contractor's Manager**"). The Contractor's Manager shall not have authority to amend or modify the contract or accept any commitment which would have an effect on the contract. In case the manager is on leave with prior intimation to employer, the deputy manager with equivalent qualification shall be provided at site by the Contractor

12. **Cooperation with other Subcontractors**

Contractor acknowledges and agrees that the Employer or Other Subcontractors of Employer may be present at the Site and agrees, at no cost or expense to the Employer, to reasonably cooperate with such Other Subcontractors to allow the performance of its and their respective obligations to occur concurrently. Employer shall inform the Other Subcontractors of the clear demarcation of Contractor's scope of work so as to ensure non-interference in such work and operations by Employer's Other Subcontractors.

13. **Reserved Rights**

13.1 <u>Plant</u>

To the extent Contractor believes, in its reasonable discretion, that it is necessary to enhance the overall performance or safety of the Plant, Contractor may propose to Employer changes and improvements to the Plant (including the software included with respect thereto) and implement such changes or improvements proposed after obtaining the prior written consent of the Employer; provided that such changes and/or improvements shall not (i) be in conflict with the Performance Standards**;** (ii) adversely impact the technical performance of the Plant or the safety of the Plant**;** (iii) adversely impact the Availability Warranty in Annexure 2 [Functional Guarantees] (iv)

increase the cost of operating the Plant; (v) place the Employer in breach of the technical requirements of the Power Purchase Contract; (vi) impair or vitiate any obligations of the Contractor under the contract; (vii) adversely affect the Supply Contract Warranties and the Works Contract Warranties; or (viii) result in non-compliance with the Type Certificate.

13.2 The Contractor shall only have the right to implement such changes or improvements if it has received the prior written consent of the Employer and such changes and improvements are carried out at no cost to the Employer and in accordance with Reserved Rights.

14. CERTAIN NOTIFICATIONS BY CONTRACTOR

14.1 Contractor shall, upon obtaining actual knowledge thereof, promptly give the Employer notice of:

(i) any events or facts or observations that the Contractor believes could be reasonably likely:

(a) to have a material adverse effect on the operation of any of the Plant or the performance of the Employer's obligations under the contract; or

(b) to cause an immediate threat to the safe operation of the Plant (or any Plant therein) and/or the safety of Persons; provided that, in the case of this Clause, the Contractor shall provide immediate verbal notice of such event, fact or observation to the Employer with notice to follow within three (3) Business Days);

(ii) any actual or proposed event that the Contractor believes would be reasonably likely to have a material adverse effect on the operation of any of the Plant or the performance of either Party's obligations under the contract;

(iii) any (a) violation of Applicable Laws, or Permit, by the Contractor's agents, officers, directors, employees, representatives and Subcontractors, Employer or any Other Subcontractor; or (b) any notices of Liens (or claims of Liens) or investigations by Governmental Authorities related to the Plant;

(iv) any actual or contemplated change in Law that Contractor believes would be reasonably likely to have a material adverse effect on the operation of any of the Plant or the performance of either Party's obligations under the contract.

14.2 If the Contractor does not comply with its obligations under Certain Notifications by Contractor, the Contractor shall, subject to Limitations of Remedies and Liability, indemnify the Employer for any loss the Employer may suffer as a consequence, including, without limitation, compensation pursuant to Employer's Obligations.

15. ASSIGNMENT AND SUBCONTRACTING

15.1 The Contractor shall not sublet, transfer or assign the contract or any part thereof without the prior written permission of Employer. The Contractor shall not subcontract any of the Services having a value of more than 30% of the Annual O&M Price of the concerned year, except upon the Employer's advance written approval of the subcontracting of such works. Such approval shall refer to the specific identity of the Subcontractor and to the scope and terms of the subcontract. In any event, the Contractor shall not subcontract all, or materially all of the Operation and Maintenance Services or the ultimate supervision of the performance of such services.

15.2 The Contractor agrees and acknowledges that any review, by approval of, or failure to approve, or rejection by the Employer as to any Subcontractor shall not relieve the Contractor of any of its obligations under the contract, and the Contractor shall be liable hereunder to the same extent as if any such Subcontract had not been entered into. The Contractor shall at all times ensure and cause the Subcontractors not to commit any act or omission which could release, void, impair or waive any guarantee or warranty on the Plant or any part thereof.

15.3 The Contractor shall supervise and direct the work of all Subcontractors and be fully responsible for the performance of the Subcontractors and to the methods, techniques, sequences and procedures of, and for coordinating the work of the Subcontractors and to the acts and omissions of all Subcontractors and their

employees, directors, officers, advisors, agents and representatives, and those of their subcontractors ("Subcontractors' Parties). With regard to any Subcontract and Subcontractor's Parties, in particular, Contractor shall ensure that all wages, labor, health and safety and social related obligations are duly performed and timely discharged in accordance with Applicable Laws. It is agreed that if the responsibility of any such payments is transferred to the Employer pursuant to Applicable Law, the Employer shall have the right to adjust all such payments against the dues to the Contractor under the contract or otherwise recover the same from the Contractor under any other Contract. It shall be at Contractor's sole responsibility to ensure the payment and discharge of all its obligations with regard to the Subcontracts and shall indemnify the Employer and any Employer Indemnified Parties for any losses incurred by such parties in relation to the Subcontracts or to Subcontractor's Parties.

16. **Inspection and Testing**

16.1 The Contractor must provide the Employer, independent engineer, Grid Operator, Grid Administrator, and any other Contractor or Contractors employed by the Employer and their respective nominees, or other inspectors where required under the Applicable Law, the Permits, the Finance Documents and/or the Grid documents (collectively hereinafter referred to as the "**Project Parties**"), with access at any time to any place where the Services are being performed in order to inspect the progress and the manner of the Services, provided that the Employer (or its designated representatives) gives the Contractor twenty four (24) hours prior written notice.

16.2 The Project Parties and their respective nominees will have the right to examine and have access to documents relating to the Services.

16.3 The Contractor must carry out all tests and/or inspections of the Plant or Spare Parts in a lawful, professional, timely, safe and environmentally responsible manner as may be necessary to ensure the safe, reliable, efficient, and optimal operation of the Plant and in accordance with the Performance Standards, Applicable Laws and Good Solar/BESS Industry Practice. All these tests and inspections are to be carried out at the Contractor's expense, as part of Services.

16.4 The Project Parties and their respective nominees are entitled to attend any test and/or inspection.

16.5 Whenever the Contractor is ready to carry out any test and/or inspection, the Contractor must give at least ten (10) days' advance notice to Employer of such test and/or inspection and of the place and time. The Contractor shall make its best efforts

to obtain from any relevant third party or manufacturer any necessary permission or consent to enable the Project Parties to attend the test and/or inspection.

16.6 The Contractor must provide the Employer with a report of the results of such test and/or inspection within five (5) days after the completion of that test or inspection in question.

16.7 If the Employer and/or any of the Project Parties fail to attend the test and/or inspection, or if it is agreed between the Parties that the Employer and/or any of the Project Parties will not attend, then the Contractor may proceed with the test and/or inspection in the absence of the Employer's and/or any of the Project Parties' inspector and provide the Employer with a report in the approved form of the results.

16.8 If any Spare Parts or the Plant fails to pass any test and/or inspection, the Contractor must either rectify or replace those Spare Parts or repair the Plant and promptly repeat the test and/or inspection upon giving notice.

16.9 The Contractor agrees that neither the performance of a test and/or inspection of Spare Parts or the Plant, nor the attendance by the Employer's and/or any of the Parties' inspector nor the issue of any test report will release the Contractor from any of its obligations under the contract.

16.10 <u>Inspection during the Term and at the End of the Term:</u>

During the Term, the Plant may be submitted to a general inspection performed by a Contractor selected by Employer:

16.10.1. Inspection during the Term

From time to time during the Term, but not more than once every year (being specified that any additional tests and inspections instructed by the Employer under this Clause will be for the Employer's account unless the tests or inspections were necessary as a result of the failure of the Contractor to fulfil its obligations under the contract);

16.10.2. End of Contract inspection: six (6) to twelve (12) months before the end of the Term, at the convenience of the Employer.

Subject to the Employer's reasonable advance notice as to the date of such inspection, Contractor is required to attend and assist the Employer and the designated inspector in performing such tests, without additional cost.

16.10.3. The final report shall be sent to the Contractor by the Employer and if any defect or damage found, same shall be rectified/replaced.

16.10.4. Without relieving Contractor from its obligations and without limiting Employer's ability to reasonably pursue the reliefs available to it, if applicable:

(i) Contractor shall, promptly following receipt of the report, submit to the Employer (a) a recovery plan to remedy all breaches, defects and malfunctions detected in the report for which the Contractor is liable and shall perform such remedial actions without delay, and (b) provide detailed measures to be put in place to prevent such defaults from recurring;

(ii) if the Contractor fails to timely complete all remedial actions before the end of the Term, the Employer shall be entitled, at Contractor's cost and risk, to employ a Replacement Contractor to perform the works.

16.11 Employer Site Visit

16.11.1. If Employer decides to visit the Plant, Contractor shall provide personnel on the Site for mutual inspection with no additional cost to Employer. If the Contractor is reasonably unable to attend such visit for unexpected reasons and/or safety reasons, Contractor shall immediately inform the Employer. As the case may be, the Contractor shall reschedule a new visit within the next seven (7) days. Rescheduling of the visits thereof shall no occur more than once per year the Employer shall adhere to the HSE practices of the Contractor.

16.11.2. If, upon request of the Employer made in accordance with Employer Site Visit, the Contractor does not provide dedicated personnel for such visits, subject to the aforementioned rescheduling allowance, any downtime of Plant Equipment(s) to perform the inspections thereof shall be considered as unavailable for the purpose of availability calculation described in Annexure 2 [Functional Guarantees] [(however never exceeding eight (8) hours per given visit)]. Notwithstanding the foregoing, Employer may request that Contractor provide personnel on the Site for additional inspections as an Additional Service.

16.11.3. If, upon request of the Employer made in accordance with Inspection and Testing, for inspection of the Plant, the Contractor provides access to have services in the Plant Equipment examined available for inspection and Employer

does not carry out such inspection, then any downtime of Plant Equipment(s) to perform the inspections thereof shall be considered as available for the purpose of availability calculation described in Annexure 2 [Functional Guarantees]

17. HAZARDOUS SUBSTANCES AND HAZARDOUS SITE CONDITIONS

17.1 Contractor shall not, nor shall it permit any other Person to bring any Hazardous Substances on the Site, other than Hazardous Substances to be used by Contractor or any Subcontractor in a manner that:

(i) does not violate any Applicable Laws, or Permits; and

(ii) is consistent in quantity and with Good Solar/BESS Industry Practices for operating and maintaining solar energy conversion plants, such as motor fuels, solvents and lubricants (collectively, "**Permissible Materials**").

17.2 Contractor shall bear all responsibility and liability for:

(i) any Hazardous Substances that are not Permissible Materials belonging to the Contractor or present on site; or

(ii) the handling of, or failure to handle, Permissible Materials in violation of Applicable Laws or otherwise in any manner that constitutes negligence or willful misconduct by Contractor or any Subcontractor.

17.3 Contractor shall use Hazardous Substances in performance of the Services in accordance with the Performance Standards, Applicable Laws and Good Solar/BESS Industry Practices and shall not:

(i) utilize, or permit or cause any Subcontractor to utilize, on the Site such Hazardous Substances as are prohibited under Applicable Law from being used in India; or

(ii) import or use at the Site such Hazardous Substances as are prohibited under Applicable Law.

17.4 Contractor shall maintain a regularly updated log of all material safety data sheets for all hazardous substances used in connection with performance of the Services at or near the Site, which shall be available for Employer to review upon reasonable request. Contractor shall maintain an accurate record and current inventory of all hazardous substances used in performance of the Services at or near the Site, which record shall

identify quantities, location of storage, use and final disposition of such hazardous substances.

17.5 Contractor shall arrange and agree for the disposal, transportation, reporting and certification (including provision of waste disposal vouchers and other certificates as required by Applicable Law or Permits) of Hazardous Substances, including waste disposal vouchers, brought onto and released at the Site by Contractor or its Sub Contractors, which are expected to include but not be limited to used oil, grease and ethylene glycol, to the extent required by Laws, in each case, by licensed, insured, competent and professional Contractors in a safe manner and in accordance with Laws. As between the Parties, Contractor shall be solely liable for any response, removal, investigation, clean-up or other remedial action required by any Laws related to any Contractor,

17.6 In the event Contractor encounters any Hazardous Substance or other hazardous conditions at the Site that are inconsistent with the Performance Standard or would reasonably be expected to impact the performance of Contractor's obligations hereunder, Contractor shall promptly report the condition to Employer. In such event, Contractor shall stop work and remove, or take other actions necessary to remedy the hazards associated with, any Contractor Hazardous Substances such that Contractor can resume work.

17.7 The Contractor shall indemnify and hold harmless the Employer against any fine, penalty or third-party Claim incurred as a result of non-compliance by the Contractor with the terms of the contract, Applicable Laws, Good Solar Industry Practice and more specifically, with its obligations under Hazardous Substances and Hazardous Site Conditions.

18. EMPLOYER'S OBLIGATIONS

During the Term, Employer shall perform the following obligations:

18.1 Access

18.1.1. On and from the Commencement Date, Employer shall provide the Contractor (and its Subcontractors) full, free and safe Access to the Plant for the purpose of enabling Contractor to fulfil its obligations under the contract.

Notwithstanding the foregoing, the Contractor shall be required to perform any works (including obtaining permits for such works) related to the Access to the Site required

for the delivery of any Spare Parts, if so requested by the Employer in writing, on the Time to time Basis.

18.1.2. The Employer shall give to the Contractor and the Contractor's personnel unrestricted Access to the Site to enable Contractor and the Contractor's personnel to carry out all elements of the Services at any time from the Commencement Date until the end of the Term. Such Access shall include the provision by the Employer of:

(i) such keys or access codes as may be required by the Contractor to gain unhindered access to the Site (as the case may be);

(ii) Access to the access roads to and on the Site If there is any deviation, and such deviations are accepted by the transport contractor, then such deviations shall be accepted by the Contractor.

Notwithstanding anything else contained in the contract all Access to the Site and Plant is subject to the applicable site safety, security and environmental requirements and Applicable Law (and the Contractor should comply with the same). The Employer will have the right to limit Access or expel any Person off the Site in case of them not fulfilling the Emergency plan of the Site, the Emergency plan of the Plant Facility.

18.3 Employer's Permits

Contractor, on behalf of the Employer, shall obtain and maintain all Permits and any Permits required by Applicable Law to be obtained in the name of the Employer in order to (i) perform Employer's obligations under the contract and (ii) enable Contractor to lawfully access the Site at the point of entry to the Site and the Plant].

19. SITE REGULATIONS

Employer shall (directly or through a Subcontractor, advisor or agent) provide the Site Regulations and revisions thereof from time to time, and shall require the Other Subcontractors and their respective agents and employees to, (i) comply with the Site Regulations; and (ii) take all necessary precautions (as required by Applicable Law or

otherwise) for the health and safety of all Persons (including Contractor's personnel) at the Site.

20. CERTAIN NOTIFICATIONS BY EMPLOYER

20.1 Employer shall, upon obtaining actual knowledge thereof, promptly give the Contractor, as soon as practicable, notice of:

20.1.1. any events or facts or observations that the Employer believes has determined that would:

(i) have a material adverse effect on the operation of any of the Plant or the performance of the Contractor's obligations under the contract; or

(ii) to cause an immediate threat to the safe operation of the Project (or any Plant therein) and/or the safety of Persons; provided that, in the case of this current Sub-Clause, the Employer shall provide as soon as possible verbal notice of such event, fact or observation to the other;

20.1.2. any (a) violation of Applicable Laws, including environmental Laws or the terms of any Permit, by Contractor or any Other Subcontractor or (ii) any notices of Liens (or claims of Liens) or investigations by Governmental Authorities related to the Project.

20.2 Failure to furnish notice pursuant to Certain Notifications by Employer shall not affect the Contractor's obligations to perform its obligations. Contractor.

21. EMPLOYER 'S OWNERSHIP OF ENERGY, EQUIPMENT, SPARES AND PROJECT BENEFITS

21.1 The Contractor acknowledges that ownership of the Energy or any benefits arising out of the operation of the Plant remains at all times, and in all circumstances with the Employer at all times and the Contractor has no legal or equitable title to or interest in the Energy or other benefit.

21.2 The ownership of all item supplied by the Contractor, including under Additional Services shall be transferred to the Employer at the end of the term of the contract:

(i) such items becoming a permanent part of the Plant against the mutually agreed payment by both the parties

21.3 The ownership of any item (not including Energy or benefits arising out of the operation of the Plant) supplied by the Contractor as part of the Services shall be transferred to the Employer upon such items becoming a permanent part of the Plant.

21.4 The Contractor agrees that any benefits, including any carbon credits, renewable energy certificates or similar royalty or credit that may arise as a result of having the Project undertaken belong to the Employer and the Contractor shall provide all reasonable assistance requested by the Employer in order to obtain such rights and benefits.

22. PRICE AND PAYMENT

22.1 Total Annual O&M Cost

Commencing on the Commencement Date and for the remainder of the Term, Employer shall, in consideration of the Contractor providing the Services and its prior receipt of an invoice with respect thereto, pay in accordance with Invoices and Payment to Contractor an annual O&M cost in INR in equal quarterly instalments at the end of every quarter for each year till 10 (Ten) years in the amounts set forth in and payable in accordance with Price Schedule No 5/SOR-5 [Schedule of Rates] of the bidding documents for the plant facilities.

Following is the yearly breakup of the Total O&M price in line with the Price Schedule No 5/SOR-5:

SCHEDULE OF RATES [SOR-5] [OPERATION AND MAINTENANCE]- PLANT FACILITIES									
S No	Description of Item	Year	PRICES (INR)						
			Currency	Yearly O&M Price in INR (Excluding GST)		Total O&M Price (INR) (Excluding GST) in figures	Total value of Applicable GST in absolute figures [GST to be calculated on absolute O&M Price	% (Percentage) of Goods & Service Tax (GST) considered	Total O&M Price including GST
				Solar PV - Part -A	BESS - Part-B				
1	2	3	4	5	6	7=5+6	8	9	10=7+8

OPERATION & MAINTENANCE									
1	Operation and Maintenance of the Plant Facility **for FIRST YEAR**	1		**0.00**	**0.00**	**0.00**	**0.00**		**0.00**
2	Operation and Maintenance of the Plant Facility **for SECOND YEAR**	2		**0.00**	**0.00**	**0.00**	**0.00**		**0.00**
3	Operation and Maintenance of the Plant Facility **for THIRD YEAR**	3		**0.00**	**0.00**	**0.00**	**0.00**		**0.00**
4	Operation and Maintenance of the Plant Facility **for FOURTH YEAR**	4		**0.00**	**0.00**	**0.00**	**0.00**		**0.00**
5	Operation and Maintenance of the Plant Facility **for FIFTH YEAR**	5		**0.00**	**0.00**	**0.00**	**0.00**		**0.00**
6	Operation and Maintenance of the Plant Facility **for SIXTH YEAR**	6		**0.00**	**0.00**	**0.00**	**0.00**		**0.00**
7	Operation and Maintenance of the Plant Facility **for SEVENTH YEAR**	7		**0.00**	**0.00**	**0.00**	**0.00**		**0.00**
8	Operation and Maintenance of the Plant Facility **for EIGHTH YEAR**	8		**0.00**	**0.00**	**0.00**	**0.00**		**0.00**
9	Operation and Maintenance of the Plant Facility **for NINETH YEAR**	9		**0.00**	**0.00**	**0.00**	**0.00**		**0.00**
10	Operation and Maintenance of	10		**0.00**		**0.00**	**0.00**		**0.00**

	the Plant Facility **for TENTH YEAR**								
	TOTAL NPV OF O&M FOR 10 YEARS (1+2+3+4+5+6+7+8+9+10)					**0.00**	**0.00**		**0.00**

Against the successful Operation and Maintenance of the entire Plant Facility (Solar & BESS) payment will be released on quarterly basis at the end of every quarter for each year till 10 (Ten) years.

The O&M of the plant will commence from the date of Operational Acceptance of the plants.

(i) Year 1 : OM -1
(ii) Year 2 : OM -2
(iii) Year 3 : OM -3
(iv) Year 4 : OM -4
(v) Year 5 : OM -5
(vi) Year 6 : OM -6
(vii) Year 7 : OM -7
(viii) Year 8 : OM -8
(ix) Year 9 : OM -9
(x) Year 10 : OM -10

The Contractor acknowledges that the Total Annual O&M cost forms the sole and exclusive consideration and reimbursement due to the Contractor for the performance of the services included under the Services and Spare Parts and that the Contractor shall not be entitled to any additional amount for their performance, for whatever reason, including, amount others due to increased costs, changes in applicable GST, customs or duties (including, without limitation those set forth in GST, Taxation and Import Duties below), and except as may be specifically provided in the contract.

Payment of amounts due to the Contractor:

Amount shall not be considered as due and payable and the period for the payment of any Price stipulated under the contract shall not commence until the Contractor

has duly fulfilled and delivered all obligations and deliverables required from the Contractor until the date of submission of the invoice for the payment to the Employer with relation to such invoice and/or within the period for which the Price included in the invoice are due.

23. **INVOICES AND PAYMENT**

23.1 Contractor shall submit Goods & Service Tax (GST) compliant invoices to Employer for the amounts due under Total Annual O&M cost above and for any other amounts that may be due under the contract.

23.2 The Total Annual O&M Cost shall be invoiced by the Contractor quarterly against the completion of concerned quarter and each invoice may be submitted by Contractor no later than the day after the completion of the quarterly period in question and, subject to the terms of the contract, shall be paid by the Employer no later thirty (30) days from the date of submission of the invoice along with all other requisite documents (If so required). The Employer shall make payments by wire transfer to the bank account designated from time to time and owned by Contractor. The payment of any invoice shall be subject to the Contractor submitting to the Employer the Monthly Performance Reports.

23.3 Additional Services may, for purposes of this Invoices and Payment, be invoiced upon full and proper completion of each individual task and shall, subject to the terms of the contract be paid by the Employer within thirty (30) days from the date of submission of the invoice along with all other requisite documents (If so required).

23.4 In the event that the Employer fails to make any payment on its respective due date, the Employer shall pay to the Contractor interest on amount of such delayed payment at the rate as applicable for 46 days term deposit scheme as established by State Bank of India for Local currency payment and London Inter Bank Offered Rate (LIBOR) for Foreign currency payment, shall become payable as from the end of the 15 days period on certified amount due, but not paid, at the end of such period.

23.5 To the extent permitted by Applicable Laws, if the amount of an invoice is disputed by the Employer, the Employer shall be entitled to withhold payment of the disputed amount for the next invoice (or part thereof), until the dispute is resolved between the Parties under Law Dispute Resolution or otherwise. The Employer shall pay at the applicable time the undisputed amount of such invoice including any undisputed portion of the invoice item in dispute. Further, the Employer shall be entitled to

withhold payment of any amount due to the Contractor, if, at the time, the Contractor is in breach of one or more of its material obligations in terms of the contract.

23.5.1. Subject to the provisions on the contract, the Contractor warrants that it has, and will be deemed to have, done everything that would be expected of a prudent, competent and experienced Contractor and in accordance with Good Solar/BESS Industry Practices in:

(i) assessing all risks which it is assuming under the Contract; and

(ii) ensuring that the **O&M Price** contain allowances to protect it against any of these risks eventuating,

and that it will not make a claim for an increase in the **O&M Price** if any of those risks eventuate.

23.5.2. Except for Liens arising out of a failure of the Employer to make any payment when due hereunder to Contractor or any other Person providing labour or services to the Project under Contract to the Employer, the Contractor acknowledges and agrees that it shall not file, claim or register any Liens and shall use its best efforts to prevent any Liens from being filed, claimed or registered by any Subcontractor or by any employee, or agent of the Contractor or Subcontractor, against the Services, Additional Services, the Plant as a whole or any part thereof, or any real or other property of the Employer, for any works done or any Services and/or Additional Services rendered under the Contract or any subcontract let by the Contractor and shall procure that all subcontracts contain undertakings to the like effect.

23.5.3. The Contractor shall indemnify the Employer against any loss, damage, cost or expense (including legal fees) of the Employer arising out of or in connection with any Lien being filed, claimed or registered as referred to Invoices and Payment.

23.5.4. The delay or failure of a party to pay any amounts due hereunder, or the withholding of any amounts which are claimed by a party to be due, shall not release the other Party from any of its obligations or liabilities under the contract.

24. SCADA, EMS & BMS

Contractor shall be required from time to time to update the SCADA, EMS and BMS software, as required for the ongoing adequate operation of the Plant Facility. Such updates shall also be provided to the Employer at no additional costs.

25. INSURANCE

25.1 Contractor ‘s insurance

The Contractor, at his own cost and expense, shall take out and maintain in full force and effect and shall cause its Subcontractors to take out and maintain in full force and effect, throughout the Term of the Contract and any extensions thereof, the following insurance policies from reputable insurers and shall provide the Employer with copies of the corresponding insurance certificates:

a) Covering physical loss or damage to the all plant facilities at the Site, with an extended maintenance coverage for the Contractor’s liability in respect of any loss or damage for the entire term of the contract.
b) Workers compensation insurance, as required by the Applicable Law and Contracts made with employees.

c) Group Medical Claim, Group Term Policy & Group Personal Accident Insurances covering the financial consequences cause by damage and loss arising from sickness, disease, injury or death of any person employed by the Contractor in respect of the services performed Automobile Public Liability insurance, as required by the Applicable Laws, for all vehicles and automotive equipment owned hired, rented, leased and non-owned by the Contractor and used in the performance of the Services

d) Comprehensive General third-party liability insurance including product and contractual liability covering the financial consequences of the liability arising out loss or damage caused to third parties or to the employer as consequence of the performance of the services.

e) All other insurance like – transit insurance (Marine/ Cargo/ others as applicable), Construction All Risk, Erection All Risk, workmen compensation, fire, third party liability, insurance against Insurance against theft, fire, act of God, Contractor’s Equipments, machinery breakdown policy, business interruption insurance, Property damage Insurance & Environmental risk insurance as required during the O&M period of the Plant shall be in the contractor’s scope & shall borne by the Contractor.

The Service Provides shall ensure that under the aforementioned insurance policies, each of the insured has the ability to claim thereunder for a minimum period of three (3) months from the date of expiry of the insurance policies for any claims that arose prior to the expiry date.

The Employer shall be named as co-insured under all insurance policies taken out by the Contractor, except for the Third-Party Liability and Workers' Compensation Insurances, and the Contractor's Subcontractors shall be named as co-insureds under all insurance policies taken out by the Contractor, except for the Cargo, Workers' Compensation. All insurer's rights of subrogation against such co-insureds for losses or claims arising out of the performance of the Contract shall be waived under such policies.

25.2 Contractor's Insurance for the Plant Facility

The Contractor shall take out and maintain an insurance policy, seamlessly with CAR policy taken earlier during construction phase, preferably from same insurance company for the plant facility during the entire term of the contract

In the event of any incident or damage or loss that would be reasonably expected to result in an insurance claim, the Contractor shall:

a) Notify without delay to the Employer
b) Prepare and conduct all and any claims made under the policies effected by it, and all monies payable by any insurers shall be paid to the Contractor take all reasonable measures to mitigate the loss, its effects and to protect salvage.
c) Collaborate with Employer and the insurer and provide them with all information and documents they may request.
d) Arrange immediate reinstatement of the damage to the employer's satisfaction, without waiting for the settlement for the corresponding insurance claim.
e) Claim in pursuant to the contract to the insurance agencies, if the claim is accepted or rejected or not accepted or partly accepted by the insurance agency then it will not limit the contractor obligation in any case and also if any losses on account of this shall be in the scope of contractor.

25.3 General Insurance Requirements

25.3.1 The Contractor shall, provide copies of the corresponding insurance certificates mentioned above.

25.3.2 If the Contractor fails to effect or maintain any insurance policy required hereunder, or fails to produce copy of the corresponding insurance certificates, the Employer may (but as no obligation), without prejudice to any other right or remedy available to it under the contract, procure the insurance for the relevant coverage and/or pay the premiums due. Such payments shall be recoverable and deducted from the payments to be made to the Contractor by the Employer under the Contract. In the event if Contractor does not pay the premium, then the Employer may pay the premium however in such case the obligations of Contractor to undertake the coverage shall

continue as envisaged, irrespective of premium being paid by Employer. The Premium if paid by the Employer shall be recovered from the Annual O&M Fees payable by the Employer to the Contractor.

25.3.3 The Contractor shall comply with the conditions stipulated in each of the insurance policies to be affected under the Contract and shall not make any alteration to the terms of any policy subscribed by it so it deviates from the requirements herein.

25.3.4 The Contractor must promptly notify to the Employer any notification received from an insurance company regarding any actual alteration to one of their policies.

25.3.5 On occurrence of any loss covered by an insurance policy contemplated under *Insurance*, the Contractor shall, as soon as reasonably possible, notify to insurance companies for the policy subscribed by it. The Contractor shall also take any appropriate measure to mitigate the effects to the loss to the maximum extent possible. The Contractor shall assist any assessment mandated by the insurance companies.

25.3.6 The required coverages referred to and set forth in this Article 33 (*Insurance*) shall in no way affect or limit the Contractor's liability with respect to its obligations under the Contract.

25.4 The Contractor shall also arrange suitable insurance to cover following during the O&M Period:

a) **Machinery Breakdown**: Electrical & or machinery breakdown of any machinery or other equipment resulting in costly repairs or even replacement of the solar panel.

b) **Business Interruption**: Cover for period of operational downtime i.e., covering the cash flow of the solar business as a result of an insured peril, for example fire or storm damage, machinery breakdown or equipment failure.

c) **Property Damage**: The insurance should cover material damage due to external causes such as fire, theft, vandalism, sabotage, hail damage, snow load, lightning strike, overload, operational mistakes, clumsiness, negligence & theft.

d) **Employers Liability**: Provides cover against the risk of accident from usual workplace risks such as working at height & manual handling during construction & O&M period..

e) **Environmental Risk Insurance**: Environmental damage coverage indemnifies solar system owners of the risk of either environmental damage done by their development or pre-existing damage on the development site.

ANNEXURE 1:

Scope of Work for Operation and Maintenance

i) The Contractor shall prepare the initial Annual Operating Plan for the Plant Facility and shall also indicate the proposed resources (manpower, material & machinery) that would be deployed for O&M.

ii) The Contractor shall be responsible for the smooth day-to-day operation of the Plant Facility.

iii) The Contractor shall provide necessary routine and preventive maintenance schedules of the plant for the Employer's approval and shall carry out all routine and preventive maintenance accordingly.

iv) The Contractor shall perform periodic overhauls and preventive maintenance required for the Plant in accordance with the recommendations of equipment manufacturers and as per the O&M manuals.

v) Contractor shall perform all break down maintenance and other maintenance in the Plant Facility. The Contractor shall be responsible for achieving the performance guarantee of the plant as indicated in the contract.

vi) The Contractor shall operate and maintain fire protection system and safety equipment for the plant.

vii) The Contractor shall do maintenance of Electricity system including overhead lines in the Plant Facility area up to the Point of Common Coupling (PCC) to the grid at the site. Necessary co-ordination shall be made by the Contractor with CSPDCL/SLDC and other agencies as may be required during the Operation and Maintenance term for smooth operation of the plant.

viii) Contractor shall work in coordination with the Employer or any Employer's designated party to optimize the Plant production.

ix) The Contractor shall provide required spare plant Equipment, Spare Parts, tools and tackles, consumables required for comprehensive operation and maintenance of the plant facility. The Contractor shall make arrangement to procure required spare parts, or equipment/s as required, overhauling of parts, tools and equipment, required to operate and maintain the Plant in accordance with the recommendations of individual original equipment

manufacturer at his own cost. Cost of imported Equipment & spare parts, if any, shall be included in the O&M quoted cost. The List of Consumables, Spare Parts, tools and equipment shall be finalised in consultation with the Employer or Employer's representative. List of recommended spare parts shall be submitted by the Contractor at the beginning of services, however the complete recommended spares will be in the scope of contractor only. In case any equipment or spares is not listed in the mandatory spares list but is required vitally for the operation of the plant, then the same shall be procured and provided by the contractor without any additional cost.

x) It is the responsibility of the Service Provide to store the materials in appropriate stock yard or container at the site so as to ensure timely availability of the materials.

xi) The Contractor shall employ only such personnel who are adequately qualified and experienced for operating and maintaining such power generating sets. The Contractor shall ensure that such personnel are on duty at the plant at all times, 24 (twenty-four) hours a day and 7 (seven) days a week commencing from the Date of Operational acceptance.

xii) Contractor shall carry out all day-to-day operation and maintenance for the Plant Facility as set forth herein. Contractor shall perform the Work and supply all required spare parts in a prudent and efficient manner and in accordance with manufacturers and systems designers' specifications, the Annual Operating Plan for the Plant and all operation and maintenance manuals, all Indian applicable laws including environmental protection, pollution, sanitary, labour act, factory act, employment and safety laws, ("Government Rules") and Prudent Utility Practice.The contractor shall adhere to all labour laws which are applicable and as specified in the Design, supply and installation contract (DSI contract) document.

xiii) Contractor shall arrange necessary security staff for watch and ward of the Plant Facility round the clock at his own cost, the details of which shall be furnished along with the bid.

xiv) Contractor shall be responsible for:

- Maximizing plant capacity utilization,
- Reducing plant downtime,

- Optimizing the useful life of the equipment of the power plant.

xv) The Contractor shall maintain all accounting records regarding the facility in accordance with the generally acceptable accounting principles under the Laws of India.

xvi) The Contractor shall maintain accurate and up-to-date operating logs, records and monthly reports regarding operation and maintenance of the Plant facility (Such records shall be distinctly recorded for Solar PV Plant and BESS Plant, in order to have clear data for assessment of any individual component of the Plant Facility) which shall include details of power output, other operating data, repairs performed and status of equipment. All such records to be maintained for a minimum of 60 (sixty) months after the creation of such record or data and for any additional length of time required by regulatory agencies with jurisdiction over the Parties. Upon expiry of term, the Contractor shall hand over all such records to EMPLOYER. However, EMPLOYER shall have access to all such records at any time. Generation and O&M reports should be made available to EMPLOYER on daily and monthly basis in required formats as well as the Quarterly and Annual Performance Reports shall be provided. Contractor shall provide communications as well as daily, weekly, monthly, quarterly and annual reports to the employer in the desired format as per the Contract with the Employer or Employer's Engineer.

xvii) The Contractor shall develop and implement plans and procedures including those for fire fighting, maintenance planning, procuring and inventory control of stores and spares, plan to meet emergencies, plant safety and security; and such other facilities and systems as may be necessary to commence Contractor's ongoing responsibilities.

xviii) The Contractor shall provide copies of all necessary documents including the following :

- Operation and maintenance manuals shall be prepared and approval shall be accorded from Employer within three months from the date of Operational acceptance.

- Failure Analysis/history/trouble shooting details of all the Equipment

- Identification of Equipment needing preventive maintenance

- List of Vendors indicating name and addresses during operation and maintenance with credentials
- root cause analysis report for any major failure.
- Record of consumables / spare parts

xix) The Contractor shall be responsible for conveying following details to the Employer on daily basis as well as on monthly basis (by the end of 5th day of each month) by fax/ e-mail giving the detail of plant performance during previous month.

- Power generated at all Solar PV Plant, Utilisation of BESS
- Power fed to the grid
- Internal power loss and internal consumption
- Power consumption for captive use (if any)
- Reactive power consumption
- Downtime of Plant Facilities including Solar PV Plant, BESS and other infrastructure of the Plant facility.

xx) The Contractor shall be responsible for liasioning with statutory authorities and local authorities in order to ensure smooth operation of the Power Plant.

xxi) Contractor shall provide constant remote surveillance to the Plant Facility

xxii) Contractor shall provide updates and revisions to Reference Documents, as and when applicable.

xxiii) Shall implement software updates to control and monitoring systems including EMS/SCADA/BESS in order to meet the plant facility operating requirement in consonance with the grid operations and in compliance with the grid codes as applicable during the operation.

xxiv) Duly and timely provide the Employer (or parties designated by the Employer) with all notifications required under the Contract including in particular such notifications set forth in Certain Notifications by Contractor;

xxv) Contractor shall provide access to the Employer to all data for the Plant Facility from the EMS including the SCADA system.

xxvi) Contractor shall at all times allow and provide Employer all necessary information for the operation of EMS including the SCADA system (with no notification or approval of access being required unless specifically and otherwise agreed to by the Parties) full, free, unconditional, safe and complete access to the EMS including the SCADA system. Contractor shall monitor and operate the Plant in accordance with the contract and shall ensure smooth operation of the plant.

xxvii) Provide the training to the Employer's personnel in relation to the operation of the complete plant facility. Training shall be provided to the employer within 190 days before end the contract.

xxviii) Contractor shall provide the insurances prescribed in insurance. The Contractor shall, with [prior intimation of 5 Business Days] at regular business hours, allow persons duly authorized by the Employer including but not limited to the officials of the insurance company of the Employer, to inspect the Project and provide to such personnel, access to all information which is necessary for their inspection, and is reasonably requested by the Employer. All representatives of the Employer shall strictly adhere to the Applicable Laws and the Health, Safety and Environmental (HSE) practices of the Contractor as provided in the Reference Documents;

xxix) Contractor shall provide for the watch and ward of the Plant at all times during the Term. The watch and ward deployment plan shall take care of comprehensive Project level security and the Contractor shall take necessary steps to prevent sabotage, theft, vandalism and malicious damage of the assets comprising the Plant, and shall also coordinate and liaison with law enforcement authorities. The Contractor shall take all possible measures to keep the plant operational and secure.

xxx) Contractor shall Coordinate with CSPDCL, Discom, SLDC and other related entities/departments/local Panchayats as required for proper operation of the Plant Facilities. Also coordinate with relevant agencies for monthly Joint Meter Readings, meter testing, and any other requirements such as any audit or inspection by the government agencies or authorities, financiers, any designated third-party agency etc. for the Project operations.

xxxi) Contractor shall be responsible for appointing a Qualified Coordinating Agency at the Pooling Substation Level and shall be responsible for carrying out the forecasting and scheduling of the energy generation from the plant facility (In accordance with the Deviation Settlement Mechanism Regulations of the Chhattisgarh Electricity Regulatory Commission). Scheduling given by the Contractor is such that no penalty is levied on the Employer due to any deviation of actual generation from scheduling beyond the allowed limit. If any penalty is imposed on the Employer due to such deviations beyond allowed limit the same shall be passed on to the Contractor and the recovery of the same will be done from the O&M Price payable to the Contractor.

xxxii) The operation and maintenance of BESS shall be done in coordination with the use cases as defined in the Technical Specifications under Annexure A of the Bid Document. In case any modification or any other requirement from the grid operator, then the same shall be discussed with Employer or Employer representative, and any such modification shall be done by the Contractor only on after Employer's approval.

xxxiii) Contractor will be required to maintain the BESS rating (In MW as well as MWh) as specified in the Technical Specifications (Annexure A, requirement of Bid Document) during the entire O&M period by means of replacement or augmentation of the Battery.

xxxiv) Water requirement for module cleaning arrangement and the cost for the same shall be borne by Contractor. The Contractor shall arrange for water on it's own, by ensuring ESIA norms.

xxxv) Contractor shall be responsible to comply with all applicable National and International Standards as well as local statutory provisions related to Environmental Protection Regulations, Health and Safety requirement and also follow the Environmental and Social Management Plan (ESMP) for the Project as developed under the Environmental and Social Impact Assessment Study.

xxxvi) Contractor will be responsible for coordinating with the OEMs for securing warrantee conditions and services from OEMs as per the warrantee of each equipment, as well also for the Project insurance claims.

xxxvii) Contractor shall carry out the performance monitoring for the Plant Facility (Solar and BESS) on continuous basis and in case of any deviation,

the Contractor shall perform the due diligence appropriately to find out the actual root cause of such deviation. Any test or inspection required such as thermal imaging, IV characteristics test etc. to analyse such deviation will be the responsibility of the Contractor. Thereafter the corrective action required to mitigate such deviation shall be undertaken by the Contractor without any additional cost.

xxxviii) Contractor shall be responsible for maintenance of all each and every civil infrastructures parts like Building, cable trench, fencing, drain, plumbing system fire-fighting system, CCTV system, security arrangement, road, earthing, any foundations, anti-weeding, clearing bushes in the solar field etc., as per the direction of employer's Engineering In-charge.

ANNEXURE 2

Functional Guarantees

1. Annual CUF Guarantee

A. In consideration for the payment of the O&M Price , from the Commencement Date until the end of the Term, the Contractor grants to the Employer the CUF Guarantee on the terms and conditions set forth in the contract.

B. The Contractor guarantees the annual CUF committed herein over the O&M Period ("**Annual CUF Guarantee**") from the date of Operational Acceptance. In the event the CUF is less than the Guaranteed CUF, the Contractor shall immediately, upon demand, indemnify the Employer, as liquidated damages and not as penalty, amounts equivalent to remuneration of the equivalent Energy, subject to a maximum of hundred (100%) percent of the Total Annual O&M Price.

C. The Procedure for measurement and verification of the CUF Guarantee is as per Annexure-C: Performance Guarantee Test procedure, defined under the Annexure A (Employers' Requirement) of the bid document.

D. The Procedure for measurement and verification of the BESS Availability shall be as per relevant section (Battery energy Storage System: System Rating Verification) of Annexure-F: Plant Documentation, Commissioning and Test Procedure, defined under the Annexure A (Employers' Requirement) of the bid document

E. Liquidated Damages for Shortfall in Annual CUF for Solar PV Plant

(i) If the Contractor fails to achieve guaranteed annual CUF, then the Contractor shall pay compensation to the Employer an amount equal to the difference in units (kWh) derived from guaranteed CUF and achieved CUF multiplied by Rs.4 per unit (kWh).

(ii) If the Contractor fails to achieve the annual guaranteed CUF at the end of 10th year, then the Contractor shall pay compensation to the Employer an amount equal to the Net Present Value (NPV) of the revenue loss for 10th to 25th year calculated as below.

(a) % CUF drop i.e. [(Guaranteed CUF of 10th year – Actual CUF of 10th year) / Guaranteed CUF of 10th year]*100 in the 10th year shall be considered as the representative CUF drop for each subsequent year starting from 11th to 25th year.

(b) Estimated revenue loss @ Rs.4 per unit (kWh) for each subsequent year will be calculated as % CUF drop in the 10th year (as per (a) above) multiplied by the respective year's estimated generation.

(c) The Net Present Value (NPV) of the revenue loss for 10th to 25th year with discount factor of 8.61% will be considered as the LD payable by the Contractor.

F. In case the Project fails to generate any power continuously for 1 month any time during the O&M period, apart from the force majeure and grid outages as certified by competent authority from STU/ CTU, it shall be considered as "an event of default". In the case of default the entire Contract Performance Security will be forfeited.

G. Penalty during O&M period against breakdown of other Infrastructure of Plant Facilites that don 't affect the generation of power directly, such as but not limited to, civil infrastructure, water supply system/network, other Infrastructure developed by the Contractor as a Scope of Work for the Project (Section-VII: Scope of Works & Technical Specifications) shall be penalised @ Rs.1000/day, for non-compliance with PM Schedule (Initiation/Completion of Scheduled maintenance Activity as agreed under this Contract) beyond 48 hours. Cumulative value of such penalty shall be limited to 50% of yearly O&M cost. Cumulative value of such penalty shall be limited to 50% of yearly O&M cost.

For the purpose of this Clause, the PM shall be inclusive of, but not limited to, the following PM activities:

Item	**Scope of Maintenance Activity**	**Periodicity**
Environmental/Corrosive Protective Coatings	White-washing/Application/Re-application of Distemper, Epoxy coatings	Once in every 2 years under the O&M Contract period, in consultation with the Owner
Roads and Access paths	Repair and maintenance of all roads – Access, Internal and Periphery roads, walkways as well as fences, gates, cable-	Once every year prior to Monsoon season, in Consultation with

	trenches and outdoor equipment platforms.	the Owner
Water Supply Network	Repair and Maintenance of Water Supply Network including piping network, valves, pumps etc.	Once Every Year in Consultation with the Owner.
Periphery Lighting	Repair and maintenance of Peripheral Lighting including replacement of non-functional lighting fixtures, Junction Boxes, Conduits etc.	Once every Six Months
Rodent Entry Points	Application/re-application of Anti-rodent protection measures like PUF filling, sealant etc. at Checker/Gland Plates, Cable Entry Points (in PCU/SMU, Switchgear Panels, Buildings, Enclosures)	Once every Six Months
All bolted/tightened structures	Tightening/fastening of bolts that are exposed to winds/vibrations like MMS members/foundation bolts	Once every Year before onset of Windy season, in consultation with the Owner.
Enclosures of Equipment requiring Temperature and Dust Controlled environment for Normal Operation	Application/re-application of insulation/Dust-Filters/Temperature-control equipment at Enclosures/Buildings housing BESS, PCU, Switchgear	Once every Year, consultation with the Owner.
Entire Plant Facility	Oversight management of the hazardous/toxic materials including its handling and disposal as per Government of	Once every Year, in consultation with the Owner.

	India Rules and environmental and safety assessments by a qualified Specialist	

Note : *The Contractor shall ensure intimation and submission of requisite Reports to the owner at least 15 days prior to initiation of maintenance action for the activity.*

H. For breakdown of generation related infrastructure, the generation loss estimated based on the outage equipment's weightage (Wi) multiplied by estimated total energy output in the outage period beyond 48 hours, in the event of no breakdown (E_{est}) multiplied by Rs. 4/kWh will be levied. E_{est} for the period shall be calculated from the guaranteed CUF (i.e. Guaranteed CUF* outage period beyond 48 hours). Cumulative value of such penalty shall be limited to 50% of yearly O&M cost. The Equipment weightage (Wi) shall be calculated as below:

$$Wi = \frac{\text{Equipment Rating (in MW)}}{\text{Plant AC Capacity (MW)}}$$

I. The Penalty specified on account of delays, as specified in Liquidated Damages and Penalty specified on account of deviations in Functional Guarantees as above shall be assessed independent of each other. Above mentioned Penalties specified under this clause of SCC are independent of each other.

2. BESS Availability

A. The Contractor shall maintain all BESS equipment to ensure Annual Equipment Availability not less than 99%. Equipment Availability includes the availability of Batteries, Battery Management System (BMS), Power Conversion System (PCS), Energy Management System (EMS) as well as the power evacuation system for BESS up to interface with the solar PV arrays.

B. BESS Equipment Availability is the percentage of hours that the BESS is available during the year. The availability guarantee shall begin upon facility commissioning till the end of O&M period. BESS annual equipment availability shall be calculated as follows.

Equipment Availability =

$$\left[1 - \left(\frac{\sum \text{Accountable BESS Outage duration in hours} \times We}{8760}\right)\right] \times 100$$

Where:

- W_e, Weightage is $\frac{Outage\ Capacity}{Rated\ Capacity}$, where Outage and Rated Capacity shall be in Energy terms i.e. MWh. Rated Capacity in a given year shall correspond to the daily throughput capacity guarantee for the beginning of the year.

C. Accountable BESS outages are outages caused or necessitated by the BESS equipment that result in reduced capacity or loss of essential function of the BESS. These outages may be initiated by failure of components, loss of battery capacity, operation of protective devices, alarms, or manual action. Such outages include both forced outages due to equipment problems and scheduled outages for BESS maintenance.

D. Accountable BESS outage duration is the elapsed time of accountable BESS outages from the instant the BESS experiences reduced capacity or is out of service to the instant it is returned to service or full capacity. If the BESS experiences reduced capacity but is determined by the Employer to be available for service even if the Employer elects not to immediately return the equipment to full capacity, such time will be discounted from the outage duration.

E. The Procurement specific nameplate ratings shall be as defined in Technical Specifications under Annexure A: (Employer's Requirement). The BESS shall be considered to be under an accountable outage if any of those ratings cannot be met. The BESS shall also be considered to be under an accountable outage if a scheduled (or required) charge cycle cannot be completed.

F. The data required for assessment of the availability of the BESS shall be collected through the Plant's integrated SCADA system.

G. Grid outage hours shall be subtracted from total no. of hours in the year.

H. If the Plane of Array Radiation is less than 2kWh/m2 on a day, the day (i.e. 24 hours) shall be excluded.

I. Liquidated Damages for Shorfall in Equipment Availability

If the annual equipment availability for BESS is less than 99% during any year, then Contractor shall compensate the Employer an amount calculated as per the following formula.

$$COM = \left(\frac{99 - EA}{EA}\right) \times C \times E$$

where,

COM is Compensation payable to the Employer in rupees

EA is Annual BESS Equipment Availability

C is ₹8/kWh

E is the intended energy output from BESS in kWh during the respective year in 99% availability condition after considering any degradation.

Recovery of Compensation

The above compensations shall be deducted from CPS submitted by the developer.

Scheduling and Forecasting:

1. The Contractor shall be responsible for appointing a Qualified Coordinating Agency if required by concerned authorities at the Pooling Substation Level for scheduling and forecasting activity. Also the contractorshall be responsible for carrying out the forecasting and scheduling of the energy generation from the plant facility (In accordance with the Deviation Settlement Mechanism Regulations of the Chhattisgarh Electricity Regulatory Commission). Scheduling given by the Contractors is such that no penalty is levied on the Employer due to any deviation of actual generation from scheduling beyond the allowed limit. If any penalty is imposed on the Employer due to such deviations beyond allowed limit the same shall be recovered from the CPS given by the contractor.

Environmental and Social Due Diligence Report

100 MW(AC) Solar PV Project (200MWp DC capacity) along with 50MW/150 MWh Battery Energy Storage System at Rajnandgaon, Chhattisgarh

by

Solar Energy Corporation of India Limited

(A Government of India Enterprise)

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LIST OF ABBREVIATIONS

AC	Alternating current
CSPDCL	Chhattisgarh State Power Distribution Corporation Limited
BESS	Battery energy storage solution
BMS	Battery Management System
BPL	Below Poverty Line
CEA	Central Electricity Authority
CPCB	Central Pollution Control Board
CTE	Consent to Establish
CTO	Consent to Operate
DC	Direct current
EHS	Environment, Health and Safety
EMP	Environmental Management Plan
EPC	Engineering Procurement and Construction
ESIA	Environmental and Social Impact Assessment
ESMF	Environment and Social Management Framework
ESMP	Environmental and Social Management Plan
ESS	Energy Storage System
GAP	Gender Action Plan
GRM	Grievance Redressal Mechanism
GW	Giga Watt
IUCN	International Union for Conservation of Nature
LC	Least Concern
MNRE	The Ministry of New and Renewable Energy
MoEF&CC	Ministry of Environment, Forests & Climate Change
NT	Near Threaten
PAP	Project Affected Persons
PV	Photovoltaic
RES	Renewable energy sources
MSL	Mean Sea Level
O&M	Operation and Maintenance
SC	Scheduled Caste
SEIAA	State Environment Impact Assessment Authority
SECI	Solar Energy Corporation of India Limited
SEMS	Social and Environmental Management System
SPCB	Sate Pollution Control Board
WB	World Bank

EXECUTIVE SUMMARY

Introduction & Project Description

Solar Energy Corporation of India Ltd. (SECI) is a CPSU under the administrative control of the Ministry of New and Renewable Energy (MNRE), set up on 20th Sept 2011 to facilitate the implementation of scaling up solar program within India. Its focus has been expanded to include wind energy as well. SECI plans to set-up a 100 MW solar PV project along with Battery Energy Storage System at the project site located in Rajnandgaon district, Chhattisgarh. In the said Project it is proposed to setup 100MW(AC) Solar PV Project (200MWp DC Capacity) with 50MW/150 MWh Battery Energy Storage system.

Existing Scenario & Necessity of this project

Analysis of the consumption data of the state suggests a typical demand curve with a steady base load during the day and a marked evening peak between the 72nd (6 in the evening) and 88th (11 in the night) time-blocks. Based on the complete dataset available for the years 2018 and 2019, Year-on Year growth is approx. to be around 7% (from 3269 MW in 2018 to 3501 MW in 2019) with the load curve character remaining same. The average purchase price of Peak power is approx. Rs. 4.50 over the last two calendar years (2018 and 2019). In the year 2019, the state purchased approx. 470 MUs of energy to meet the peak demand from the IEX at a weighted average energy price of Rs. 4.46/unit. During the evening (between 6 pm to 9 pm) the demand peaks, on an average, to approx. 250 MW above the off-peak load.

For the financial year of 2019-20, Chhattisgarh State Power Distribution Company Limited accrues a power purchase cost of INR 3.27 for power from Central Generating Stations, INR 3.19 from State Generating Stations and INR 7.76 from various Renewable Energy Generators. Assuming an escalation of 3% year on year of the cost of electricity from the former two, financial analysis would show that a tariff of INR 4.00 for the proposed plant of 100 MW with BESS in Rajnandgaon would be cheaper than the renewable energy generators and would approach the cost of electricity from conventional energy sources. This builds a worthy case for the proposed plant.

Approach and Methodology

The Environmental and Social Management Framework (ESMF, June 2020 of SECI) is intended to identify and assess the several environment and social impacts (both positive and negative) that may result from the proposed setting up of 100MW(AC) Solar PV Project (200MWp DC Capacity) with 50MW/150 MWh Battery Energy Storage system, as well as to provide a corresponding management plan to handle any adverse/negative impacts.

All the available information and data (quantitative, qualitative) regarding the proposed project has been collected from the Detailed Project Report (DPR), consultation with stake-holders and other secondary sources including data from Chhattisgarh Environment Conservation Board, Asian Development Bank Report, Forest Survey Report, District Survey Report for minor mining etc.

The scope of the ESDDR that has been finalized on the basis of project screening and categorization are; describe the sub-project and its components; describe the baseline environmental and social conditions of the sub-project areas and the proposed project facilities; identification and analysis of key environmental issues viz. presence of any ecologically sensitive areas in the vicinity of the project site, as well as social issues (if any) associated with the project; interactions / discussions with the key stakeholders; Environmental and Social Screening and categorization of the sub-project as per the requirements of ESMF of SECI; develop Environmental and Social Management Action Plan (ESMAP) outlining suitable mitigation measures to be adopted by the relevant implementing actor; outline the requirements of specific permissions / clearances / approvals that may be applicable to the proposed project and the requirements of any detailed study [e.g. preparation of Environmental and Social Impact Assessment (ESIA), Resettlement Action Plan (RAP), Tribal Development Plan (TDP), etc.].

Project Screening

The project screening was carried out to understand the nature, scale and magnitude of environmental and social issues associated with the project. The screening activity was conducted as per the guidelines provided in Environmental and Social Management Framework (ESMF of SECI, June 2020) and on the secondary data analysis, field assessments and stakeholder interactions/consultations. Thereafter, based on the aforementioned the environmental and social impacts were identified and analyzed to develop an Environmental and Social Management Action

Plan (ESMAP) outlining suitable mitigation measures to be adopted by the relevant implementing actors associated with the present project.

Based on the Environmental and Social Screening carried out as part of this due diligence exercise using the screening matrix of the Environmental and Social Management Framework of SECI, the present project of setting up of 100MW(AC) Solar PV Project (200MWp DC Capacity) with 50MW/150 MWh Battery Energy Storage system, is categorized as 'Low Impact' category. The project components have limited environment and social impacts, which can be mitigated with the adoption of suitable mitigation measures.

Baseline Environmental and Social Features

The baseline information forms the basis to analyze the probable impacts of the proposed project vis-à-vis the present background environmental and social quality of the study area. The baseline information of existing environmental quality and social features related to the physio-chemical aspects, ecological aspects, socio-economic and cultural aspects of the project area has been collected and collated from various secondary sources and from available literature.

Environmental and Social Impacts and their Mitigation

Though the project envisages few environmental and social impacts, however they are temporary in nature and can be mitigated with the proper implementation safeguard measures suggested in the ESDDR designed for the project along with effective monitoring of the implementation. The project is expected to benefit Chhattisgarh, by providing Renewable Energy at peak hour at very competitive rate.

Institutional Arrangement for implementing ESDDR

SECI has proposed to develop the Solar Park with battery storage project in Build Own Operate model. Project would be set up in a turnkey EPC mode, with EPC contractor being determined through a transparent international competitive bidding process.

Cost Estimate

As per the revised DPR the total cost of the proposed project has been estimated to be Rs. 963 Crore, (including battery replacement cost in 15th Year – Rs. 100 Crores).

Implementation Schedule

SECI will award the EPC Contract for implementing the setting up of 100MW(AC) Solar PV Project (200MWp DC Capacity) with 50MW/150 MWh Battery Energy Storage system at Rajnandgaon, Chhattisgarh. It will also include a transmission line connecting to the Grid at Thelkadi, Chhattisgarh sub-station with an approximate length of 33 km.

It is anticipated that entire work will be completed within 18 months from the date of start.

1. INTRODUCTION

1.1 INTRODUCTION & PROJECT DISCRIPTION

Solar Energy Corporation of India Ltd. (SECI) is a CPSU under the administrative control of the Ministry of New and Renewable Energy (MNRE), set up on 20th Sept 2011 to facilitate the implementation of scaling up solar program within India. Its focus has been expanded to include wind energy as well.

SECI plans to set-up a 100 MW solar PV project along with Battery Energy Storage System at the project site located in Rajnandgaon district, Chhattisgarh. In the said Project it is proposed to setup 100MW(AC) Solar PV Project (200MWp DC Capacity) with 50MW/150 MWh Battery Energy Storage system.

1.2 CONTEXT OF THE PROJECT

The power sector of a country is the powerhouse of its economic development. India's power scenario has borne witness to many interesting developments in the past decade. Capacity addition has been consistent over the past decade with the present installed capacity standing at 364.96 GW as of 31.10.2019. Coal continues to be the dominant fraction in the energy mix of the country, topping at 62.85% of the total installed capacity. Nevertheless, renewable energy has seen an unprecedented push with right policies formulation and timely execution. At present the proportion of renewable installed capacity is around 23%. The complete break up of India's installed capacity is given in Table 1-1. The table gives an exhaustive view of the generation controlled by State, Private and Central entities.

TABLE 1-1: ALL INDIA INSTALLED CAPACITY (AS ON 31.10.2019) IN MW

Ownership	Thermal					Nuclear	Hydro	RES	Grand Total
	Coal	Lignite	Gas	Diesel	Total				
State	65861.50	1290.00	7118.71	236.01	74506.21	0.00	26958.50	2349.98	103814.69
Private	74173.00	1830.00	10580.60	273.70	86857.30	0.00	3394.00	79397.22	169648.52

Central	57660.00	3140.00	7237.91	0.00	68037.91	6780.00	15046.72	1632.30	91496.93
Total	197694.50	6260.00	24937.22	509.71	229401.42	6780.00	45399.22	83379.50	364960.14

Source:http://www.cea.nic.in/reports/monthly/installedcapacity/2019/installed_capacity-0.pdf

1.2.1 INSTALLED CAPACITY OF RENEWABLE ENERGY

The renewable energy installed capacity comprises of Small hydro, wind, solar and biomass. The installed capacity may be divided into these sub sectors as per the Table 1-2.

TABLE 1-2 INSTALLED CAPACITY OF RENEWABLE ENERGY IN MW (AS ON 31.10.2019)

Small Hydro	Wind Power	Bio-Power		Solar Power	Total Capacity
		BM Power/ Cogeneration	Waste to Energy		
4647.11	37090.02	9806.31	139.8	31696.26	83379.5

Source:http://www.cea.nic.in/reports/monthly/installedcapacity/2019/installed_capacity-pdf

Among all renewable energy resources, India is blessed with abundant solar energy. Having a potential of generating over 5,000 trillion kilowatts of clean energy, India experiences around 300 sunny days in a year and solar insolation of 4-7 kWh/m^2/day.

1.2.2 CHHATISGARH: POWER SCENARIO AND SCOPE FOR SOLAR PROJECT

The state of Chhattisgarh was formed on 1 November 2000 post the bifurcation of Madhya Pradesh. It is the ninth largest state in India and the 16th most populous. Over the years, Chhattisgarh has emerged as a preferred investment destination. The area is well connected by rail, road and air.

The greatest strength of the state of Chhattisgarh is the abundance of resources. It is a leading producer of coal, iron ore and dolomite. Considerable resources of bauxite, limestone and quartz are also found in the state. The state accounts for approximately 15% of the total steel produced in the country. State government has released an Industrial policy for the year 2014-2019 to incentivize the growth of the sector and bring it on par with the developed industrial states of the country. The Chhattisgarh State Industrial Development Corporation (CSIDC) has set up industrial

growth centers, five industrial parks and three integrated infrastructure development centres (IIDC). The state has a notified special economic zone (SEZ) in Rajnandgaon District.

The state of Chhattisgarh is power surplus state with an installed capacity of 13910 MW as of September 2019, more than 94% of which is thermal power. The detailed breakup of the installed capacity vis-à-vis the sources has been given in Table 1-3.

TABLE 1-3 INSTALLED CAPACITY OF CHHATTISGARH IN MW (SOURCE: CEA)

Ownership	Thermal					Hydro	Nuclear	RES	Grand Total
	Coal	Lignite	Gas	Diesel	Total				
State	2080	0	0	0	2080	120	0	11.05	2211.05
Private	8850	0	0	0	8850	0	0	526.8	9376.8
Central	2173.65	0	0	0	2173.65	100	48	0	2321.65
Total	13103.65	0	0	0	13103.65	220	48	537.85	13909.5

Renewable power accounts for only 6% of the installed capacity. A favorable environment created by good policy structures will help bring about change in the energy mix of the state, which already has a robust transmission and distribution system in place. The Government of Chhattisgarh released a solar policy on September 2017 that aims to encourage, develop and promote solar power generation in the state that would assist it in developing in an environmentally and economically sustainable manner. The breakup of Renewable Energy Installed Capacity is given in Table 1-4.

Table 1-4 Chhattisgarh Breakup of RES in MW (as on 31.10.2019) (Source: CEA)

Small Hydro Power	Wind Power	Bio Power Total	Solar Power			Total Capacity
			Ground Mounted	Roof Top	Total	
76.00	0.00	230.50	215.83	15.52	231.35	537.85

1.2.3RATIONALE FOR PROJECT

Analysis of the consumption data of the state suggests a typical demand curve with a steady base load during the day and a marked evening peak between the 72nd (6 in the evening) and 88th (11 in the night) time-blocks. Based on the complete dataset available for the years 2018 and 2019, Year-on Year growth is approx. to be around 7% (from 3269 MW in 2018 to 3501 MW in 2019) with the load curve character remaining same. Shown in the figure below is the average demand curve, time block-wise for the years 2018 and 2019.

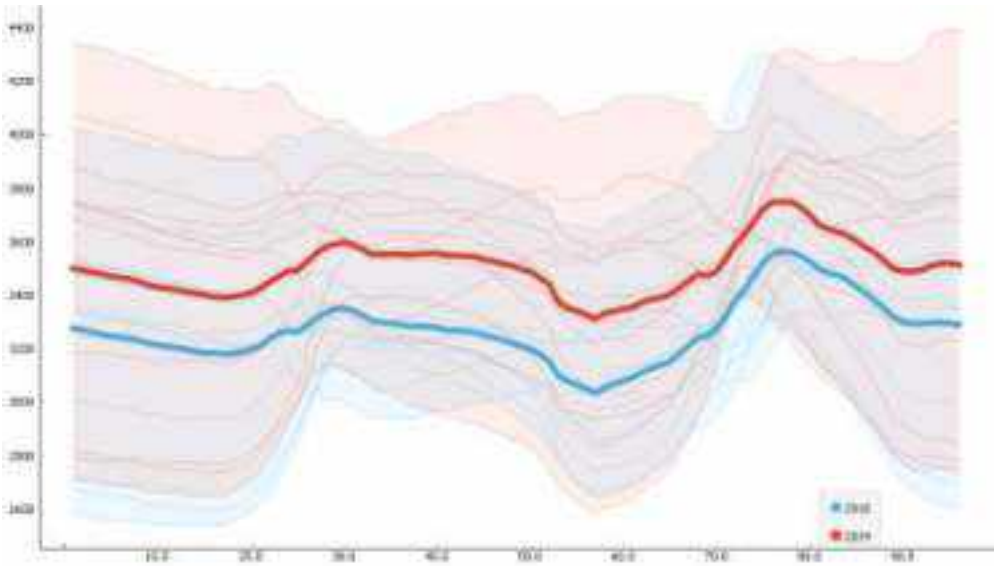


FIGURE 1-1: AVERAGE DEMAND CURVE (YEAR-WISE)

The nature of the distribution of the average demand can be assessed from the following box-plots and frequency distribution curves:

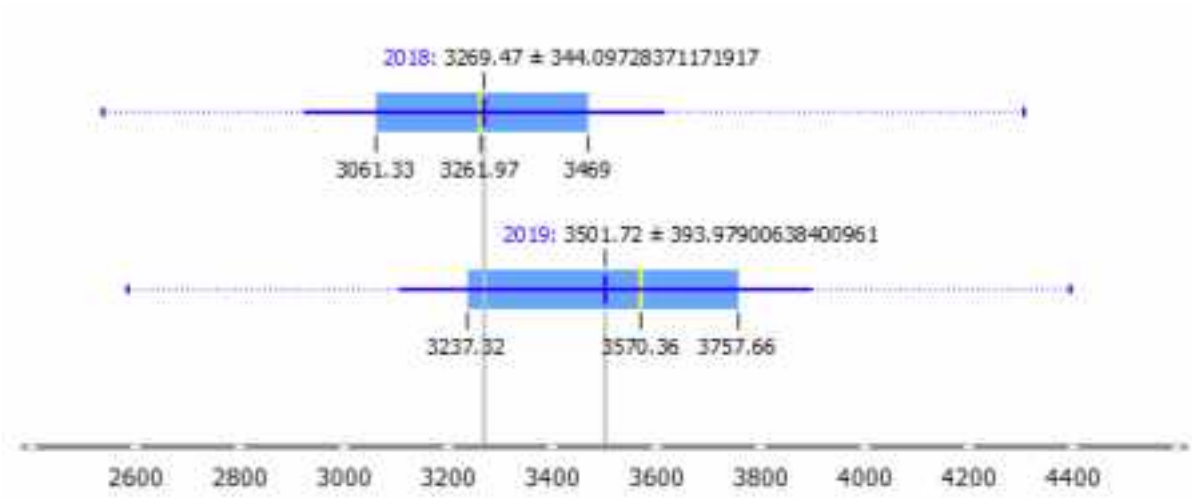


FIGURE 1-2: BOX PLOT: YOY DEMAND

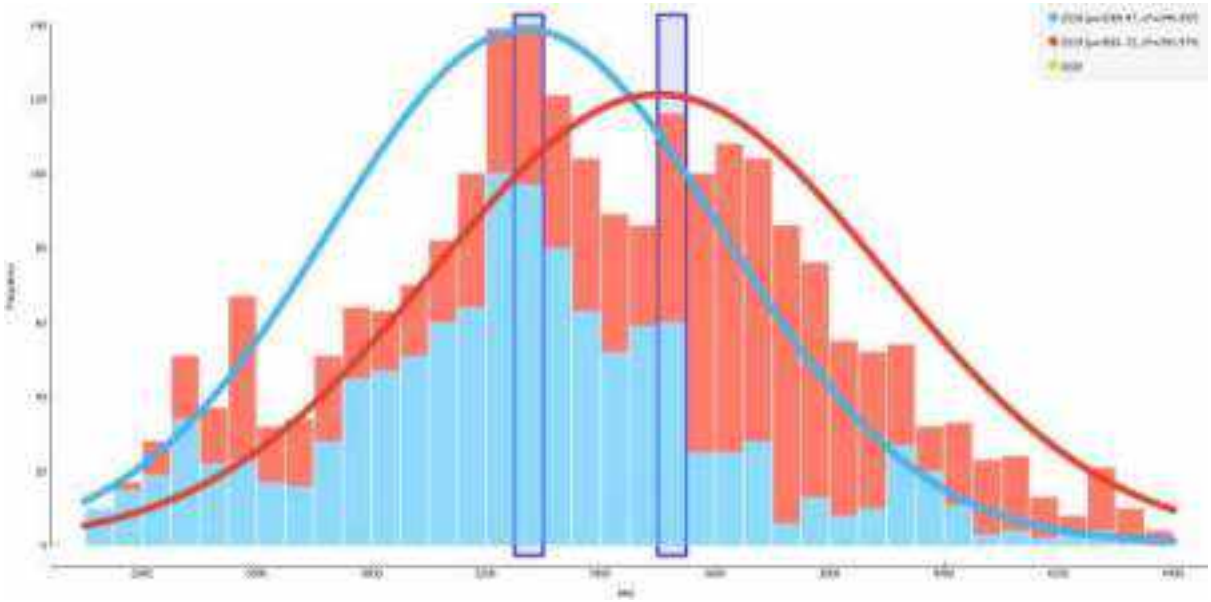
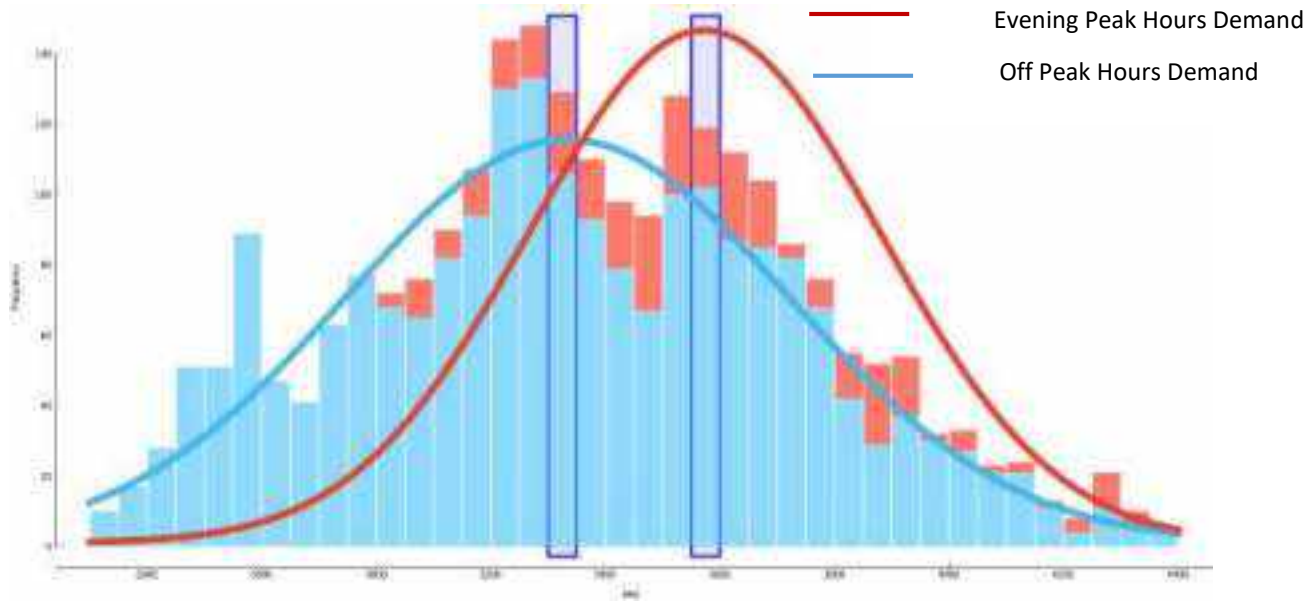


FIGURE 1-3: FREQUENCY DISTRIBUTION OF DEMAND

Further to above, the difference between Peak and Off-Peak demands can be assessed from the following frequency distribution curves:



As evident from the box plots below, the Peak and Off Peak demands differ by approx. 250 MW:

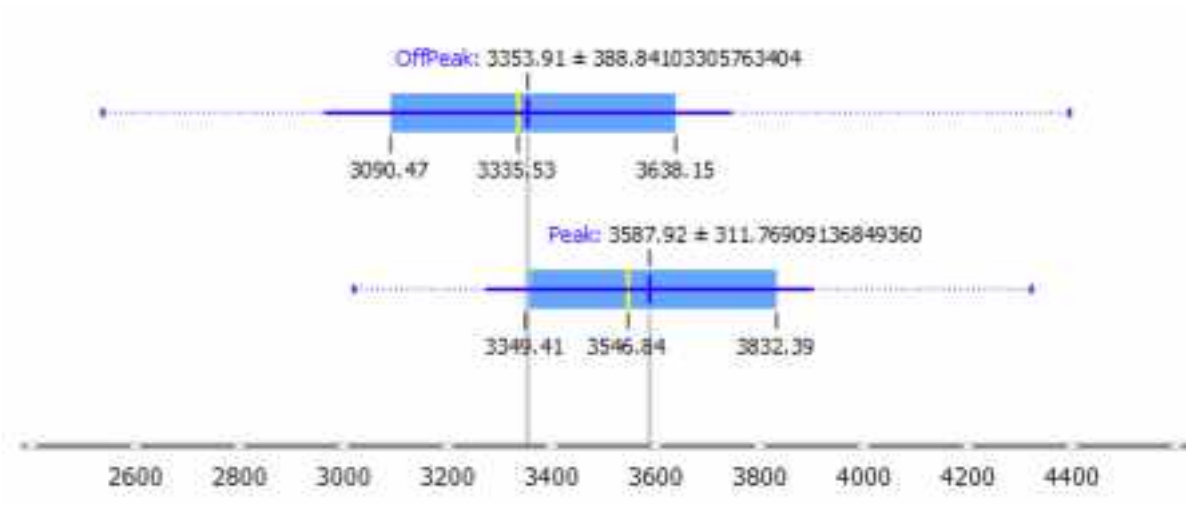


FIGURE 1-4: PEAK VS. OFF-PEAK DEMAND

The average purchase price of Peak power is approx. Rs. 4.50 over the last two calendar years (2018 and 2019). In the year 2019, the state purchased approx. 470 MUs of energy to meet the peak demand from the IEX at a weighted average energy price of Rs. 4.46/unit. During the evening (between 6 pm to 9 pm) the demand peaks, on an average, to approx. 250 MW above the off-peak load.

For the financial year of 2019-20, Chhattisgarh State Power Distribution Company Limited accrues a power purchase cost of INR 3.27 for power from Central Generating Stations, INR 3.19

from State Generating Stations and INR 7.76 from various Renewable Energy Generators (Reference: Determination of Revised ARR for FY 2019-20). Assuming an escalation of 3% year on year of the cost of electricity from the former two, financial analysis would show that a tariff of INR 4.00 for the proposed plant of 100 MW with BESS in Rajnandgaon would be cheaper than the renewable energy generators and would approach the cost of electricity from conventional energy sources. This builds a worthy case for the proposed plant.

1.3 STRUCTURE OF THE REPORT

Chapter 1	**Introduction & Project Description** This chapter describes briefly describes the project and its background
Chapter 2	**Approach and Methodology** This chapter presents the different steps followed during the process of environmental & social Due Diligence and scope of the present study.
Chapter 3	**Environmental and Social Profile of the Project Area** Description of the baseline environmental and social condition including the baseline physical environment, biological environment and socio-cultural conditions of the project area are briefly described in this chapter.
Chapter 4	**Environmental and Social Safeguard Due Diligence** This chapter captures the policy and legal framework of government of India as well the policies of World Bank applicable to the project followed by its compliance, consultation processes carried out with the various sections of community and stakeholder groups, potential environmental and social impacts associated with the proposed project, institutional arrangement for implementation of ESMP, Grievance Redress Mechanism, Gender Assessment, Development and Gender Based Violence (GBV).
Chapter 5	**Findings of Gap Analysis** This chapter provides the major observations of Gap Analysis with respect to major environment and social attributes of the project.
Chapter 6	**Implementation Schedule and Responsibilities** This chapter envisages the implementation schedule, responsibilities and respective time frame for implementation of ESMP
Chapter 7	. **Recommendations** This chapter provides the necessary recommendations to ensure compliance with the ESMF towards improving the environmental and social performance of the project.

2. APPROACH AND METHODOLOGY

2.1 METHODOLOGY

The Environmental and Social Management Framework (ESMF, June 2020 of SECI) is intended to identify and assess the several environment and social impacts (both positive and negative) that may result from the proposed setting up of 100MW(AC) Solar PV Project (200MWp DC Capacity) with 50MW/150 MWh Battery Energy Storage system, as well as to provide a corresponding management plan to handle any adverse/negative impacts. The methodology adopted for conducting Environmental and Social Due Diligence for the proposed interventions is given in **Figure 2-1** below.

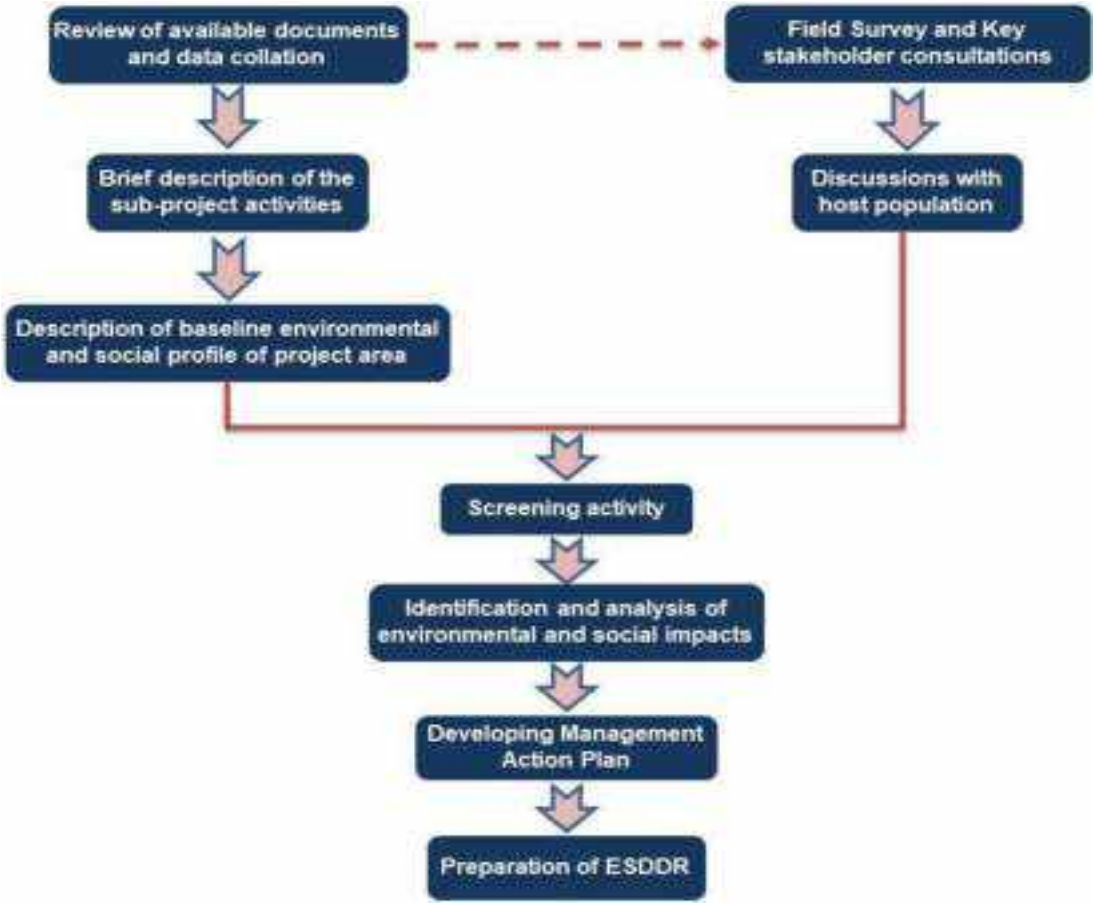


FIGURE 0-1 METHODOLOGY ADOPTED FOR CONDUCTING ENVIRONMENTAL AND SOCIAL DUE DILIGENCE

2.2 REVIEW OF AVAILABLE DOCUMENTS AND DATA COLLATION

Review of available documents and collating information from various documents to assess the possible environmental and social impacts of the proposed project. All the available

information and data (quantitative, qualitative) regarding the proposed project has been collected from the Detailed Project Report (DPR), consultation with stake-holders and other secondary sources including data from Chhattisgarh Environment Conservation Board, Asian Development Bank Report, Forest Survey Report, District Survey Report for minor mining etc.

2.3 DESCRIBING THE SUB-PROJECT ACTIVITIES

With the help of information and data available, collected and consultations with stake-holders, a brief description and analysis of the project activities has been established.

2.4 DISCUSSION WITH THE KEY STAKEHOLDERS

The key stakeholders including the Chhattisgarh Energy Department, Chhattisgarh State Power Distribution Company Limited, District Administration, State Forest Department, local people were interacted (both formally and informally) during the field visits while preparing the ESDDR. Most of the associated government departments were visited to collect the relevant data and their feedback on the proposed project activities. Also, they were asked about the mitigation plans proposed to be adopted, suggestions for improvement and any public grievances.

2.5 BASELINE ENVIRONMENTAL AND SOCIAL PROFILE OF PROJECT AREA

With the help of secondary information/data received from the available documents and from the discussions/interactions with key stakeholders and host population, a brief description of the baseline environmental and social profile of the project area has been established.

2.6 SCREENING ACTIVITIES

The project screening has also been carried out to understand the nature, scale and magnitude of potential environmental and social impacts associated with the proposed project. The screening activities have been conducted as per the guidelines provided in Environmental and Social Management Framework of SECI (ESMF, June 2020) and on the basis of secondary data analysis, field assessments and stakeholder interactions/consultations.

The screening checklist included criteria that detailed out the impact level of various activities during the construction and operation phases. The criteria included environmental factors such as the presence of eco-sensitive region in and around the project area, clearance of tree cover, improper storage of excavation spoils, flooding of adjacent areas, elevated noise and dust

levels, damage to existing utilities, etc. Social criteria included factors such as requirement of land acquisition, displacement of tribes, loss of livelihood and gender issues.

2.7 IDENTIFICATION AND ASSESSMENT OF IMPACTS

Based on the analysis of the data collected from field surveys, stakeholder interactions/ consultations and secondary sources, issues related to the environmental and social sectors were identified. The impacts so identified were compared with the existing baseline environmental and social condition of the study region. Though the project envisages few environmental and social impacts, however they are temporary in nature can be mitigated with the proper implementation safeguard measures suggested in the ESDDR designed for the project along with effective monitoring of the implementation.

2.8 DEVELOPING MANAGEMENT ACTION PLAN

Based on the identified and assessed potential environmental and social impacts, an appropriate mitigation / management action plan has been developed recommending suitable measures needed to prevent, minimize, mitigate, or compensate for adverse impacts (if any) and to improve the environmental and social performance. The mitigation plans are suggested for different stages of the project, as applicable: designing phase, construction phase and, operation and maintenance phase.

2.9 SCOPE OF WORK

Based on the Environmental and Social Screening carried out as part of this due diligence exercise using the screening matrix provided in the Environmental and Social Management Framework of SECI concludes that the present project of setting up of 100MW(AC) Solar PV Project (200MWp DC Capacity) with 50MW/150 MWh Battery Energy Storage system, is categorized as 'Low Impact' category. The project components have limited environment and social impacts, which can be mitigated with the adoption of suitable mitigation measures. The scope of the ESDDR that has been finalized on the basis of project screening and categorization are given below:

- Describe the sub-project and its components;
- Describe the baseline environmental and social conditions of the sub-project areas and the proposed project facilities;

- Identification and analysis of key environmental issues viz. presence of any ecologically sensitive areas in the vicinity of the project site, as well as social issues (if any) associated with the project;
- Interactions / discussions with the key stakeholders;
- Environmental and Social Screening and categorization of the sub-project as per the requirements of ESMF of SECI;
- Develop Environmental and Social Management Action Plan (ESMAP) outlining suitable mitigation measures to be adopted by the relevant implementing actor;
- Outline the requirements of specific permissions / clearances / approvals that may be applicable to the proposed project and the requirements of any detailed study [e.g. preparation of Environmental and Social Impact Assessment (ESIA), Resettlement Action Plan (RAP), Tribal Development Plan (TDP), etc].

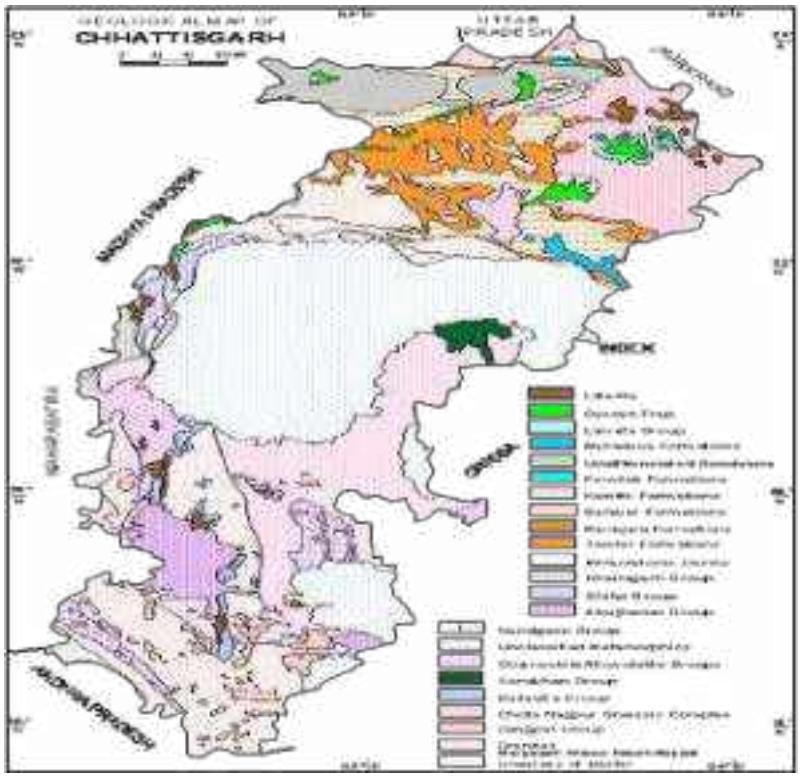
3. ENVIRONMENTAL AND SOCIAL PROFILE OF PROJECT AREA

Baseline environmental and study was conducted to understand the present status of the environmental resources in the project area. The environment status of project area was based on field survey and secondary data review. Environmental impact assessment involved prediction of potential impacts by the development of the project on the surrounding area. Based on baseline environmental status and proposed project activities potential impacts have been assessed and predicted and appropriate mitigation measures are suggested to avoid / reduce/ compensate the potential adverse impacts and enhance the positive impacts.

3.1 TOPOGRAPHY, PHYSIOGRAPHY AND GEOLOGY

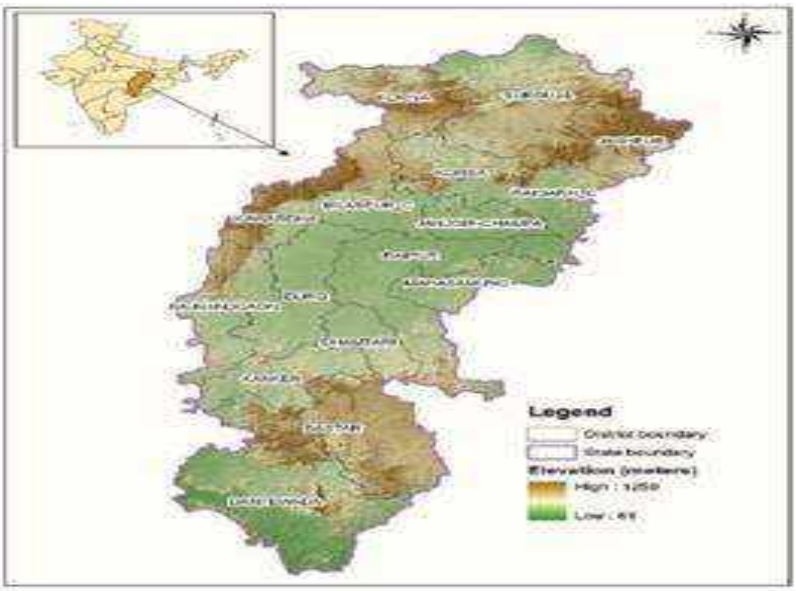
Based on regional topography Chhattisgarh region is divided into three regions, the Northern Hills, the Central Plains and the Bastar Plateau. The central Chhattisgarh basin is characterised by two major landform types, the gently sloping Chhattisgarh Plain and the undulating land. The elevation of the plain ranges from about 250 m on the eastern margin to about 330 m in the west. The gentle gradient of the Chhattisgarh Plain is largely due to its geological structure with flat to gently dipping Cuddapah sedimentary formations. The geological structure of Chhattisgarh state mainly consists of Achaean and Cudappah rocks but Dharwad, Gondwana, Deccan Trap and old Alluvial Laterite rock systems are also found in some pockets of the State. Geological and elevation maps of Chhattisgarh State are given in Map 1 and Map 2, respectively.

The Rajanadgaon District can be divided into three district parts, plateau, Hilly terrain and undulating plain. Most of the north western and southern hilly track of the district measuring 3,892 Sq.km is occupied by protected and reserved forests. Nearly 73% of area falls under Mahanadi river basin, 21% under Godavari basin and 6% area in the northern part of the district falls under Narmada basin.



Map 1: Geological Map of Chhattisgarh

Source: Mines Department, Government of Chhattisgarh



Map 2: Elevation Map of Chhattisgarh

Source: Water Policy for Drought Proofing Chhattisgarh, S. Gupta, Institute for Human Development, 2002

Soil of various types found in the area can be broadly be placed under three groups (i) deep black soil (ii) yellow soil and (iii) red lateritic soil.

3.2 SEISMICITY

Chhattisgarh has very low rates of seismic activity. In recent years, tremors from earthquakes in neighbouring states have been felt, most notably in 1969. The Bureau of Indian Standards (BIS) updated he seismic hazard map of India in 20003. The main change was merging of Zones I & II. As per this updating, the entire Chhattisgarh state falls in Zone II as shown in Map 3. It reveals that the project region falls in Zones II low to moderate risk zone.

Map 3: Seismic Zone Map

Source: IS 1893 (Part 1) 2002

3.3 RAINFALL

Rainfall data was collected for Raipur IMD station, which is the nearest IMD station in the project area. On an average, 1289 mm of rainfall is received annually mainly from south-east monsoon in the project area (**Table 3-1**). The graphical presentation and rainy days in the project road area is presented in **Figure 3-1** & **Figure 3-2** respectively. The region is classified as heavy rainfall area. Normally rains start in June and continue up to October. Nearly 94.5 % of annual rainfall is received during June to October months. About 2.3% of the normal rainfall is received during the winter season. On an average, there are about 62.3 rainy days in a year.

Table 3-1: Rainfall in the Project Area

Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
6.7	12.3	24.6	15.7	18.8	189.8	381.0	344.7	230.2	53.9	7.4	3.7	1288.8
(0.8)	(1.0)	(1.7)	(1.6)	(1.9)	(9.3)	(16.0)	(15.7)	(9.7)	(3.6)	(0.6)	(0.4)	(62.3)

Note: Values given in parentheses are no. of rainy days

Source: IMD Station Raipur, (1951 to 1980)

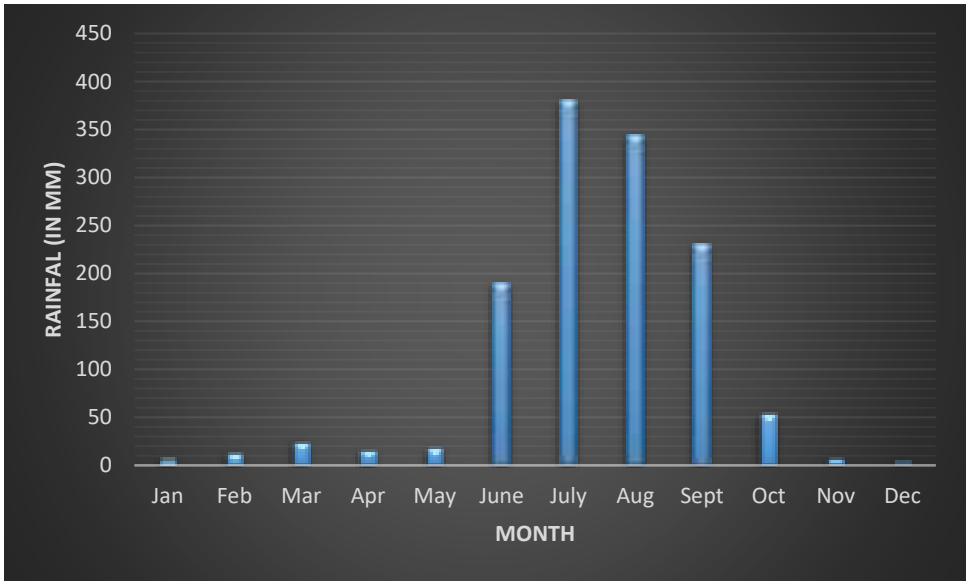


Figure 3-1 Graphical Presentation of Rainfall in the Project Area

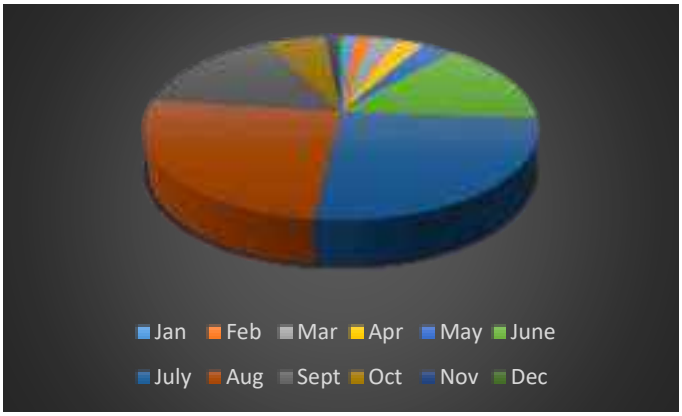


Figure 3-2 Graphical Presentation of Rainy Days in the Project Area

3.4 GROUND WATER HYDROLOGY

Ground water is the dominant water source in the area. The sources of recharging of ground water are mostly from precipitation (rainfall) and partly from flowing water bodies and ponds. Hand pumps are commonly used to draw the water from ground in the villages. Static water levels vary along the stretch of project area. First or upper ground water aquifer lies in the range of 5 to 15 m below ground level (bgl). The ground water level in the area show a decline of 1.2 m to 1.5 m from post monsoon to pre monsoon period.

3.5 CLIMATOLOGY

The climate of the project area is characterized by intensely hot dry summer and well distributed rainfall, in south-west monsoon season and winter. Generally, the project area experiences the following four seasons in a year:

- The summer season (also known as pre-monsoon season) starts around Holi festival in March but the mercury rises to the peak in May and first week of June with the mean daily maximum temperature at about 40°C, and the mean daily minimum at about 26°C.
- The rainy season starts around mid-June and continues up to September.
- The winter season starts around the last week of November and continues up to February.
- The intervening period October and November, is the Post-monsoon season or retreating monsoon period.

a) Temperature and Relative Humidity

The mean daily maximum temperature varies from 27.3°C to 42.0°C, while the mean daily minimum temperature varies from 13.2°C to 28.3°C. Data collected from IMD indicates that May is hottest month.

Relative humidity is highest during July to September months (85 to 87% at 8:30 hr and 76 to 78% at 17:30 hr) and lowest during April and May months (39% at 8:30 hr and 23% at 17:30 hr).

b) Wind Pattern

Wind pattern in the area is given in **Table 3-2**. the prevailing winds are blown from SW – W sector towards NE – E sector during morning and evening hours from March to September.

During February to October months, wind blow from NE and E direction to SW and W direction. Calm period is low and observed for 6 to 57% of the time.

Table 3-2 Wind Pattern

Sl. No.	Months		N	NE	E	SE	S	SW	W	NW	Calm
1	January	I	21	22	8	4	6	3	2	3	31
		II	22	11	5	2	4	7	6	5	38
2	February	I	20	18	7	5	9	7	3	6	25
		II	20	8	3	2	5	11	14	12	25
3	March	I	16	15	6	5	10	13	10	7	18
		II	16	7	4	2	5	15	19	14	28
4	April	I	7	6	4	4	11	25	21	9	13
		II	9	5	3	3	7	16	26	16	15
5	May	I	9	4	4	3	11	25	24	14	6
		II	13	6	3	4	7	13	22	23	9
6	June	I	3	2	1	2	7	36	34	9	6
		II	9	3	3	4	10	25	27	14	5
7	July	I	1	1	2	1	8	43	33	4	7
		II	3	2	3	2	10	33	34	7	6
8	August	I	2	2	2	2	9	37	35	6	5
		II	2	3	3	2	6	31	36	8	9
9	September	I	8	7	5	3	8	20	23	10	16
		II	11	10	6	4	6	19	19	10	15
10	October	I	17	22	10	5	7	6	4	5	14
		II	13	26	14	6	4	4	3	3	27
11	November	I	26	27	9	3	3	2	2	1	27
		II	17	24	7	3	2	1	1	2	43
12	December	I	20	22	7	5	5	1	0	2	38
		II	17	15	4	2	1	1	1	2	57

All values are percentage of the total time.

Source: IMD Station Raipur (1951 to 1980)

Note: I and II indicate observations at morning (8.30 hrs) and evening hours (17.30 hrs), respectively.

3.6 BIOLOGICAL ENVIRONMENT

Biodiversity encompasses the variety of all life on earth. India is one of the 12-mega diverse countries of the world. The diversity of physical features and climatic conditions in India has

resulted in diverse ecological habitats like forests, grasslands, wetlands, coastal and marine ecosystems and desert ecosystems which harbors and sustain massive components of biodiversity.

Chhattisgarh is gifted with the most pristine and abundant set of natural resources in the country. Mountain, Plateau, and Plains eco-systems constitute roughly a third each of its physiography. Dense, green, and untouched, its forests are also the source of major rivers like Mahanadi, Narmada, Indrāvati, and an exotic flora-fauna.

FLORA

The floral species found in around the Project area are reported below:

Table 3-3 Flora Species

Sl.	Botanical Name	Vernacular Name	Occurrence
I.	**Trees**		
1.	*Acacia nilotica*	Babool	Very Frequent
2.	*Acacia leucophloea*	Reunjha	Frequent
3.	*Acacia catechu*	Khair	Frequent
4.	*Aegle marsupium*	Bel	Occasionally
5.	*Azadirachta indica*	Neem	Very Frequent
6.	*Albizzia procera*	Safed sirish	Very Frequent
7.	*Albizzia lebbeck*	Kala sirish	Very Frequent
8.	*Ailanthus excelsa*	Maharukh	Very Frequent
9.	*Butea monosperma*	Palash	Occasionally
10.	*Cassia fistula*	Amaltas	Frequent
11.	*Careya arborea*	Kumbhi	Occasionally
12.	*Diospyros melanoxylon*	Tendu	Abundant
13.	*Emblica officinalis*	Amla	Occasionally
14.	*Eucalyptus sp*	Nilgiri	Frequent
15.	*Ficus glomerata*	Gular	Frequent
16.	*Lagerstroemia parviflora*	Senha	Frequent
17.	*Leucaena leucocephala*	Subabul	Abundant
14.	*Mangifera indica*	Aam	Frequent
15.	*Madhuca indica*	Mahua	Occasionally
16.	*Shorea robusta*	Sal	Occasionally
17.	*Syzygium cumini*	Jamun	Frequent
18.	*Terminalia arjuna*	Arjun	Abundant
19.	*Terminalia tomentosa*	Saja	Frequent
20.	*Tamarindus indica*	Imli	Occasionally
21.	*Tactona grandis*	Sagun	Occasionally
22.	*Zyziphus jujuba*	Ber	Abundant

II.	Herbs and Shrubs		
23.	*Achyranthes aspera*	Apmarga	Very Frequent
24.	*Asparagus racemosus*	Satavari	Occasionally
25.	*Argemone mexicana*	Satyanashi	Abundant
26.	*Abrus precatorius*	Gunja	Abundant
27.	*Careya herbacea*	Chhoti kumbhi	Occasionally
28.	*Calotropis procera*	Ark	Frequent
29.	*Datura metel*	Dhatura	Occasionally
30.	*Ipomoea batata,*	Besharam	Occasionally
31.	*Lantana camara,*	Raimunia	Frequent
32.	*Sida acuta*	Baraira/Bala	Occasionally
33.	*Solanum surattense*	Mokoi	Occasionally
34.	*Urena lobata*	Lotloti	Occasionally

FAUNA

The faunal species found in around the Project area are reported below:

Table 3-4 Fauna Species

MAMMALS		
Latin name	**Common name**	**WPA Schedule**
Bandicota indica	Large bandicoot Rat	V
Funambulus palmarum	Three striped squirrel	IV
Herpestes edwardsi	Indian grey mongoose	IV
Lepus nigricollis	Indian hare	IV
Mus booduga	Common Indian field mouse	V
Mus musculus	Home Mouse	V
Nosokia indica	Bandicoot rat	V
Rattus rattus	Common Indian rat	V
Suncus murinus	House shrew	V
AMPHIBIANS		
Bufo melanostictus	Common toad	IV
Fejervarya limnocharis	Rice field frog	IV
Hoplobatrachus tigerinus	Indian Bull frog	IV
Rana cyanophlyctis	Skipper frog	IV
Hyla arborea	Tree frog	IV
Polypedates maculatus	Common tree frog	IV
REPTILES		
Bungarus caeruleus	Common Indian Krait	IV
Chameleo zeylanicus	Chameleon	IV
Chrysopelea taprobanica	Tree Snake	IV
Calotes versicolor	Garden lizard	IV
Dryphis nasutus	Whip Snake	IV
Eutropis carinata	Indain grass Skink	IV

Eutropis multifasciata	Common skink	IV
Hemidactylus flaviviridis	Indian wall lizard	IV
Ptyas mucosa	Dhaman / Indian Rat snake	IV
Typhlops diardii	Giant Blind Snake	IV
BIRDS		
Acridotheris tristis	Common myna	IV
Actitis hypoleucos	Common Sandpiper	IV
Aegithinia tiphia	Common Iora	IV
Artamus fuscus	Ashy Woodswallow	IV
Bubulcus ibis	Cattle Egret	IV
Caprimulgus affinis	Savanna Nightjar	IV
Chalcophaps indica	Emerald Dove	IV
Charadrius dubius	Little Ringed Plover	IV
Charadrius hiaticula	Common Ringed Plover	IV
Columba livia	Blue rock pigeon	IV
Coracias benghalensis	Indian roller	IV
Latin name	**Common name**	**WPA Schedule**
Corvus splendens	House crow	V
Coturnix coturnix	Common Quail	IV
Cuculus canorus	Common Cuckoo	IV
Cuculus micropterus	Indian Cuckoo	IV
Cypsiurus balasiensis	Asian Palm Swift	IV
Dendrocitta vagabunda	Indian tree pie	IV
Dendrocopus marhatensis	Maratha Woodpecker	IV
Egretta garzetta	Little egret	IV
Elanus caeruleus	Black-winged Kite	IV
Eudynamys scolopaceus	Common Koel	IV
Falco tinnunculus	Common Kestrel	IV
Halcyon pileata	Black-capped Kingfisher	IV
Halcyon smyrnensis	White-Breasted King fisher	IV
Haliastur indus	Brahminy Kite	IV
Hierococcyx varius	Common Hawk Cuckoo	IV
Himantopus himantopus	Black-winged Stilt	IV
Hydrophasianus chirurgus	Pheasant-tailed Jacana	IV
Ictinaetus malaiensis	Black Eagle	IV
Lalage melanoptera	Black-headed Cuckoo	IV
Lanius cristatus	Brown Shrike	IV
Merops orientalis	Little Green Bee Eater	IV
Microcarbo niger	Little Cormorant	IV
Milvus migrans	Common Black kite	IV
Motacilla alba	White wagtail	IV
Passer domesticus	House sparrow	IV
Perdicula asiatica	Bush quail	IV
Pericrocotus cinnamomeus	Small Minivet	IV

Pericrocotus roseus	Rosy Minivet	IV
Psilopogon haemacephalus	Coppersmith Barbet	IV
Psittacula cyanocephala	Blossom headed Parakeet	IV
Pycnonotus cafer	Red-vented bulbul	IV
Rhipidura albicollis	White-throated Fantail	IV
Saxicolodies fulicata	Indian robin	IV
Streptopelia capicola	Ring-necked dove	IV
Streptopelia chinensis	Spotted dove	IV
Streptopelia tranquebarica	Red Collared Dove	IV
Streptopelia tranquebarica	Spotted-necked Dove	IV
Sturnus contra	Pied myna	IV
Butterflies		
Precis lemonias lemonias	Lemon pansy	IV
Precis hierta hierta	Yellow Pansy	IV
Latin name	**Common name**	**WPA Schedule**
Tros aristolochiae	Common rose	IV
Euploea corecor	Common Crow	IV
Dananus aglea	Glassy Blue Tiger	IV
Precis orithya	Blue pansy	IV
Neptis hylas	Common sailor	IV
Papilio demoleus	Lime butterfly	IV
Catopsilia crocale	Common emigrant	IV
Other insects		
Anax imperator	Emperor Dragonfly	Not listed
Tettigonia viridissima	Common Grasshopper	Not listed
Hieroglyphus banian	Rice grasshopper	Not listed
Pecilocerus pictus.	Common painted	Not listed
Nephotettix apicalis	Paddy Jassids	Not listed
Hyblea purea	Skeletonizer or Teak	Not listed
Spodoptera mauritia	Swarming caterpillar	Not listed
Rhopalosiphum maidis	Aphids	Not listed

It is also evident from the lists that there were no endemic or endangered species of flora and fauna around the Project site.

3.7 FOREST AREA AND LAND USE

Chhattisgarh was carved out of Madhya Pradesh in the year 2000. It covers an area of 1,35,192 sq km, which is 4.11% of the geographical area of the country. The State is bordered by the Madhya Pradesh in the northwest, Uttar Pradesh in the north, Jharkhand in the northeast, Maharashtra in the southwest, Telangana in the south and Odisha in the southeast. The State falls under East Deccan physiographic zone and can be divided into three agro-climatic zones,

viz. the Chhattisgarh Plains, the Northern Hills of Chhattisgarh and the Bastar Plateau. The land use pattern of State of Chhattisgarh is presented below:

Table 3-5 Land Use Pattern – State of Chhattisgarh

Land Use Type	Area (in 000' ha)	Percentage
Geographical Area	13519	
Reporting area for land utilization	13790	100
Forests	6316	45.80
Not available for land cultivation	1029	7.47
Permanent pastures and other grazing lands	887	6.43
Land under misc. tree crops and groves	1	0.01
Culturable wasteland	351	2.54
Fallow land other than current fallows	258	1.87
Current fallows	267	1.94
Net area sown	4681	33.94

Source: Land Use Statistics, Ministry of Agriculture, GoI, (2014-15)

As per the Champion & Seth Classification of Forest Types (1968), the forests in Chhattisgarh belong to two Type Groups i.e Tropical Moist Deciduous Forests and Tropical Dry Deciduous Forests which are further divided into 12 Forest Types. The State's two main tree species are Sal (Shorea robusta) and Teak (Tectona grandis). Other major species are Bija (Pterocarpus marsupium), Saja (Terminalia tomentosa), Dhavdha (Anogeissus latifolia), Mahua (Madhuca indica), Tendu (Diospyros melanoxylon) and bamboo (Dendrocalamus strictus) etc.

District wise forest cover of Chhattisgarh is presented below.

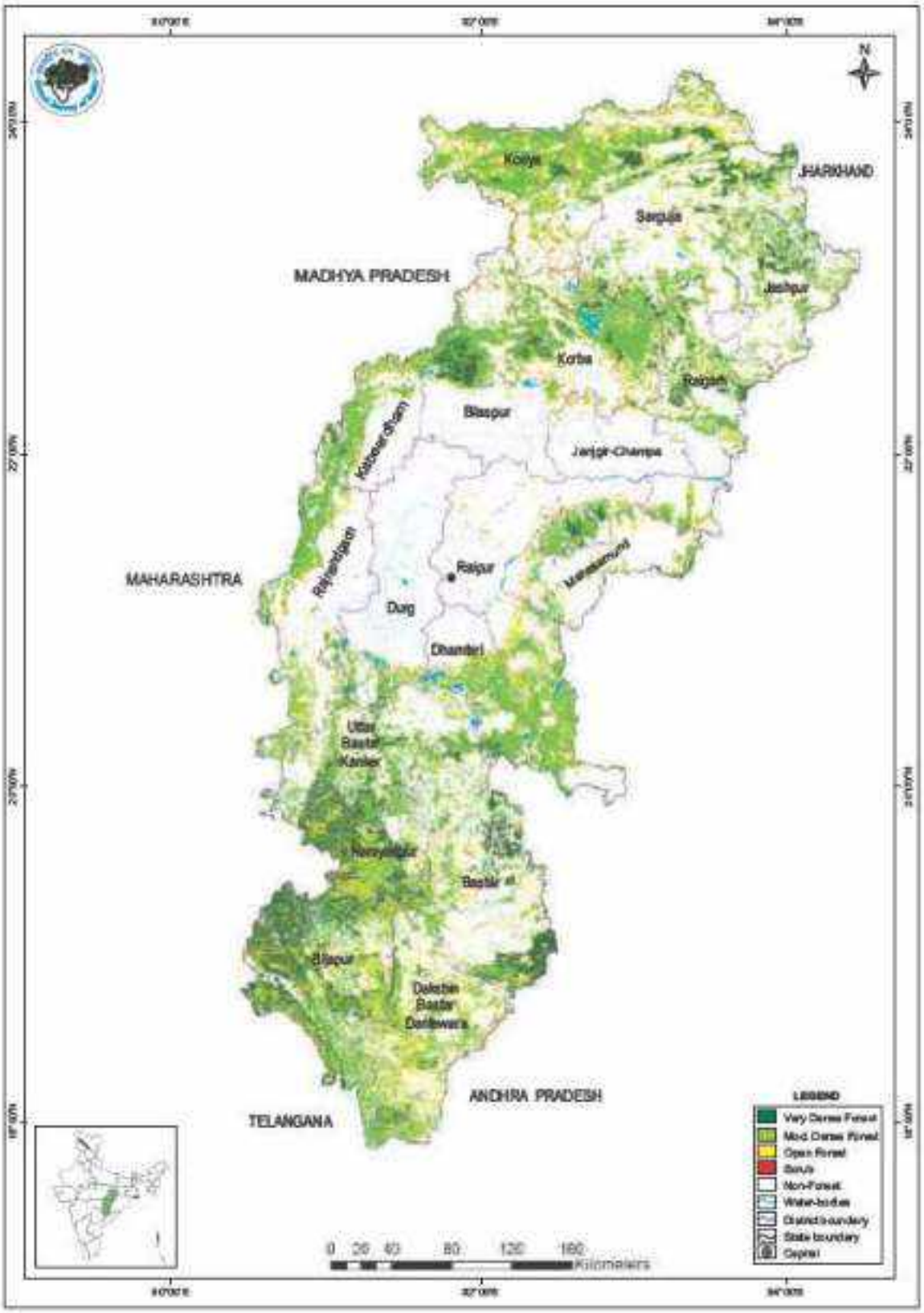
Table 3-6 District wise Forest Cover in Chhattisgarh

District	Geographical Area (GA)	Very Dense Forest	Mod. Dense Forest	Open Forest	Total	% of of GA	Scrub
Bastar	10,470	954.84	2,117.50	1,160.52	4,232.86	40.43	34.87
Bijapur	8,530	2,048.29	2,926.49	1,537.37	6,512.15	76.34	1.98
Bilaspur	8,272	395	1,539.19	522.7	2,456.89	29.7	48.3
Dakshin Bastar Dantewada	8,298	250.63	2,305.07	1,907.45	4,463.15	53.79	26.34

Dhamtari	4,084	49	1,385.52	424.6	1,859.12	45.52	8.91
Durg	8,535	44	512.04	220.35	776.39	9.1	20.48
Janjgir-Champa	3,853	2	22.13	125.76	149.89	3.89	13.98
Jashpur	5,838	225.36	1,316.71	573.7	2,115.77	36.24	21
Kabeerdham	4,235	79.09	1,083.84	385.79	1,548.72	36.57	12.75
Korba	6,598	203	2,313.62	877.08	3,393.70	51.44	92.03
Koriya	6,604	78.53	2,579.90	1,438.18	4,096.61	62.03	66.69
Mahasamumd	4,790	4	515.22	425.75	944.97	19.73	27.38
Naraynpur	4,653	1,127.55	1,690.63	978.12	3,796.30	81.59	19.22
RaigarhT	7,086	237.96	1,591.03	791.34	2,620.33	36.98	25.18
Raipur	12,383	141.83	2,413.04	1,075.05	3,629.92	29.31	54.43
Rajnandgaon	8,070	31	1,749.51	754.67	2,535.18	31.41	50.13
Surguja	15,732	706.72	3,930.64	2,445.25	7,082.61	45.02	77.86
Uttar Bastar Kanker	7,161	488.92	2,205.48	701.61	3,396.01	47.42	7.99
Grand Total	**1,35,192**	**7,067.72**	**32,197.56**	**16,345.29**	**55,610.57**	**41.14**	**609.52**

Source: India State of Forest Report, 2019

Forest cover map of Chhattisgarh is placed below.

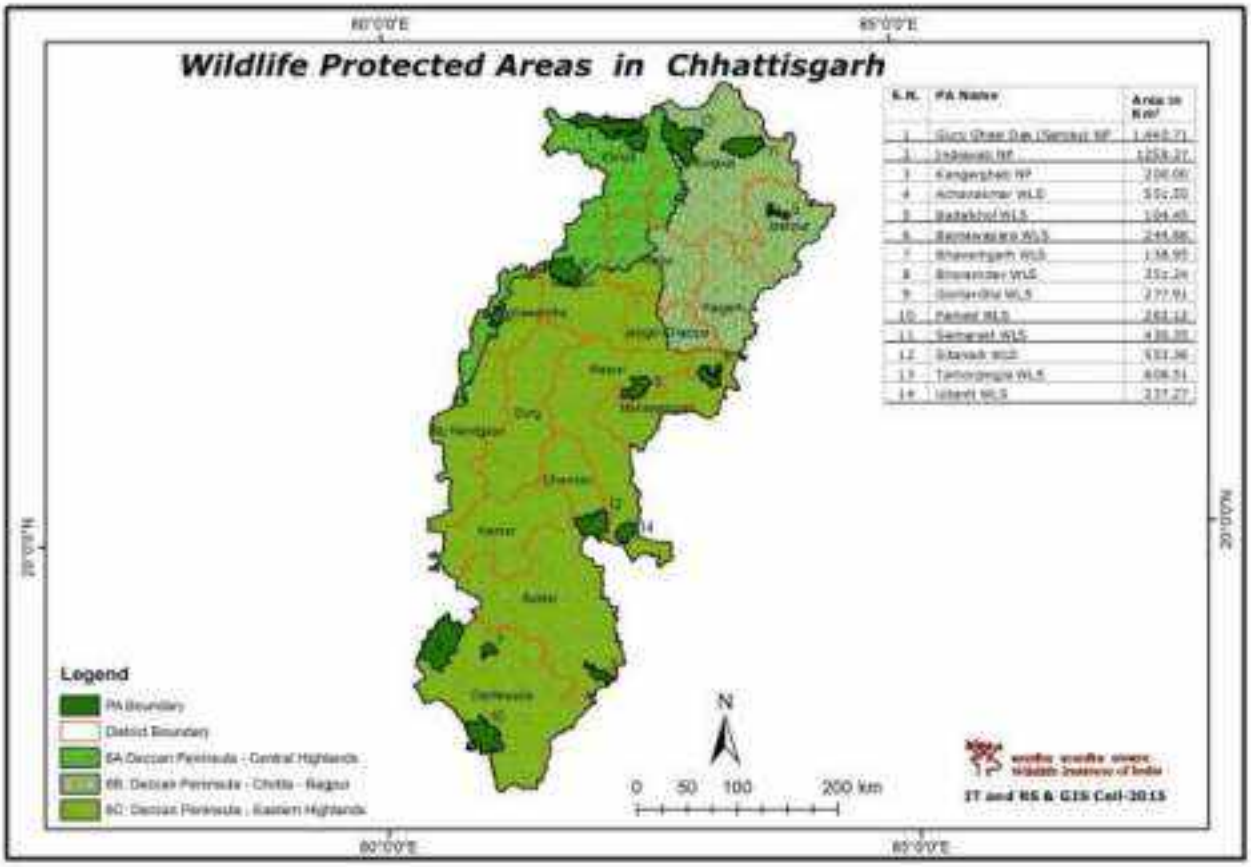


Map 5: Forest Cover Map of Chhattisgarh

Source: India State of Forest Report, 2019

3.8 ECOLOGICAL SENSITIVE AREAS

As per Protected Area Gazette Notification Database, there are 03 National Parks and 11 Wildlife Sanctuary located in the State of Chhattisgarh.



Map 6: Wildlife Protected Areas in Chhattisgarh

Out of the above 14, no protected area is situated in the Rajnandgaon district. Further, there are 03 tiger reserves, 02 elephant reserve and 04 important bird areas in Chhattisgarh, however, all are located outside the Rajnandgaon district.

3.9 SOCIO-CULTURAL ENVIRONMENT

Rajnandgaon district is situated in the western part of newly created Chhattisgarh state, the district lies between latitude 20°70"- 22°29" North latitude and 80°23" to 81°29" East longitude covering an area of 8172.33 sq.kms. Its greatest length in the north-south is about 185 kms, while its width in the east-west extends about 80 kms. It is surrounded by Kawardha district in north, Durg district in the east; Bastar district is the in south and Garchiroli, Bhandara (Maharashtra) and Balaghat (Madhya Pradesh) districts in the west. The District headquarter Rajnandgaon is on the Mumbai - Howrah line of south-eastern railways. The National Highway

no. 6 (Great Eastern Road) (AH 46) also passes through the town of Rajnandgaon. The nearest airport to the District is at Mana (Raipur), about 80 kms away. All-important places within the district are well connected by a network of the state highways and all-weather roads. The district is divided into 8 tehsils and 9 blocks for its administrative functioning and revenue collections. It is further divided in 1 Nagar Palik Nigam, 2 Nagar Palika , 5 Nagar Panchayat , 9 Janpad Panchayat , 692 Gram Panchayat. Rajnandgaon town (N 21°5' E 81°2') is the district Headquarters. Profile of the District Rajnandgaon as per Census – 2011 is present below:

District Profile - Rajnandgaon			
Number of Villages	Total		1,653
	Inhabited		1,600
	Uninhabited		53
Number of Towns	Statutory		8
	Census		-
	Total		8
Number of Households	Normal		317,515
	Institutional		587
	Houseless		386
Population	Total	Persons	1,537,133
		Males	762,855
		Females	774,278
	Rural	Persons	1,264,621
		Males	626,212
		Females	638,409
	Urban	Persons	272,512
		Males	136,643
		Females	135,869
Sex Ratio (Number of females per 1000 males)		Total	1,015
		Rural	1,019
		Urban	994
Literates (in percentage)	Persons		75.96
	Males		85.4
	Females		66.7
Scheduled Castes	Persons		156,623
	Males		76,979
	Females		79,644
Scheduled Tribes	Persons		405,194
	Males		198,032
	Females		207,162
Workers and Non-Workers			
Total Workers (Main and Marginal)	Persons		800,092

	Males		436,611
	Females		363,481
(i) Main Workers	Persons		595,959
	Males		358,946
	Females		237,013
(ii) Marginal Workers	Persons		204,133
	Males		77,665
	Females		126,468
Non-Workers	Persons		737,041
	Males		326,244
	Females		410,797
Category of Workers (Main & marginal)			
(i) Cultivators	Persons		342,116
	Males		182,739
	Females		159,405
(ii)Agricultural Labourers	Persons		290,108
	Males		125,229
	Females		164,879
(iii)Workers in household industry	Persons		10,847
	Males		6,403
	Females		4,444
(iv) Other Workers	Persons		157,021
	Males		122,240
	Females		34,781
Source of household lighting (% of household)	Electricity		87.31
	Kerosene		11.89
	Solar		0.35
	Other Oil		0.16
	Any Other		0.07
	No Lighthing		0.21
Main Source of Drinking Water (in %)	Tapwater from treated source		14.3
	Tapwater from un-treated source		8.76
	Covered well		0.78
	Un-covered well		8.35
	Handpump		62.99
	Tubewell/Borehole		4.35
	Spring		0.08
	River/ Canal		0.13
	Tank/ Pond/Lake		0.03
	Other sources		0.23
Percentage Distribution of Household living in Pemanent, Semi-Permanent and Temporary Houses	Total	Permanent	26.23
		Semi-Permanent	67.65
		Temporary	5.93

	Rural	Permanent		17.54
		Semi-Permanent		76.24
		Temporary		6.1
	Urban	Permanent		64.28
		Semi-Permanent		30
		Temporary		5.18
Type of Latrine Facility (% of Household)	Total	Flush / Pour latrine	Piped Sewer System	0.96
			Septic Tank	14.43
			Other System	3.25
		Pit Latrin	With slab/Ventilated improved pit	3.21
			Without slab/open pit	3.01
		Night soil disposed into open drain		0.06
		Service Latrine	Night soil removed by human	0
			Night soil removed by animal	0.06
		No Latrin within premises	Public Latrine	1.63
			Open	73.39
	Rural	Flush / Pour latrine	Piped Sewer System	0.57
			Septic Tank	6.87
			Other System	3.73
		Pit Latrin	With slab/Ventilated improved pit	3.68
			Without slab/open pit	3.6
		Night soil disposed into open drain		0.02
		Service Latrine	Night soil removed by human	0
			Night soil removed by animal	0.06
		No Latrin within premises	Public Latrine	0.18
			Open	81.28
	Urban	Flush / Pour latrine	Piped Sewer System	2.69
			Septic Tank	47.56
			Other System	1.18
		Pit Latrin	With slab/Ventilated improved pit	1.13
			Without slab/open pit	0.4
		Night soil disposed into open drain		0.19
		Service Latrine	Night soil removed by human	0
			Night soil removed by animal	0.04

		No Latrin within premises	Public Latrine	7.99
			Open	38.82
Type of drainage connectivity for waste water outlet (% of household)	Total	Closed Drainage		3.56
		Open Drainage		19.21
		No Drainage		77.23
	Rural	Closed Drainage		2.36
		Open Drainage		9.48
		No Drainage		88.17
	Urban	Closed Drainage		8.81
		Open Drainage		61.88
		No Drainage		29.31
Avilabilty of Kitchen Facility (% of household)	Total	Cooking inside house	Has Kitchen	64.26
			Does not have kitchen	31.68
		Cooking outside house	Has Kitchen	1.53
			Does not have kitchen	2.35
		No cooking		0.19
	Rural	Cooking inside house	Has Kitchen	61.85
			Does not have kitchen	33.94
		Cooking outside house	Has Kitchen	1.61
			Does not have kitchen	2.47
		No cooking		0.14
	Urban	Cooking inside house	Has Kitchen	74.82
			Does not have kitchen	21.77
		Cooking outside house	Has Kitchen	1.19
			Does not have kitchen	1.85
		No cooking		0.39
Avilabilty of Fuel Used for Cooking (% of household)	Total	Firewood		88.4
		Crop Residue		0.51
		Cowdung Cake		0.86
		Coal/lignite/charcoal		0.92
		Kerosene		0.6
		LPG/PNG		8.39
		Electricity		0.05
		Bio-gas		0.05
		Any other		0.04
		No Cooking		0.19
	Rural	Firewood		96.68
		Crop Residue		0.49
		Cowdung Cake		0.95
		Coal/lignite/charcoal		0.19

		Kerosene	0.18
		LPG/PNG	1.23
		Electricity	0.05
		Bio-gas	0.05
		Any other	0.03
		No Cooking	0.14
	Urban	Firewood	52.14
		Crop Residue	0.57
		Cowdung Cake	0.44
		Coal/lignite/charcoal	4.13
		Kerosene	2.44
		LPG/PNG	39.78
		Electricity	0.03
		Bio-gas	0.04
		Any other	0.05
		No Cooking	0.39

3.10 LAND REQUIREMENT FOR THE PROJECT

The project is proposed to be developed on Revenue Waste Land allocated by State Government for the development of Solar Park. The overall land initially identified for the proposed project is around 405 hectares, after preliminary assessment by SECI based on the contour maps developed from Digital Elevation Map of the site suitable areas for the project has been identified marked and has been mentioned in the below table. SECI has also carried out the topography survey for the said land parcels. The location of different plots are identified and same was marked in Google Maps and shown in Figure 3-2(a) and (b).

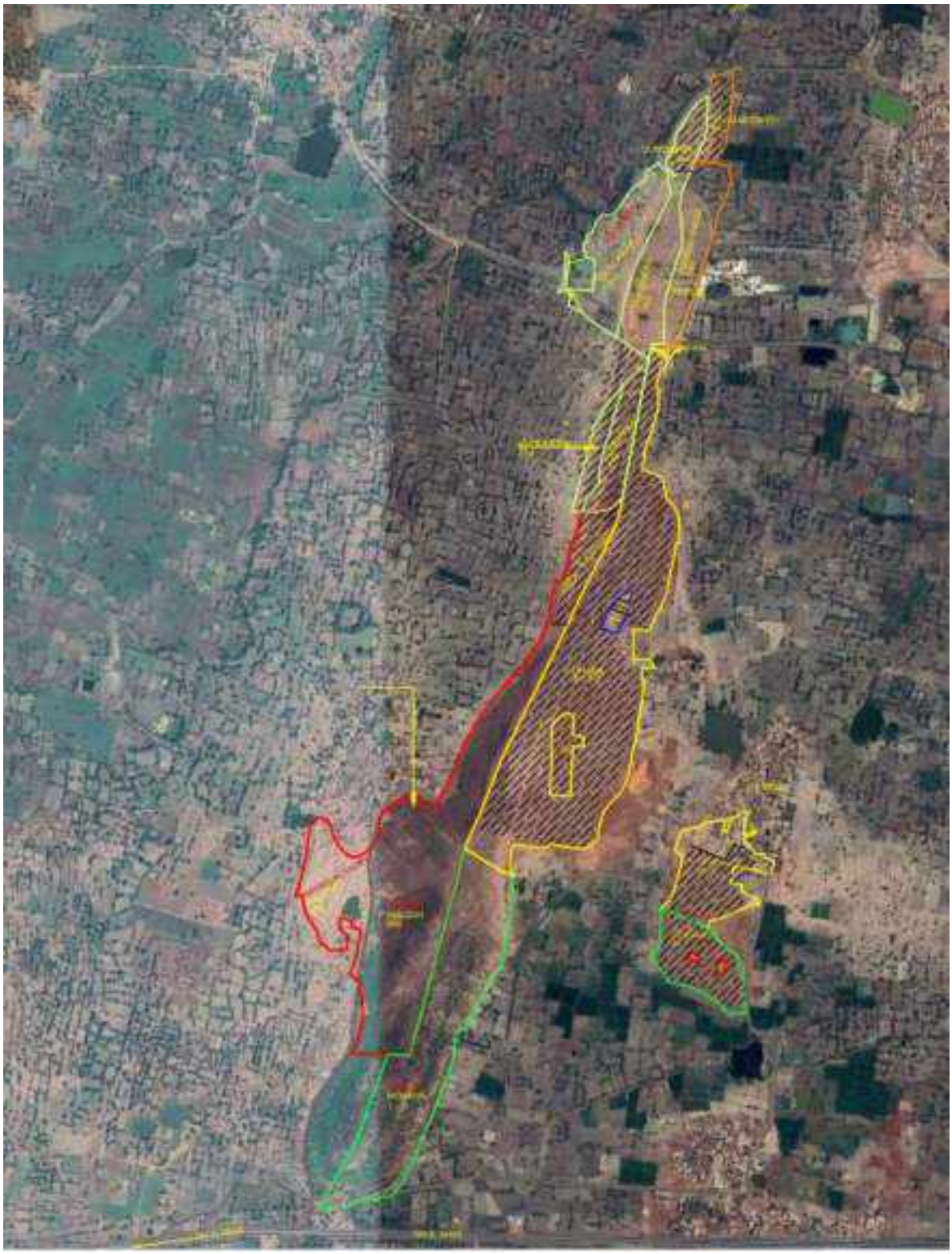


FIGURE 0-2(A): INDICATIVE LAYOUT OF THE SITE SUPERIMPOSED ON VILLAGE MAP

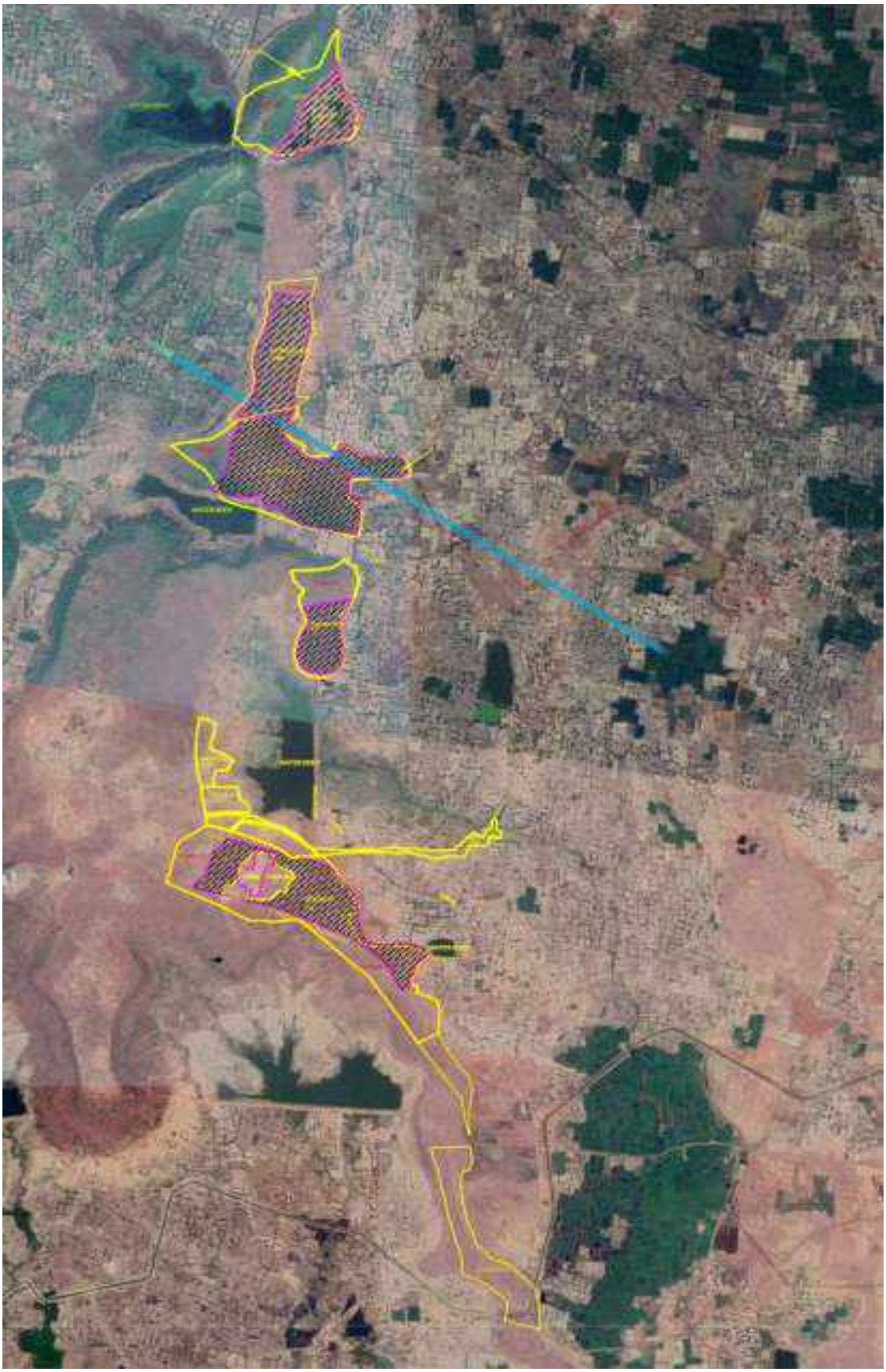


FIGURE 0-2(B): INDICATIVE LAYOUT OF THE SITE SUPERIMPOSED ON VILLAGE MAP

The entire 378 ha of land that has been transferred to the project is government land as shown in the maps above. The project however will require 200 ha. SECI is in process of conducting the topography survey. After the conclusion of the topographic survey, SECI will finalize the tentative project boundary, wherein, due care shall be taken to avoid tree cutting, acquisition of private land, gothan area, any damage to property of cultural importance, community building, schools etc.

The proposed project falls under the villages listed in Table 13-6. It is also proposed to construct a transmission line of length 33 km approx. the exact route shall be determined at later stage by conducting a detailed route survey analysis.

Table 3-7 List of Project Affected Villages

S.NO	VILLAGE NAME	TEHSIL	AREA AS PER RECORD (P-II) (Ha)
I	RENGAKATHERA	Dongargarh	3.22
		Dongargarh	6.13
SUB- TOTAL (I)			**9.35**
II	DUNDHERA	Dongargarh	9.22
		Dongargarh	10.78
		Dongargarh	2.25
		Dongargarh	2.55
		Dongargarh	5.99
SUB- TOTAL (II)			**30.79**
III	AMLIDEEH	Dongargarh	40.56
SUB- TOTAL (III)			**40.56**
IV	DHABA	Dongargaon	0.24
		Dongargaon	39.7
		Dongargaon	10.93
		Dongargaon	2.58
		Dongargaon	9.59
SUB- TOTAL (IV)			**63.04**
V	KOHKHA	Dongargaon	36.3
		Dongargaon	7.8
		Dongargaon	0.41
SUB- TOTAL (V)			**44.5**
VI	ODARBANDH	Dongargaon	30.44
		Dongargaon	22.89
SUB- TOTAL (VI)			**53.34**
VII	TOLAGAON	Dongargaon	51.09
		Dongargaon	

SUB- TOTAL (VII)			**51.09**
VIII	MARGAON	Dongargaon	19.67
		Dongargaon	6.62
		Dongargaon	4.05
		Dongargaon	2.33
		Dongargaon	4.87
		Dongargaon	2.7
SUB- TOTAL (VIII)			**40.23**
IX	GIRGAON	Dongargaon	52.88
SUB- TOTAL (IX)			**52.88**
X	GUGHWA	Dongargaon	19.24
		Dongargaon	
SUB- TOTAL (X)			**19.24**
Grand Total (I+II+III+IV+V+VI+VII+VIII+IX+X)			**405.022**

3.11 DEMOGRAOHIC PROFILE OF AFFECTED VILLAGES

The details of the 10 Project Affected Villags, as per Census – 2011 data is presented below:

Tehsil		Dongargarh			Dongargaon						
Village		Renga kathera	Dundera	Amlidih	Dhaba	Kohkha	Odarbandh	Tolagaon	Margaon	Girgaon	Gughwa
Number of Households		356	370	212	276	283	83	113	332	167	97
Population	Total	1772	1917	1081	1,284	1,334	409	585	1,769	841	480
	Males	899	951	546	648	639	202	286	848	433	232
	Females	873	966	535	636	695	207	299	921	408	248
Literates	Total	1098	1162	690	879	926	277	434	1,112	616	309
	Males	649	661	396	500	492	155	227	614	342	163
	Females	449	501	294	379	434	122	207	498	274	146
Scheduled Castes	Total	88	100	90	88	212	5	145	338	11	83
	Males	50	54	45	36	102	3	78	165	6	36
	Females	38	46	45	52	110	2	67	173	5	47
Scheduled Tribes	Total	490	578	305	527	363	202	83	506	322	78
	Males	249	277	157	273	175	92	39	250	165	37
	Females	241	301	148	254	188	110	44	256	157	41
Workers and Non-Workers											
Total Workers (Main and Marginal)	Total	1093	1129	623	681	747	277	392	848	460	277
	Males	569	565	319	364	372	134	192	484	244	137
	Females	524	564	304	317	375	143	200	364	216	140
(i) Main Workers	Total	915	1042	579	277	318	229	330	802	278	89
	Males	476	537	296	184	173	113	166	464	240	70
	Females	439	505	283	93	145	116	164	338	38	19
Category of Workers (Main)											
(a) Cultivators	Total	219	753	401	60	294	46	160	483	208	54
	Males	164	373	201	55	157	18	78	276	192	44
	Females	55	380	200	5	137	28	82	207	16	10
	Total	508	240	155	7	14	162	152	264	36	24

(b) Agricultural Labourers	Males	147	132	79	2	7	82	76	136	18	20
	Females	361	108	76	5	7	80	76	128	18	4
(c) Workers in household industry	Total	-	3	-	7	-	4	-	-	1	2
	Males	-	1	-	4	-	2	-	-	1	2
	Females	-	2	-	3	-	2	-	-	-	-
(d) Other Workers	Total	188	46	23	203	10	17	18	55	33	9
	Males	165	31	16	123	9	11	12	52	29	4
	Females	23	15	7	80	1	6	6	3	4	5
(ii) Marginal Workers	Total	178	87	44	404	429	48	62	46	182	188
	Males	93	28	23	180	199	21	26	20	4	67
	Females	85	59	21	224	230	27	36	26	178	121
Category of Workers (Marginal)											
(a) Cultivators	Total	2	43	1	2	96	22	37	27	172	13
	Males	1	6	1	1	49	10	15	9	4	7
	Females	1	37	-	1	47	12	22	18	168	6
(b) Agricultural Labourers	Total	171	40	42	312	333	25	24	17	7	162
	Males	89	20	21	135	150	10	11	9	-	49
	Females	82	20	21	177	183	15	13	8	7	113
(c) Workers in household industry	Total	-	3	-	-	-	1	-	-	-	8
	Males	-	1	-	-	-	1	-	-	-	7
	Females	-	2	-	-	-	-	-	-	-	1
(d) Other Workers	Total	5	1	1	90	-	-	1	2	3	5
	Males	3	1	1	44	-	-	-	2	-	4
	Females	2	-	-	46	-	-	1	-	3	1
Non-Workers	Total	679	788	458	603	587	132	193	921	381	203
	Males	330	386	227	284	267	68	94	364	189	95
	Females	349	402	231	319	320	64	99	557	192	108

4. ENVIRONMENTAL AND SOCIAL SAFEGUARD DUE DILIGENCE

4.1 POLICY, LEGAL AND REGULATORY REQUIREMENTS

The policy, legal and regulatory requirements that are relevant to the environmental and social aspects of the proposed project shall comply with the policy, legal and regulatory requirements of the Government of India (GoI), respective State Governments and World Bank.

The policy, legal and regulatory requirements that are applicable to the environmental and social aspects of the investments implemented under the programme are as follows:

- Policy and Regulatory Framework of Government of India (GoI)
- Environmental Policy and Regulations of the respective State Governments
- Legislations applicable to construction activities
- Environmental and Social Management Framework of SECI (ESMF, June 2020)
- The World Bank Environmental and Social Safeguard Policy
- The World Bank Group General Environment, Health and Safety (EHS) Guidelines; and for Power Transmission and Distribution

4.2 KEY APPLICABLE LAWS AND REGULATIONS – ENVIRONMENTAL

The key environmental laws and regulations as relevant to the Renewable project is tabulated below.

Table 4-1 Key Applicable Laws and Regulations – Environmental

Act/ Rule/ Policy	Year	Objective	Project Applicability	Authority Responsible
Environmental (Protection) Act	1986	To protect and improve the overall environment	It is an Umbrella Act for all environmental legislations in the county.	MoEF&CC, SPCB
Environment Impact Assessment Notification (and subsequent amendments)	2006	To provide environmental clearance to developmental activities, to mitigate the impact of the project on the	Not Applicable	MoEF&CC, SEIAA (State Environment Impact Assessment Authority) SPCB.

Act/ Rule/ Policy	Year	Objective	Project Applicability	Authority Responsible
		surrounding environment.		
Indian Forest Act	1927	To protect Forest land from impacts of the project.	If RE Project and Transmission line pass through Forest Areas then it will attract the provision of Forest Conservation Act requiring Forest Clearance	State Forest Department / MoEFCC, Regional Office
The Forest (Conservation) Act The Forest (Conservation) Rules	1980 1981	To keep a check on the forested land and check on deforestation by restricting conversion of forest areas into non-forest areas.		State Forest Department and Regional Office of MoEFCC and Central Government depending upon the extent of forest acquisition
National Forest Policy (Revised)	1988	To maintain ecological stability through preservation and restoration of biological diversity	RE Projects where clearing of forest/ felling of trees is required.	Forest Department, GoI
Wildlife (Protection) Act	1972	Parliament of India enacted for protection of plants and animal species by protecting National Parks and Sanctuaries.	If RE project located inside the boundary of Wildlife Sanctuary or National Park, Wildlife reserves. If Project area under bio-reserves or National biodiversity reserves	National Board of Wildlife or Chief Wildlife Warden of State.
Biological Diversity Act	2002	An Act to provide for conservation of biological diversity, sustainable use of its components, and fair and equitable sharing of the benefits arising out of the use of biological resources, knowledge and for		MoEFCC, National Biodiversity Authority and State Biodiversity Boards

Act/ Rule/ Policy	Year	Objective	Project Applicability	Authority Responsible
		matters connected therewith or incidental thereto.		
Air (Prevention and Control of Pollution) Act	1981	To control air pollution by controlling discharge of pollutants as per the prescribed. Approval for Consent to Operate (CTO) and Consent to Establish (CTE).	CTE & CTO is not applicable to RE projects as per Chhattishgarh solar power policy. CTE & CTO will be applicable if the contractor establishes high capacity Batching Plant. Installation of DG sets also requires NOC Activities during construction phase should conform to the Air Act with respect emission standard.	SPCB
Water (Prevention and Control of Pollution) Act	1974	To control water pollution by controlling discharge of pollutants as per the prescribed norms. Approval for Consent to Operate (CTO) and Consent to Establish (CTE).	CTE & CTO is not applicable to RE projects. CTE & CTO will be applicable if the contractor establishes high capacity Batching Plant. Discharges of domestic wastewater from toilets Activities during construction phase should conform to the Water Act with respect to discharge standard.	SPCB

Act/ Rule/ Policy	Year	Objective	Project Applicability	Authority Responsible
Permission for abstraction of Ground water under Environmental (Protection) Act	1986	To protect unauthorized abstraction of Ground water.	If the RE project requires to abstract ground water at the time on construction and operation phase. No Objection Certificate (NOC) for ground water withdrawal will be required	Normally Central Ground Water Authority is the concerned authority. In case of Chhattisgarh the concerned authority for such permission is Chhattisgarh Ground Water Authority/ Commissioner of Rural Development Authority
Construction and Demolition Waste Rules	2016	For addressing the indiscriminate disposal of C & D Waste and enable channelization of the waste for reuse and recycling in gainful manner	Approval required from local authorities, if waste generation is >20 tons in a day or 300 tons per project in month	Local Authority and State Pollution Control Board
E-waste (Management and Handling) Rules	2016	To control/mitigate potential impacts due to e-waste handling & storage on the site.	Applicable for RE projects while using and repairing, storing of equipment. To obtain authorization From SPCB. Filing of return and maintenance of records in the forms given in the Rules	SPCB
Hazardous and Other Waste (Management and Trans-boundary Movement) Rules	2016	To control/mitigate potential impacts due to Hazardous-waste Import, Export, Handling, Storage and disposal.	Applicable to RE projects at the time of Construction (Prior to initiation of any work)	SPCB

Act/ Rule/ Policy	Year	Objective	Project Applicability	Authority Responsible
		Proper management of Hazardous Waste Storage facility.	At the time of operation phase hazardous waste will be generated in from of refuse of turbine oil, transformer oil and their tank bottom sludge. In addition disposal of PV cells also attract the provisions of rules Permission for storage of hazardous and other wastes will be required for handling hazardous wastes	
The Bio Medical Waste Management Rules	2016	To control storage, transportation and disposal of Bio Medical Waste.	Comply with the handling and disposal Requirements of the rules.	SPCB
Noise-Pollution (Regulation and control) Rules	2000	To control noise levels and maintain it to the standards prescribed for various areas like residential, commercial or silent zones by the Central Pollution Control Board (CPCB).	Noise abatement during construction time and compliance under the rules to maintain stipulated standards.	CPCB, SPCB
Ozone Depleting Substances (regulation and Control) Rules	2000	To control and reduce the use of Ozone depleting substances to protect the Ozone layer	Applicable to RE Projects where air conditioning units installed	Secretary, MoEFCC
Batteries (Management and Handling) Rules	2001	The Act defines the requirements for disposal of used batteries for bulk users. The	Applicable when batteries are used for storage of power.	SPCB

Act/ Rule/ Policy	Year	Objective	Project Applicability	Authority Responsible
		developers in sub-project would be likely bulk users.		
Electricity Act	2003	Laws relating to generation, transmission, distribution, trading and use of electricity, promotion of efficient and environmentally benign policies.	Applicable for RE and Transmission line projects. Where the national grid connectivity is being involved.	State Electricity Board, Power Grid State transmission and distribution companies
The Central Electricity Authority (Technical Standards for Connectivity to the Grid) Amendment Regulations	2013	Guidelines for Gird – Connectivity (Technical Standards) for RE projects Compensation payments for transmission (ROW)[1]	Applicable for RE and Transmission line projects. Where the national grid connectivity is being involved.	Ministry of Power, Central Electricity Authority (CEA),
Energy Conservation Act 2001	2001	Established under the National Mission for enhanced Energy Efficiency.	Not directly applicable for RE projects	BEE (Bureau of Energy Efficiency).
Ancient Monuments and Archaeological Sites and Remains Act	1958	Conservation of cultural and historical remains found in India.	For the project located within 300 m from such features.(first 100 meters as prohibited area followed by 200 meters to be regulated area)	Archaeological Dept. GOI, Indian Heritage Society and Indian National Trust for Art and Culture Heritage (INTACH).

[1] http://powermin.nic.in/sites/default/files/uploads/Guidelines_for_payment_of_compensation_towards_damages_in_regard.pdf -Guidelines for compensation

4.3 KEY APPLICABLE LAWS AND REGULATIONS – LAND AND SOCIAL

The key laws and regulations governing land and social issues and relevant to the Renewable project is tabulated below.

Table 4-2 Key Applicable Laws and Regulations – Land and Social

Act/ Rule/ Policy	Year	Objective	Project Applicability	Authority Responsible
73rd Constitution Amendment Act,	1992	The Act enables participation of Panchayat level institutions in decision-making. Panchayats at the village level will be involved for preparation and implementation of the project.	Applicable for any project located in panchayat area	Department of Panchayat Raj, State Government
Chhattisgarh Panchayats Act	1993	The act gives powers to the Panchayats in case there is any grievance arises by the project. There is Provision for application of consent from the respective panchayat body/village administrative officer etc., during the project life cycle.	SECI will ensure that all grievances raised by locals related to the project are addressed through grievance redressal process.	Department of Panchayat Raj, State Government
Right of way and compensation as per provision of Electricity Act, 2003 and Indian Telegraph Act, 1885.	2003	To ensure adequate compensation for loss of land under tower footings and restrictive use of land under ROW.	Transmission Line	Ministry of Power, Central Electricity Authority (CEA),
Guidelines issued by Ministry of Power for payment of compensation	Oct 2015	To determine compensation	Any sub project that also includes transmission line or	Corporation / Municipality /Local Body

Act/ Rule/ Policy	Year	Objective	Project Applicability	Authority Responsible
towards damages caused by tower and Right of Way for transmission lines.		tower base area impacted due to installation of tower / pylon structure; and compensation towards diminution of land value in the width of Right of Way (RoW) corridor due to laying of transmission line and imposing certain restrictions	as an associate project of solar park.	or the State Government.

4.4 OTHER LEGISLATIONS APPLICABLE TO CONSTRUCTION ACTIVITIES UNDER THE PROJECT

- Workmen's Compensation Act 1923 (the Act provides for compensation in case of injury by accident arising out of and during the course of employment);
- Payment of Gratuity Act, 1972 (gratuity is payable to an employee under the Act on satisfaction of certain conditions on separation if an employee has completed 5 years);
- Employees PF and Miscellaneous Provision Act 1952 (the Act provides for monthly contributions by the employer plus workers);
- Maternity Benefit Act, 1951 (the Act provides for leave and some other benefits to women employees in case of confinement or miscarriage, etc.);

- The Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redressal) Act, 2013 is introduced to prevent and provide redressal of complaints of sexual harassment.
- The Protection of Women from Domestic Violence Act, 2005 defines domestic violence, describes the powers and duties of protection officers, service providers and lists the procedures for obtain reliefs.
- Contract Labor (Regulation and Abolition) Act, 1970 (the Act provides for certain welfare measures to be provided by the contractor to contract labour);
- Minimum Wages Act, 1948 (the employer is supposed to pay not less than the Minimum Wages fixed by the Government as per provisions of the Act);
- Payment of Wages Act, 1936 (it lays down as to by what date the wages are to be paid, when it will be paid and what deductions can be made from the wages of the workers);
- Equal Remuneration Act, 1979 (the Act provides for payment of equal wages for work of equal nature to Male and Female workers and not for making discrimination against Female employees);
- Payment of Bonus Act, 1965 (the Act provides for payments of annual bonus subject to a minimum of 83.3% of wages and maximum of 20% of wages);
- Industrial Disputes Act, 1947 (the Act lays down the machinery and procedure for resolution of industrial disputes, in what situations a strike or lock-out becomes illegal and what are the requirements for laying off or retrenching the employees or closing down the establishment);
- Industrial Employment (Standing Orders) Act; 1946 (the Act provides for laying down rules governing the conditions of employment);
- Trade Unions Act, 1926 (the Act lays down the procedure for registration of trade unions of workers and employers. The trade unions registered under the Act have been given certain immunities from civil and criminal liabilities);
- Child Labour (Prohibition and Regulation) Act, 1986 (the Act prohibits employment of children below 14 years of age in certain occupations and processes and provides for

regulation of employment of children in all other occupations and processes. Employment of child labour is prohibited in Building and Construction Industry);

- Inter-State Migrant Workmen's (Regulation of Employment and Conditions of Service) Act, 1979 (the inter-state migrant workers, in an establishment to which this Act becomes applicable, are required to be provided certain facilities such as housing, medical aid, travelling expenses from home to the establishment and back, etc.);
- The Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 and the Cess Act of 1996 (all the establishments who carry on any building or other construction work and employs 10 or more workers are covered under this Act; the employer of the establishment is required to provide safety measures at the building or construction work and other welfare measures, such as canteens, first-aid facilities, ambulance, housing accommodation for Workers near the workplace, etc.);
- The Factories Act, 1948 (the Act lays down the procedure for approval of plans before setting up a factory, health and safety provisions, welfare provisions, working hours and rendering information-regarding accidents or dangerous occurrences to designated authorities);
- Hazardous Wastes (Management, Handling and Trans-boundary Movement) Rules, 2008 (the Rules govern handling, movement and disposal of hazardous waste);
- Manufacture, Storage and Import of Hazardous Chemicals Rules 1989, amended 1994 and 2000 (the Rules provide indicative criteria for hazardous chemicals and require occupiers to identify major accident hazards and prepare on-site and off-site emergency plans).
- All the laws and regulations set by different authorities (MoEF, NGRBA, CPCB, etc.) have been reviewed to understand the applicable laws in the context of this proposed sub-project in Kanpur District I. All the applicable laws enlist the responsible authority and reasons for its applicability. It is therefore proposed that during the implementation of this project responsible authorities should be contacted acted by the implementing agency for monitoring the law and regulation.

4.5 APPLICABLE WORLD BANK POLICIES

As the Project is seeking financing from the World Bank and therefore the Bank's Operational Policies pertains to environmental and social safeguards are also applicable to this Project. The

Operational Policies of World Bank that are applicable to the project under Namami Gange programme are as follows:

TABLE 4-3: APPLICABLE SAFEGUARD POLICIES OF WORLD BANK

S. No.	World Bank Safeguard Policies	Subject Category	Applicable (Yes / No)	Reason for Applicability
1	OP 4.01	Environmental Assessment	Yes	Umbrella Policy applicable for all infrastructure projects.
2	OP 4.36:	Forests	No	Applicable to protect forest health and commercial forestry activities . In the execution of Project, no Forest diversion has been envisaged. No commercial forestry activity will be supported.
3	OP 4.04	Natural Habitats	No	Applicable to protect natural habitats including forest and wild life impacted due to project. No forest land diversion and tree felling is envisaged under the proposed project activities. None of project location and activities is also located near to any National Park / Sanctuary / Eco sensitive zones and nor fall within 10 Km. radius of such protected areas.
4	OP 4.12	Involuntary Resettlement	No	Applicable in case of Private Land Acquisition to minimize / avoid resettlement wherever feasible. No land acquisition and/or resettlement is envisaged for the establishment of proposed Project.
5	OP 4.10	Indigenous people	Yes	Applicable to protect the dignity, right and cultural uniqueness of tribes & indigenous people impacted for the project. Project does not lie in the notified Schedule areas of Chhattisgarh. Though tribal population is located in the project area, none of them will be adversely impacted due to loss of land or any other immovable property. The project however will carry out FPIC and prepare TDP.

Furthermore, in addition to the General EHS guidelines of the World Bank Group, Environmental, Health, and Safety (EHS) Guidelines for Electrical Power Transmission and Distribution should be customized for the site once the design is finalized.

4.6 COMPLIANCE TO REGULATORY REQUIREMENTS

The projects may require some statutory permission/clearances under different Acts and Rules at different stage of the project. These are listed in **Table 4-5.**

TABLE 4-4 SUMMARY OF STATUTORY CLEARANCE REQUIREMENT OF THE PROJECT

S. No.	Type of Clearance/Permits (If Applicable)	Applicability	Project Stage	Responsibility	Time Required
1.	Forest Clearance for land diversion	For diversion of forest land in case transmission line passing through forest area	Pre Construction	SECI/ State Agency	10-11 months
2.	Tree felling permission	For tree cutting for establishment of solar-wing hybrid park or transmission line	Pre construction	SECI/State Agency	1-2 months
3.	NOC (Consent to Establish and Consent to Operate) under Air and Water Act from SPCB	For siting and erection Batching plants etc. DG sets & toilet water treatment (if Reqd)	Construction Stage (Prior to erection and operation of Plants)	EPC Contractor	2-4 months
4.	Explosive License from Chief Controller of Explosives	For storing fuel oil, lubricants, diesel etc.	Construction stage (Prior to storing fuel, lubricants and Diesel, etc.)	Contractor	2-3 months

S. No.	Type of Clearance/Permits (If Applicable)	Applicability	Project Stage	Responsibility	Time Required
5.	Permission for storage of hazardous chemical from CPCB	Manufacture storage and Import of Hazardous Chemical	Construction stage (Prior to initiation of any work)	Contractor	2-3 months
6.	Authorization Under Hazardous Waste rules	For proper disposal of Used Oil/Other Hazardous wastes generated during construction & operations	Construction & operation	Contractor	2-3 Months
7.	Permission for extraction of ground water for use in project construction activities from State Ground Water board	Extraction of ground water	Construction stage (Prior to initiation of installation of bore wells and abstraction of water from such source)	Contractor	1-2 months
8.	Permission for use of water for construction purpose from irrigation department	Use of surface water for construction	Construction stage (Prior to initiation of abstraction of water from such source)	Contractor	1-2 months
9.	Labour license from Labour Commissioner Office	Engagement of Labour	Construction stage (Prior to initiation of any work)	Contractor	months

4.7 STAKEHOLDER CONSULTANTS

The key stakeholders including the Chhattisgarh Energy Department, Chhattisgarh State Power Distribution Company Limited, District Administration, State Forest Department, local people were interacted (both formally and informally) during the field visits while preparing the ESDDR. Most of the associated government departments were visited to collect the relevant data and their feedback on the proposed project activities. Also, they were asked about the mitigation plans proposed to be adopted, suggestions for improvement and any public grievances.

4.8 ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

The Solar PV project has substantial environmental and social benefits. The project generates power without emitting air pollution & greenhouse gases the project will generate employment in the local community. The society will benefit from accessibility of power supply. Ultimately, the project will uplift the socio-economic environment of the region.

Potential environmental impacts, both bio-physical and socio-economic, are assessed in terms of the direct and indirect nature of the impact, extent, duration and significance. The level of assessment of each potential impact are based on the important environmental issues identified.

The impacts of major infrastructure projects can be divided into two principal categories. First direct impacts which result from physical presence of the facilities and the way they are designed, built and operated. Second, indirect impacts, which stem from the construction and economic activities surrounding construction and the induced development resulting from new project. These impacts occur in two main phases- construction and operation. Direct environmental impacts are those that are directly caused by construction or operation. During construction these impacts primarily occur within project site area or immediately adjacent to it, and at ancillary sites such Labour camp. Direct construction impacts can include the damage to ecological features such as land resources and water bodies, damage to manmade structures and resettlement.

The Solar PV power plant project may influence various environmental components at different stages of the project viz: Pre-construction/ Design phase, Construction phase, Operation phase and Decommissioning phase. The impacts may be direct or indirect and may be beneficial or adverse with respect to the environment. The major works associated with the construction phase mainly are site clearance, earth work in embankment, excavation and cross drainage works, dumping of soils and waste materials and other construction activities and

associated works like mobilization of constructional equipment, setting up of labour camps, transportation and storage of materials, etc. These activities have potential impacts on physical, biological as well as social environment. The likely impacts on various environmental components have been described as follows:

4.8.1 IMPACTS DURING DESIGN/ PRE-CONSTRUCTION PHASE

During the pre-construction phase land procurement activity will be carried out. And this activity will impact on socio economic condition of area. On the other hand, the site selection is directly related with surrounding environmental conditions.

Impacts on Land

Project is proposed to be set up on approximately 200 Ha of government land, whereas the Govt. of Chhattisgarh has offered over 405 Ha of land. The screening exercise carried out shows that the land is free from any habitation and there is no structure on the identified land parcels. SECI will finalize the tentative project boundary, wherein, due care shall be taken by to avoid tree cutting, acquisition of private land, gothan area, any damage to property of cultural importance, community building, schools etc. So, there will not be any physical displacement of people due to the project. Whereas, for transmission line compensation will be paid for the restrictive use of land per the policy "Right of way and compensation as per provision of Electricity Act, 2003 and Indian Telegraph Act, 1885, if any. However, some temporary damages/ disturbances can happen, which will be compensated as per the law of the land and applicable/prevailing guidelines.

The transmission line of length 33km is envisaged to be constructed for power evacuation from proposed project. Installation of towers and right of way will result in restrictive use of land. Though PAP will continue to cultivate the land under ROW, trees and houses beyond a certain height cannot be grown or constructed. The footprint of towers though will be a small area and it will be possible to cultivate the land under the tower footings.

Mitigation Measures:

- The entire affected person will be identified in advance prior to commencement of construction works.
- The R&R Plan will be prepared for affected persons once the alignment is finalized and exact location of tower footings is identified.

- All the affected persons (TL) will be compensated as per prevailing rules and policy of the state government for the transmission line.

Impacts on Forest Land

Since the baseline study indicates that the project is not located in forest land; any impact on forest land due to location of solar park is not envisaged. The proposed alignment of transmission line if at all passes through the forest land can be avoided by shifting the alignment in this particular area. So, after implementing the shifting of alignment, there will not be any impact on forest land.

4.8.2 IMPACTS DURING CONSTRUCTION PHASE

Most of the adverse environmental impacts are related to construction works which are inevitable but are manageable through certain environmentally friendly practices. The negative environmental effects can be taken care of at an early stage through proper engineering design and through the proper management of contract during construction practices.

The standard construction works involved are site clearance, excavation, filling of earth materials and sub grade materials, handling of hazardous materials like bitumen, diesel, etc., dumping of unusable debris materials, transportation of materials to construction site, and other related activities and associated works like mobilization of construction equipment's, setting up of labour camps, material storage etc. These activities have certain impacts of various magnitudes on different components of environment. The anticipated impacts due to all these activities have been described below:

Impact on Land Resources

There will be change in the land use in project site especially after construction of inside road, installation of Solar Park, Pooling Sub-Station, Stockyard & Site Office etc. All of the above components of the proposed development will require the clearing of vegetation to a certain extent apart from grubbing and excavation.

Site is a barren land very less vegetation can be observed in the area. Along with natural drainage, density of vegetation is relatively high due to higher moisture content in the soil. Only taller vegetation would need to be cleared for installation of PV panels in the proposed layout. Vegetation removal could result in windblown dust which could constitute an in direct visual impact. Impact would be minor short-term negative in nature.

The excavation activity will lead to generation of excavated materials which would mainly be soil mixed with pebbles in the project area. The suitable materials will be re-used as fill materials, aggregates. The unsuitable excavated material will need to be disposed off as per EMP. The disposal of debris materials in haphazard manner will not only hamper the aesthetic look of the area but at the same time they are potential contaminant for the surrounding land. The underground wiring and pipeline would require a trench to be excavated along the PV panel modules resulting in disturbance and potential erosion of the substrate. Excavation is required for establishment of solar panel, trench and access road construction other infrastructure etc. in the solar park. Considering this impact would be moderate localized and short-term negative.

To establish tower for transmission line excavation is required and impact for excavation would be minor localized short-term negative impact. Some land would be needed to establish site offices and construction camps, labour camps. These will require temporary land for a short period. Such land parcels however will be taken on lease by the contractor in mutual agreement with the landowner.

There could be loss of crop during installation of towers and stringing.

Mitigation Measures

- The earth material generated due to excavation will be used to optimum quantity to reduce impact on land resources.
- Road layout will ensure that as much as possible avoidance of disturbance of natural drainage.
- The proposed access roads inside project area do cut cross several non-perennial drainage channels and would require construction of adequate number of cross-drainage structures to mitigate the adverse impacts on the surface runoff
- It should be ensured that no additional access roads other than those proposed as per the layout plan are created.
- It will be ensured that no trees are required to be cut while installation of solar PV panels. If any tree is still required to be cut, permission from the state forest department need to be obtain along with compensatory plantation as per the guidelines issued by the state forest department.

- The Construction camps will be located preferably on barren land and sufficiently away from settlements and water bodies.
- The Construction camp will be provided with necessary sanitation arrangements and basic facilities.
- After dismantling of Camp the natural condition of the land will be restored.
- No site will be left unattended after excavation activity.
- All crop damages to be compensated at market value.

Impact on Soil

Construction will require clearing, grubbing as well as excavation for foundation to establish solar panel and other developments such as office building, road and infrastructure. The impact on the soil due to the project activities are envisaged as below:

i. Loss of Topsoil

The site clearance process includes excavation and vegetation clearance which ultimately induces vegetation loss as well as loss of top soil. Clearing and grubbing would be required for establishing solar Park to the area required to established Solar PV panel. The activities associated with the site preparation and excavation plus movement of vehicles and equipment can disturb the surrounding lands. Top soils of the project site will be stored and re-use. So impact on top soil due to construction activities will be minimized.

The proposed transmission line 33 km starched pass mainly through barren land and agriculture fields the impact on top soil is anticipated due to foundation work to establish the electric towers. Around 105 towers would be required for 33 km length. For foundation works excavation is required which may lead to loss of top soil if proper care is not taken. Additional impact on topsoil is also envisaged due to movement of vehicles and equipment at site and storage of materials into the agricultural fields. Top soil will be impacted by those activities and it will take some time to return to the original condition. In view of such activities impact on top soil in the construction phase would be moderate localized medium term negative. However, the extent of impact on topsoil can be minimized by following mitigation measures:

Mitigation Measures

- In case of good quality topsoil comes under the construction area it should be preserved with utmost care and needs to be used for gardening or agricultural area.

- On the proposed alignment of the transmission line, at the time of construction good quality top soil should be kept sufficiently away from the construction zone to avoid contamination and needs to be reused in the agriculture field.
- No construction materials should be stacked in the agriculture field.

ii. Contamination of Soil

Due to temporary camp site or stockyards, workshops, and other ancillary sites there is chance of loss to soil fertility due to various activities like accidental spillage of lubricants / fuel and other chemicals that may potentially cause soil contamination. The repair works of underground pipeline / cable network may lead to increased soil erosion in that localized pocket. Such contamination of soil will reduce the soil fertility and impact would be minor localized medium-term negative.

Mitigation Measures

- The earth material generated due to excavation will be used to optimum quantity to reduce impact on soil environment.
- Proper stripping and stockpiling of soil layers to reduce dust pollution.
- The construction camp will be provided with necessary sanitation arrangements and basic facilities to avoid soil contamination.

iii. Soil compaction

Compaction of soil is anticipated due to the movement of construction vehicles and heavy machines as well as at camp site and stockyard. Thus, regulation of movement of heavy equipment and vehicles shall be essential to prevent this.

Vehicular movement in agricultural field to support erection of transmission line will create soil compaction near transmission line area. Stockpile in the agricultural field should be restricted otherwise it would create soil compaction. The impact of soil compaction would be moderate regional medium term negative.

Mitigation Measure

- The excavation activities and vegetation clearance will strictly be limited to the pegged area, road and drains formations and other construction area.
- All the usable excavated materials will be re-used as fill materials and aggregates.

- The movement of construction vehicles and equipment will be restricted to only designated route.
- It should be ensured that no additional access roads other than those proposed as per the layout plan are created.

iv. Soil erosion

Inadequate soil stabilization measures in cleared areas could lead to erosion that could cause the loss of riparian vegetation and siltation of nearby drainage channels/ surface water bodies. Impact of soil erosion would be moderate/ regional/ long term and negative.

Mitigation Measure

- Designated storage site for fill materials and adequate stockpiling to prevent erosion and runoff related problem.
- Garland drains around excavated soil will trap silt. Silt trap will reduce siltation load in the nearby drainage and surface water body.
- Appropriate soil conservation and rainwater harvesting interventions to be done at the project site by use of simple techniques such as recharge pits, say @one per every 20 meters and (if possible) a number of small ponds to cover about 1% of project area if the slope is less than 2%, trench-cum-field bunds for every 400 square meters, if the slope is 2-5% and construction of appropriate number of Gabion check dams if the slope is more than 5% along with appropriate bonding at periodic intervals. Bunding will prevent soil erosion and recharge structures as mentioned above will improve water recharge significantly.

Impact on Water Resources

Proposed project will lead to increase in surface run-off. No surface water bodies are available inside project site however certain non-perennial drainage channels feeding these surface water bodies could be altered during to clearing and grubbing operations. Such alteration will reduce availability of water in the water body. Thus assessed impact would be moderate regional short term negative. It will be ensured that natural drainage system should be maintained properly. Any kind of dumping should be strictly prohibited. Drain should be free from any blockage.

As no surface water bodies are available inside project site, required water demand will be meet through ground water extraction.

Impact on Water Quality

Construction activity may temporarily deteriorate surface water quality of the water bodies outside project area resulting in increase in turbidity as well as in oil and grease. Considering contaminants and its interaction with water environment. Anticipated impact would be minor regional short to medium term negative. These impacts can be managed through following proposed mitigation measures:

- All water and liquid wastes arising from construction activities will be properly disposed off and will not be discharged into any water body/ stream course without adequate treatment.
- Littering or unauthorized discharge will not be permitted.
- Permission of the engineer and the concerned regulatory authorities will be obtained for disposal of the waste as the designated disposal point.
- The stream course and drain will be kept free from dumping of solid wastes and earth materials.
- The construction materials and debris will be stored away from water bodies or water ways and only at the designated sites along the construction zones.

Impact on Ambient Air Quality

The air quality parameter is the most common environmental feature, which is being affected by any project construction. The major indicators of Ambient Air Quality are suspended particulate matters (SPM), Particulate matters of size less than 10µ (PM10), particulate matters of size less than 2.5 µ (PM2.5), Sulphur dioxide (SO2), nitrogen oxides (NOx), carbon monoxide (CO) in the atmosphere. Significant amount of dust is likely to be generated due to site clearance and excavation activities, exhaust of mobile and stationary construction equipment, batching plant, embankment and grading activities, transportation of earth materials and dumping of spoils, which lead to potential deterioration of air quality during the process. The emissions will be limited to the project area and dispersed rapidly. The activities will be confined to project area and which is away from the locality.

The improper sanitation at work camps and waste disposal usually lead to odour problem. Foul odour may also be caused during laying of pavement. The above mentioned problems related to the deterioration of air quality, however, impact will be moderate regional short term negative.

Mitigation Measures

Generation of Dust:

- Water will be sprayed, in earth handling sites, other excavation areas for suppressing fugitive dust during construction phase.
- Water sprinkling and transporting construction materials with tarpaulin coverage during the construction stage.
- Dust emission from stock piles of excavated material will be controlled either by covering the stockpiled materials or water spraying over it.
- As soon as construction is over all the surplus earth will be utilized properly & all loose earth will be removed from the site.

Mitigation measures for Plants & Equipment:

- The emissions will be limited to the project area and dispersed rapidly as the activities will be confined to project area and which is away from the locality.
- All the vehicles used during the construction stage to have valid PUC certificate
- Provision of effective air pollution control systems in batch mix plants such as dust containment cum suppression system for the equipment, construction of wind breaking walls along periphery of plant sites, construction of the metaled roads within the premises, regular cleaning and wetting of the ground within the premises, etc.
- Gaseous Pollution
- All the Construction vehicles and machineries will be regularly maintained to conform to the emission standards stipulated under Environment (Protection) Rules, 1986.
- All the DG sets will conform to the emission standards as stipulated under Environment (Protection) Rules, 1986.
- The workers working at Batch mix plants will be provided masks.

Impacts on Ambient Noise Level

Operation of heavy machineries; movement of heavy vehicles, aggregate mixing activities generates high noise increasing the ambient noise level in the surrounding.

Workers working near the noise generating equipment and plants are likely to be exposed to high noise level. The acceptable limits (for 8 hour duration) of the equivalent noise level exposure during one shift is 90 dB (A). Hence, noise generated due to various activities in the

construction camps may affect health of the workers if they are continuously exposed to high noise level. For reasons of occupational safety, exposure to impulses or impact noise should not exceed 140 dB (A) (peak acoustic pressure). Exposure to 10,000 impulses of 120 dB (A) are permissible in one day. The noise likely to be generated during excavation, loading and transportation of material will be in the range of 90 to 105 dB (A) and this will occur only when all the equipment operates together and simultaneously. This is however, is a remote possibility. The workers in general are likely to be exposed to an equivalent noise level of 80 to 90 dB (A) in an 8-hour shift, for which all statutory precautions should be taken into consideration. However, careful planning of machinery selection, operations and scheduling of operations can reduce these levels. A typical Noise generation due to different activities has been given in the Table 4-6.

TABLE 4-6: TYPICAL NOISE LEVELS OF PRINCIPAL CONSTRUCTION EQUIPMENT

Type of Machinery/Equipment	Typical Noise Level during Major Construction Activity (Noise Level in dB(A) at 50 Feet)
CLEARING	
Bulldozer	80
Front end loader	72 - 84
Dump truck	83 - 94
Jack hammer	81 - 98
Crane with ball	75 - 87
EXCAVATION AND EARTH MOVING	
Bulldozer	80
Backhoe	72 - 93
Front end loader	72 - 84
Dump truck	83 - 94
Jack hammer	81 - 98
Scraper	80 - 93
STRUCTURE CONSTRUCTION	
Crane	75 - 77
Welding generator	71 - 82
Concrete mixer	74 - 88
Concrete pump	81 - 84
Concrete vibrator	76
Air compressor	74 - 87
Pneumatic tools	81 - 98
Bulldozer	80
Cement and dump trucks	83 - 94
Front end loader	72 - 84
Dump truck	83 - 94
Paver	86 - 88

Type of Machinery/Equipment	Typical Noise Level during Major Construction Activity (Noise Level in dB(A) at 50 Feet)
GRAND AND COMPACTING	
Grader Roller	80 -93 73 - 75
PAVING	
Paver Truck Tamper	86 - 88 83 - 94 74 - 77
LANDSCAPING AND CLEAN UP	
Bulldozer Backhoe Truck Front end Loader Dump Truck Paver	80 72 - 93 83 - 94 72 - 84 83 - 94 86 - 88

Source: CPCB, Govt. of India

It is evident from the above table that the operation of construction machinery e.g. bulldozer, loader, backhoes, concrete mixer, etc. will lead to rise in noise level to the range between 80-95 dB (A). Vehicles carrying construction materials will also act as the noise sources. The magnitude of impact from noise will depend upon types of equipment to be used, construction methods and also on work scheduling. However, the noise pollution generated due to different construction activities is a temporary affair. Each type of activity can generate different type and levels of noise that continue for a short period during the operations of those activities. The noise generation will be limited to the project area as the activities will be confined to project area which is away from the locality. The impact of noise on the ambient environment would be moderate local medium term negative. Implementing proper mitigation measures can reduce a lot of problem associated with noise pollution due to construction activities.

Mitigation Measures:

- The main stationary noise producing sources such as generator sets shall be provided with noise shields around them. The noise shields can either be a brick masonry structure or any other physical barrier which is effective in adequate attenuation of noise levels. A three meter high enclosure made up of brick and mud with internal plastering of a non-reflecting surface will be very effective in this regard
- The plants and equipment used for construction will strictly conform to CPCB noise standards.

- Vehicles and equipment used will be fitted with silencer and maintained accordingly.
- Noise to be monitored as per monitoring plan and if the noise level at any time found to be higher than immediate measure to reduce noise in that area will be ensured.
- Noise standards of industrial equipment will be strictly enforced to protect construction workers from severe noise impacts.
- All the workers working very close to the noise generating machinery shall be provided earplugs to avoid any ill impacts on their health.
- An awareness programme will be organized for drivers and equipment operators to make them aware of the consequences of noise and to act properly at site.

Impact on Social Environment

Employment

The project is likely to bring in positive benefits either from short term job opportunities during construction stage or long term during operational stage. The local community will be hired based on skill sets. The implementation of the projects will also create off-site infrastructure/ rental opportunities (canteens, guest houses, water tankers, vehicles etc.) in the vicinity. Project will ensure that those who are eligible and are vulnerable are given preference in the employment.

The proposed Solar project with additional employment opportunities will result in improvement in the standard of living of the local community in addition to the potential increase in land prices in the vicinity of the project site.

Aesthetics

Disturbance of landscape aesthetics due to excavation is expected during the construction phase. However, it will be temporary and will be restored with proper management plans within a specified timeframe. Impact on aesthetics environment would be moderate.

Mitigation Measures:

- The site will be cleaned immediately after the construction activity is over.
- The debris materials will be disposed off only at identified area for disposal and proper leveling will be done after disposing the materials and shall be covered with top soil and some landscaping will be done at the disposal site

Loss of Access

Though screening results shows part of the land being used for cultivation which is in the south of the identified land parcels. These parcels are not being considered for the park. The developer will ensure that there is no loss of access by leaving enough space for the cultivators to access their land parcels.

Public Health and Safety

Health and safety are of major concern during the construction as well as operational phases. The impact on health and safety can be envisaged for workers at site. Emission of gaseous pollutants and dusts are major result of various processes like material treatment. This emission effect is only for short term till the construction work is over but the effect may be significant from the point of view that the workers are directly exposed to these emissions. Apart from this, safety risks to workers, primarily in the areas of storage and handling of dangerous materials, and in operation of heavy machinery, slopes, power line, work at height are also involved during the construction works.

Mitigation Measures

- The project will comply with the requirements of the EHS Guidelines.
- The plants and equipment will be installed sufficiently away from the settlement.
- All the construction equipment and vehicles will conform with the emission standards stipulated by the CPCB.
- Safe working techniques will be followed up and all the workers will be trained
- All the workers will be provided with proper personal safety equipment at construction as well as plant site
- Proper caution signage, barricading, delineators etc. will be installed at Construction zone and temporary diversions
- Proper traffic management will be ensured at the Construction zone as per IRC.
- An Emergency Response system in case of any incidence will be developed and implemented.
- Periodical health check facility will be provided at camp sites.

Impact of Labour influx on Host Population

The influx of workers and followers can lead to adverse social and environmental impacts on local communities, especially if the communities are rural, remote or small. Such adverse impacts may include increased demand and competition for local social and health services, as

well as for goods and services, which can lead to price hikes and crowding out of local consumers, increased volume of traffic and higher risk of accidents, increased demands on the ecosystem and natural resources, social conflicts within and between communities, increased risk of spread of communicable diseases, and increased rates of illicit behavior and crime. Such adverse impacts are usually amplified by local-level low capacity to manage and absorb the incoming labor force, and specifically when civil works are carried out in, or near, vulnerable communities and in other high-risk situations. While many of these potential impacts may be identified in a project's Environmental and Social Impact Assessment (ESIA), they may only become fully known once a contractor is appointed and decides on sourcing the required labor force. This means that not all specific risks and impacts can be fully assessed prior to project implementation, and others may emerge as the project progresses.

Mitigation Measures

Within 30 days from the appointed date, the Concessionaire/Contractor shall prepare and submit 4 hard copies and 1 soft copy of Labour Influx and Worker's Camp Management Plan that addresses specific activities that will be undertaken to minimize the impact on the local community, including elements such as worker codes of conduct, training programs on HIV/AIDS, etc. A Workers' Camp Management Plan addresses specific aspects of the establishment and operation of workers' camps This Labour Influx and Worker's Camp Management Plan will include:

- mandatory and repeated training and awareness raising for the workforce about refraining from unacceptable conduct toward local community members, specifically women;
- informing workers about national laws that make sexual harassment and gender-based violence a punishable offence which is prosecuted;
- introducing a Worker Code of Conduct as part of the employment contract, and including sanctions for non-compliance (e.g., termination), manual scavenging, engagement with local residents, child labour, non-discrimination, harassment of co-workers including women and those belonging to SC and STs and other minority social groups,
- contractors adopting a policy to cooperate with law enforcement agencies in investigating complaints about gender-based violence.
- training programs on HIV/AIDS and other communicable diseases,
- workers' Camp Management Plan addressing specific aspects of the establishment and operation of workers' camps provided the ULB/ Executing Agency is unable to cater to the

demand for affordable housing for this additional workforce in terms of rentals, hostels, apartments etc.; and

- compliant handling Mechanism at the project level

Other Environmental Concerns of Construction Phase:

Various other environmental impacts during construction stage include:

Labour Camps

Construction workers are a much neglected group in the country. Unless the workers are provided proper amenities to live at the labour camp site the environmental issues of proposed construction cannot be properly met. The labour camps to be set up will need to have adequate provisions for water supply else uncontrolled interaction of construction workers with the existing surface water bodies could lead to pollution of these water bodies e.g. dumping of construction waste into these water bodies, washing of the construction machinery/ equipment etc. The lack of provision of adequate sanitary facilities may lead to direct or indirect faecal pollution of surface water resources. The contractor shall ensure that the mitigation measures proposed shall be implemented properly.

At labour camps lot of wastes are generated. These wastes are solid as well as liquid waste mainly refuse water and kitchen waste. The disposal of such waste material to the surrounding land can potentially damage the land and would generate health risk to not only surrounding area but within the premises itself. Improper drainages system within the premises also creates insanitary condition thereby enhancing health risk. Impact would be moderate local short to medium term negative.

Mitigation Measures

- Contractor will follow all relevant provisions of the Factories Act, 1948 and the Building and the other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 as well as the guidelines will be followed for construction and maintenance of labour camp throughout the construction period.
- The Construction/labour camps will be established only on area approved by site project team comprising SECI & Contractor.
- The labour camp will be located away from water bodies, schools and residential areas. The camp will be constructed with proper accommodation facilities.

- The workers camp will be provided with drinking water supply system so that local water sources are not disturbed.
- The camp should be provided with fuel for cooking like kerosene and /or LPG to avoid any cutting of trees for fuel wood.
- All camps will be provided with proper sanitation facilities, separate toilets and bathrooms for female and male workers, septic tanks with soak pits of sufficient size, dust bins etc.
- Waste water from domestic uses and solid wastes will be disposed of without violating environmental norms. The measures will be site specific.
- The labour camps will be provided with crèche, first aid facilities, etc. as required under Factory Act.
- If the COVID situation persists, arrangements for quarantine /isolation of vulnerable / infected individuals would need to be ensured. Additional waste management measures for Bio Medical waste may be required in such a situation.
- After completion of construction, the contractor will dismantle the camp and restore it to the original condition of the area before handing over the site to the land owner.

Different wastes generated

Construction waste like concrete waste, debris will be generated from construction activities. The waste will be inert in nature but in absence of proper disposal construction waste will create soil and water pollution and disturb the drainage system. Impact would be moderate local short to medium term negative.

Mitigation Measures

- Construction waste should be stored separately in a designate area.
- The waste can be used as filler material.

4.8.3 IMPACTS DURING OPERATIONAL PHASE

During operation stage, given the long-term nature, impacts would require adequate mitigation measures to minimize predicted impacts. In general, solar power generating facilities need to occupy a very large area in comparison to other types of power generation facilities relative to the level of power output generated. This is an important component of the visual aspect of Solar power plants as they can occupy large parts of a landscape, especially when viewed from

an elevated position. The land use changed in the construction phase due to installation of Solar Park, Pooling Sub-Station, Stockyard & Site Office etc. will remain unchanged.

Impacts on Water Quality and Resources

During the operation phase, the possibility of degradation of water quality is very remote. The water requirements during the operation phase would be limited to cleaning operations for PV panels and other office building requirements including administrative buildings etc.

In this phase of the Solar Projects, requirement of 100 KL/day water is estimated for module washing. Water demand will be met through Ground water abstraction. Such ground water abstraction may lead to direct negative impact on the water environment. Due to consumption of ground water on regular basis impact would be moderate regional long term negative.

Mitigation Measures

- Installation of alternative waterless cleaning technology for Solar PV
- Used water should be properly channelled to settling tank for stabilization and treatment so that recycled water could be reused for PV washing which will reduce the load on ground water.
- Adequate capacity of Rain Water storage will be built to harvest rain water which will be connected with drainage network. The stored water can be used for washing of Solar PV to promote optimal use of surface and ground water.
- Building of artificial ground water recharge structures as per guideline of Ground Water Board to promote ground water level.
- Requisite permissions need to be obtained before withdrawing ground water from bore wells/ tube wells from the competent authority.

Impact on Air Quality

No emissions are expected due to the operation of the Solar PV Park. The solar PV panels do not release any greenhouse gas emissions or any other toxic pollutants.

Impact on Noise Quality

Operation of Solar PV Park will not generate noise.

Impact on Ecological Resources

At the time of operation phase Solar PV Park will not pose any risk on the surrounding ecology.

Impact on Social Environment

Employment

The project is likely to bring in positive benefits with temporary job opportunities during operation stage. Local people will be targeted for skilled and semi- skilled tasks wherever feasible. The implementation of the projects will also create off-site infrastructure (hotels, restaurants, canteens, guest houses etc.) in the vicinity. Apart from technical manpower and more staffs required for regular cleaning and security purpose which can be recruited from local community.

Establishment of Transmission tower and stringing will result in restrictive use of land under the RoW of the proposed alignment of transmission line. It will create obstruction in the movement of man and machine required for the agricultural activities. In order to minimize the impact, project will pay 85% of the land value of the land under for the tower pads and 15% of the land value for the land under ROW. The ownership of the land however will remain with the landowner.

Hazardous Waste

During operation and maintenance generation of hazardous waste including damaged solar panels, transformer oil, E-Waste, batteries waste require special care because they poses serious threat to the public health safety. Generation of the waste will be continuous till the operational line of the project. Impact of hazardous waste will be minor local long term negative. Hazardous waste will be disposed off separately as per identified different rules.

At the time of handling Solar panels, they might get broken, cracked, deformed or scratched. Random disposal of such panel may lead to soil pollution as well as it will possess threat to public health safety.

Mitigation Plan

- The out-of-use (damaged, substandard, or out-of-use) solar panel should be stored separately and handed over to the manufacturer or authorized vendor for proper recycling/disposal.

E-Waste

Improper disposal of generate E waste may create soil pollution and health hazardous.

Mitigation Measures

- E waste should be stored separately
- Maintain records of e-waste generated
- End-of-life electrical and electronic equipment are not admixed with e-waste containing radioactive material if any.
- E-waste generated should be channelized through collection centre or dealer of authorized producer or dismantler or recycler or through the designated take back service provider of the producer to authorized dismantler or recycler;
- E waste should be managed in compliance of E-Waste (Management) Rules, 2016.

Batteries waste

From the storage unit of the power plant battery waste will be generate as a result of end-of-life or defect in the storage cell. Batteries waste should be handled with utmost care. Any kind of leakage and spillage from batteries will create soil and water pollution and also create health hazardous for the people working around. The draft Batteries Rules (2020) should be reviewed by the Contractor to develop the final mitigation measures.

Mitigation Measures

- Batteries should be maintained properly so that any kind of leakage and spillage from batteries can be avoided.
- Batteries should be disposed off by depositing with the dealer, manufacturer, importer, assembler, registered recycler, re-conditioner or at the designated collection centers,
- Batteries waste should be managed in compliance with the Batteries (Management and Handling) Rules, 2001 in case of lead acid battery.

Solid Waste

At the operation phase solid waste will be generated from the office. Waste will be comprised of organic waste, recyclable waste and non- recyclable waste. Improper disposal of solid waste will create soil, water, air pollution and aesthetic problem. Impact of solid waste will be minor local long term/ negative.

Mitigation Measures

- Waste should be segregate at source.
- Organic waste will be converted in to soil conditioner by composting.
- Recyclable waste will be sold to the authorized recycler.
- Inert waste will be disposed off in low lying area

4.8.4 IMPACTS DURING DECOMMISSIONING PHASE

Impacts on Water Quality and Resources

The decommissioning activities which are likely to have adverse impacts are dismantling of the built up structures, access roads and other infrastructure facilities within the power plant area. The impacts would be similar to the construction stage. It will be ensured that debris and other waste materials are not disposed in the surface water bodies.

But due to end of project operation extraction of ground water will be stopped and it will reduce the stress on ground water environment. Impact would be minor regional long term positive.

Impact on Air Quality

At the time of decommissioning of the solar PV Park it is expected that the activities will generate dust and exhaust emissions. The Activities involved include dismantling, disassembly of the various components of power plant. This activity will generate air pollution and impacts would be moderate local short term negative.

Mitigation Measures

- Proper handling, using mask will reduce impact of air pollution

Impact on Noise Quality

The decommissioning activity will generate noise due to dismantling, disassembly of the various components of solar power plant. The contractor needs to comply with occupational health safety guideline during this stage. Impact would be moderate local short term negative.

Impact on Soil & Land Use

The decommissioning activities are likely to have impacts on soil erosion due to demolition activities. Therefore, proper environmental protection measures should be adopted to prevent any adverse incidences. Parcels of land under permanent structures e.g. roads / buildings / warehouse etc. need to be restored to its near original state by re-laying of the topsoil. This

phase will not create negative impact to the flora and fauna present in and around the site. Impact would be moderate local long term positive.

Impact on Social Environment

Employment

Decommissioning activities will create few temporary jobs by the contractor and all long term jobs will not be there anymore.

Aesthetics

The site needs to be restored to its near original state before being handed over the original landowners.

Public Health and Safety

The maintenance of transmission line needs to be done on regular basis, accidental failing of live wire of transmission line will create life threat to human being, grazing and other animal. The transmission line will also run on the water body in a few places, such location may create major accident potential. Impact would be significant local short-term negative.

Mitigation Measures

- Impact could be mitigated through regular monitoring and maintenance of the transmission line.

4.9 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

An Environment and Social Management Plan has been developed following the delineation of impacts and mitigation measures. These measures will be adopted by the SECI and imposed as conditions of contract of the sub-contractor employed for respective phases of the power project.

The measures identified for different phases, are tabulated in Tables 4-7, 4-8 and 4-9 which describes the nature of the potential environmental impact, the measures, which have or will be taken, the implementing agency and responsible organization.

Table 4-7: Environmental and Social Management Plan (ESMP) for Solar Park

Environmental component / Issues	Potential Impact	Mitigation Measures	Location	Time Frame	Institutional Responsibility	
					Implementation	Supervision
Design and Pre-Construction Phase						
Land Environment	Loss of access	• The land identified is owned by the government thus there will not be any land acquisition and resettlement impacts. The land identified is free of encroachment and other encumbrances. • The developer will ensure access to cultivation sites located in the south. • Any unidentified impact will be mitigated as per the entitlement matrix of RPF of the agreed ESMF. Any such issue if identified will be recorded in CESMP. • Any loss of access will be avoided. Developer will consult the community around the site before barricading of the site.	Project Site	Design and Pre-Construction Stage	SECI	SECI

Environmental component / Issues	Potential Impact	Mitigation Measures	Location	Time Frame	Institutional Responsibility	
					Implementation	Supervision
Drainage Pattern and Water Bodies	The blocking of water course will in turn affect the water tank/storage.	• The Solar panels, building and battery housing as well as substation should be constructed away from these natural drains. • For internal access road network balancing culverts of sufficient capacity will be provided across these drains to allow free flow of water.	Drainage converging into nearby areas	Design & Preconstruction Construction Stage	Contractor (Site-in charge / Head-EHS / Head-Civil)	SECI
Construction Phase						
Land Resources	Loss of Vegetation	• Vegetation will be removed from the construction zone before commencement of construction. All works will be carried out such that the damage or disruption to flora other that those identified for cutting is minimum. • Only ground cover/shrubs that impinge directly on the permanent works or necessary temporary works will be removed with prior approval from the Environmental Expert.	Road network, drainage, building etc. within park	Construction stage	Contractor (Site-in charge / Head-EHS / Head-Civil)	SECI

Environmental component / Issues	Potential Impact	Mitigation Measures	Location	Time Frame	Institutional Responsibility	
					Implementation	Supervision
		• The Contractor, under any circumstances will not cut or damage trees. • Trees identified under the project will be cut only after receiving clearance from the Forest Department and after the receipt of written permission from Engineer. • Access to areas of the natural vegetation that are to be considered must be prohibited. A temporary fence should remain on site until all construction activities have completed. • Construction vehicles, machinery and equipment will move or be stationed in the designated area only to prevent compaction of vegetation outside the construction area. • Collection of firewood is prohibited.				

Environmental component / Issues	Potential Impact	Mitigation Measures	Location	Time Frame	Institutional Responsibility	
					Implementation	Supervision
		• No fires may be ignited with the intent to destroy the flora on the site and surrounding				
	Site Clearance	• The earth material generated due to excavation will be used to optimum quantity to reduce impact on land resources. • Road layout will ensure that as much as possible avoidance of disturbance of natural drainage. • The proposed access roads inside project area do cut cross several non-perennial drainage channels and would require construction of adequate number of cross-drainage structures to mitigate the adverse impacts on the surface runoff • It should be ensured that no additional access roads other than those proposed as per the layout plan are created. • It will be ensured that no trees are required to be cut while installation of solar PV panels.	Solar Park	Construction Phase	Contractor (Site-in charge / Head-EHS / Head-Civil)	SECI

Environmental component / Issues	Potential Impact	Mitigation Measures	Location	Time Frame	Institutional Responsibility	
					Implementation	Supervision
		If any tree is still required to be cut, permission from the state forest department need to be obtain along with compensatory plantation as per the guidelines issued by the state forest department. • The Construction camps will be located preferably on barren land and sufficiently away from settlements and water bodies. • The Construction camp will be provided with necessary sanitation arrangements and basic facilities. • After dismantling of Camp the natural condition of the land will be restored. • No site will be left unattended after excavation activity.				
Soil	Loss of Top soil	• In case of good quality topsoil comes under the construction area it should be preserved with utmost care and need to	Within the Solar Park	Construction Phase	Contractor (Site-in charge / Head-EHS)	SECI

Environmental component / Issues	Potential Impact	Mitigation Measures	Location	Time Frame	Institutional Responsibility	
					Implementation	Supervision
		be used for gardening or agricultural area. • No construction materials should be stacked in the agriculture field.				
	Contamination of soil	• The earth material generated due to excavation will be used to optimum quantity to reduce impact on soil environment. • Proper Stripping and stockpiling of soil layers to reduce dust pollution. • The Construction camp will be provided with necessary sanitation arrangements and basic facilities to avoid soil contamination	Within the Solar Park	Construction Phase	Contractor (Site-in charge / Head-EHS)	SECI
	Soil Compaction	• The excavation activities and vegetation clearance will strictly be limited to the pegged area, road and drains formation and other construction area. • All the usable excavated materials will be re-used as fill materials and aggregates.	Within the Solar Park	Construction Phase	Contractor (Site-in charge / Head-EHS / Head-Civil)	SECI

Environmental component / Issues	Potential Impact	Mitigation Measures	Location	Time Frame	Institutional Responsibility	
					Implementation	Supervision
		• The movement of construction vehicles and equipment will be restricted to only designated route. • It should be ensured that no additional access roads other than those proposed as per the layout plan are created.				
	Soil Erosion	• Designated storage site for fill materials and adequate stockpiling to prevent erosion and runoff related problem. • Garland drains around excavated soil will trap silt. Silt trap will reduce siltation load in the nearby drainage and surface water body.	Within the Solar Park	Construction Phase	Contractor (Site-in charge / Head-EHS / Head-Civil)	SECI
Water	Water Requirement for Construction	• Building artificial ground water recharge structures through rain water harvesting. • Lined drains will be provided with cut in between to facilitate ground water recharging. The cut will be made of granular coarse material, which will increase the infiltration rate.	Solar Park	Construction Phase	Contractor (Site-in charge / Head-EHS / Head-Civil)	SECI

Environmental component / Issues	Potential Impact	Mitigation Measures	Location	Time Frame	Institutional Responsibility	
					Implementation	Supervision
		• Rainwater Harvesting pits will be provided in consultation with Ground Water Board in the project area. • The Contractor will arrange separate water supply arrangement for construction work and will not interfere with the normal public water supply. • Requisite permissions need to be obtained before withdrawing ground water from bore well s/ tube wells from the competent authority.				
	Water Quality	• All water and liquid wastes arising from construction activities will be properly disposed off and will not be discharged into any water body/ stream course without adequate treatment. • Littering or unauthorized discharge will not be permitted. • Permission of the engineer and the concern regulatory	Water Body, Local Stream, Drainage within the Solar Park	Construction Phase	Contractor (Site-in charge / Head-EHS)	SECI

Environmental component / Issues	Potential Impact	Mitigation Measures	Location	Time Frame	Institutional Responsibility	
					Implementation	Supervision
		authorities will be obtained for disposal of the waste as the designated disposal point. • The stream course and drain will be kept free from dumping of solid wastes and earth materials. • The construction materials and debris will be stored away from water bodies or water ways and only on the designated sites along the construction zones.				
Air	Generation of Dust	• Water will be sprayed during construction phase, in earth handling sites, other excavation areas for suppressing fugitive dust. • Water sprinkling and transporting construction materials with tarpaulin coverage during the construction stage. • During the sub-grade construction, sprinkling of water will be carried out on regular basis during the entire	Within the Solar Park	Construction Phase	Contractor (Site-in charge / Head-EHS)	SECI

Environmental component / Issues	Potential Impact	Mitigation Measures	Location	Time Frame	Institutional Responsibility	
					Implementation	Supervision
		construction period especially in the winter and summer seasons. • Dust emission from stock piles of excavated material will be controlled either by covering the stockpiled materials or water spraying over it. • As soon as construction is over all the surplus earth will be utilized properly all loose earth will be removed from the site.				
	Plants and Equipment	• The emissions will be limited to the project area and dispersed rapidly as the activities will be confined to project area and which is away from the locality. • All the vehicles used during the construction stage to have valid PUC certificate • Provision of effective air pollution control systems in Batch mix plants such as dust containment cum suppression system for the equipment,	Plants and equipment area	Construction Phase	Contractor (Site-in charge / Head-EHS)	SECI

Environmental component / Issues	Potential Impact	Mitigation Measures	Location	Time Frame	Institutional Responsibility	
					Implementation	Supervision
		Construction of wind breaking walls along periphery of plant sites, construction of the metalled roads within the premises, regular cleaning and wetting of the ground within the premises, etc.				
	Gaseous pollution	• All the Construction vehicles and machineries will be regularly maintained to conform to the emission standards stipulated under Environment (Protection) Rules, 1986. • All the DG sets will conform to the emission standards as stipulated under Environment (Protection) Rules, 1986. • The workers working at Batch mix plants will be provided masks.	Construction area	Construction Phase	Contractor (Site-in charge / Head-EHS)	SECI
Noise	Noise Level	• The main stationary noise producing sources such as generator sets shall be provided with noise shields around them.	Construction Area	Construction Phase	Contractor (Site-in charge / Head-EHS)	SECI

Environmental component / Issues	Potential Impact	Mitigation Measures	Location	Time Frame	Institutional Responsibility	
					Implementation	Supervision
		• The plants and equipment used for construction will strictly conform to CPCB noise standards. • Vehicles and equipment used will be fitted with silencer and maintained accordingly. • Noise to be monitored as per monitoring plan and if the noise level at any time found to be higher than immediate measure to reduce noise in that area will be ensured. • Noise standards of industrial enterprises will be strictly enforced to protect construction workers from severe noise impacts. • All the workers working very close to the noise generating machinery shall be provided earplugs to avoid any ill impacts on their health. • An awareness programme will be organized for drivers				

Environmental component / Issues	Potential Impact	Mitigation Measures	Location	Time Frame	Institutional Responsibility	
					Implementation	Supervision
		and equipment operators to make them aware of the consequences of noise and to act properly at site.				
Biological Environment	Ecological Resources	• Stockpiling of the construction materials should be avoided in and arounds trees in the site. • The contractor shall ensure adequate measures to ensure that no illegal poaching of wild animals is being done by construction workers. • The developer shall ensure compliance to the EMP measures for setting up of the labour camp sites etc.	Within the Solar Park	Construction Phase	Contractor (Site-in charge / Head-EHS)	SECI
Social	Aesthetics	• The site will be cleaned immediately after the construction activity is over. • The debris materials will be disposed off only at identified area for disposal and proper levelling will be done after disposing the materials and shall be covered with top soil	Solar Park	Construction Phase	Contractor (Site-in charge / Head-EHS)	SECI

Environmental component / Issues	Potential Impact	Mitigation Measures	Location	Time Frame	Institutional Responsibility	
					Implementation	Supervision
		and some Landscaping will be done at the disposal site				
	Public Health and Safety	• The project will comply with the requirements of the EHS Guidelines of the World Bank Group and SECI. • The plants and equipment will be installed sufficiently away from the settlement. • All the construction equipment and vehicles will conform to the emission standards stipulated by the CPCB. • Safe working techniques will be followed up and all the workers will be trained • All the workers will be provided with proper personal safety equipment at construction as well as plant site • Proper caution signage, barricading, delineators etc. will be installed at Construction zone and temporary diversions	Solar Park	Construction Phase	Contractor (Site-in charge / Head-EHS)	SECI

Environmental component / Issues	Potential Impact	Mitigation Measures	Location	Time Frame	Institutional Responsibility	
					Implementation	Supervision
		• Proper traffic management will be ensured at the Construction zone as per IRC. • An Emergency Response system in case of any incidence will be developed and implemented • Periodical health check facility will be provided at camp sites.				
Other Environmental Concerns	Labour Camp: • Influx of migrant labourer's • additional pressure on the local resources and social infrastructures • Risk of social conflict	• The contractor will preferably engage local labour force except for the labourer's requiring special skills and non-availability of such skilled labourers from local area. • Project to assess and manage labor influx risk based on risks identified in the ESIA. Depending on the risk factors and their level, appropriate site-specific Labor Influx Management Plan and/or a Workers' Camp Management Plan.	Construction Camp	Construction Phase	Contractor (Site-in charge / Head-EHS)	SECI

Environmental component / Issues	Potential Impact	Mitigation Measures	Location	Time Frame	Institutional Responsibility	
					Implementation	Supervision
		• Project will incorporate social and environmental mitigation measures into the civil works contract. The responsibilities for managing these adverse impacts will be clearly reflected as a contractual obligation, with a mechanism for addressing non-compliance. **Worker's Accommodation** • For migrant labourers the contractor will provide labour camps with all basic facilities sufficiently away from local habitation • No labour camp will be provided within 1 km from Forest area, Wildlife Sanctuary, National Park or any other protected area. • Provisioning adequate arrangements of drinking water, lighting, ventilation, bedding, bathing; sanitation facilities and other basic facilities in the labour camps;				

Environmental component / Issues	Potential Impact	Mitigation Measures	Location	Time Frame	Institutional Responsibility	
					Implementation	Supervision
		• Ensuring proper health-check-ups of all labourer's employed at the project site; • Awareness program on HIV aids and other communicable disease may be provided to the work force • Providing separate toilet facilities for men and women at the accommodation as well as site; and • Facilitating healthcare services and medical care in case of sickness. • Locate handling sites away from populated areas • Follow proper operation and handling measures to minimize exposure • Provide prior warning /signals for blasting • Provide sirens in vehicles to avoid any collision with human/animals • Organise awareness programs on environmental resource management				

Environmental component / Issues	Potential Impact	Mitigation Measures	Location	Time Frame	Institutional Responsibility	
					Implementation	Supervision
		• Organise Health camps • Use of child labour will be strictly prohibited. Contractor will maintain a labour register with name, age and sex with supporting document (preferably copy of Aadhar card or voter's ID card). This will be monitored by Environmental and Social office of contractor and SECI. • Provide signage near construction sites and approach roads **Avoiding Gender Based Violence** • Contractor will prepare and implement robust measures to address the risk of gender-based violence that include (i) mandatory and repeated training and awareness raising for the workforce about refraining from unacceptable conduct toward local community members, specifically women; (ii)				

Environmental component / Issues	Potential Impact	Mitigation Measures	Location	Time Frame	Institutional Responsibility	
					Implementation	Supervision
		informing workers about national laws that make sexual harassment and gender-based violence a punishable offence which is prosecuted; (iii) introducing a Worker Code of Conduct as part of the employment contract, and including sanctions for non-compliance (e.g., termination), and (iv) contractors adopting a policy to cooperate with law enforcement agencies in investigating complaints about gender-based violence. • Additional measures can aim to reduce incentives to engage with the local community by providing workers with the opportunity to spend their time off away from the host community, where feasible with a small transport allowance, ideally allowing workers to regularly return for brief visits to their families, spouses and friends, or to visit				

Environmental component / Issues	Potential Impact	Mitigation Measures	Location	Time Frame	Institutional Responsibility	
					Implementation	Supervision
		nearby urban centers that provide a variety of legal social opportunities. For workers who need to travel further it may be attractive to forego weekends off in exchange for longer breaks that would allow for such home leave travel.				
	Waste generation	• Construction waste should be stored separately in a designate area. • The waste can be used as filler material. • The packing material will be segregate and stored for selling to the authorized recycler • The plastic waste should me managed in accordance with Plastic Waste Management Rules 2016.	Solar Park	Construction Phase	Contractor (Site-in charge / Head-EHS)	SECI

TABLE 4-8: ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP) FOR INFRASTRUCTURE DEVELOPMENT AND SOLAR PARK FOR OPERATION AND DECOMMISSIONING PHASE

Environment Component / Issues	Potential Impact	Mitigation Measures	Time Frame	Institutional Responsibility	
				Implementation	Supervision
Operation Phase					
Water	Water Quality and resource	• Installation of alternative waterless cleaning technology for Solar PV • Used water should be properly channelled to settling tank for stabilization and treatment so that recycled water could be reused for PV washing which will reduce the load on ground water. • Adequate capacity of Rain Water storage will be built to harvest rain water which will be connected with drainage network. The stored water can be used for washing of Solar PV to promote optimal use of surface and ground water. • Building of artificial ground water recharge structures as per guideline of Ground Water Board to promote ground water level. • Requisite permissions need to be obtained before withdrawing ground water from bore wells/ tube wells from the competent authority.	Operation and Maintenance phase	EHS Engineer of O & M	SECI
Noise	Noise Level	• Plantation of vegetation around the Grid substation;	Operation and Maintenance phase	EHS Engineer of O & M	SECI

Environment Component / Issues	Potential Impact	Mitigation Measures	Time Frame	Institutional Responsibility	
				Implementation	Supervision
Waste	Cleaning of/Broken Solar Panel	• Storing area of such waste should be on an impervious platform. • The storing area should have the arrangement of arresting of spillage and cover from above. • The waste should be stored separately and handed over to the authorized vender for proper disposal as per Hazardous and other waste Act 2016.	Operation and maintenance Phase	O&M engineers at site	SECI
	Generation of E-Waste	• E waste should be stored separately • Maintain records of e-waste generated • End-of-life electrical and electronic equipment are not admixed with e-waste containing radioactive material if any. • SECI should ensure that e-waste generated by them is channelized through collection centre or dealer of authorised producer or dismantler or recycler or through the designated take back service provider of the producer to authorised dismantler or recycler; • E waste should be managed in compliance of E-Waste (Management) Rules, 2016.	Operation and maintenance Phase	O&M engineers at site	SECI

Environment Component / Issues	Potential Impact	Mitigation Measures	Time Frame	Institutional Responsibility	
				Implementation	Supervision
	Battery Waste	• Batteries should be maintained properly so that any kind of leakage and spillage from batteries can be avoided. • Batteries should be disposed off by depositing with the dealer, manufacturer, importer, assembler, registered recycler, reconditioner or at the designated collection centres, • Batteries waste should be managed in compliance with the Batteries (Management and Handling) Rules, 2001 in case of lead acid battery. Additional measures in line with Draft Rules of 2020 should be considered.	Operation and maintenance Phase	O&M engineers at site	SECI
	Solid Waste	• Waste should be segregate at source. • Organic waste will be converted in to soil conditioner by composting. • Recyclable waste will be sold to the authorized recycler. • Inert waste will be disposed off in to low lying area.	Operation and maintenance Phase	O&M engineers at site	SECI
Decommissioning Stage					
Air	Dust Generation	• Proper handling, using of PPEs	Decommissioning Stage	SECI	SECI
Noise	Noise level	• Use of PPEs	Decommissioning Stage	SECI	SECI

Environment Component / Issues	Potential Impact	Mitigation Measures	Time Frame	Institutional Responsibility	
				Implementation	Supervision
Land	Soil and land use	• Parcels of land under permanent structures e.g. roads / buildings / warehouse etc. will be restored to its near original state by re-laying of the topsoil	Decommissioning Stage	SECI	SECI
Social	Employment	• Temporary employment provided in the park will be discontinued. Developer will undertake CSR activities during operation that will include training for alternative or self-employment.	Decommissioning Stage	SECI	SECI
	Aesthetics	• Site to be restored in its original shape	Decommissioning Stage	SECI	SECI

Table 4-9: Environmental and Social Management Plan (ESMP) for Transmission Line

Activities	Potential Impact	Mitigation Measures	Time Frame	Institutional Responsibility	
				Implementation	Supervision
Design and Pre-construction Phase					
Land Issues	Right to use land for transmission line	• Careful route selection to avoid existing settlements • Analysis of alternative to minimize alignment passing over agriculture land Compensate for the land under tower pads as well as ROW as per Guidelines issued by Ministry of Power for payment of compensation towards damages caused by tower and Right of Way for transmission lines and assist for loss of livelihood or sources of livelihood as per the agreed entitlement framework of RPF • All the affected persons will be identified in advance prior to commencement of construction works.	Design and Pre-Construction Stage	Contractor (Site-in charge / Head-EHS / All HoDs)	SECI
	Loss of forest land and tree	• Obtain statutory forest clearances from the Government • Compensatory plantation to be done against the tree felling as per rule • The condition of the forest clearance/ tree felling permission to be strictly complied.	Design and Pre-Construction Stage	Contractor (Site-in charge / Head-EHS)	SECI

Activities	Potential Impact	Mitigation Measures	Time Frame	Institutional Responsibility	
				Implementation	Supervision
Encroachment into farmland	Loss of agriculture productivity	• Minimise encroachment into farmland by careful alignment selection. • Farmers / landowners compensated for significant trees that need to be trimmed / removed along ROW. • Statutory approvals for tree trimming / removal	Design and Pre-construction stage	Contractor (Site-in charge / Head-EHS)	SECI
Interference with drainage patterns/Irrigation channels	Flooding hazards / loss of agricultural production	• Appropriate siting of towers to avoid channel interference	Design and Pre-construction stage	Contractor (Site-in charge / Head-EHS)	SECI
Water Bodies	Interference in water tanks.	• All the water tanks in the alignment of transmission lines will be avoided by change of alignment in these sections	Design and Pre-Construction Stage	Contractor (Site-in charge / Head-EHS)	SECI
Construction Phase					
Land Resources	Loss of Vegetation	• Vegetation will be removed from the construction zone before commencement of construction. All works will be carried out such that the damage or disruption to flora other that those identified for cutting is minimum. • Trees allowed growing up to a height within the RoW by maintaining adequate clearance between the top of	Construction Stage	Contractor (Site-in charge / Head-EHS)	SECI

Activities	Potential Impact	Mitigation Measures	Time Frame	Institutional Responsibility	
				Implementation	Supervision
		tree and the conductor as per the regulation • Only ground cover/shrubs that impinge directly on the permanent works or necessary temporary works will be removed with prior approval from the Environmental Expert. • The Contractor, under any circumstances will not cut or damage trees. • Trees identified under the project will be cut only after receiving clearance from the Forest Department and after the receipt of written permission from Engineer. • Construction vehicles, machinery and equipment will move or be stationed in the designated area only to prevent compaction of vegetation outside the construction area. • Collection of firewood is prohibited. • No fires may be ignited with the intent to destroy the flora on the site and surrounding			
	Site Clearance	• The earth material generated due to excavation will be used to optimum quantity to reduce impact on land resources.	Construction Phase	Contractor Contractor	SECI

Activities	Potential Impact	Mitigation Measures	Time Frame	Institutional Responsibility	
				Implementation	Supervision
		• The proposed access roads inside project area do cut cross several non-perennial drainage channels and would require construction of adequate number of cross-drainage structures to mitigate the adverse impacts on the surface runoff • It will be ensured that no trees are required to be cut while installation of Towers. If any tree is still required to be cut, permission from the state forest department need to be obtain along with compensatory plantation as per the guidelines issued by the state forest department. • No scare will be left unattended after excavation activity.		(Site-in charge / Head-EHS / Head-Civil)	
Soil	Loss of Top soil	• On the proposed alignment of the transmission line, at the time of construction good quality top soil should be kept sufficiently away from the construction zone to avoid contamination and needs to be reused in the agriculture field. • No construction materials should be stacked in the agriculture field.	Construction Phase	Contractor (Site-in charge / Head-EHS / Head-Civil)	SECI
	Contamination of soil	• The earth material generated due to excavation will be used to optimum	Construction Phase	Contractor	SECI

Activities	Potential Impact	Mitigation Measures	Time Frame	Institutional Responsibility	
				Implementation	Supervision
		quantity to reduce impact on soil environment. • Proper Stripping and stockpiling of soil layers to reduce dust pollution.		(Site-in charge / Head-EHS / Head-Civil)	
	Soil Compaction	• The excavation activities and vegetation clearance will strictly be limited to the Row of the Transmission line. • All the usable excavated materials will be re-used as fill materials and aggregates. • The movement of construction vehicles and equipment will be restricted to only designated route. • It should be ensured that no additional access roads other than those proposed as per the layout plan are created.	Construction Phase	Contractor (Site-in charge / Head-EHS / Head-Civil)	SECI
	Soil Erosion	• Designated storage site for fill materials and adequate stockpiling to prevent erosion and runoff related problem. • Garland drains around excavated soil will trap silt. Silt trap will reduce siltation load in the nearby drainage and surface water body.	Construction Phase	Contractor (Site-in charge / Head-EHS / Head-Civil)	SECI
Water	Water Requirement	• The Contractor will arrange separate water supply arrangement for construction work and will not interfere with the normal public water supply.	Construction Phase	Contractor (Site-in charge / Head-EHS)	SECI

Activities	Potential Impact	Mitigation Measures	Time Frame	Institutional Responsibility	
				Implementation	Supervision
		• Requisite permissions need to be obtained before withdrawing ground water from bore well s/ tube wells from the competent authority.			
	Water Quality	• All water and liquid wastes arising from construction activities will be properly disposed off and will not be discharged into any water body/ stream course without adequate treatment. • Littering or unauthorized discharge will not be permitted. • Permission of the engineer and the concern regulatory authorities will be obtained for disposal of the waste as the designated disposal point. • The stream course and drain will be kept free from dumping of solid wastes and earth materials. • The construction materials and debris will be stored away from water bodies or water ways and only on the designated sites along the construction zones.	Construction Phase	Contractor (Site-in charge / Head-EHS)	SECI
Air	Generation of Dust	• Water will be sprayed during construction phase, in earth handling sites, other excavation areas for suppressing fugitive dust.	Construction Phase	Contractor (Site-in charge / Head-EHS)	SECI

Activities	Potential Impact	Mitigation Measures	Time Frame	Institutional Responsibility	
				Implementation	Supervision
		• Water sprinkling and transporting construction materials with tarpaulin coverage during the construction stage. • As soon as construction is over all the surplus earth will be utilized properly all loose earth will be removed from the site. • The workers working at Mixing machine will be provided with masks			
Noise	Noise level	• The main stationary noise producing sources such as generator sets shall be provided with noise shields around them. • The mixing equipment used for construction will strictly conform to CPCB noise standards. • Vehicles and equipment used will be fitted with silencer and maintained accordingly. • All the workers shall be provided earplugs to avoid any ill impacts on their health. • An awareness programme will be organized for drivers and equipment operators to make them aware of the	Construction Phase	Contractor (Site-in charge / Head-EHS)	SECI

Activities	Potential Impact	Mitigation Measures	Time Frame	Institutional Responsibility	
				Implementation	Supervision
		consequences of noise and to act properly at site.			
Biological Environment	Ecological Resources	• Stockpiling of the construction materials should be avoided in and arounds trees in the site. • The contractor shall ensure adequate measures to ensure that no illegal poaching of wild animals is being done by construction workers. • The developer shall ensure compliance to the EMP measures for setting up of the labour camp sites etc.	Construction Phase	Contractor (Site-in charge / Head-EHS)	SECI
Social	Aesthetics	• The site will be cleaned immediately after the construction activity is over. • The debris materials will be disposed off only at identified area for disposal and proper levelling will be done after disposing the materials and shall be covered with top soil and some Landscaping will be done at the disposal site	Construction Phase	Contractor (Site-in charge / Head-EHS)	SECI
	Worker and Public Health and Safety	• The project will comply with the requirements of the EHS Guidelines of the World Bank Group, 2007. The relevant ones are General guidelines and those for Power Transmission and Distribution.	Construction Phase	Contractor (Site-in charge / Head-EHS)	SECI

Activities	Potential Impact	Mitigation Measures	Time Frame	Institutional Responsibility	
				Implementation	Supervision
		• Safe working techniques will be followed for all the workers, who will be trained at the time of induction into the site workforce. • All the workers will be provided with proper personal safety equipment • An Emergency Response system in case of any incidence will be developed and implemented • Periodical health check facility will be provided at camp sites.			
Other Environmental Concern	Waste generation	• Construction waste should be stored separately in a designate area. • The waste can be used as filler material. • The packing material will be segregate and stored for selling to the authorized recycler • The plastic waste should me managed in accordance with Plastic Waste Management Rules 2016.	Construction Phase	Contractor (Site-in charge / Head-EHS)	SECI
	• Influx of migrant labourers	• The contractor will preferably engage local labour force except for the labourer's requiring special skills and	Construction Phase	Contractor (Site-in charge / Head-EHS)	SECI

Activities	Potential Impact	Mitigation Measures	Time Frame	Institutional Responsibility	
				Implementation	Supervision
	• additional pressure on the local resources and social infrastructures • Risk of social conflict	non-availability of such skilled labourers from local area. • Project to assess and manage labor influx risk based on risks identified in the ESIA. Depending on the risk factors and their level, appropriate site-specific Labor Influx Management Plan and/or a Workers' Camp Management Plan. • Project will incorporate social and environmental mitigation measures into the civil works contract. The responsibilities for managing these adverse impacts will be clearly reflected as a contractual obligation, with a mechanism for addressing non-compliance. Worker's Accommodation • For migrant labourers the contractor will provide labour camps with all basic facilities sufficiently away from local habitation • No labour camp will be provided within 1 km from Forest area, Wildlife Sanctuary, National Park or any other protected area.			

Activities	Potential Impact	Mitigation Measures	Time Frame	Institutional Responsibility	
				Implementation	Supervision
		• Provisioning adequate arrangements of drinking water, lighting, ventilation, bedding, bathing and other basic facilities in the labour camps; • Ensuring proper health-check-ups of all labourer's employed at the project site; • Providing separate toilet facilities for men and women at the accommodation as well as site; and • Facilitating healthcare services and medical care in case of sickness. • Locate handling sites away from populated areas • Follow proper operation and handling measures to minimize exposure • Provide prior warning /signals for blasting • Provide sirens in vehicles to avoid any collision with human/animals • Organise awareness programs on environmental resource management • Organise Health camps • Use of child labour will be strictly prohibited. Contractor will maintain a labour register with name, age and sex with supporting document (preferably copy of Aadhar card or voter's ID card).			

Activities	Potential Impact	Mitigation Measures	Time Frame	Institutional Responsibility	
				Implementation	Supervision
		This will be monitored by Environmental and Social office of contractor and SECI. • Provide signage near construction sites and approach roads Avoiding Gender Based Violence • Contractor will prepare and implement robust measures to address the risk of gender-based violence that include (i) mandatory and repeated training and awareness raising for the workforce about refraining from unacceptable conduct toward local community members, specifically women; (ii) informing workers about national laws that make sexual harassment and gender-based violence a punishable offence which is prosecuted; (iii) introducing a Worker Code of Conduct as part of the employment contract, and including sanctions for non-compliance (e.g., termination), and (iv) contractors adopting a policy to cooperate with law enforcement agencies in investigating complaints about gender-based violence.			

Activities	Potential Impact	Mitigation Measures	Time Frame	Institutional Responsibility	
				Implementation	Supervision
		• Additional measures can aim to reduce incentives to engage with the local community by providing workers with the opportunity to spend their time off away from the host community, where feasible with a small transport allowance, ideally allowing workers to regularly return for brief visits to their families, spouses and friends, or to visit nearby urban centers that provide a variety of legal social opportunities. For workers who need to travel further it may be attractive to forego weekends off in exchange for longer breaks that would allow for such home leave travel			
Operation and Maintenance Phase					
Location of transmission towers and transmission line alignment and design	Exposure to safety related risks	Setback of dwellings to overhead line route designed in accordance with permitted level of power frequency and the regulation of supervision at sites.	O&M Stage	SECI / O&M Contractor SECI	SECI

Activities	Potential Impact	Mitigation Measures	Time Frame	Institutional Responsibility	
				Implementation	Supervision
Oil spillage	Contamination of land / nearby water bodies	Substation transformers located within secure and impervious sump areas with a storage capacity of at least 100% of the capacity of oil in transformers and associated reserve tanks	O&M Stage	SECI / O&M Contractor (Head EHS)	SECI
Inadequate Provision of staff/workers health and safety during operations	Injury and sickens of staff / workers	• Careful design using appropriate technologies to minimize hazards • Safety awareness raising for staff • Preparation of fire emergency action plan and training given to staff on implementing emergency action plan	O&M Stage	SECI / O&M Contractor (Head EHS)	SECI
Electric shock hazards	Injury / mortality to staff and public	• Careful design using appropriate technologies to minimize hazards Regular monitoring of faults and immediate repair/ replacement of damaged wires/ towers • Issue of warning to the local public regarding the malfunctioning and scheduling of repairs/replacement • Barriers to prevent climbing on /dismantling of transmission towers • Appropriate warning signs on facilities • Electricity safety awareness raising in project areas	O&M Stage	SECI / O&M Contractor (Head EHS)	SECI

Activities	Potential Impact	Mitigation Measures	Time Frame	Institutional Responsibility	
				Implementation	Supervision
Transmission line maintenance	Exposure to electromagnetic interference	Transmission line design to comply with the limits of electromagnetic interference overhead power lines	O&M Stage	SECI / O&M Contractor (Head-EHS/Electrical)	SECI

4.10 CONSTRUCTION & OCCUPATIONAL HEALTH AND SAFETY

Prior to the start of the construction of the activities, the EPC contractor has to frame a site specific Occupational Health and Safety (OHS) plan in line with the best industrial practises and Occupational Health and Safety guidelines of the World bank and get it approved from SECI.

During the complete Project execution faces, EPC contractor has to follow the OHS plan. EPC contractor must have to conduct regular training session for its employees to get them accustomed with the site specific OHS plan.

4.11 IMPLEMENTATION ARRANGEMENT

SECI is proposed to develop the Solar Park with battery storage project in Build Own Operate model. CI. Project would be set up in a turnkey EPC mode, with EPC contractor being determined through a transparent international competitive bidding process. The implementation arrangement of the project is given **Figure 4-1**.

SECI

- Borrower of World Bank loan
- To provide counterpart funding for the project
- To enter into long term PPA
- Invite tenders for EPC contractor
- Monitor Progress of project, including ESMP
- Own and operate the project
- Interface with the World Bank and other agencies

STATE GOVERNMENT

- To provide land for the project
- Provide necessary clearance for project
- To offtake power generated from the project through long term PPA

CONTRACTOR

- Preparation of ESIA and ESMP report for the Project
- Implementation of ESMP measures as per Contract
- Report on progress and shortcomings of the measures implemented to Environmental Specialist of SECI

FIGURE 4-1 IMPLEMENTATION ARRANGEMENT

4.12 GRIEVANCE REDRESS MECHANISM

Effective environmental and social grievance redressal mechanism gives an opportunity to the organization to implement a set of specific measures to ensure good governance accountability and transparency in managing and mitigation of environmental and social issue of a particular project. This consists of defining the process for recording/receiving complaints and their redressal in respect of environmental and social matters.

Three-tier appropriate grievance redressal mechanism will be established at project level to ensure speedy resolution of disputes. An integrated system will be established with Grievance Redressal Cell (GRCs), with necessary officers, officials and systems, at the state as well as SECI. Grievances if any, may be submitted through various mediums, including in person, in written form to a noted address, e-mail, or through direct calls to concerned officials. The Social and Environmental Expert in the concerned agency shall be responsible for coordination of grievance/complaints received.

Grievances of PAPs, in writing, will be brought to GRC for redressal by the ESMP implementation agency. The ESMP implementation agency will provide all necessary help to PAPs in presenting his/her case before the GRC. In case an aggrieved person is illiterate or any vulnerable person (differently abled or woman), can use toll free number to register the grievance or can approach NGO responsible for implementation of ESMP. An aggrieved person can keep his or her identify confidential. The GRC will respond to the grievance within 15 days. The GRC will normally meet once in a month but may meet more frequently, if the situation so demands. Time period of 45 days will be available for redressing the grievance of PAPs. The decision of the GRC will not be binding to PAPs. This means the decision of the GRC does not debar PAPs taking recourse to court of law, if he/she so desires. Broad functions of GRC are as under:

- Record the grievances of PAPs, categorize and prioritize them and provide solution to their grievances related to resettlement and rehabilitation assistance
- The GRC may undertake site visit, ask for relevant information from Project Authority and other government and non-government agencies, etc in order to resolve the grievances of PAPs
- Fix a time frame within the stipulated time period of 45 days for resolving the grievance
- Inform PAPs through implementation agency about the status of their case and their

decision to PAPs and Project Authority for compliance.

The GRC will be constituted within 3 months by an executive order from competent authority (centre/ state) from the date of mobilization of ESMP implementation agency. The Social Officer of SECI will pursue the matter with assistance from implementation agency in identifying suitable persons from the nearby area for the constitution of GRC.

A three-tier appropriate grievance redressal mechanism will be established to ensure speedy resolution of disputes. An integrated system will be established with necessary manpower at the project level, state as well as in SECI. Grievances if any may be submitted through various mediums, including in person, in written form to a noted address, e-mail, or through direct calls to concerned officials. The Social and Environmental Expert in the concerned agency shall be responsible for coordination of grievance/complaints received. All grievances recorded either though GRC or toll free number or web based grievence registration, will be made public.

Grievance redressal through toll free number or web based mechanism

In case of grievances received through a toll free number or web based system, a person will be appointed in-charge of screening and resolution of the same/communicating with the concerned officials. The person in-charge based on the nature of complaint, will forward the same to the concerned official. A ticket or a unique number will be generated for all such complaints. The complainant will follow up based on that unique number. All calls and messages will be responded to within a two week time frame. If responses are not received within 15 days, the complaint will be escalated to project head. It is also recommended to maintain a grievance register on action taken and disposal of grievance.

Site level Grievance Redressal Cell

A site level GRC will be set up that is easily accessible to the affected community. The details of the system is given in table below.

Table 4-10: Details of GRM Committee

Tier	Representative	Roles and responsiblity
I	Field Officer- Member Secretary	Overall responsibility is to convene and conduct the meeting on monthly basis for the grievances received from the local community

Tier	Representative	Roles and responsiblity
	Representatives from Community (Village Head)	Will be part of GRC to protect rights of community. Will be first level of contact for the community and will also be responsible for informing the community about the decisions taken.
	Representatives from Developers	Along with the community representative, will be responsible for informing the community regarding the decisions taken and will provide technical inputs.
II	SECI- Head or representative	If not resolved at site level, the grievances will be escalated to tier 2. The Social Specialist of SECI will be responsible for policy interpretation based on field level inputs provided by field Officer of SECI.
	SECI- Social/Gender Specialist	
III	Judiciary	If unresolved, aggrieved persons have the right to approach the Judiciary. Project will assist any PAPs approaching judiciary.

4.13 GENDER ASSESSMENT, DEVELOPMENT

According to ESMF, the objective of Gender Assessment and Development is to analyse gender issues during the preparation stage of sub projects, design interventions and primary data collection. The gender analysis shall be carried out based on findings from gender specific queries and requirements during data collection and community consultation process. The quantitative and qualitative analysis shall include sex disaggregated data, issues related to gender disparity, needs, constraints, priorities and understanding of gender based inequitable risks, benefits and opportunities as well as gender relevant indicators.

4.14 GENDER BASED VIOLENCE (GBV)

GBV is an umbrella term for any harmful act that is perpetrated against a person's will and that is based on socially ascribed gender differences. GBV includes acts that inflict physical, mental, sexual harm or suffering; threats of such acts; and coercion and other deprivations of liberty, whether occurring in public or in private life. The project site includes both the actual locations where civil works are conducted and also the associated areas such as the locations of workers' camps, quarries, etc. These GBV risks need to be assessed throughout the project's life by monitoring the situation, assessing the effectiveness of risk mitigation measures, and adapting them.

Since a sub project involves construction work that will demand a constant supply of labourers, the influx of migrant workforce can be a potential risk for the host population. The influx of

labour force can lead to the risk of Gender-Based Violence. Hence, it is proposed that EPC shall conduct regular sensitization programme on gender equality for its employee and Project affected families. Code of conduct shall be framed for handling the cases of gender violence and proper records shall be maintained be the EPC contractor.

4.15 INTEGRATION OF ESMAP WITH PROJECT

To ensure the implementation of safeguard measures by the EPC contratcor, the ESMAP including the suitable conditions for the preparation of project specific detailed ESAMP and necessary recommendation of ESDDR will be included in the bid document. The ESMAP clearly outlines the responsibility for various safeguard management actions associated with the project activities related to Labour Management, Assessment of Gender Based Violence and Grievance Redress Mechanism as well as to ensure compliance of the same in accordance with the safeguard requirements of the ESMF.

4.16 REQUIREMENTS FOR PREPARATION OF ESHS MANAGEMENT STRATEGIES AND IMPLEMENTATION PLANS (ESHS-MSIP)

The EPC contractor shall submit comprehensive and concise Environmental, Social, Health and Safety Management Strategies and Implementation Plans (ESHS-MSIP) as part of Contractors' Environmental and Social Management Plan (CESMP). These strategies and plans shall describe in detail the actions, materials, equipment, management processes etc. that will be implemented by the EPC contractor, and its subcontractors. In developing these strategies and plans, the EPC contractor shall have regard to the ESHS provisions of the Contract Agreement including those as may be more fully described in the following:

a) Works Requirements described in Contract Agreement;

b) Environmental and Social Impact Assessment (ESIA);

c) Environmental and Social Management Plan (ESMP);

d) Consent Conditions (regulatory authority conditions attached to any permits or approvals for the project).

4.17 REQUIREMENTS FOR THE PREPARATION OF THE CODE OF CONDUCT

The EPC Contractor shall submit the Code of Conduct that will apply to the its employees and Sub-contractors. The Code of Conduct shall ensure compliance with the ESHS provisions of the Contract Agreement, including those as may be more fully described in the following:

a) Works Requirements described in Contract Agreement;

b) Environmental and Social Impact Assessment (ESIA);

c) Environmental and Social Management Plan (ESMP);

d) Consent Conditions (regulatory authority conditions attached to any permits or approvals for the project).

4.18 MINIMUM REQUIREMENTS FOR THE CODE OF CONDUCT

A minimum requirement for the Code of Conduct should be set out, taking into consideration the issues, impacts, and mitigation measures identified in:

a) Project reports e.g. ESIA/ESMP.

b) consent/permit conditions

c) required standards including World Bank Group EHS Guidelines

d) national legal and/or regulatory requirements and standards (where these represent higher standards than the WBG EHS Guidelines)

e) relevant standards e.g. Workers Accommodation: Process and Standards (Indian Standards, and in the absence of such Indian Standards those of IFC and EBRD) relevant sector standards e.g. workers accommodation

f) grievances redress mechanisms

The types of issues identified could include risks associated with: labor influx, spread of communicable diseases, sexual harassment, gender based violence, illicit behavior and crime, and maintaining a safe environment etc. A satisfactory code of conduct will contain obligations on all project staff (including sub-contractors and day workers) that are suitable to address the following issues, as a minimum.

4.19 COMPLIANCE WITH APPLICABLE LAWS, RULES, AND REGULATIONS OF THE JURISDICTION

- Compliance with applicable health and safety requirements (including wearing prescribed personal
- protective equipment, preventing avoidable accidents and a duty to report conditions or practices that pose a safety hazard or threaten the environment)
- The use of illegal substances

- Non-Discrimination (for example on the basis of family status, ethnicity, race, gender, religion, language, marital status, birth, age, disability, or political conviction)
- Interactions with community members (for example to convey an attitude of respect and non-discrimination)
- Prohibition of child labour (for example employment of children below 14 years of age is prohibited in Building and Construction Industry)
- Sexual harassment (for example to prohibit use of language or behavior, in particular towards women or children, that is inappropriate, harassing, abusive, sexually provocative, demeaning or culturally inappropriate)
- Violence or exploitation (for example the prohibition of the exchange of money, employment, goods, or services for sex, including sexual favors or other forms of humiliating, degrading or exploitative behavior)
- Protection of children (including prohibitions against abuse, defilement, or otherwise unacceptable behavior with children, limiting interactions with children, and ensuring their safety in project areas)
- Sanitation requirements (for example, to ensure workers use specified sanitary facilities provided by their employer and not open areas)
- Avoidance of conflicts of interest (such that benefits, Concession Agreement, or employment, or any sort of preferential treatment or favors, are not provided to any person with whom there is a financial, family, or personal connection)
- Respecting reasonable work instructions (including regarding environmental and social norms)
- Protection and proper use of property (for example, to prohibit theft, carelessness or waste)
- Duty to report violations of this Code
- Non retaliation against workers who report violations of the Code, if that report is made in good faith. The Code of Conduct should be written in plain language and signed by each worker to indicate that they have:
    - received a copy of the code;
    - had the code explained to them;
    - acknowledged that adherence to this Code of Conduct is a condition of employment; and

- understood that violations of the Code can result in serious consequences, up to and including dismissal, or referral to legal authorities

5. FINDINGS OF GAP ANALYSIS

As prescribed in the ESMF, a Gap Analysis with respect to major environment and social attributes has been done and the major observations are presented in **Table 5-1** below :

TABLE 0-1: GAP ANALYSIS FINDINGS

Sl. No.	Key Principles and Attributes	GAP	Remarks
1	Assessment of environmental and social Impacts	To be complied by EPC contractor through their ESIA consulting agency	• As per ESDDR study and screening checklist, the present project is categorized as having 'Low Impact'. • The project does not trigger EIA notification 2006. • Construction of the proposed solar PV project along with Battery storage does not attract any land acquisition. The duration of associated impact shall be during construction phase. This can be mitigated through proper project specific Environmental Management Plan (EMP) prepared and implemented by the EPC contractor under the supervision of SECI
2	Implementation of Mitigation and Management Measures	To be complied during construction and operation stages	The EPC contractor is mandated to prepare the project specific ESAMP and the same ESAMP shall be implemented after the approval of SECI Bank. Periodic progress reporting (Monthly, Quarterly and Yearly) Status Reports and Annual Audit Report on the implementation of environmental and social safeguard measures requires to be adhere by the EPC Contractor, and the frequency of submission to SECO shall also be revealed in the detailed ESMP.
3	Principle of Avoidance	Complied	To avoid the disturbance to local public, project is proposed to be setup on vacant government land

Sl. No.	Key Principles and Attributes	GAP	Remarks
4	Linkages with other projects	Not Applicable	This ESDDR is prepared for the establishment of proposed 100 MW(AC) Solar PV Project (200MWp DC capacity) along with 50MW/150 MWh Battery Energy Storage System and associated transmission line and there is no linkage with other project.
5	Involuntary restriction of access to legally designated parks and protected areas	Not Applicable	All the project components are planned within government land; there is no involvement of any designated parks and protected areas.
6	Recognition of untitled persons such as squatters and encroachers including customary rights	Not Applicable	It is important to highlight that the total available land area as per government record is about 400 hectare. However, for the said project configuration, the land requirement is only about 200 hectare. SECI is in process of conducting the topography survey. After the conclusion of the topographic survey, SECI will finalize the tentative project boundary, wherein, due care shall be taken by to avoid tree cutting, acquisition of private land, gothan area, any damage to property of cultural importance, community building, schools etc.
7	Avoiding displacement of Indigenous People	Not Applicable	The project will neither displace nor have any temporary disturbance on the indigenous people. However, a separate management plan for indigenous people shall be framed for local tribal population as part of CESMP.
Planning			
1	Threshold for Resettlement Plan (RP)	Not Applicable	The project has neither trigger any impact related to resettlement / livelihood nor have any adverse impact on encroacher and squatters.
2	Need to replace / restore	Not Applicable	The project does not have any

Sl. No.	Key Principles and Attributes	GAP	Remarks
	CPRs		impact on CPRs.
3	Consultation and participation of PAPs during project planning	Complied	Consultation with local residents and various stakeholder groups are conducted during planning stage. The project is categorised as 'low-impact' implying minimum or no adverse impacts. Temporary disturbances to public are envisaged during excavation works, which will be mitigated through appropriate measures in ESMP. Over and above, public consultation will be carried out while updating the ESMP.
4	Participation of NGOs in project planning	To be complied by Implementation authority (SECI / EPC contractor etc.)	NGOs are recognized as a major stakeholder group in the project implementation stage, for awareness creation about project activities and for ensuring community participation. Consultation Framework provided as part of Social Management Plan (in ESMP) suggests for conducting meetings with NGOs to solicit feedback from local community.
5	Cut-off date	Not Applicable	The project has neither trigger any impact related to resettlement / livelihood nor have any adverse impact on encroacher and squatters.
6	Definition of a family for R&R assistance		
7	Need and scope of census and socio-economic surveys		
8	Compensation		
9	Primary Authority for Land Acquisition		
10	Principle to restore/improve living standards		
11	Compensation for land at replacement value		
12	Treatment of depreciation and Salvage		

Sl. No.	Key Principles and Attributes	GAP	Remarks
13	Transaction and transition fee		
14	Land for Land as an option for compensation		
Resettlement Assistance			
1	Cash assistance over and above compensation	Not applicable	The project has neither trigger any impact related to resettlement / livelihood nor have any adverse impact on encroacher and squatters.
2	Assistance to poorest of the poor or vulnerable category of people		
3	Provision of infrastructure and public services at resettlement sites		
Implementation			
1	Implementation of RP	Not applicable	The project has neither trigger any impact related to resettlement / livelihood nor have any adverse impact on encroacher and squatters.
2	Participation of civil society in implementation of RP		
3	Opportunity for PAPs to participate in planning, design and implementation		
4	Disclosure of Resettlement Plan		
Grievance Redressal Mechanism			
1	Procedure for dispute resolution and appeals	To be complied by Implementation authority (SECI / EPC contractor etc.)	GRM is already in place. Same procedure shall be extended for said Project also. (Refer section 4.12)
2	Composition of Grievance Redress Committee		

Sl. No.	Key Principles and Attributes	GAP	Remarks
3	Participation of representative of PAPs and civil society		
Monitoring			
1	Independent monitoring	To be complied by Implementation authority	ESMF provides for independent environment and social compliance monitoring / audit by third party inspection agency for each of the sub projects. ESMP should be accordingly amended for implementation.
2	Periodic evaluation and monitoring	To be complied by Implementation authority	Internal Monitoring framework provided in ESMP should be updated to include parameters such as, formation of GRC, site specific restoration of excavated roads/construction sites, dust pollution, greenery maintenance along the periphery of project site, environmental monitoring (air, noise, soil, water) and inclusion of project specific EMP in the Bid / Contract Document. The reporting mechanisms of the project including the periodic progress reporting (Monthly, Quarterly and Yearly), other Status Reports and Annual Audit Reports on the implementation of environmental and social safeguard measures shall be included in the Bid / Contract Document.
3	Provision for Environment and Social Experts in Executing Agencies	To be complied by the Implementation Authority	The proposed project involve numerous construction activities. Accordingly, the available Project Staffs of SECI; shall be trained and assigned for monitoring as well as ensure compliance of environmental and social safeguard measures associated with the day to day construction activities of the proposed project.

Sl. No.	Key Principles and Attributes	GAP	Remarks
			The Environmental Social Experts deployed at the SECI Corporate Office, New Delhi can provide necessary guidance/training to the designated Project Staffs of Executing Agencies, as and when required, related to the implementation of environmental and social safeguard measures.

6. IMPLEMENTATION SCHEDULE AND RESPONSIBILITY

The implementation schedule, responsibilities and respective time frame is tabulated below:

TABLE 0-1: IMPLEMENTATION SCHEDULE AND ASSOCIATED RESPONSIBILITIES

Sl. No.	Action	Responsibility	Timeframe
ENVIRONMENT SAFEGUARD			
1	Prepare ESMP and incorporate suitable conditions in Contract to prepare & implement ESMP by the EPC Contract.	SECI/ EPC Contractor	The ESMP shall be updated by EPC contractor before execution of the project.
2	Obtain 'Consent' from State Pollution control Board for establishment and operation of STPs.	SECI / EPC Contractor	Immediate and ensure that the works shall be initiated after receiving the Consents.
3	Initiate implementation of the recommended measures (presented in Sect. 7.1 and 7.2).	SECI / EPC Contractor	Throughout the project period.
DETAILED ENVIRONMENTAL MANAGEMENT PLAN			
4	Preparation of updated EMP & part of Contract and obtain the approval of the SECI/ Word Bank.	EPC Contractor	Within 3 months of the commencement of Contract.
SOCIAL SAFEGUARDS			
5	Acquisition of land for construction of project.	SECI / EPC Contractor	SECI shall obtained the physical possession of the land from Energy Department, Govt. of Chhattisgarh prior to award of work to the EPC contractor. EPC contractor shall follow all the acts, rules and regulations land taking for installation of transmission line.
6	Hiring of NGO/CBO for information dissemination	SECI / EPC Contractor	Immediate / Prior to disbursement of retroactive claim under the project.
7	Prepare IEC material	SECI / NGO	One Month after Action No. 6.
8	Establish GRC	SECI	Immediate.
9	Designate Grievance Officer	SECI	Already designated
10	Information dissemination	SECI	Continuous after Action No. 7.
11	In- Country disclosure of this DDR	SECI	Immediate (Prior to initiation of Bidding process).

7. RECOMMENDATIONS

The Environmental and Social Due Diligence Report (ESDDR) is prepared by SECI, on the basis of Detailed Project Report. Based on the Environmental and Social Screening carried out as part of this due diligence exercise using the screening matrix of the Environmental and Social Management Framework (ESMF, June 2020), the present project of 100 MW(AC) Solar PV Project (200MWp DC capacity) along with 50MW/150 MWh Battery Energy Storage System and associated transmission line, falls under 'Low Impact' category.

The project does not trigger EIA notification 2006 and RFCTLARR Act, 2013. The project components have limited environment and social impacts during construction phase. These associated impacts can be mitigated through the adoption of suitable mitigation measures in the form of project specific Environmental Management Plan (EMP) prepared and implemented by the EPC Contractor under the supervision of SECI.

Based on the findings of due diligence exercise, the following recommendations are provided with an objective to ensure compliance with the ESMF:

7.1 DESIGN AND PLANNING ASPECTS

- Suitable conditions shall be incorporated in the Bid/Contract documents to prepare and implement EAMP by the EPC Contractor during the execution/operation stages.
- A detailed project specific ESMP requires to be prepared by the EPC Contractor before execution of the project and shall obtain approval from the SECI / World Bank. The detailed ESMP shall include the information pertains to land/site layout, Project design, management practices, cumulative impact assessment (if any).
- Permission for tree felling (if any) shall be obtained from the Forest Department.
- Labour license requires to be obtained by EPC Contractor prior to construction.
- Construction materials shall be procured from the quarries approved / licensed from the competent authorities' viz. Department of mining of State Government; SEIAA; District Collector.
- Permission shall be obtained for the use of water for construction purpose from irrigation department/CGWA (for Surface or Ground Water) respectively.

- Pollution under Control Certificate should be obtained for Construction Vehicles.
- Higher capacity DG sets shall be complied with CPCB norms, adequate Stack Height and Acoustic Measure shall be mandated.
- Appropriate measures should be taken to control/channelize the discharge of untreated effluent directly into the river.
- Tree plantation along with landscaping around the Project is advised in order to improve the aesthetic value.
- Formal Intimation to line department to be given regarding excavation works in order to avoid or minimize the damages to existing utilities in the construction site.
- A Gender Action Plan to be prepared to address the risk of gender based violence in the project and adjoining communities.
- Orientation and sensitization training needs to be provided for all project staff and contractors, in particular, safety supervisors and engineers on GBV at all levels.
- ICC committees addressing GBV need to be constituted at site, corporate level.
- GBV needs to be integrated with GRM with special provisions, so, confidentiality/personal information can be controlled /maintained.
- Independent Environment and Social/Compliance Monitoring Audit by the third party independent inspection agency shall be carried out annually, as per the ESMF requirements of SECI.
- Periodic progress reporting (Monthly, Quarterly and Yearly) requires to be done by the EPC Contractor, and the frequency of submission to SECI shall be revealed in the ESMP.

7.2 DESIGN AND OPERATIONAL SPECIFIC

- In coordination with the local agriculture / horticulture department, awareness programme shall be organized for the local farmers.
- services of local NGOs/CBOs may be hired for information dissemination and public consultations.
- To avoid inconvenience advance notice shall be circulated / given to the local residents, shop owners, vendors and squatters. Local community shall also be consulted before

commencement of works at respective locations; this shall be organized through awareness campaigns and disclosure of information related to the project components.

- SECI shall adopt the public relation activities to disseminate the necessary information about the project like (i) announcement on FM radio, (ii) space in local newspaper, (iii) printing and distributing pamphlets through local newspaper vendors, and (iv) putting up information boards at construction sites.
- SECI through the EPC contractor shall ensure (i) adequate safety measures during construction, (ii) ensure uninterrupted access to residences and shops, (iii) sprinkle water to control dust, and (iv) restoration of sites without delay.
- Excavated materials shall be used for backfilling of the trench area, low lying areas of the site.
- Consideration shall be given for constructing garland drain around the site with small opening intermittently in the boundary wall allowing rainwater to drain-off without accumulating in the adjacent residential areas.
- Efficient site restoration measure shall be developed and checked regularly by assigned engineer to avoid the public and traffic inconvenience.
- Maintenance of site health (Air, water, Noise, Soil Quality) and safety of worker (OHS) shall be checked on regular basis.
- A register should be consistently maintained at all project site offices to report the grievances. The grievances should be resolved by conducting monthly review meetings and if site team is unable to resolve the issue on its own, the complaint/matter is brought up to Senior Management of SECI.
- Apart from that, a separate register shall be maintained by the EPC Contractor in weekly meetings to address the grievances (if any discussed and resolved). If the matter will not be resolved in weekly meeting, it will be forwarded to higher level for decision.
- Independent Environment and Social/Compliance Monitoring Audit by the third party independent inspection agency as prescribed in the ESMF shall be carried out to understand the implementation of ESMF provisions.
- Periodic progress reporting (Monthly, Quarterly and Yearly) requires to be done by the Concessionaire, and the frequency of submission to SECI shall be revealed in the ESMP.

Annexures

ANNEXURE – I

Environmental and Social Screening Checklist

Environmental and Social Information Format for Screening
Project Title: 100 MW(AC) Solar PV Project (200MWp DC capacity) along with 50MW/150 MWh Battery Energy Storage System **Implementing Agency:** Solar Energy Corporation of India **Project Cost:** Rs. 900 Cr. Approx. **Project Components:** Solar PV panel, Inverter, Battery storage etc. **Project Location (Area / District):** Rangakathera, Dundera, Dhaba, Kokha, Amlidih, Girgaon, Margaon, Khukhwa, Odarbandh, and Tolagaon villages in the Rajnandgaon district in the state of Chhattisgarh,

Sub project activities affecting the natural physical environment			
S. No.	**Information/Checklist confirmation**	**Status**	**Detailed Information**
1	Preliminary secondary data related to soil quality and its bearing strength		Hard rock available at a depth around 0.4 to 0.5 m. In the initial 0.4 to 0.5 m depth, poorly graded sand and gravel was present.
2	State /National Boundaries		District: Rajnandgaon State: Chhattisgarh
3	Anticipated change in Topography (Cut and Fill activity)		Negligible – only due to site levelling activity, as solar panels can be placed following the ground profile.
4	Clearance of land, vegetation, any other physiographic feature (number and type specify)? Specify area under each feature (in Hectare)		Project is proposed to be set up on approximately 200 Ha of government land, whereas the Govt. of Chhattisgarh has offered over 405 Ha of land. Most of the land is free from any habitation and there is no any structure located in the area. SECI will finalize the tentative project boundary, wherein, due care shall be taken by to avoid tree cutting, acquisition of private land, gothan area, any damage to property of cultural importance, community building, schools etc. So, there will not be any physical displacement of people due to the project.
5	Addition of new features to		Negligible – only due to site levelling activity, as solar panels can be placed

	topography due to project		following the ground profile.
6	Anticipated underground works		Not anticipated
7	Anticipated changes in existing drainage pattern		Not anticipated
8	Land Reclamation works		Not anticipated
9	Water source identified for activities		Ground Water is proposed to be used for construction activities
10	Identification of erosion prone areas		Not applicable
11	Change in Land cover due to project		Project is proposed to be set up on approximately 200 Ha of government land, whereas the Govt. of Chhattisgarh has offered over 405 Ha of land. Most of the land is free from any habitation and there is no any structure located in the area. SECI will finalize the tentative project boundary, wherein, due care shall be taken by to avoid tree cutting, acquisition of private land, gothan area, any damage to property of cultural importance, community building, schools etc. So, there will not be any physical displacement of people due to the project.
12	Site prone to any natural hazard		Not anticipated
13	Activities changing hydrology or water courses or aquifers		Not anticipated
14	Abstraction / transfers of water from ground or surface waters		Ground Water is proposed to be used for construction activities
15	Water quality characteristics and its availability		Water quality is not available. However, likelihood of change in water quality due to setting of the Project is very low.
16	Other activities impacting the physical environment		Project is proposed to be set up on approximately 200 Ha of government land, whereas the Govt. of Chhattisgarh has offered over 405 Ha of land. Most of the land is free from any habitation and there is no any structure located in the area. SECI will finalize the tentative project boundary,

			wherein, due care shall be taken by to avoid tree cutting, acquisition of private land, gothan area, any damage to property of cultural importance, community building, schools etc. So, there will not be any physical displacement of people due to the project.
17	Water body identified for floating solar is reservoir / backwater/ any other (specify)		Not applicable
18	Does the identified water body is used for water supply?		Not applicable
19	Is water body used for fishing activities?		Not applicable
20	Is water body used for any other human activity?		Not applicable
21	Will project activity restrict access to the water body		Not applicable
22	Any order/policy specific to the site		Not applicable
Project activities affecting the biological environment			
S. No.	**Information/Checklist confirmation**	**Status**	**Aerial distance (within 05 km) of proposed-project location boundary**
1	Vicinity to National Park, Wildlife Sanctuary, Reserved forests, woodland, protected forests		The various components of the proposed project at Rajnadgaon is not located near any eco-sensitive area and there is no such area within 10 Kms.
2	Vicinity to Migratory bird routes		Project area is not in the vicinity of migratory bird route.
3	Site in vicinity to congregatory areas (nesting, roosting, breeding, foraging)		The various components of the proposed project at Rajnadgaon is not located near any eco-sensitive area and there is no such area within 10 Kms.
4	Vicinity to sensitive flora, fauna		The various components of the proposed project at Rajnadgaon is not located near any eco-sensitive area and there is no such area within 10 Kms. There is no endemic or endangered species of

			flora and fauna around the Project site.
5	Areas already subjected to pollution or environmental damage		No
6	Vicinity to eco-sensitive areas (wetlands, CRZ, water course, mountains etc)		The various components of the proposed project at Rajnadgaon is not located near any eco-sensitive area and there is no such area within 10 Kms.
7	Presence of endangered species / habitat areas		The various components of the proposed project at Rajnadgaon is not located near any eco-sensitive area and there is no such area within 10 Kms. There is no endemic or endangered species of flora and fauna around the Project site.
8	Vicinity to island, coastal marine or underground water		No
9	Loss of any native species or genetic diversity		Not anticipated
10	Any season specific issues with site regarding ecological functions		No
Project activities affecting the visual environment			
S. No.	**Information/Checklist confirmation**	**Status**	**Aerial distance (within 05 km) of proposed-project location boundary**
1	Area with Outstanding Natural Beauty (ANOBs) or Natural Heritage sites		No
2	Area with Archaeological importance		No
3	Area with high scenic value		Not applicable
4	Existing viewpoints/ pause points		Not applicable

Project activities affecting the settlement / infrastructure			
S. No.	**Information/Checklist confirmation**	**Status**	**Details thereof (quantification wherever possible) with source of information data**
1	Settlement area/Built up environment in vicinity / distance	No	There is some cultivation going on in the south of the identified land parcels but those land parcels will not be considered for the park area.
2	Agricultural land/land under livelihood (area in Hectare)	No.	
3	Type of crops grown / number of crops	No	
4	Source of Irrigation	No	Rain
5	Drinking water sources	No	There are some natural drains that carries water to the downstream villages
6	Area of sensitive receptors	No	
7	Religious –Physical Resources	No	Project is proposed to be set up on approximately 200 Ha of government land, whereas the Govt. of Chhattisgarh has offered over 405 Ha of land. Most of the land is free from any habitation and there is no any structure located in the area. SECI will finalize the tentative project boundary, wherein, due care shall be taken by to avoid tree cutting, acquisition of private land, gothan area, any damage to property of cultural importance, community building, schools etc. So, there will not be any physical displacement of people due to the project.
8	Community-Physical Resources	No	
9	Underground utility lines like electricity lines, pipelines for gas, etc	No	Not Applicable
10	Defence Installations / Airport Routes	No	The nearest airport to the District is at Mana (Raipur), about 80 kms away
11	Likely damage to existing infrastructure, public	No	Project is proposed to be set up on approximately 200 Ha of government land, whereas the Govt. of Chhattisgarh has offered

	utilities, amenities etc.		over 405 Ha of land. Most of the land is free from any habitation and there is no any structure located in the area. SECI will finalize the tentative project boundary, wherein, due care shall be taken by to avoid tree cutting, acquisition of private land, gothan area, any damage to property of cultural importance, community building, schools etc. So, there will not be any physical displacement of people due to the project.
12	Presence of Indigenous / vulnerable communities	Yes	ST population is living in the Project affected areas. No tribal family or community will be adversely impacted due to the project. However, It is proposed to prepared management plan for indigenous / vulnerable communities as part of CESMP.
13	Major Movement Corridors /Traffic		NH – 6 is passing very close to project site.
14	Anticipated waste generation & Waste Disposal Facility		Municipal Solid waste from labor camps, Battery waste and E-waste during the operation phase
15	Potential Water sources for project activities		Ground Water
16	Source of energy including electricity and fuel for various purposes for the project (amount of fuel in MT & electricity in MW)		Proposed project is 100 MW(AC) Solar PV Project (200MWp DC capacity) along with 50MW/150 MWh Battery Energy Storage System
17	Facilitates for transportation of construction materials		NH-6 shall be used for transportation material by road.
18	Facilities for storage of construction goods & materials		Construction goods and material shall be stored in designated areas only. Applicable Acts and rules shall be followed for the storage of construction goods and material.
19	Facilities for storage of any hazardous material		Construction equipment and DG set operation will generate some hazardous waste at construction sites in terms of waste oil tanks, used oil, etc. Such waste is being disposed off in compliance with Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016.

20	Facilities for long term housing for operational workers		Project is envisaging to be constructed in 18 Months. Peak labor influx during construction phase is 400 approx. For providing accommodation, temporary labor camp shall be constructed during construction phase. Labor camps will be equipped with drinking water facility, one Community latrine per 20 persons and sewage treatment facility. At construction sites and labor camps, separate bins are placed for biodegradable and non-biodegradable wastes. Hazardous/E-waste/others are being stored for safe disposal as per Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 and E-Waste (Management) Rules, 2016.
21	List of construction works (Permanent &Temporary)		
22	Facilities for construction workers (temporary labour camp, drinking water, waste disposal, etc.)		Project is envisaging to be constructed in 18 Months. Peak labor influx during construction phase is 400 approx. For providing accommodation, temporary labor camp shall be constructed during construction phase. Labor camps will be equipped with drinking water facility, one Community latrine per 20 persons and sewage treatment facility. At construction sites and labor camps, separate bins are placed for biodegradable and non-biodegradable wastes. Hazardous/E-waste/others are being stored for safe disposal as per Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 and E-Waste (Management) Rules, 2016.
23	Facilitates for disposal of waste (dry or wet)		At construction sites and labor camps, separate bins are placed for biodegradable and non-biodegradable wastes. Hazardous/E-waste/others are being stored for safe disposal as per Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 and E-Waste (Management) Rules, 2016.
24	Facilitates for disposal liquid waste/effluents		Project is envisaging to be constructed in 18 Months. Peak labor influx during construction phase is 400 approx. For providing accommodation, temporary labor camp shall

			be constructed during construction phase. Labor camps will be equipped with drinking water facility, one Community toilets per 20 persons and sewage treatment facility.
25	New Road, rail etc during construction or operational phase	No	Not anticipated
26	Any closure or diversion to the current movement pattern due to the project during construction or operational phase	No	Not anticipated
27	New or diverted transmission lines due to the project	Yes	Through overhead 132kV transmission line of length 33 km approx. to the nearest 132 kV CSPTCL's Substation at Thelkadi, Chhattisgarh
28	Is there a risk of long term build-up of pollutants in the environment from storage of hazardous material, disposal of effluents and waste disposal?		No
29	Cumulative effects due to proximity to other existing or planned projects with similar impacts		Not anticipated

Social Screening Checklist

S. No.	Screening Criteria	Assessment of Category (High/ low)	Remarks /Explanatory note for categorization
1	Is the project in an eco-sensitive area or adjoining an eco-sensitive area? (Yes/No) If Yes, which is the area? Elaborate impact accordingly.	No impact	The various components of the proposed project at Rajnadgaon is not located near any eco-sensitive area and there is no such area within 10 Kms.
2	Will the project create significant/ limited/ no social impacts?	Low Impact	Project is proposed to be set up on approximately 200 Ha of government land, whereas

			the Govt. of Chhattisgarh has offered over 405 Ha of land. Most of the land is free from any habitation and there is no any structure located in the area. SECI will finalize the tentative project boundary, wherein, due care shall be taken by to avoid tree cutting, acquisition of private land, gothan area, any damage to property of cultural importance, community building, schools etc. So, there will not be any physical displacement of people due to the project.
3	Land acquisition resulting in loss of income from agricultural land, plantation or other existing land-use.	Low Impact	Project is proposed to be set up on approximately 200 Ha of government land, whereas the Govt. of Chhattisgarh has offered over 405 Ha of land. Most of the land is free from any habitation and there is no any structure located in the area. SECI will finalize the tentative project boundary, wherein, due care shall be taken by to avoid tree cutting, acquisition of private land, gothan area, any damage to property of cultural importance, community building, schools etc. So, there will not be any physical displacement of people due to the project.
4	Land acquisition resulting in relocation of households.	No Impact	Project is proposed to be set up on approximately 200 Ha of government land, whereas the Govt. of Chhattisgarh has offered over 405 Ha of land. Most of the land is free from any habitation and there is no any structure located in the area. SECI will finalize the tentative project boundary, wherein, due care shall be taken by to avoid tree cutting,

			acquisition of private land, gothan area, any damage to property of cultural importance, community building, schools etc. So, there will not be any physical displacement of people due to the project.
5	Any reduction of access to traditional communities (to areas where they earn for their primary or substantial livelihood).	No Impact	No displacement of traditional communities.
6	Any displacement or adverse impact on tribal settlement(s).	Low Impact	Project is proposed to be set up on approximately 200 Ha of government land, whereas the Govt. of Chhattisgarh has offered over 405 Ha of land. Most of the land is free from any habitation and there is no any structure located in the area. SECI will finalize the tentative project boundary, wherein, due care shall be taken by to avoid tree cutting, acquisition of private land, gothan area, any damage to property of cultural importance, community building, schools etc. So, there will not be any physical displacement of people due to the project.
7	Any specific gender issues.	No Impact	No gender specific issue directly related to the project is envisaged. However, better sanitation facility will improve health status of women in the area.
8	Will the project create significant / limited / no Social impacts during the construction stage?	Low and short term Impact	Construction activity associated with labour influx might have short term impact.
9	Flooding of adjacent areas	No Impact	Not anticipated
10	Improper storage and handling of substances leading to contamination of soil and water	No Impact	Project is envisaging to be constructed in 18 Months. Peak labor influx during construction phase is 400

			approx. For providing accommodation, temporary labor camp shall be constructed during construction phase. Labor camps will be equipped with drinking water facility, one Community toilets per 20 persons and sewage treatment facility. At construction sites and labor camps, separate bins are placed for biodegradable and non-biodegradable wastes. Hazardous/E-waste/others are being stored for safe disposal as per Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 and E-Waste (Management) Rules, 2016.
11	Elevated noise and dust emission.	Low and short term impact during construction activities	Proper measure will be taken during construction and operation phases of the proposed project to minimise the noise and dust emissions. Contractor / Concessionaire should ensure the proper acoustic measure for noise generating unit like DG set as per CPCB norm, etc. The Contractor / Concessionaire have to submit the method statement to comply with Air Act, 1981 and Noise Rules as per EP Act, 1986 before initiation of construction activities
12	Disruption to traffic movements	No Impact	Not anticipated

ANNEXURE – 2

ENVIRONMENTAL AND SOCIAL GRIEVANCE FORM

Complainant Name	
Contact Details	Address Contact No.:
Location of Complaint	
Details of Complaints	
Directions	
Confidentially Requested	Yes ☐ ☐
Signature of Complainant	**Date:**
Reference No.:	*For official use only*
Date Received:	*For official use only*
Complaint taken by:	*For official use only*
Complaint assigned	*For official use only*
Date of complaint Acknowledged:	*For official use only*
Complaint referred to	*For official use only*

FORMAT FOR GRIEVANCE REDRESSAL MECHANISM REGISTER

Sl. No.	Name of the Complainant	Unique complaint number	Address & Contact No.	Gist of the Complaint	Forwarded to whom	Whether grievance redressed or not	If yes, Gist of disposal	If rejected, gist of reasons	If not attended reasons

MONTHLY STATUS REPORT ON ENVIRONMENTAL AND SOCIAL GRIEVANCE REDRESSAL

Sl. No.	Name of the unit	No. of pending complaints at the end of previous month	No. of complaint received during the month	Action initiated during the month	Completed during the month	No. of complaint s pending at end of month	No. of grievance redressed	No. of dismissal	Total	Remarks

SOLAR ENERGY CORPORATION OF INDIA LIMITED (SECI)

FINAL ENVIRONMENTAL AND SOCIAL MANAGEMENT FRAMEWORK

June 2020

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Abbreviations

AC	Alternating current
APTransco	Andhra Pradesh Transmission Company
APPCB	Andhra Pradesh Pollution Control Board
BESS	Battery energy storage system
BMS	Battery Management System
BOD	Biochemical Oxygen Demand
BPL	Below Poverty Line
CEA	Central Electricity Authority
CPCB	Central Pollution Control Board
CTE	Consent to Establish
CTO	Consent to Operate
DC	Direct current
EAC	Expert Appraisal Committee
EHS	Environment, Health and Safety
EMP	Environmental Management Plan
EPC	Engineering Procurement and Construction
ESIA	Environmental and Social Impact Assessment
ESMF	Environment and Social Management Framework
ESMP	Environmental and Social Management Plan
ESS	Energy Storage System
FGD	Focus Group Discussions
GAP	Gender Action Plan
GHG	Green House Gas
GRM	Grievance Redressal Mechanism

GW	Giga Watt
IFC	International Finance Corporation
IMD	Indian Meteorological Department
IPDP	Indigenous Peoples Development Plan
IREDA	Indian Renewable Energy Development Agency
ISPHT	Innovation in Solar Power and Hybrid Technologies
IUCN	International Union for Conservation of Nature
JNNSM	Jawaharlal Nehru National Solar Mission
MNRE	The Ministry of New and Renewable Energy
MoEF&CC	Ministry of Environment, Forests & Climate Change
PARK DEVELOPER	New & Renewable Energy Development Corporation of Andhra Pradesh
PAP	Project Affected Persons
PV	Photovoltaic
RAP	Resettlement Action Plan
REC	Renewable energy certificate
MSL	Mean Sea Level
NAAQS	National Ambient Air Quality Standards
NABL	National Accreditation Board for Testing and Calibration
NISE	National Institute of Solar Energy
O&M	Operation and Maintenance
OBC	Other Backward Caste
PHC	Primary Health Centre
RF	Reserve Forest
SC	Scheduled Caste
SEIAA	State Environment Impact Assessment Authority
SECI	Solar Energy Corporation of India Limited

ESMS	Environmental & Social Management System
SPCB	Sate Pollution Control Board
VGF	Viability Gap Funding
WB	World Bank
WRA	Wind Resource Assessment
WTG	Wind Turbine Generators

Executive Summary

Solar Energy Corporation of India (SECI) is proposing to implement the Innovations in Solar Power and Hybrid Technologies Project (ISHTP) with World Bank financial support to demonstrate large scale use of Solar-Wind Hybrid, Floating Solar PV generation systems & Battery based Energy Storage Systems, and related infrastructure like transmission lines and substations. The project endeavors to prove the commercial viability of these emerging technologies to give a broad set of options for energy security for India, while ensuring minimal environmental and social impacts. With use of these state-of-the-art technologies, reduced consumption of fossil fuels will ensure that the impact of the energy generation and use in the system will reduce Green House Gas Emissions, and optimized lay out will reduce land required, another permanent environmental and social impact. However, there could be some residual impacts of the novel combination of technologies proposed to be supported at large scale. In order to ensure that these are appropriately addressed, SECI has developed this Environmental and Social Management Framework (ESMF) to guide subsequent project preparation and implementation, including for sub-projects, both currently identified, and those being identified. The ESMF is divided into 9 chapters, following an introductory chapter, as below:

Environmental and Social Policy/Act/Rules Regulations: This describes the regulatory framework within which the project activities would be undertaken and determines the response required from the project to comply with the requirements set out. It covers the national, state and local requirements, in addition to WB policies, and EHS guidelines of the World Bank Group, as they apply to the proposed sub-projects. It highlights the fact that while the project supported activities are not covered under the Environmental Impact Assessment notification of the Government of India, several other requirements are to be satisfied by the project. In addition, relevant requirements of the WB safeguards policies are also elucidated here.

Baseline Case Study of Sample Sub-projects: Since there is no such projects to understand impacts of the proposed activities, and not all locations have been decided, in order to understand potential impacts, similar projects were identified for review. Solar parks in Madhya Pradesh, and Karnataka were studied and there were small floating solar installations (in kW range, unlike the proposed MW range) that were reviewed to identify potential impacts and feasible mitigation measures.

Environmental and Social Assessment Process: This chapter starts providing guidance for environmental management for sub-projects to be supported under ISHTP. It starts with screening of the potential locations for specific sensitive receptors. It also describes the process of scoping, and undertaking an Environmental and Social Impact Assessment (ESIA) to develop an Environmental and Social Management Plan (ESMP). It includes generic plan and provides several templates for guiding the subsequent preparation of ESIA, including the ESMP. It also refers to an Annexure that has detailed ToR for the undertaking the ESIA. It builds on Bank's OP4.01 guidance and WBG EHS guidelines, as these apply to the project activities. Emphasis is laid on Stakeholder Consultation processes to inform the ESIA and ESMP formulation.

Environmental and Social Management Framework: This section is focused on the various social assessments to be undertaken for the sub-projects, depending on the site conditions and its socio-economic milieu. Guidance is provided on entitlements of affected persons, handling indigenous people issues, and labour influx. Definitions and an Entitlement Matrix are provided for the development of a Resettlement Action Plan in case of involuntary land take being involved. Sample table of contents for various instruments – RAP, IPDP, and Gender Action Plan are also included.

Consultation Framework and Information Disclosure: The document also covers these two important aspects of robust project management with succinct guidance on undertaking consultations with stakeholders, including, but not limited to, project affected people. It describes process of mapping stakeholders and mechanisms for undertaking site-level consultations. Guidance is also provided on information to be disclosed in terms of timing, content, audience, location, language and other relevant parameters.

Institutional Arrangements are described in the next chapter. Roles and responsibilities for environmental management are laid out with SECI playing key role, but with support from other entities like state government. The project envisages that SECI staff will include an Environmental and Social Officer and separate Environmental and Social Experts will be used for sub-projects. The Grievance Redressal Process and a three-tiered Mechanism have also been outlined for customization in light of actual site conditions for sub-projects.

Monitoring and Evaluation Framework: provides guidance for this important function in subsequent stages of the project, with a focus on the sub-projects based activities. It covers

the important environmental aspects to be monitored, including safety and occupational health, as well as condition of the biophysical environment so that corrective measures, if any are required, can be undertaken promptly. It also covers reporting on various parameters including livelihood restoration, employment of local population, etc. Reporting formats have also been included for uniform collection and analysis of data.

Budget guidance is short and covers various items to be covered at the sub-project level. It has a list of items that would need to be checked and costs estimated when the sub-projects are assessed for environmental and social impacts.

Capacity building requirements are covered in the last chapter. These include the training on E&S assessments as they are required by the WB as there are currently no national or other requirements for such type of projects. Various target groups have been identified and content of several modules have been defined. Indicative duration for such sessions has been provided.

Thus the ESMF provides a comprehensive guidance base for management of environmental and social aspects of the ISHTP, in line with WB policies and guidelines.

1. INTRODUCTION

1.1 Introduction

India is set on a path of development where the demand for energy is rising exponentially and the current energy produced by thermal and hydro power plants is not enough to meet the growing demand. India has undertaken several steps in promoting the power generation through clean and green energy technologies to meet the growing demand.

The Ministry of New and Renewable Energy (MNRE) is the nodal Ministry of the Government of India for all matters relating to renewable energy. This ministry functions with an aim to develop and deploy new and renewable energy for supplementing energy requirements of the country.

SECI (Solar Energy Corporation of India Limited) is a PSU under the administrative control of the Ministry of New and Renewable Energy (MNRE), set up on 20th Sept, 2011 to facilitate the implementation of Jawaharlal Nehru National Solar Mission (JNNSM) dedicated to solar energy. However, over the years, the mandate of SECI has also been broadened to cover the entire renewable energy domain.

Wind and solar energy are becoming popular owing to abundance, availability and ease of harnessing for electrical power generation. Power generation from renewable sources is on the rise in India, with the share of renewable energy in the country's total energy mix rising from 7.8% in the year 2008 to 20% as on 31.03.2018[1]. By 31.03.2018 the total installed capacity of renewable energy in India reached up to 69.022 GW. Wind energy accounts for about 49.3% of the total renewal energy installed capacity, with 34.046 GW of installed capacity, making India the world's fourth-largest wind energy producer. The contribution of solar energy is 31.4 percent of total installed capacity with 21.651 GW which makes India the 6th largest solar energy producer. So, the total share of wind and solar energy in combination reached up to 80.7% of total installed capacity of renewable energy in the country by 31st March, 2018. Small hydro power (4.486 GW) and bio-energy (8.839 GW) constitute the remaining capacity.

[1] http://powermin.nic.in/en/content/power-sector-glance-all-india

India has set an ambitious target of achieving 175 GW of renewable power generation by year 2022. With this ambitious target, India will become one of the largest Green Energy producers in the world, surpassing several developed countries. India plans to achieve 40% cumulative Electric power capacity from non-fossil fuel-based energy resources by 2030 with the help of transfer of technology and low cost International Finance including from Green Climate Fund.

The recent new technologies which introduce more possibilities of extracting maximum power from a limited resource have been further explored. The new system which emerged from research and development are Hybrid Power Plants where solar panels and wind turbines can perform in the same defined space without interfering much in each other's functionality. Due to the intense investment already made in the established solar or wind power plants, the limit of production can be further optimized by introducing solar panels in existing wind farms or adding wind turbines in existing solar farms or plan a hybrid (wind and solar) for a new power plant. This will give rise to a more constant power generation as solar panels cannot produce power during the night whereas; the wind turbines can work in the day and as well in the night. Likewise, during times when wind speed is not adequate for power generation while the solar radiation is strong.

Another major leap in renewable energy sector is the floating Solar PV Panels; this technology has explored the possibility of introducing power plants on vast surface of water bodies. Research indicates these floating solar PV plants are more efficient system when compared with similar capacity plants operating on land due to reduced heating of the panels. Additionally, the percentage of water surface covered by the PV panel helps reduce the evaporation losses of the water body.

1.2 Description of Innovation in Solar Hybrid Technologies Project (ISHTP)

The ISHTP will finance innovative renewable energy projects and BESS to demonstrate applications that can be deployed at a large scale in India's power system, and build SECI's market facilitation capacity in a rapidly evolving RE market. As the ISHTP Implementing Agency (IA), SECI is the sole recipient of World Bank / CTF financing. SECI will invest in selected innovative RE technologies and BESS demonstration projects, and monitor and disseminate its experience in design, construction, operation and contractual arrangements to renewable market stakeholders in India. The proposed project has two components:

Component A: Investments in Innovative Renewable Energy (RE) Solutions

The Component will support innovative power subprojects. The scope of subprojects will be

defined based on-site requirements, including: (a) site development (including site identification, feasibility and environmental studies, land acquisition and resettlement, obtaining permits); (b) construction of RE power plants and BESS, including design, supply and installation of equipment, associated civil works, construction of ancillary infrastructure; (c) construction of power evacuation and other common infrastructure (i.e. road access, water supply); and (d) operation and maintenance (O&M) contracts. An ISHTP Operations Manual (OM) sets investment criteria for subprojects. The estimated cost of this component is US$398 million, which includes US$150 million from the World Bank, US$28 million from the CTF loan, US$20 million from the CTF grant, and US$200 million from SECI. The eligible subproject typologies are:

- **Utility-Scale Hybrid Subprojects:** The ISHTP will finance large-scale Greenfield hybrid solutions, combining wind, solar or BESS technologies that are tailored to meet site-specific requirements. Subprojects are expected to demonstrate benefits for the Indian power system, including better capacity utilization factors, reducing variability of RE power plants (i.e. due to the relative diurnal and seasonal complementarity of solar and wind resources), and optimizing use of power evacuation infrastructure. The first subproject [has been] appraised, comprises about 35 percent of IBRD/CTF investment resources, and includes:

160 MW Solar PV-Wind Power Plant with BESS Subproject in Ramagiri, Andhra Pradesh (AP) ('Ramagiri WSH Subproject')

The subproject comprises design, construction, O&M of co-located 120 MW of solar PV, 40 MW of wind power (about 20 wind turbine generators), 10 MW/22 MWh BESS, associated infrastructure, and control and energy management systems. The subproject is being set up on about 900 acres in the Ramagiri and Muthavakuntla villages, Anantapuram district, in AP, a wind and solar resource-rich province. The WSH power will be transmitted to a 220/33 kilovolts (kV) pooling substation (PSS) through a 33 kV transmission line and evacuated via a double circuit (D/C) 220 kV transmission line to the 400/220 kV Hindupuram substation (under construction by AP State Transmission Company [APTRANSCO]) located about 45 km from the PSS site. The PSS, 220 kV evacuation line and interconnection with the Hindupuram substation is being implemented by APTRANSCO under the GoI's Green Energy Corridor Project. Site preparation activities including land acquisition will be done by SECI with assistance from New and Renewable Energy Development Corporation of Andhra Pradesh and AP Solar Power Corporation Private Limited (APSPCL). The Andhra Pradesh Southern Power Distribution Company, Ltd. (APSPDCL) will be the sole off-taker under a long-term power purchase agreement (PPA) signed with SECI. SECI will select an Engineering, Procurement and Construction (EPC) contractor through competitive bidding and will sign a 10-year O&M contract. Further, SECI will retain an Owner's Engineer (OE) till one year of

O&M period. The BESS is installed to demonstrate use cases which benefit the generator: avoiding curtailment, minimizing deviation settlement mechanism penalties due to forecasting/scheduling errors, and piloting ramp rate control benefits. This is the first project of its kind in India and at this scale in the world.

- **BESS Subprojects:** () The ISHTP will finance BESS applications integrated with other RE generation technologies or providing grid services enabling improved use of power. As this technology is not yet commercially viable, selection of subprojects will be determined *inter alia* by the use cases most likely to be deployed at large scale in the Indian power system including time shifting, capacity firming, ramp rate control, and frequency regulation, and by the ability under existing regulations to recover at least part of the costs of the BESS. A US$20 million CTF grant has been allocated to partially defray the costs of these subprojects.

100 MW(AC) Solar PV Project (200MWp DC capacity) along with 50MW/150 MWh Battery Energy Storage System at Rajnandgaon, Chhattisgarh

The subproject comprises design, construction, O&M of 100 MW(AC) Solar PV Project (200MWp DC capacity) along with 50MW/150 MWh Battery Energy Storage System associated infrastructure, and control and energy management systems. The Project is proposed to be setup on 225 Ha (approx.) in District Rajnandgaon, Chhattisgarh. The power generated through the project is propose to be evacuated through overhead 132kV transmission line of length 33 km approx. to the nearest 132 kV CSPTCL's Substation at Thelkadi, Chhattisgarh. For the execution of the Project, land will be provided by the Energy department, GoCG and acquisition of private land is not envisaged. The Chhattisgarh State Power Distribution Company Ltd. (CSPDL) will be the sole off-taker under a long-term power purchase agreement (PPA) signed with SECI. SECI will select an Engineering, Procurement and Construction (EPC) contractor through competitive bidding.

- **Utility-Scale FSPV Subprojects:** (about [100] MW targeted) The ISHTP will finance FSPV power plant subprojects – solar PV systems installed on synthetic floating beds anchored to the bottom or on the shore of selected water bodies. Sites will be selected where there is existing associated infrastructure such as reservoirs of the operating dams or sites where there are externalities such as high evaporation loss (in case of irrigation dams) or where the land is either unavailable or too expensive. [Based on initial discussions by SECI in multiple states (including AP, Kerala and Tamil Nadu), the target capacity estimate of a potential pipeline of subprojects ranges from 20-100 MW].

Component B: Technical Assistance, Capacity Building, Implementation Support, Monitoring and Dissemination

This component, completely financed out of CTF grant, will support technical assistance, studies, workshops, training, study tours, and other capacity building and dissemination activities, including (but not limited to):

- Capacity building and institutional development to support implementation of SECI's five-year business plan (2018-2022), which is under preparation. A rolling capacity building plan will be agreed after the plan's approval by its management and can include a range of inputs to strengthen SECI's core functions and business lines, including project management, monitoring, engineering, procurement and contract management, O&M, financial management and organizational and process

management.

- Activities for ISHTP subproject development and management, including activities associated with identification of sites, preparation of environmental, feasibility, and other subproject preparation studies, due diligence for land acquisition and resettlement, bid document preparation, safeguards and project monitoring, project management consulting services, and OE services.
- Support to policy and regulatory proposals, stakeholder consultations and knowledge sharing activities to support scale-up of innovative technologies.

1.3 Sample Project Overview

This ESMF focuses on the following renewable energy power generation technologies to augment the power requirements. The technologies include solar power generation (in and outside solar park), Wind power generation, Floating solar PV projects over large water bodies and opportunities for Solar-Wind hybrid technologies. A brief of these technologies is presented in the sub sections hereunder.

(a) Solar PV power generation (In and outside Solar Park)

Fortunately, India lies in sunny regions of the world. Most parts of India receive 4.7 kWh of solar radiation per square meter per day with 300-325 sunny days in a year. India has abundant solar resources, as it receives about 3000 hours of sunshine every year, equivalent to over 5,000 trillion kWh. India can easily utilize the solar energy. Today, the Government of India is encouraging generation of electricity from various renewable energy sources such as wind, solar, small hydro, biomass by giving various fiscal & financial incentives.

Figure 1-1: Solar PV panels installation

MNRE has rolled out a scheme dated 12.12.2014 plans to set up 25 solar parks, each with a capacity of 500 MW and above; thereby targeting around 20000 MW of solar power installed capacity. These solar parks will be set up within in a span of 5 years commencing from 2014-15 and the solar projects may then come up as per demand and interest shown by developers. Based on the success of solar park scheme, MNRE has further enhanced the capacity of solar park scheme to 40000 MW.

The solar park is a concentrated zone of development of solar power generation projects and provides developers an area that is well characterized, with proper infrastructure and access to amenities and where the risk of the projects can be minimized.

(b) Wind Power Generation – Land based

Harnessing wind energy has come a long way in India, at par with international development, with the private sector actively participating in the path laid down by Ministry of New and Renewable Energy (MNRE) over the last decade. The policy formulated for the development of wind power by MNRE supported by the State Policies, including the evacuation of power through the State Electricity Boards/ State Transmission Companies, has placed India on the world wind energy map.

Figure 1-2: View of WTG in a row (NIWE)

As a step towards achieving these broad goals and to tackle the challenges in sustaining the development and accelerating the pace of utilization of wind energy in the country, the National Institute of Wind Energy (NIWE) has been established by MNRE at Chennai (along with a state of the art test facility at Kayathar) as an autonomous R&D institution of Government of India.

The use of wind as a renewable energy source involves the conversion of power contained in masses of moving air into rotating shaft power. The conversion process utilizes aerodynamic forces (lift and/or drag) to produce a net positive turning moment on a shaft, resulting in the production of mechanical power which can be converted to electrical power.

In India the factor which mostly governs the availability of wind energy at a particular site is its geographical location with respect to the monsoon wind.

The availability of data on wind speed being a basic requirement for determining the feasibility of wind power generation at any site and due to the highly uneven distribution of wind speed over the country, an assessment of the wind resource over different regions was undertaken before any plans of harnessing the wind energy were drawn for implementation. NIWE has assessed the wind potential within the country and released Indian Wind Atlas maps (online GIS).

Floating Solar PV plant power generation

A floating Solar PV power generation results from the combination of PV plant technology and floating technology. This fusion of new concept consists of Floating System: A floating body (Structure + Floater) that allows the installation of the PV module. The module is anchored in

a way that it can adjust to water level fluctuations and waves while maintain the position in the desired direction. At present very few floating solar PV plants exist in India (mainly small scale) which were installed for research / and or experimental purposes.

The advantage of the floating system is reduction of evaporation, thus helping preserve water levels during extreme summer particularly in man-made water bodies.

When panels are installed on floating platform, the heating problem of solar panel as experienced on land is solved to a great extent. Research studies[2] reveal that the reported power generation is almost 10% more when compared to similar capacity plants installed over land.

Figure 1-3: Floating Solar 10 Kw (Chandigarh)

(c) Solar- Wind Hybrid power generation

The availability of renewable energy resources at a site is an important factor to develop the hybrid projects. In many parts of India, Wind and Solar energy are abundantly available which pave way for their optimal integration. Wind speed is low in summer whereas the solar radiation is brightest and longest. The wind is strong in monsoon months whereas less sunlight is available owing to cloud cover. Because the peak operating times of wind and solar systems occur at different times of the day and year, hybrid systems are more likely to produce round-the-clock power.

[2] URL: http://www.sersc.org/journals/IJSEIA/vol8_no1_2014/7.pdf (A Study on Power Generation Analysis of Floating PV System Considering Environmental Impact - Young-Kwan Choi / International Journal of Software Engineering and Its Applications / Vol.8, No.1 (2014), pp.75-84

Figure 1-4: Hybrid Solar-Wind project (NIWE)

Wind-Solar Hybrid System means the Combined generation of power at existing or new solar/wind power projects (or) Co-located i.e. addition of Wind or Solar Power capacity at the interconnection point of the RE pooling station point of existing wind or solar power installations (or) Co-injection i.e. addition of Wind or Solar Power capacity after inter connection point (i.e. EHV Side) of the RE pooling station of existing wind or solar power capacity may also be coupled with any other Renewable Energy Sources and other emerging Technologies like Energy Storage systems. Under the category of wind-solar hybrid power plants, Wind and Solar PV systems will need to be configured to operate at the same point of grid connection. In addition, the issues related to maintenance needs to be planned as part of hybrid plants whereby the solar panels could be shifted to create adequate working space for maintenance of wind energy structures and equipment.

Such large scale solar, wind and hybrid (solar-wind) power generation projects could not be undertaken without causing any adverse effect to natural resources, forests, habitats (such as coasts and wetlands); resettlement issues, acquisition of productive land, etc. The impacts can be significant if such renewable projects are proposed in close vicinity of populated areas and rich biodiversity / forest areas. Wind and solar power projects can exert considerable environmental and social impacts during construction, which involves site preparation; construction of access roads, tower foundation / base slabs, erection of towers and transmission lines and the movement of vehicles.

1.4 Rationale and Objectives of Environmental and Social Management Framework

While, solar and wind projects in India do not require a regulatory environmental clearance, it is also understood that large-scale projects will have environmental and social impacts and these impacts need to be avoided and mitigated as far as possible. For large-scale projects (even if environmental clearance is not required), it is unlikely that projects could be undertaken without any adverse impacts on natural resources, forests, habitats (such as coasts and wetlands); land acquisition; resettlement; or loss of livelihood. Given that the sub-projects can be from anywhere in the country, this guiding framework is prepared to ensure that subsequent project activities have a common understanding of the environmental and

social issues involved, and a harmonized approach to handling these issues is followed. This Environmental and Social Management Framework (ESMF) will be used to identify the environmental and social impacts of each sub-project and help design commensurate mitigation/enhancement measures as well as to assign the responsibility for implementation of these measures.

The overall goal of the ESMF is to ensure that decision making in subsequent stages of the project is informed and influenced by environmental and social considerations for each of the sub-projects, many of which are still to be identified. It aims to integrate environmental and social concerns into the project's design and implementation. To achieve this, main objectives of the ESMF are

a) To establish clear procedures and methodologies for the environmental and social planning, review, approval and implementation of subprojects to be financed under the Project;

b) To specify appropriate roles and responsibilities, and outline the necessary reporting procedures, for managing and monitoring environmental and social concerns related to subprojects;

c) To determine the training, capacity building and technical assistance needed to successfully implement the provisions of the ESMF;

d) To establish the Project funding required to implement the ESMF requirements; and

e) To provide practical information resources for implementing the ESMF.

It may be mentioned here that though the project activities for the development of this ESMF have been identified based on the analysis of such activities in sample projects, this is a live document which can be improved upon at the sub-project level by the concerned authorities, as and when the need arises.

This framework has been prepared based on review of (i) sample projects of similar nature; (ii) secondary data on various environmental and social issues; (iii) existing regulatory frameworks; and (iv) preliminary environmental and social assessment of proposed solar and wind hybrid project at Anantapur District of Andhra Pradesh. Consultations with various stakeholders were carried out as part of ESMF preparation.

1.5 Structure of Environmental and Social Management Framework

The ESMF includes the following information:

- Existing Regulatory Framework Applicable to the Project

- Environmental and Social Baseline of the State and Key Issues
- Environmental and Social Management Framework
- Community Consultation
- Institutional Arrangement for Implementation
- Grievance Mechanism and Public Disclosure
- Capacity Building

2.0 POLICY AND REGULATORY FRAMEWORK

2.1 Introduction

India has developed a fairly comprehensive regulatory framework to address environmental and social concerns in relation to development projects. Its wide ranging enactments cover almost all major issues that need to be addressed in the course of development of infrastructure from a social and environmental perspective.

The increase of environmental concerns has necessitated appropriate tools to protect the environment. After Stockholm Conference, first exclusive environmental act, Water (Pollution Prevention and Control) Act was enacted in India in 1974. In accordance with this act, Central and State Boards for Prevention and Control of Water Pollution were set up. Later these boards were renamed into Central Pollution Control Board and respective State Pollution Control Boards. Department of Environment was set up in 1980. Subsequently in 1985, it was upgraded to a full-fledged Ministry of Environment and Forest to serve as the focal point in the administrative structure for the planning, promotion and coordination of environmental and forestry programmes. The Ministry of Environment and Forest (MoEF) has overall authority for the administration and implementation of government policies, laws and regulations related to the environment, including conservation, environmental assessment, sustainable development and pollution control. MoEF identifies the need to enact new laws and amend existing environmental legislation when required, in order to continue to conserve and protect the environment. At the state level, the MoEF authority is implemented by the Department of the Environment and the Department of Forest.

In 1976, the 42nd Constitutional Amendment created Article 48A and 51A, placing an obligation on every citizen of the country to attempt to conserve the environment. As a result, a number of laws related to environmental conservation were passed to strengthen existing legislation. Environment (Protection) Act, 1986 is the landmark legislation as it provides for the protection of environment and aims at plugging the loopholes in the other related acts.

The Government of India through specific legislations regulates the environmental and social management system in India. The Ministries / Statutory Bodies responsible for ensuring environmental compliance by project proponents include:

- The Ministry of Environment, Forests and Climate Change (MOEFCC)
- Ministry of Rural Development (MoRD)
- Central Pollution Control Board (CPCB)

- State Pollution Control Boards (SPCBs)
- State Revenue Department
- Ministry / Department of Environment in the States

2.2 National Policies and Programme on RE and State-level Legislation and Regulations

MNRE has setup an autonomous institution i.e. National Institute of Solar Energy (NISE) as an apex National R&D institution in the field of Solar Energy. Similarly, the National Institute of Wind Energy was setup, more than 20 years back for providing technical support to the Ministry in the implementation of its wind energy programs. For market development and financing of renewable energy projects, a separate financing institution called the Indian Renewable Energy Development Agency (IREDA) has been set up as a public-sector undertaking.

Key Policies on Wind and Solar Energy:

Some of the key policies guiding the growth and development of renewable energy sector in India related to solar, wind and hybrid solar & wind power generation in India includes:

i. Draft National Policy on Renewable Energy (RE) based mini /micro grids

The objective of the policy is to promote the deployment of micro and mini grids powered by RE sources such as solar, biomass, micro hydro, wind etc. in un-served and underserved parts of the country by encouraging the development of State-level policies and regulations, that enable participation of ESCOs[3]. The policy offers likely implementation solutions and approaches for overcoming common issues and challenges that hamper the growth of mini grid sector. The States are encouraged to refer to this policy document for developing their respective programs, policies and regulations. The underlying principles of the policy are listed below:

- Mainstream RE mini grids for enhancing access to affordable energy services, and improving local economy
- Streamline project development procedures for ESCOs
- Provide operational frameworks to operate along with the Distribution Company (DISCOM) grid

[3] ESCO (Energy Service Companies) means a person, a group of persons, local authority, panchayat institution, users' association, co- operative societies, non-governmental organizations, or a company that builds, commissions, operates and maintains the mini grid

- Optimize access to central financial assistance and other incentives
- Foster innovation in mini grid models to cater to rural needs

ii. Wind Power Program

Wind Power Program aims to catalyze commercialization of grid interactive wind power throughout the country. The Ministry has targeted 60GW production of energy from wind power plants by 2022 (as per the Paris Agreement). To re-assess the potential of wind farms in India, MNRE has constituted a Committee at National Institute of Wind Energy (NIWE). The program has prompted many representatives to set up wind power plants by the help of fiscal and financial incentives available which includes concessions defined in the guidelines developed by the Ministry of New and Renewable Energy. The key incentives offered by the MNRE's wind program are:

- **Excise duty relief**: The exemption on wind power plant components. Central Board of Excise and Customs (CBEC) shall exempt charges for all Wind Operated Electricity Generations (WOEG).
- IREDA has specific **Financing norms and schemes** for Project, only Equipment, Loan for manufacturing etc.
- **Preferential Tariffs** by state regulatory bodies for wind power projects are states under the regulatory for Useful life (25 years for wind), control period (5 years), Tariff period (13 years minimum for wind and 25 years for solar) etc.
- **Accredited Depreciation** (AD) as a promotional policy -80% (AD for wind)
- Projects which do not avail AD are eligible to **Generation Based Incentive** (GBI) @ 0.50 per unit of power fed to grid subject to a ceiling of Rs. 1 Crore per MW.
- **Income Tax Holiday** under section 80 1A. Tax deduction in respect of profit/gains from industrial undertakings or enterprises engaged in infrastructure development. Clause 6.1, case 4 & 5 for setting up & revival of infrastructural project respectively. Clause 6.2, 100% exemption for 10years for power plants.

iii. Policy for repowering of wind power generation projects

The policy was announced by the Ministry of New and Renewable Energy in August, 2016. The policy aims at optimal utilization of wind energy resources in the country and it provides a new lease of life to existing wind power projects. The projects shall be implemented through the respective state nodal agency and the state will facilitate for acquiring additional footprint for higher capacity turbines. The guidelines for placement of wind turbines, 7Dx5D criteria would be relaxed for micro siting. The repower projects will be allowed to avail Accelerated Depreciation benefits or GBI as per the conditions applicable to new wind power projects.

Other incentives provisioned under the policy include:

- For repowering projects, Indian Renewable Energy Development Agency (IREDA) will provide an additional interest rate rebate of 0.25% over and above the interest rate rebates available to the new wind projects being financed by IREDA.
- All fiscal and financial benefits available to the new wind projects will also be available to the repowering project as per applicable conditions.
- National Solar Mission

The National Solar Mission is a major initiative of the Government of India and State Governments to promote ecologically sustainable growth of power while addressing India's energy security challenge. It will also constitute a major contribution by India to the global efforts to meet the challenges of climate change.

Launched in 2010, the Mission has set the ambitious target of deploying 20,000 MW of grid connected solar power by 2022 is aimed at reducing the cost of solar power generation in the country through (i) long term policy; (ii) large scale deployment goals; (iii) aggressive R&D; and (iv) domestic production of critical raw materials, components and products, as a result to achieve grid tariff parity by 2022. Mission will create an enabling policy framework to achieve these objectives and make India a global leader in solar energy.

The mission is currently in phase-II of the implementation. After taking into account the experience of the initial years, capacity is being aggressively ramped up to create conditions for up scaled and competitive solar energy penetration in the country. Government has revised the target of Grid Connected Solar Power Projects from 20,000 MW by the year 2021-22 to 100,000 MW by the year 2021-22 under the National Solar Mission and it was approved by Cabinet on 17th June 2015.

SECI is a nodal agency under the National Solar Mission and is implementing several schemes for setting up of Solar Power projects with Viability Gap Funding (VGF). After the notification of Standard Bidding Guidelines by the Ministry of Power in 2017, SECI issues tenders on that mode, without provision of VGF.

iv. National Wind-Solar Hybrid Policy

MNRE has published this policy on 14 may 2018 with an objective to promote large scale grid connected Hybrid wind-solar system and encourage new technology & methods involving combined operation of wind as well as solar PV plants. Hybrid plants have benefits in terms of optimal and efficient utilization of transmission infrastructure and better grid stability by reducing the variability in renewable power generation. The installation can be most beneficial where wind power density is very high and the size of the solar PV capacity to be added as a

hybrid system is relatively smaller. The policy lays down two options for development of hybrid wind-solar power plants as described below:

1) Hybridization of existing wind/solar power projects,

Existing wind or solar power projects, willing to install solar PV plant or WTGs respectively to avail benefit of hybrid project, may be allowed to do so with following conditions

- No additional connectivity/transmission capacity charges shall be levied by the respective transmission entity for hybridization at existing wind/solar PV plants if already granted transmission connectivity/ access is being used. Transmission charges may be applicable for the additional transmission capacity/ access granted as per prevailing regulation.
- In case capacity margins are available at the receiving transmission sub-station of respective transmission entity, at which the existing wind/solar projects is connected, additional transmission capacity/access may be allowed subject to its technical feasibility. In such a case, any transmission augmentation required up to the receiving transmission sub-station will be the responsibility of project developer.
- In case of AC integration assessment of solar and wind power injected from the hybrid project in to the grid will be worked out by apportioning the reading of main meter installed at the receiving station based on readings of ABT meters installed on LT or HT side of the wind and solar PV plant as the case may be.
- In case of DC integration assessment of solar and wind power injected from the hybrid project in to the grid will be worked out by apportioning the reading of main meter installed at the receiving station on the basis of readings of DC meters installed at the DC output of the wind and solar PV plant. Till such time the methodology for DC metering of hybrid systems and standards & regulations are framed for DC meters, only AC integration will be permitted.
- The additional solar/wind power generated from the hybrid project may be used for (a) captive purpose; (b) sale to third party through open access; (c) sale to the distribution company (ies) either at tariff determined by the respective SERC or at tariff discovered through transparent bidding process; and (d) sale to the distribution company (ies) at APPC under REC mechanism and avail RECs. For bidding purpose, State or Central entities may bid for hybridization of existing projects connected to InSTS or ISTS as the case may be.
- Government entities may invite bids for hybridization of existing wind and solar plants with tariff being the main criteria for selection.

2) New Wind-Solar Hybrid Plants

New wind-solar hybrid projects shall be encouraged with following provisions: -

- The hybrid power generated from the wind-solar hybrid project may be used for (a) captive purpose; (b) sale to third party through open access; (c) sale to the distribution company (ies) either at tariff determined by the respective SERC or at tariff discovered through transparent bidding process; and (d) sale to the distribution company (ies) at APPC under REC mechanism and avail RECs.
- The power procured from the hybrid project may be used for fulfilment of solar RPO and non-solar RPO in the proportion of rated capacity of solar and wind power in the hybrid plant respectively.
- For procurement of hybrid power through transparent bidding process different parameters may be used. Parameters that may be considered for bidding could be capacity delivered at grid interface point, effective CUF and unit price of electricity.
- Government entities may invite bids for new hybrid plants keeping qualifying criteria such as those discussed in iii above, the tariff being the main criteria for selection.

3) Battery Storage:

The policy also has provision of battery storage for hybrid project and specifically mentions the following

Battery storage may be added to the hybrid project (i) to reduce the variability of output power from wind solar hybrid plant; (ii) providing higher energy output for a given capacity (bid/ sanctioned capacity) at delivery point, by installing additional capacity of wind and solar power in a wind solar hybrid plant; and (iii) ensuring availability of firm power for a particular period.

Bidding factors for wind solar hybrid plants with battery storage may include minimum firm power output throughout the day or for defined hours during the day, extent of variability allowed in output power, unit price of electricity, etc.

The additional solar/wind power procured from hybrid project shall be used for fulfilment of solar/non-solar RPO as the case may be.

2.3 Environment & Social (Policy/Acts/Rule& regulations)

Below is a set of key acts / regulations that are applicable for establishing RE projects in India regarding Environment and Social aspects:

Table 2-1: Key Acts / Regulation applicable for RE Projects

Act/ Rule/ Policy	Year	Objective	Project Applicability	Agency Responsible
Environmental (Protection) Act	1986	To protect and improve the overall environment	It is an Umbrella Act for all environmental legislations in the county.	MoEFCC, SPCB
Environment Impact Assessment Notification (and subsequent amendments)	2006	To provide environmental clearance to developmental activities, to mitigate the impact of the project on the surrounding environment.	Not Applicable	MoEFCC, SEIAA (State Environment Impact Assessment Authority) SPCB.
Indian Forest Act	1927	To protect Forest land from impacts of the project.	If RE Project and Transmission line pass through Forest Areas then it will attract the provision of Forest Conservation Act requiring Forest Clearance	State Forest Department / MoEFCC, Regional Office
The Forest (Conservation) Act The Forest (Conservation) Rules	1980 1981	To keep a check on the forested land and check on deforestation by restricting conversion of forest areas into non-forest areas.		State Forest Department and Regional Office of MoEFCC and Central Government depending upon the extent of forest acquisition
National Forest Policy (Revised)	1988	To maintain ecological stability through preservation and restoration of biological diversity	RE Projects where clearing of forest/ felling of trees is required.	Forest Department, GoI
Wildlife (Protection) Act	1972	Parliament of India enacted for protection of plants and animal species	If RE project located inside the boundary of Wildlife Sanctuary or	National Board of Wildlife or Chief Wildlife Warden of State.

Act/ Rule/ Policy	Year	Objective	Project Applicability	Agency Responsible
		by protecting National Parks and Sanctuaries.	National Park, Wildlife reserves. If Project area under bio-reserves or National biodiversity reserves	
Biological Diversity Act	2002	An Act to provide for conservation of biological diversity, sustainable use of its components, and fair and equitable sharing of the benefits arising out of the use of biological resources, knowledge and for matters connected therewith or incidental thereto.		MoEFCC, National Biodiversity Authority and State Biodiversity Boards
Air (Prevention and Control of Pollution) Act	1981	To control air pollution by controlling discharge of pollutants as per the prescribed. Approval for Consent to Operate (CTO) and Consent to Establish (CTE).	CTE & CTO is not applicable to RE projects as per AP solar and wind power policy. CTE & CTO will be applicable if the contractor establishes high capacity Batching Plant. Activities (DG sets Included) during construction phase should conform to the Air Act with respect emission standard.	SPCB
Water (Prevention and Control of Pollution) Act	1974	To control water pollution by controlling discharge of pollutants as per	CTE & CTO is not applicable to RE projects as per AP solar and wind power policy.	SPCB

Act/ Rule/ Policy	Year	Objective	Project Applicability	Agency Responsible
		the prescribed norms. Approval for Consent to Operate (CTO) and Consent to Establish (CTE).	CTE & CTO will be applicable if the contractor establishes high capacity Batching Plant. Activities (discharges from toilets included) during construction phase should conform to the Water act with respect discharge standard.	
Permission for abstraction of Ground water under Environmental (Protection) Act	1986	To protect unauthorized abstraction of Ground water.	If the RE project requires to abstract ground water at the time on construction and operation phase. No Objection Certificate (NOC) for ground water withdrawal will be required	Normally Central Ground Water Authority is the concerned authority. In case of Andhra Pradesh the concerned authority for such permission is Commissioner of Rural Development Authority
Construction and Demolition Waste Rules	2016	For addressing the indiscriminate disposal of C& D Waste and enable channelization of the waste for reuse and recycling in gainful manner	Approval required from local authorities, if waste generation is >20 tons in a day or 300 tons per project in month	Local Authority and State Pollution Control Board
E-waste (Management and Handling) Rules	2016	To control/mitigate potential impacts due to e-waste handling & storage on the site.	Applicable for RE projects while using and repairing, storing of equipment. To obtain authorization from SPCB.	SPCB

Act/ Rule/ Policy	Year	Objective	Project Applicability	Agency Responsible
			Filing of return and maintenance of records in the forms given in the Rules	
Hazardous and Other Waste (Management and Trans-boundary Movement) Rules	2016	To control/mitigate potential impacts due to Hazardous-waste Import, Export, Handling, Storage and disposal. Proper management of Hazardous storage facility.	Applicable to RE projects at the time of Construction (Prior to initiation of any work) At the time of operation phase hazardous waste will be generated in from of refuse of turbine oil, transformer oil and their tank bottom sludge. In addition, disposal of PV cells also attracts the provisions of rules Permission for storage of hazardous and other wastes will be required for handling hazardous wastes	SPCB
The Bio Medical Waste Management Rules,	2016	To control storage, transportation and disposal of Bio Medical Waste.	Comply with the handling and disposal Requirements of the rules.	SPCB
Noise-Pollution (Regulation and control) Rules	2000	To control noise levels and maintain it to the standards prescribed for various areas like residential, commercial or silent zones by the Central Pollution	Noise abatement during construction time and compliance under the rules to maintain stipulated standards.	CPCB, SPCB

Act/ Rule/ Policy	Year	Objective	Project Applicability	Agency Responsible
		Control Board (CPCB).		
Ozone Depleting Substances (regulation and Control) Rules	2000	To control and reduce the use of Ozone depleting substances to protect the Ozone layer	Applicable to RE Projects where air conditioning units installed	Secretary, MoEFCC
Batteries (Management and Handling) Rules	2001	The Act defines the requirements for disposal of used batteries for bulk users. The developers in sub-project would be likely bulk users.	Applicable when batteries are used for storage of power.	SPCB
Electricity Act	2003	Laws relating to generation, transmission, distribution, trading and use of electricity, promotion of efficient and environmentally benign policies.	Applicable for RE and Transmission line projects. Where the national grid connectivity is being involved.	Power Grid, State transmission and distribution company
The Central Electricity Authority (Technical Standards for Connectivity to the Grid) Amendment Regulations	2013	Guidelines for Gird – Connectivity (Technical Standards) for RE projects Compensation payments for transmission (ROW)[4]	Applicable for RE and Transmission line projects. Where the national grid connectivity is being involved.	Ministry of Power, Central Electricity Authority (CEA),

4 http://powermin.nic.in/sites/default/files/uploads/Guidelines_for_payment_of_compensation_towards_damages_in_regard.pdf -Guidelines for compensation

Act/ Rule/ Policy	Year	Objective	Project Applicability	Agency Responsible
Energy Conservation Act 2001	2001	Established under the National Mission for enhanced Energy Efficiency.	Not directly applicable for RE projects	BEE (Bureau of Energy Efficiency.
Ancient Monuments and Archaeological Sites and Remains Act	1958	Conservation of cultural and historical remains found in India.	For the project located within 300 m from such features. (first 100 meters as prohibited area followed by 200 meters to be regulated area)	Archaeological Dept. GOI, Indian Heritage Society and Indian National Trust for Art and Culture Heritage (INTECH).
Andhra Pradesh Water, Land and Trees Act (WALTA Act)	2002	Andhra Pradesh Water, Land and Trees Act 2002 is a comprehensive law enacted by the Govt. Of Andhra Pradesh and it is a unique initiative in the country. APWALTA promotes water conservation and tree cover; regulates the exploitation and use of ground and surface water. The objective is protection and conservation of land, water sources and environment and matters connected therewith or incidental thereto.	Applicable for permission for ground water abstraction, cutting of trees in Andhra Pradesh	District Authority

Act/ Rule/ Policy	Year	Objective	Project Applicability	Agency Responsible
The Karnataka Preservation of Trees Act, The Karnataka Preservation of Trees Rules	1976 1977	To regulate the felling of the trees and for the planting of adequate number of trees to restore ecological balance and for matters connected therewith. The Act also stipulates constitution of a Tree Authority in different areas. The Act also elaborates the restriction on felling of trees and liability for preservation of trees. Section 8(2) of the Act specifies that "Any person desiring to fell a tree, shall apply in writing to the concerned Tree Officer for permission in that behalf. The application shall be accompanied by a site plan or survey sketch specifying clearly the site or survey number, the number, kind and girth of tree sought to be cut and the reasons therefore along with the consent of the	For felling of trees	Department of Forests, Department of Social Forestry, GoAP

Act/ Rule/ Policy	Year	Objective	Project Applicability	Agency Responsible
		owner or occupant".		
ACTS AND REGULATIONS GOVERNING LAND & SOCIAL ISSUES				
Recognition of Forest Rights Act - The Scheduled Tribes and other Traditional Forest Dwellers	2006	Act seeks to recognize and vest the forest rights and occupation in forest land in forest dwelling Scheduled Tribes and other traditional forest dwellers who have been residing in such forests for generations but whose rights could not be recorded	Applicable when any sub project is located in customary forest land including reserved and protected forests; protected areas and also community forest.	Ministry of Tribal affairs (nodal agency); Department of tribal welfare at district level
Rights of Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act (RFCTLARRA) (replaced Land Acquisition Act, 1894)	2013	To ensure least disturbance to the owners of the land and other affected families and provide fair compensation to the affected families whose land has been acquired.	Applicable for any sub project involving Land acquisition for the power plant.	Administrator (as per Act), Municipality/ Municipal Corporation/ District Collector/ Sub-Divisional Magistrate & Revenue Officer
73rd Constitution Amendment Act,	1992	The Act enables participation of Panchayat level institutions in decision-making. Panchayats at the village level will be involved for preparation and implementation of the project.	Applicable for any project located in panchayat area	Department of Panchayat Raj, State Government

Act/ Rule/ Policy	Year	Objective	Project Applicability	Agency Responsible
Land Purchase policy		Provision of Direct Land Purchase by respective state governments such as Bihar, M.P., Karnataka, West Bengal. etc. from land owners considering need for immediate land for any projects	In any project requiring private land	Land purchase committees of respective state government.
Guidelines issued by Ministry of Power for payment of compensation towards damages caused by tower and Right of Way for transmission lines.	2015	To determine compensation Tower base area impacted due to installation of tower / pylon structure; and compensation towards diminution of land value in the width of Right of Way (RoW) corridor due to laying of transmission line and imposing certain restrictions.	Any sub project that also includes transmission line or as an associate project of solar park.	Corporation / Municipality /Local Body or the State Government.

2.4 Labour Laws Applicable in the Project

All the workers are governed by the relevant Indian labour laws as stated below. The Developer shall undertake the requisite license from Labour Commissioner prior to initiation of any works onsite. Some of these are directly relevant during the construction stage of the proposed sub-projects:

Applicable Acts	Coverage Provisions
Minimum Wages Act 1948	The act ensures minimum wages for each category of workers

Child Labour (Prohibition and Regulation) 1986	Prohibits employment of children below 14 years age
The Labours Act 1988	Ensure general labour standards and health and safety of construction workers
The Factories Act, 1948	Ensures Health and safety considerations of workers
Workmen's Compensation Act, 1923	Ensure fair compensation in case of injury by accidents during the course of employment
Contract Labour (Regulation and Abolition) Act, 1970	Ensure basic welfare measures to be made available to the contract workers by the employer
The Building and other Construction Workers Act, 1996	Ensure safety measures at construction work site and other welfare measures such as canteens, first-aid facilities, ambulance, housing accommodation for Workers near the Workplace etc.
Payment of Wages Act, 1936	Ensures regular payment by laying down as to by what date the wages are to be paid, when it will be paid and what deductions can be made from the wages of the workers.
Equal Remuneration Act, 1979	The Act provides for payment of equal wages for work of equal nature to men and women workers and not for making discrimination against Female employees.
Payment of Bonus Act, 1965	The Act provides for payments of annual bonus subject to a minimum of 8.33% of wages and maximum of 20% of wages.

2.5 Summary of Statutory Clearance/Permits Requirement

The projects may require some statutory permission/clearances under different Acts and Rules at different stage of the project. These are listed in **Table 2.2**.

Table 2-2: Summary of Statutory Clearance Requirement of the Project

S. No.	Type of Clearance/Permits	Applicability	Project Stage	Responsibility	Time Required
1.	Forest Clearance for land diversion	For diversion of forest land if RE Project and Transmission line pass through Forest Areas	Pre-Construction	SECI/ State Agency	10-11 months
2.	Wild life Clearance	If RE project located inside the boundary of Wildlife Sanctuary or National Park, Wildlife reserves. If Project area under bio-reserves or National biodiversity reserves	Pre-Construction	SECI	10-12 months
3.	Tree felling permission	For tree cutting, if any	Pre -construction	State Agency/ SECI	1-2 months
4.	NOC (Consent to Establish and Consent to Operate) under Air and Water Act from SPCB	For siting and erection Batching plants etc. DG sets & toilet water treatment (if reqd.)	Construction Stage (Prior to erection and operation of Plants)	Contractor	2-4 months
5.	Explosive License from Chief Controller of Explosives	For storing fuel oil, lubricants, diesel etc. beyond optimal permissible limit	Construction stage (Prior to storing fuel, lubricants and Diesel, etc.)	Contractor	2-3 months
6.	Permission for storage of hazardous chemical from CPCB	Manufacture storage and Import of Hazardous Chemical	Construction stage (Prior to initiation of any work)	Contractor	2-3 months
7.	Authorisation Under Haz. Waste rules	For proper disposal of Used Oil/Other Haz wastes generated during construction & operations	Construction & operation	Contractor & SECI	2-3 Months
8.	Permission for extraction of ground water for Solar Panel cleaning and other activities	Extraction of ground water	Operation Stage (Prior to initiation of installation of Bore wells and	SECI	1-2 months

S. No.	Type of Clearance/Permits	Applicability	Project Stage	Responsibility	Time Required
			abstraction of water from such source)		
8.	Permission for use of water for construction	Use of surface / ground water for construction	Construction stage (Prior to initiation of abstraction of water from such source)	Contractor	1-2 months
9.	Labour license from Labour Commissioner Office	Engagement of Labours	Construction stage (Prior to initiation of any work)	Contractor	2-3 months
10.	NOC for Storage of Battery	Applicable when batteries are used for storage of power.	Operation Stage	SECI	4-6 months

2.6 Land Procurement for RE power generation projects

For the development of renewable energy power generation projects land will be required. As far as possible government land will be utilized for such projects. Wherever private land is involved for such project, it shall be procured within the framework of "The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013" (LA Act 2013) and the state policies on procurement of private land to ensure that there are no adverse impacts on the owners whose land is being procured under the project. The compensation is based on the state 'multiplication factor' value which is multiplied to the market value, second component is the addition of all the assets attached to the land or the building, lastly 100 percent of solatium value. The assimilation of all the components defines the compensation against land for development, guidelines for land acquisition and resettlement and rehabilitation is elaborated in the policies.

If the government revenue land is recorded as forest land (with or without tree cover) in the revenue records or it is defined as a forest land as per Revenue Department, then the applicant will have to take necessary permissions, as per provisions of Forest Conservation Act 1980, from concerned authorities.

2.7 Forest Land Diversion for Wind Farms

The guidelines for diverting forest land for non-forest purpose were developed under the Forest (Conservation) Act, 1980 for wind energy projects. The following guidelines are adopted for development of wind farms on forest land:

- The wind power plants cannot be developed over National Parks and Sanctuaries,

areas of Outstanding Natural Beauty (AONBs), Natural Heritage Site, Sites of Archaeological importance and sites of specific scientific interests and other important landscapes. Also, a safe distance shall be maintained if the selected site is near to the above-mentioned areas.

- The distance of the turbines shall be positioned 300 meters (considering safe distance) away from any settlement, highway and village habitation.
- The wind turbines shall be painted with orange stripes at ends to avoid bird hits. The wind farm should not stand in the migratory path of birds and should not be near the breeding sites of the migratory birds as the humming noise of the turbine may cause disturbance for the avian habitat.
- Wind mills of less than 500KW capacity will not be allowed on forest land. For optimization of wind energy in the given forest land, wind farm should have at least 500 KW power generating capacity.
- If the terrain permits wind mill of capacity of at least 1 MW should be preferred. This shall not be applicable to projects already in pipeline having wind mill capacity from 500KW up-to 1MW.
- For exception, a 'Stand Alone' wind mill up to 10KW off-grid will be allowed in the forest area to have access to energy in remote areas.
- Initially the forest land shall be leased for 30 years' period. Initially for the first 4 years, the lease will be in favour of the developer. Later for the stage-II approval the lease shall be transferred in the name of investor/power producer. In case the developer failed to develop wind farms, the land shall be reverted back to the Forest Department without any compensation.
- A lease rent of Rs. 30,000/- per MW for the period of lease. Additional compensatory afforestation, net present value etc. shall be charged from the user agency. Afforestation shall be done on the expense of developer.
- Details of alternative explored on non-forest land shall be provided with the proposal.
- 65% to 70% leased out areas of wind farms shall be utilized for developing medicinal plant gardens wherever feasible by the forest department. The intervening distance between two wind mills should be planted by dwarf species of trees in the project cost and the transmission lines should be aligned collaterally along the road.

2.8 State Policies for generation of power from RE sources

Wind and solar projects are classified as white industries by Central Pollution Control Board/State Pollution Control Boards and kept out of the purview of stringent scrutiny since the projects have insignificant long term adverse impacts on surrounding environment.

Most of the states/developers prefer that the land procured for the projects be maximum government revenue land with minimum private land acquisition. The preferred land parcels are generally fallow lands / rain fed irrigated land parcels / barren / open scrub lands. Designated forest area is generally avoided due to the clearance requirements and anticipated delays.

Most of the States have their respective policies and procedure guidelines for the procurement of land for the development of power generation projects from renewable energy, some of which are mentioned in subsequent sub-sections:

(a) Andhra Pradesh Solar Policy 2015

The policy targets an additional 5000MW in the next five years in the State to meet the growing demand for power in an environmentally sustainable manner. The policy objective is to promote distributed generation that can help in avoiding upstream network cost and contribute towards loss reduction. As the energy consumption is very high in the agricultural sector, the policy aims to deploy solar powered agricultural pump sets and meet power requirements. The policy shall also promote local manufacturing facilities which will generate employment in the state. The government will develop solar parks with 2500MW capacity in 500-1000ha clusters.

It is the responsibility of the project developer to acquire the land required for the project. However, in case of land owned by Revenue Department, the land allotment shall be done as per the prevailing government policy. Solar PV power projects will be exempted from obtaining any NOC/Consent for establishment under pollution control laws from AP Pollution Control Board.

(b) Andhra Pradesh Wind Power Policy 2015

The policy is to encourage, develop and promote wind power generation in the state with a view to meet the growing demand for power in an environmentally manner. There are three categories of wind power projects:

Category I	Project set up on government/ revenue lands or forested area or	Land allotted on first-come-first-serve basis on wind power potential areas, as per New Land Allotment Policy of Revenue Department. District collector shall handover

	assigned lands and also in private lands selling power within state.	the possession of land in the joint name of PARK DEVELOPER and developer. In case of forest land, submit the application through the Nodal Agency to the forest department. Private land shall be procured by the developer.
Category II	Projects set up for captive use or group captive use /3rd party sale within or outside the state.	State will promote wind power producers to set up wind power projects with no cap on capacity for captive use/group captive or sale of power to 3rd party within the State/States other than Andhra Pradesh
Category III	Sale of power at average power purchase cost and availing Renewable Energy Certificate (REC)	State will promote wind power producers to set up wind power projects with no cap on capacity for sale through Renewable Energy Certificate (REC) mechanism.

Hybrid projects are encouraged to enable better utilization of common infrastructure and related facilities.

(c) Andhra Pradesh Wind-Solar Hybrid Power Policy Draft, 2016:

Similar to the Government of India, The Government of Andhra Pradesh has prepared Draft Andhra Pradesh Wind-Solar hybrid Power Policy in 2016 with an objective of optimal utilization of transmission infrastructure. Under the Policy the Government of Andhra Pradesh target to achieve 18000 MW of RE capacity addition by year 2021-2022, comprising of 10000 MW solar power and 8000 MW wind power.

The main objective of the Policy is to provide a framework for promotion of large grid connected wind-solar PV systems for optimal and efficient utilization of transmission infrastructure and land, reducing the variability in renewable power generation and thus achieving better grid stability, optimal utilization of transmission infrastructure being built by State Utility to evacuate renewable power, encouragement of new technologies such as combined operation of wind and solar PV plants coupled with any other Renewable Energy Sources and other emerging Technologies like Energy Storage systems.

The policy provided incentives to developers for establishing the RE system.

(d) Gujarat Wind Energy Policy (2016 to 2021)

Gujarat state has a wind energy potential of more than 35,000MW. The state is committed to promote generation of clean and green sources of energy. The policy enables an individual, whether incorporated or not will be eligible for setting up Wind Turbine Generators (WTGs) either of captive use or for selling of electricity. A 100% captive use is permissible for Micro Small Medium Enterprises.

Gujarat Energy Development Authority (GEDA) being the state nodal agency facilitates in registration of Wind Projects, Identification of potential sites and Renewable Energy Certifications (REC).

Land for Project development: The Wind Turbine Generators may be set up on private land, or revenue wasteland allotted by the State Government / GEDA land, if available. The allotment of GEDA land on lease shall be done upon approval of the Coordination Committee. Issues other than the allotment of GEDA land including interpretation of any of the provisions of this Policy will also be decided by the coordination committee.

Incentives: The projects for either captive use or third-party sale within the state will be exempted from payments of electricity duty in accordance with Electricity Duty Act, 1958 and amendments. Additional incentives include:

- GST for solar modules to 5%.
- Clean Development Mechanism (CDM) under Kyoto Protocol will be shared among the producer and the procurer. The percentage shared to 100% to producer for the first year, and 10% incremental annually for the consecutive years from the sixth year onwards the share of CDM benefits partnership to be 50:50.
- Renewable Purchase obligation (RPO) tariff will be regulated and fixed as per the Gujarat Electricity Regulatory Commission (GERC).

(e) Gujarat Solar Power Policy 2015

The Gujarat Solar power policy 2015, aims to scale up the solar power generation in sustainable manner. The main objectives of the policy are to promote green and clean power, reduce use of fossil fuels for power generation, promote investment, employment & skill enhancement, promote productive use of barren /uncultivable land, encourage growth of local manufacturing facilities in line with 'Make in India' and lastly to promote R&D, innovation in renewable energy sector.

Gujarat Energy Development Agency (GEDA) is the nodal agency for registration of projects, facilitating approvals for power evacuations, recommending the solar power projects for REC and respond to queries and problems of developers.

(f) Kerala Renewable Energy Policy 2002

This policy is directed towards a greater thrust on overall development and promotion of renewable energy technologies and applications. Renewable Energy covers all sources of energy solar, wind, biomass, small hydel power plants up to 25 MW capacity, tide, wave, geo-thermal etc. The nodal agency for the development of non-conventional energy for the state of Kerala is ANERT (Agency for non-renewable energy and Rural Technology). The

procedures for project preparation, approvals monitoring etc. are structured by the nodal agency.

The nodal agency is responsible for promoting the development of renewable energy sources and function as a single window clearing agency for all renewable energy power projects for issuing all necessary clearances and approvals on behalf of Government of Kerala. The agency also provides technology support, fiscal incentives etc. and responsible for certifying or arranging for certification of all devices related to renewable energy sources.

The eligible producers were the grid –grade electricity generators. The producers sell power to Kerala State Electricity Board (KSEB) at rates defined by the board. Producers for captive use shall be considered under eligible producers and can sell the excess produce to KSEB at the prescribed tariff rate.

The Central clearing Agency has representatives from ANERT, KSEB, Power Department other experts in corresponding fields to coordinate matters relating to different renewable energy projects.

(g) Policy Guide lines for the development of wind power in Kerala through private developers 2005

The developmental policy for land procurement is categorized as under:

- Project -Captive Power Plants (CPP) on Government Land – the nodal agency calls for a two-stage tendering process and land is allotted to the highest bidder. The land shall be preferentially allotted to given to HT/EHT industrial consumers having settled undisputed dues with KSEB/State Utility and any other requisites from the statutory authorities and Local Bodies.
- Development on Private Land-The Technical Proposal is submitted on a prescribed format provided by ANERT. The decision is made in 120 days by ANERT. A petition is filled to State Electricity Regulatory Commission (SERC) for Open Access (to enter bulk power agreement with Kerala State Electricity Board). All necessary clearances are to be attained by the developer solely. No-Objection Certificate from Local Self-Governance, Wind farm proof of Ownership or Lease Rights should be submitted to ANERT.
- WTGs Developer shall be required to provide Bank guarantee @Rs 1 Lakhs per MW (2 Lakh maximum depending on the capacity) to ANERT ensure the developer succeeds in commissioning the Wind Farm and transmission line in the time mentioned. Pooling station and Evacuation facility is developed by KSEB/STU as per the Master Plan by ANERT. But the costs will be borne by the developer and 50% initially by ANERT, which will be returned back after the (COD) Commercial Operative Date. Other infrastructure costs shall be borne by the developer.

(h) Kerala Solar Energy Policy 2013

The policy was framed to mainstream the use of solar energy in the energy mix of Kerala and to ensure optimal usage of solar potential in the region. The mission is to install 500MW solar power by 2017 and 2500MW by 2030. The installations to be targeted for macro and micro levels and the incentives & disincentives packages to be made for identified groups. Policy promotes entrepreneurs/start-ups industries/ institutions that are engaged in innovative solar based systems. ANERT shall act as a facilitator for developer for making available the subsidies from MNRE/ other central agency.

(i) Chhattisgarh Solar Energy Policy 2017 – 2027

Chhattisgarh currently has a total renewable energy potential of 4500 MW which includes solar (grid connected and roof top), wind, biomass and small hydro. Chhattisgarh Solar Policy is targeted to tap solar potential. The main objective of the policy are as under:

- To encourage, develop and promote solar power generation in the State with a view to meet the growing demand for power in an environmentally and economically sustainable manner.
- To enhance the private sector participation in solar power generation.
- To create a favorable environment for development of solar manufacturing capabilities within the State.
- To contribute to long term energy and ecological security of Chhattisgarh with gradual reduction in dependence on con-ventional thermal energy sources such as coal.
- To promote the Off-Grid Solar applications to meet the energy needs of vulnerable section of society residing in far flung area and also to promote Stand-alone system.
- Universalization of access to clean energy.
- To encourage Decentralized, Distribution Generation System in the State.
- To create opportunities for huge direct and indirect employment in solar generation, manufacturing and related Support industries.
- To productively utilize the available waste-lands/non-industrialized unused land for solar generation.
- To create skilled and Semi-skilled human resources for the Sector.
- To encourage innovative projects pertaining to Solar Power Generation.

The incentives proposed in the policy are as under:

- As available under state industrial policy will be applicable.
- Exemption from electricity duty for auxiliary consumption or captive consumption within the state.
- If the incentives available under industrial policy are less than those under solar policy, then the incentives as per solar policy will prevail.

- For third party sale through open access to entities outside the state, the open access charges will be as per state regulations or Central Electricity Regulatory Commission.
- Wheeling and transmission charges will be as per state regulations.
- Cross subsidy surcharge for sale of power inside the state shall be as per state regulations.

Reservation of land for the renewable project: The prime responsibility for identifying the land for renewable energy shall be with the developer. Government shall endeavour to assess clearly the land suitable for the development of solar installations in the possession of either Government, private or tribal individuals. For tribal lands, in addition to the lease rentals, a revenue (not profit) sharing mechanism for the land owner is envisaged as follows.

- The willingness of the land owner is mandatory.
- The land ownership rights shall continue to fully vest with the original owner. The developer shall have only rights to setup and operate the project.
- Revenue (not profit) sharing based on the power generated, possibly in the range not below of 5% is envisaged.
- The payment of share of revenue shall be made directly to the bank account of the land owner. For this purpose, a tripartite agreement has to be entered into among the developer, the land owner and the KSEB.
- Only lands which do not have an immediate productive use shall be thus identified/ permitted.

(j) Maharashtra Comprehensive Policy for Grid connected Power Projects based on New and Renewable (Nonconventional) Energy Sources – 2015

The policy targets total of 14,400 MW capacity power projects based on renewable energy to be installed in next five years. The policy envisages setting up of grid-connected renewable power projects of capacity 5000MW from wind and 7500MW from solar and remaining from biomass, small hydro, industrial waste and other renewable energy sources. Maharashtra Energy Development Agency (MEDA) will implement the policy as per the methodology. It shall give assistance with respect to matters relating to the MNRE. Hybrid projects shall also be allowed under this policy.

Out of 7500MW target under this policy, 2500MW capacity solar power project will be

developed by MAHAGENCO in PPP mode to fulfil the Renewable Generation Obligation (RGO). Remaining 5000MW will be developed by the other developers. The policy states:

- Solar parks should be a minimum capacity of 1MW and above.
- Land to be procured by the developer, but government waste land can be granted on lease hold basis as per availability.
- District collector can allot up to 4 hectares of land for grid connected solar power projects of up to 2MW capacity after scrutiny of the regional plan. Such land will be given on lease at 50% concessional rate in accordance with Maharashtra Land Revenue Code and disposal of government land rules, 1971.
- Private land owners can lease /rent their land for solar power projects.
- Developer can generate electricity for captive use and can be sold through REC mechanism.
- The projects are exempted from obtaining NOC/ consent from Pollution Control Board.

2.9 Applicable World Bank Safeguard Policies

The implementation of the World Bank Operational Policies seeks to avoid, minimize or mitigate the adverse environmental and social impacts, including protecting the rights of those likely to be affected or marginalized by the proposed project. Based on the information collated by the consultants during the baseline study, following OP's are likely to apply to the proposed project and would require adequate measures to address the safeguard concerns.

Table 2-3: Applicable WB Policies

World Bank Safe Guard Policies	Objective	Applicability	Safeguard Requirements
OP 4.01 Environmental Assessment	The objective of this policy is to ensure that Bank financed projects are environmentally sound and sustainable.	The environmental issues will be addressed adequately in advance. An integrated Environmental Screening and Environmental Assessment (EA) with Environmental Management Plan (EMP) will be developed to manage environmental risks and maximize environmental and	EIA and/or EMP required.

World Bank Safe Guard Policies	Objective	Applicability	Safeguard Requirements
		social benefits wherever it is applicable.	
OP 4.04 Natural Habitats	The policy recognizes that the conservation of natural habitats is essential for long-term sustainable development. The Bank, therefore, supports the protection, maintenance and rehabilitation of natural habitats in its project financing, as well as policy dialogue and analytical work. The Bank supports and expects the Borrowers to apply a precautionary approach to natural resources management to ensure environmentally sustainable development	This policy may apply to the Project due to activity requiring forest/ wildlife lands, locating close to the natural habitats with the potential to cause significant adverse impact or degradation of natural habitats whether directly (through construction) or indirectly (through human activities induced by the project).	EIA and EMP required
OP 4.36 Forests	This policy focuses on the management, conservation, and sustainable development of forest ecosystems and resources. It applies to project that may have impacts on (a) health and quality of forests;	Impact of construction activities on Forest areas required to be taken care of. Generally, diversion of reserve forest will be avoided, however the roadside trees along state highways being declared as protected forest, and roadside tree felling will attract the provision of Forest (Conservation) Act. The forest related issues, avoidance/	Forest land diversion Application has to be prepared and submitted to forest department. The issue of forest loss and its mitigation/compensatory measures is required to be integrated in EIA study and EMP.

World Bank Safe Guard Policies	Objective	Applicability	Safeguard Requirements
	(b) Affect the rights and welfare of people and their level of dependence upon forests and projects that aim to bring about changes in the management, protection or utilization of natural forests or plantations, whether they are publicly, privately or community owned. The Bank does not support the significant conversion or degradation of critical forest areas or related critical natural habitats.	minimization of forest loss and its management should be integrated with EA study and EMP.	
OP/BP 4.12 Involuntary Resettlement	The objective of this policy is to avoid or minimize involuntary resettlement where feasible, exploring all viable alternative project designs. Furthermore, it intends to assist displaced person in improving their former living standards; community participation in planning and implementing resettlement; and to provide assistance to affected people,	There will be need for limited land acquisition resulting in: relocation or loss of shelter, loss of assets or access to assets; loss ofincome sources or means of livelihood. This policy applies to all components of the project that result in involuntary resettlement, regardless of the source of financing. It also applies to other activities resulting in involuntary resettlement, that in the judgment of the Bank, are (a) directly and significantly related to the Bank-assisted project,	Social Impact Assessment and Resettlement Action Plan in consultation with the community and project authorities

World Bank Safe Guard Policies	Objective	Applicability	Safeguard Requirements
	regardless of the legality of title of land	(b) necessary to achieve its objectives as set forth in the project documents; and (c) carried out, or planned to be carried out, contemporaneously with the project.	
OP/BP 4.10 Indigenous People	This policy aims to protect the dignity, right and cultural uniqueness of indigenous people; to ensure that they do not suffer due to development; that they receive social and economic benefits	This policy may apply if there are indigenous people in the project area; when potential adverse impacts on indigenous people are anticipated; and if indigenous people are among the intended beneficiaries.	Indigenous people development Plan
OP/BP 4.11 Physical Cultural Resources	This policy aims at assisting in the preservation of cultural property, historical, religious and unique natural value-this includes remains left by previous human inhabitants and unique environment features, as well as in the protection and enhancement of cultural properties encountered in Bank-financed project.	This policy may apply to sub-projects where cultural property, historical, religious and unique natural value-this includes remains left by previous human inhabitants and unique environment features may be affected due to project.	Application has to be prepared and submitted to Archaeological department in case any impact is envisaged due to the project. The impact on such features should be integrated with EIA study and included in EMP
OP4.37 Safety of Dams	This policy aims at ensuring safe dams, where facilities supported by the Bank are dependent on such dams.	This policy applies to existing as well as new dams and dams under construction, whether or not financed by the Bank, wherever Bank supported project is	Since the project will mostly depend on existing dams, in case of floating solar plants, SECI will provide previous assessments of

World Bank Safe Guard Policies	Objective	Applicability	Safeguard Requirements
		dependent on the safety of such dams.	dam safety or recommendations of improvements needed in the existing dam or DUC. These need to be satisfactory to the Bank, which can be confirmed on a case-by-case basis once SECI provides evidence that (a) an effective dam safety program is already in operation, and (b) full-level inspections and dam safety assessments of the existing dam, which are satisfactory to the Bank, have already been conducted and documented.

2.10 Community Health, Safety and Security

While acknowledging the public authorities' role in promoting the health, safety, and security of the public, client's responsibility is to avoid or minimize the risks and impacts to community health, safety, and security that may arise from project related-activities, with particular attention to vulnerable groups. The objective of Performance Standard 4 is:

- Avoid or minimize the risks to, and impacts on, the health and safety of the local community over the project life cycle, from both routine and non-routine circumstances.
- Ensure that the safeguarding of personnel and property is carried out in a legitimate manner that avoids or minimizes risks to the community's safety and security.

IFC – EHS Guidelines

The EHS Guidelines include information relevant to power generation and transmission that occur during the construction and operation phases of a facility, along with recommendations for their management. Additional recommendations for the management of environmental issues during the construction and decommissioning phases are provided in the General EHS

Guidelines. The impacts addressed in the General EHS Guidelines include:

- Construction site waste generation;
- Soil erosion and sediment control from materials sourcing areas and site preparation activities;
- Fugitive dust and other emissions (e.g. from vehicle traffic, land clearing activities, and materials stockpiles);
- Noise from heavy equipment and truck traffic;
- Potential for hazardous materials and oil spills associated with heavy equipment operation and fueling activities.

The EHS guidelines are technical reference documents with industry specific examples of good international industry practice. The document is available online on URL: http://www.ifc.org/ehsguidelines for download. For IFC-financed projects, application of the EHS Guidelines to existing facilities may involve the establishment of site-specific targets with an appropriate timetable for achieving them. The environmental assessment process may recommend alternative (higher or lower) levels or measures, which, if acceptable to IFC, become project- or site-specific requirements.

The below industry specific, relevant to solar / wind / hybrid solar-wind guidelines should be used together with the general EHS guidelines:

(a) Environmental, Health, and Safety Guidelines for Electric Power Transmission and Distribution

The EHS Guidelines for Electric Power Transmission and Distribution include information relevant to power transmission between a generation facility and a substation located within an electricity grid. The document lists the likely impacts during the construction phase along with the performance indicators and monitoring guidelines.

The detailed document can be downloaded from URL:
http://www.ifc.org/wps/wcm/connect/66b56e00488657eeb36af36a6515bb18/Final%2B-%2BElectric%2BTransmission%2Band%2BDistribution.pdf?MOD=AJPERES&id=1323162154847

(b) Environmental, Health, and Safety Guidelines for Wind Energy

The EHS Guidelines for wind energy include information relevant to environmental, health, and safety aspects of onshore and offshore wind energy facilities. It should be applied to wind energy facilities from the earliest feasibility assessments, as well as from the time of the environmental impact assessment, and continue to be applied throughout the construction and operational phases.

The detailed document can be downloaded from URL:

http://www.ifc.org/wps/wcm/connect/2c410700497a7933b04cf1ef20a40540/FINAL_Aug+2015_Wind+Energy_EHS+Guideline.pdf?MOD=AJPERES

3.0 BASELINE- CASE STUDY SAMPLE SUB-PROJECTS

3.1 Introduction

Documentation of Environmental and Social Baseline information for the proposed project sites is necessary for assessing the likely impacts because the project. The major objectives for which the Baseline information of the project site must be collected are as follows:

- To confirm the presence of environmentally sensitive areas from secondary sources or preliminary site observations.
- To verify the extent of applicability of GoI, and World Bank policies in project activities.
- Identify potential negative and positive impacts; provide clarity on which issues need to be investigated more comprehensively during preparation of Environmental & Social Impact Assessment that will be done during the design stage.
- To provide inputs for sequencing of projects, and factoring in timelines, like those associated with regulatory clearance processes, into project implementation.

Since the sub projects under this project are not known, few projects of similar nature were studies to establish baseline. The sample project study helped in identification of environmental and social issues and likely adverse environmental and social impacts of the investments in projects. Since the proposed project is for innovative technologies, commercial scale of similar solar-wind hybrid with storage projects and large scale battery storage projects are not available in India and therefore small-scale projects largely put for research and development purpose were identified for review purpose.

The sample projects reviewed for this purpose are:

I. Solar projects:

(i) Rewa (Madhya Pradesh)- 750 MW

(ii) Pavagada (Karnataka)- 2000 MW and

(iii) Mandsaur (Madhya Pradesh)- 500 MW,

II. Wind projects:

(iv) Tirunelveli (Tamil Nadu)- 51 MW,

(v) Kayathar (Tamil Nadu)-

III. Hybrid project:

(i) Kayathar (Tamil Nadu)-54 kW

(ii) Anantapur (Andhra Pradesh)- 160 MW

IV. Battery Energy Storage System projects:

(i) 100 MW(AC) Solar PV Project (200MWp DC capacity) along with 50MW/150 MWh Battery Energy Storage System at Rajnandgaon, Chhattisgarh

The study of sample project cases covers an analysis of environmental, social and other data obtained from secondary sources, and consultation with different stakeholders.

3.2 Review of Solar Projects

The consolidated parameters of solar projects are depicted in table 3.1 below.

Table 3-1: Consolidated parameters of sample projects reviewed

S. No.	Parameter	Rewa (Madhya Pradesh)	Pavagada (Karnataka)	Mandsaur (Madhya Pradesh)	Anantapur (Andhra Pradesh)	Rajnandgaon Chhattisgarh
1	Project Villages Location	Badwar, Barseta Desh, Barseta Pahar, Ram Nagar Pahar and Etar Pahar	Thirumani, Balasamudra, Vollur, Kyathaganacherlu, Rayacharlu	Gujarkhedi (uninhabited) and Runija Villages; Sitamau Block; Suwasra	Ramagiri and Muthuvakuntla	Dhaba, Khoka, Rangakhetra, Amlidih, Dhundera, Orebabandh, Giragaon, Tolagaon, Margaon and Dhudwa
2	Tehsil	Gurh	Pavagada / Tumkur (Karnataka State)	Tehsil, Mandsaur	Ramagiri,	Dongragaon and Rajnandgaon
3	District Name/ State	Rewa / Madhya Pradesh	Tumkur, Karnataka	Mandsaur, Madhya Pradesh	Anantapur, Andhra Pradesh	Rajnandgaon, Chhattisgarh
4	Location coordinates	Longitude 81° 31′ 38″ E to 81° 37′ 31″ East Latitude 24° 27' 1″ N to 24° 29′ 47" North	Latitude 14°13′ to 14°20′ North Longitude 77°23′ to 77°30′ East	Between Latitude 24^0-4′-30″ N to 24^0-6′-10″ N and Longitude 78^0-45′-50″ E To 75^0-46′-30″ E	Latitude 14.3104^0 N Longitude 77.5060^0 E	Latitude 21°5'32.89"N, Longitude 80°50'30.37"E

5	Climatic zone	Humid subtropical climate zone	Warm & Humid		semi-arid climate	Tropical (Hot and Humid)
6	Average Elevation	360 meters above MSL			Varies between 470 m to 517 m amsl	250 m to 330 m above msl

S. No.	Parameter	Rewa (Madhya Pradesh)	Pavagada (Karnataka)	Mandsaur (Madhya Pradesh)	Anantapur (Andhra Pradesh)	Rajnandgaon Chhattisgarh
7	Road Accessibility	National Highway – 75; *Connecting Rewa town (north side) and Sidhi town (south side)*	Linked by MDR to Taluk Headquarters; SH to Tumkur 180 km from Bengaluru		Nearest Railhead from the site location is Dharmavaram (31 Km) and the district headquarter Anantapur is located about 61 Km away from proposed site.	Nearest railhead from the site location I Rajnandgaon Sttation. NH – 6 is passing very close to project site.
8	Nearest Airport	Allahabad Airport (160 kms)	Bengaluru Airport (200 kms)		Bengaluru Airport (187 Km)	Raipur Airport (95 km)
9	Land availability	Estimated 82% government land and rest private acquisition for a total of 1500 Ha approximately	12,000 Acres on long-term lease (30 year)	553.6 Ha approximately	900 acres approximately	377 Ha approximately
10	Key Social issues	Private land acquisition; loss of livelihood and sources of livelihood.	Land on long term lease though there will be loss of sources of livelihood for tenants.	Loss of land and livelihood. No displacement.	The project site is mainly located on government and assigned land. There is no settlement in the proposed area. The tentative alignment of transmission line passes through	The project site is located on government land. There is no settlement in the proposed area.

S. No.	Parameter	Rewa (Madhya Pradesh)	Pavagada (Karnataka)	Mandsaur (Madhya Pradesh)	Anantapur (Andhra Pradesh)	Rajnandgaon Chhattisgarh
					mainly private lands but does not encounter settlement areas. However, all the affected persons whose assigned land will be affected belong to BPL category.	
11	Key environmental issues				Protection of existing surface water resources / natural drainage. Waste management including hazardous waste disposal. Pre-construction stage activities impacting topography, drainage and slope. Water recycling / ground water recharge considering	Protection of existing surface water resources / natural drainage. Waste management including hazardous waste disposal. Pre-construction stage activities impacting topography, drainage and slope. Water recycling / ground water recharge considering scarcity of water resource.

S. No.	Parameter	Rewa (Madhya Pradesh)	Pavagada (Karnataka)	Mandsaur (Madhya Pradesh)	Anantapur (Andhra Pradesh)	Rajnandgaon Chhattisgarh
					scarcity of water resource.	
12	Water requirement	Estimated at 1.55 MLD			Estimated at 330 cum	Estimated at 105 KL per day
13	Proposed capacity	750 MW	2000 MW	250 MW	160 MW	100 MW(AC) Solar PV Project (200MWp DC capacity) along with 50MW/150 MWh BESS
14	Site conditions	A few scattered trees, almost flat to sloping hard surface	Largely flat land; seasonal cultivation	Largely flat and rocky land, se asonal cultivation in case of good monsoon	Undulated land rocky strata with scanty bushy vegetation and without any habitation.	Undulated land rocky strata with scanty bushy vegetation and without any habitation.
15	Power Evacuation	Vindhyachal - Jabalpur 400 KV line (airborne distance of 30 kms) *(Actual alignment yet to be established)*		400 kV Mandsaur-Sitamau substation; alignment currently being finalized.	400 KV line Hindupur substation Total distance from Ramagiri wind-solar hybrid power 45 Km. The actual alignment yet to be established	Through overhead 132kV transmission line of length 33 km approx. to the nearest 132 kV CSPTCL's Substation at Thelkadi, Chhattisgarh
16	Soil characteristics	Sandy loam	weathered loamy red soil	Sandy and black cotton soils	Sandy and black cotton soil	Deep black soil, yellow soil and red let

Detailed description of the baseline data on environmental and social parameters for Anantapur is provided in **Annexure-I** and Rajnandgaon, Chhattisgarh is provided in Annexure-XVI

3.3 Review of wind projects

a) **NLC Wind project-** Neyveli Lignite Corporation (NLC) plans to set up a 51-MW wind power farm at Kaluneerkulam in Tamil Nadu. The consultant's team visited the multiple sites (under operations stage) managed by NLC and NIWE in the state of Tamil Nadu. Following environmental and social aspects were observed during the site visits.

An area of approximately 1 Ha (100 meters x 100 meters) is acquired for setting up a single unit WTG (1.5MW). The footprint of the WTG may not be very large but land to the tune of 1 Ha is acquired for ensuring safety and maintenance requirements.

- At present 9 Wind Turbine Generators (WTG) have been commissioned and work on the balance WTG are on-going. One of the key issues in delay is due to the non-availability of land parcels for setting up of the WTG.
- Most of the land owners continue to cultivate the remaining parcel of land available with them. There have been no alternative livelihood options being explored by the parcel owners except the employment by the firm for ensuring safety and security of the installed WTG. Informal consultations with a few of the land owners who have sold their land (mainly marginal land parcel owners) reveals that land was sold to meet family expenses (marriage of daughters etc). It was observed during the site visits that the original land owners are also cultivating some portion of the sold land as it is lying vacant.
- In all the installed WTGs, the original land parcel owners have also been employed in the project for ensuring safety and security of the installed WTG. This has also provided additional source of income for the complete project duration to the land parcel owner.
- The WTG does not lead to any large-scale employment generation possibilities for the locals due to the requirement of skilled man power for preventive maintenance / operations and repair tasks.
- No adverse impacts due to the installation / operation of the WTG have been reported during the informal consultations with the local residents. There have been no issues related to noise pollution, bird hits etc. The noise levels generated from “gear operated WTG” was found to be slightly higher when compared with “gearless WTG” operations for 1.5/2MW WTG.
- Currently none of the proposed WTG sites were fenced but NLC plans to undertake fencing of all the sites in future to avoid any encroachments etc. There have been no safety issues or public access requirements reported in any of the sites.

b) **NIWE Wind project-** NIWE established its research Station at Kayathar (Thoothukudi), Tamil Nadu around 20 years back as a technical focal point of excellence to foster the development of wind energy in the country. The consultant’s team conducted detailed discussions with NIWE in order to gain understanding of the wind-based power generation technology and its development potential. Following

were the key points of discussion concerning environmental and social management framework:

- A typical footprint (direct surface area of impact which last the life of the facility) for a single WTG of 1.5 MW / 2 MW is calculated based on the size of the blade lengths. For a 40 meter to 45-meter blade length, an area of approximately 100 meter by 100 meter (1 hectare) is required. This includes the area occupied by the wind turbine pads, sub stations, service buildings and other supporting infrastructure facilities. An area of approximately 1 Ha (100 meters x 100 meters) is acquired for setting up a single unit WTG (1.5MW).
- Additionally, there is a radius of restriction which is calculated as (tower height plus (+) 0.5 times the blade diameter) wherein there are height restrictions for buildings / vegetation to ensure safety of the WTG.
- The setbacks / spacing between multiple WTGs are influenced by issues including visual impacts, noise, flicker effect and safety. The wind turbines do generate marginal amount of noise due to the mechanical components and aerodynamic sources. These impacts can be mitigated through turbine siting. Shadow flicker is generally not considered a significant issue in siting of wind turbines. However, in case of sensitive receptors (schools/colleges, health care facilities etc.), adequate modelling techniques could be used to identify safe distance to avoid shadow flicker effects.
- In addition to the permanent impacts which last the life time of a facility (approximately 25 years), there are usually reversible short-term construction stage adverse impacts. These impacts are associated with temporary construction of approach roads to proposed site, storage facilities; transportation of heavy machinery / equipment and manpower. Therefore, large wind turbines cannot be installed in hilly terrains or areas which lack road access as the movement of heavy machinery / equipment may not be feasible.
- Based on the discussions with the NIWE officials there have been no reported incidents of bird kills due to WTGs at the site.

3.4 Review of Solar-Wind Hybrid Project

Not much work has been undertaken in hybrid solar-wind power generation in India at present and currently it is more on experimental basis. The results have been encouraging due to reduced cost of transmission lines, better utilization of available land resource and most importantly a more stable power supply to the grid.

- NIWE has installed a 54-kW solar along with the existing wind power generation WTGs.

Looking at the potential of the hybrid solar-wind power generation at existing and new sites, Government of India has also come up with a policy for development of hybrid solar
– wind power generation India. The policy document has been reviewed in the previous chapter of the report.

3.5 Review of RE integrated with BESS Project

RE integrated with BESS projects are a very new phenomenon in India and there are no large-scale operational projects available in the country. SECI has awarded tenders for RE coupled with BESS projects under its '1200 MW RE with assured peak power supply' tender, but the projects are under development. Therefore, such projects are being proposed for demonstration of various use-cases of Battery systems for various grid-support applications.

4.0 ENVIRONMENTAL AND SOCIAL ASSESSMENT PROCESS

The ESMF would be used for incorporation of environmental and social safeguards in the planning, execution and operation stages of each sub-project activity. A step-by-step methodology has been provided that can be followed along with engineering and institutional interventions required for the sub-project activities.

4.1 Environmental and Social Screening

Various sub projects shall be appraised during the planning stage based on the step-by step process beginning with screening phase. The screening checklist will help categorize sub-projects based on the extent of adverse social and environmental impacts. The corrective actions and mitigation plans can be formulated according to the severity of the impacts identified during the planning stage.

The project will use a structured approach to environmental and social management to allow the project development process, follow the hierarchy of avoidance, minimization, compensation/mitigation for negative impacts and enhancement of positive impacts where practically feasible and advantageous. The overall process is depicted in a flow chart below:

Following sections describe what needs to be done at each stage of the overall project life – sub-project selection, design of the project supported interventions, implementation of the project activities, institutional mechanisms to support implementation, budgetary allocations to implement proposed mitigation measures and reporting on progress.

4.2 Screening and Environment and Social Due Diligence (ESDD)

This step will involve review of the available environmental and social information about the sub-project and its surrounding areas. It would help identify issues to be verified during reconnaissance site visits and also provide a preliminary idea regarding the nature, extent, and timing of environmental and social issues that would need to be handled during the subsequent stages. It will also help identify opportunities for avoidance and/or minimization of such issues early in the project cycle so that these could be appropriately addressed as part of the design process. The steps for environmental and social screening and due diligence to be followed for all the projects will as below:

a) Confirm the presence of environmentally sensitive areas from secondary sources or Site reconnaissance.

b) Verify the extent of applicability of GoI, and World Bank policies in sub-project activities

c) Identify potential negative and positive impacts based on the project components, proposed activities and location of the project. Provide clarity on which issues need to be investigated more comprehensively during preparation of Environmental & Social Impact Assessment.

This should help with sequencing of sub-projects, and factoring in timelines like those associated with regulatory clearance processes into project implementation.

The process of preparing the environmental and social screening checklist and ESSD will typically cover:

- Describing the need for the project, i.e. the issues or problems to be addressed.
- Describing the proposed project or options.
- Identifying the potential environmental and social impacts of the projects or options.
- Undertaking a preliminary evaluation of the potential environmental and social impacts of the project or options.
- Consulting local officials on the project or options, and the potential impacts.
- Describing the preliminary consultation with relevant agencies and local community. The focus of these consultations would be informing the local community, reviewing the likely issues and problems.
- Selecting a preferred project option or short list of options. The appraisal of the available DPR / Feasibility study reports should be included from an environmental and social perspective.
- Identifying the planning approvals which are likely to be required from MOEFCC, SPCB and other regulatory agencies.
- Determining the type and scope of EIA study. ToR for an Environmental and Social Assessment Study of the preferred option or a short list of options.

The results of this step will help identify the scope of the ESA study and timeframe required for obtaining the regulatory clearances (if any). The environmental and social safeguard screening as well as ESDD shall occur during the project preparation stage as a soon as the accurate site location is known for the sub-project. The formulation of the sub-project specific ToR shall be done based on the screening and ESDD outputs highlighting environmental and social components that require detailed assessment during the ESA stage. A generic ToR for ESIA study is attached in **Annexure-II** for similar sub-projects.

EIAs may take the form of Comprehensive EIAs or Rapid EIAs depending on whether the environmental and social impacts can be readily mitigated. Comprehensive EIAs generally

need to rely on data collected over a 12-month period whereas Rapid EIAs can rely on data collected in one season (other than the monsoon season) to facilitate a speedier assessment process.

Rapid EIAs are generally acceptable if the analysis of environmental and social impacts is sufficient for the purposes of selecting a preferred project option and determining appropriate measures for mitigating environmental and social impacts. The outcome of a Rapid EIA process will sometime determine if a Comprehensive EIA is required and, if this is likely, then it will often be more efficient to prepare a Comprehensive EIA from the outset. Having identified the probable adverse impacts, the next step shall involve quantification of the impacts and developing action plans to mitigate such adverse impacts.

The checklists that would help identify the screening components that need to be investigated in detail during the preliminary stages of evaluation or to conclude that insignificant adverse impacts are anticipated, are given in **Annexure III**.

Since there is limited prior experience of working on MW-scale Floating Solar PV (FSPV) plants, separate criteria have been developed to guide the deployment of this innovative technology withiin this project. These would be applied for selection, preparation, and implementation of FSPV sub-projects. These are included in **Annex IV**.

The ESDD and preparation of ESDD Report will inform SECI of environmental and social impediments that needs to be addressed while executing the project. The ESDDR will help prepare a/n preliminary/outline Environmental and Social Management Plan that will be part of bid document. This draft ESMP will be used by the EPC contractor who will be responsible for preparing a detailed ESMP based on ground truthing that will include mitigation measures, implementation and monitoring & reporting plan addressing all the issues identified.

The ESDDR shall comprise of (i) a description of the sub-project and its components (ii) an environmental and social profile of the sub-project areas and the proposed project facilities (iii) an Environmental and Social Screening and categorization of the sub-project as outlined in Environmental and Social Management Framework (iv) an analysis of environmental and social issues associated with the project and (v) Environmental and Social Management Plan (ESMP) out lining various management measures to be implemented by the contractor. The ESDDR will also help in determining if full ESIA is required or a detailed assessment of only specific aspects is required for a given sub-project at a later stage, in consultation with the World Bank.

SECI will primarily be responsible for the preparation of ESDDR and ESMP and overall management of their implementation.

The ESDDR along with ESMP shall be submitted to World Bank along with the DPR for review. The ESDDR and ESMP upon approval and prior to the initiation of the bid process, shall be disclosed locally and on the World Bank website.

The ESMP shall be included in the bid document, clearly outlining the responsibility for various safeguard management actions for the sub-project in line with its safeguard requirements as outlined ESDDR and ESMF.

4.3 Environmental and Social Impact Assessment

The ESIA is the most commonly used tool to ensure that environmental and social aspects are considered during decision making – by influencing design to prevent /minimize, and where unavoidable, mitigating the residual adverse impacts and/or enhancing positive impacts. It also provides a platform for getting views from stakeholders including the directly affected population to improve the design. Detailed guidance regarding the EIA/SIA contents is available in the OP4.01 /OP 4.12 of World Bank. The key steps in preparing the ESIA would involve:

a) Defining the scope in line with the already completed screening, and the Operational Policies of the World Bank. The template ToR provided in **Annexure-II** shall act as a guidance document.

b) Obtaining information from primary or secondary sources regarding the current conditions of environmental and social features within the influence area of the sub-project. Generally, the impact zone for environmental impacts is considered as 10 km buffer along the proposed site whereas for the social impacts, it is considered up to 2 km buffer along the proposed site or even lesser depending upon the location of PAP/ settlements / land parcels that are likely to be impacted due to the project either directly

or indirectly. The environmental impacts zone for renewable energy generation projects could also be much less than 10 km in majority of the sub-projects.

c) Carrying out effective stakeholder consultation along the proposed sub-project impact zone will be critical to identifying any social, cultural, gender specific and indigenous community concerns/issues. This shall also include landless labourers / marginalized communities whose livelihood may be impacted due to sub-project.

d) Identifying feasible alternatives for proposed layout changes, use of alternative technologies etc. in close collaboration with the project design team.

e) Identifying and estimating quantitatively (to the extent possible), key impacts and classify these for ease of understanding and determination of significance (by severity, duration, project phase, etc.)

f) Selecting measures that can help manage these impacts in cost effective manner – reduce the negative ones; and enhance positive ones and estimate the residual impacts, including those that may need further study.

g) Clarifying the institutional arrangements, any capacity building needs, and resource requirements including grievance redress mechanism and budget as part of the preparation of environmental and social management plan.

The following will be the outline contents for each ESIA under the project:

i. Executive Summary

ii. Project Description

iii. Policy, Legal and Institutional Framework

iv. Current (Baseline) Environmental & Social Status

v. Potential Environmental & Social Impacts

vi. Analysis of Alternatives

vii. Stakeholder Consultations, including Community Consultations / Public Disclosure

viii. Environmental & Social Management Plan (including additional studies, if any)

ix. Grievance Redressal Mechanism

x. RAP / IPDP (if required) depending upon the likely R&R impacts else would be addressed under the EMP document.

xi. Recommendations and Conclusion

xii. Annexes (including data sources, List of EIA preparers, consultation details, etc.)

4.4 Environmental & Social Baseline Information

The process of preparing the environmental and social screening checklist and scoping will typically cover:

Describing the need for the project

Describing the proposed project or options.

Identification of the issues or problems to be addressed.

Identifying the potential environmental and social impacts of the projects or options.

Consulting local officials on the project or options, and the potential impacts.

Preliminary consultation with relevant agencies and local community to assess the gravity of these issues and impacts from the perspective of the stakeholders. The focus of these consultations would be to inform the local community, reviewing the likely issues and problems.

Undertaking a preliminary evaluation of the potential environmental and social impacts of the project or options.

Selecting a preferred project option or short list of options. (The appraisal of the available DPR / Feasibility study reports should be included from an environmental and social perspective).

Identifying the regulatory approvals required from MOEFCC, CPCB, SPCB and other regulatory agencies.

Determining the type and scope of EIA study. Developing terms of reference (ToR) for an Environmental and Social Assessment Study of the preferred option or a short list of options.

While more extensive data is likely to be required for ESIAs, some data on baseline conditions (mostly secondary sources) will generally be required for screening to compare the environmental and social impacts of project options and to assess the extent of any environmental and social impacts.

The robustness of screening will often be dependent on the quality of data on baseline conditions and the assessment of projects induced environmental and social impacts. The assessment of baseline conditions should take into account:

Past trends in environmental and social quality

Community preferences and competing demands for resources Other

current or proposed development programs in the project area.

Good maps are generally required to indicate the spatial relationship between the sources and recipients of the environmental and social impacts. Google Earth and other open source satellite imagery data can also be very useful in identification and indicating changes in land use and other environmental features. Following are the essential maps:

A map specifying the location coordinates of the proposed sub project

A study area map indicating features such as locations of human settlements, locations of other wind farm / solar farms and its distances, other neighbourhood industries with details, if any

Schematic layout of the project showing the position of wind turbine / array of solar panels including spacing between the row and perpendicular distance between two turbines/ solar panel modules.

A layout map showing access road, internal access roads, underground cable, substation and switchyard and additional structures including all utilities.

A map specifying the land use patterns / drainage / topography of the project site and study area.

A map marking the sensitive zones in the study area, such as national parks and sanctuaries, forests, defence installations, international border, protected areas, and airports (if applicable).

4.5 Probable Impacts

Environmental and social impact analysis of a project (or project options) consists of comparing the expected changes in the biophysical and socioeconomic environment with and without the project. For each potential environmental or social impact, the analysis should predict the nature and significance of the expected impacts or explain why no significant impact is anticipated.

Based on the information available for the selected case studies / sub-projects for the development of ESMF, key environmental issues / impacts identified that would require detailed investigations during the ESA stage are listed below. A summary of the issues and potential impacts is presented in the following paragraphs to guide preparation of sub-project ESIA and ESMPs.

(a) Impacts on Natural Physical Environment

The proposed Renewable Energy projects will require excavations for laying foundation, water for construction and operation stage, area for storage of spare parts/ equipment etc. The

physical environment would be used differently at construction and operation stages.

The site climatic conditions are an integral part of the impact assessment, where the resource used for the project purpose will be used judiciously and conserving, replenishing techniques for these resources would be at utmost priority. The ESA study should provide a detailed assessment for all the resources required for the project.

(b) Impacts on Biological Environment

Wherever forest land is acquired for Renewable Energy projects would require the appropriate clearance procedures to be adopted for conversion of land use / compensatory land allocation.

There is a high probability that these projects are likely to come up in remote / barren land parcels with minimal tree cover. The protection of existing tree cover is crucial in such areas and should not lead to removal of trees. This may lead to increased dust in these areas. Minimum alteration to existing ground cover in such sites is a chosen strategy. In case of Wind power plants, the probability of high wind density falls under forest land with heavy tree coverage, all necessary precautions for safety buffer etc. should be considered while planning such power generation facilities.

The proposed Renewable Energy Projects should be completely contained entities with controlled access thereby minimizing the risks of wild animals getting impacted in all aspects. The ESA study shall establish the wildlife species movement corridors/ paths/ habitat if any applicable in and around the proposed site. The ESA study shall establish the status of wildlife in vicinity of the proposed site and adequate mitigation measures to ensure no conflicts / poaching occurs during the various stage of project development.

There will not be any anticipated impacts on the ambient noise levels and air quality due to the proposed solar, wind and hybrid solar-wind projects. The proposed sub project is likely to have minimal short term adverse impacts due to increased noise levels during the construction phase.

(c) Impacts on Visual Environment

The concern for the impact on visual environment is predominant in wind power projects where the height of the wind turbine is often found to be at a 50meter, 80meter or 100meter height. The movement of the wind turbine and the motion at which it moves can be harmful for the exposed sensitive receptors. The preferable locations for most of the high-density wind areas are in the hilly regions or forested land, thus a higher probability of blocking or hampering scenic value of the place.

(d) Impacts on the settlement Infrastructure

Based on the reviews and the studies for renewable energy power sector, the disruption/change in the built infrastructure environment (roads, sewage system, water supply,

solid waste disposal etc.) does affect the settlements in its surroundings. This is an often occurrence because the infrastructure is made available for the power plants by compromising/changing the existing fabric of the area.

(e) Impacts on Land/water Form

The proposed innovative RE projects will require water for construction and operation stage. The water for construction stage would be a one-time requirement whereas the requirement of water during the operations stage would be a continuous one.

Most of the proposed sub-projects would be in remote areas with arid conditions and scarcity of water generally. The ESA study should provide a detailed assessment of the water requirements during the operations phase along with an adequate assessment of the existing available water resources.

For floating solar projects, the impact on aquatic bodies is yet unknown and needs to be investigated in detail. Presently no major floating solar power projects have been built nationwide. However, in future if SECI is to develop a floating solar power plant then a separate project specific ESIA study shall be undertaken

(f) Impacts on Private Land, Livelihood and Human Environment

Based on the review of sample projects, each MW of solar power requires 5 acres of land and a typical footprint (direct surface area of impact which last the life of the facility) for a single WTG of 1.5 MW / 2 MW is calculated based on the size of the blade lengths. For a 40 meter to 45-meter blade length, an area of approximately 100 meters by 100 meters (1 hectare) is required. This includes the area occupied by the wind turbine pads, sub stations, service buildings and other supporting infrastructure facilities. An area of approximately 1 Ha (100 meters x 100 meters) is acquired for setting up a single unit WTG (1.5MW). Additionally, there is a radius of restriction which is calculated as (tower height plus (+) 0.5 times the blade diameter) wherein there are height restrictions for buildings / vegetation to ensure safety of the WTG.

The review of sample projects indicates potential land acquisition for the park area and associate facilities. In these sample projects land was either taken on lease (Pavagada) or was directly purchased (Rewa / Mandsaur) on willing buyer willing seller basis. The sample projects visited however, indicates very little encroachment on site thus impact on non-titleholders will be minimum. The land identified is largely owned by the government or are assigned land. The review identified following social impacts:

- Loss of agricultural land in case of private land acquisition, although in most cases agriculture is season as it is primarily rainfed;
- Loss of livelihood due to impacts on sources of earning;

- Impact on natural drainage leading to loss of water in downstream areas
- Probable loss of common property resources such as religious places and cremation ground;
- Impact on host community due to influx of construction workers.

The proposed projects would be fully fenced entities wherein access would be restricted. The proposed site may include tracks /pathways which are frequently used by the local villagers while performing their day-to-day activities. Such tracks need to be clearly identified during the ESA stage in consultation with the local stakeholders so that the same can be included into the project layout plan or alternative route / tracks may be identified if it is unavoidable.

(g) Impact of labour Influx

At the peak of construction, it is expected that 500 labourers will be working at the site. The influx of workforce will put additional pressure on existing resources. The workforce normally consists of solitary migrant males and that can be potential risk for host population. Specifically, influx of labour force can lead to:

a) Risk of conflict and social unrest due to cultural differences between the labourers and local community

b) Risk of spread of communicable diseases due to interaction of the labourers and the local community

c) Risk of gender-based violence

d) Health hazard for host community due to lack of sanitation facilities and waste management.

A summary of the likely issues and potential impacts & mitigation measures is presented in the table 4.1 below.

Table 4-1: Summary of potential impacts and proposed mitigation measures

S. No.	Activity	Potential Environmental & Social Impacts	Proposed Mitigation
1	Pre-Construction Stage	Loss of land / and other physical assets	Carrying out analysis of alternatives to avoid / minimize involuntary taking of land and other physical assets.

S. No.	Activity	Potential Environmental & Social Impacts	Proposed Mitigation
			Compensation as per applicable laws/ regulations & guidelines
		Loss of livelihood	Preferable employment with developer Alternative livelihood options and training for skill enhancement CSR activities may be undertaken by developer to ensure alternative livelihood opportunities
		Loss of Access rights	Thorough analysis of alternatives that access enjoyed by the community remains intact may be ensured. In case of unavoidable circumstances, alternative access shall be provided.
		Loss of Common property resources	To the extent possible will be avoided Impacted CPR's will be replaced by the project.
		Transmission line alignment	To the extent possible settlement area; places of social, cultural and historical importance; and productive agricultural land through analysis of alternatives may be avoided. Loss of land under towers and ROW to be mitigated as per the guidelines of Ministry of Power.
2	Site Preparation	Soil Erosion; Alteration of natural drainage	Construction facilities may be placed 500 meters from water bodies,

S. No.	Activity	Potential Environmental & Social Impacts	Proposed Mitigation
			The natural water way should not be blocked. Minimize cut & fill operations, the site clearing and grubbing operations should be limited to specific locations only. Any disruption of socially sensitive areas with regard to human habitation and areas of cultural significance will be avoided. The existing slope and natural drainage pattern on the site should not be altered. If trees on private lands are felled or damaged during construction operations, compensation shall be paid to the owner as determined by the forest/horticulture departments. The contractor shall ensure that site preparation activities do not lead to disruption of activities of the local residents.
3	Construction Activity	Noise from construction works	Construction activity shall be restricted to daytime as far as possible to avoid disturbance to surrounding areas. Wherever required, personal protective equipment such as ear plugs, earmuffs, helmets etc. should be provided to the persons working in high risk areas.
		Dust	Construction machinery shall be properly maintained to minimize exhaust emissions of CO, SPM and hydrocarbons.

S. No.	Activity	Potential Environmental & Social Impacts	Proposed Mitigation
			Dust generated as a result of clearing, levelling and site grading operations shall be suppressed using water sprinklers. Dust generation due to vehicle movement on haul roads / access roads shall be controlled through regular water sprinkling.
		Labour influx and Safety Issues	Prevent entry of unauthorized personnel and proper storage and control of hazardous materials on site. Labour management plan to be prepared by contractor and shared with client Labour camps to be set up as per ESMP The site shall be secured by fencing and manned at entry points
4	Laying of transmission lines	Exposure to safety related risks	Setback of dwellings to overhead line route designed in accordance with permitted level of power frequency and the regulation of supervision at sites
5	Water for Construction	Conflicts with existing users due to scarcity of resource base.	A detailed assessment of the available resources and consent of the local panchayat for withdrawal of water from existing surface water sources shall be taken. If ground water is withdrawn, adequate approvals from the GWB / SPCB department need to be undertaken before setting up bore wells.

S. No.	Activity	Potential Environmental & Social Impacts	Proposed Mitigation
6	Road safety and traffic management plan	Increase in road accidents	The movement of heavy machinery and equipment shall be restricted to defined routes. Proper signage to be displayed at major junctions. Road diversions and closures to be informed well in advance to the local residents. Vehicular movement to be controlled near sensitive locations viz. schools, colleges, hospitals identified along designated vehicular transportation routes.
7	Base Camp Construction Activity – Labour Camp Management	Conflicts with the local residents	Alternate arrangement for cooking fuel, heating and cooking should be made to meet cooking fuel requirement of the labour Work force should be prohibited from disturbing the flora, fauna including hunting of animals, Wildlife hunting, poaching and tree felling. Adequate facilities ensuring sanitation for labour camps. Contractor will arrange for separate toilets for men and women. Treated Water will be made available at Site for Labour drinking purpose. Adequate accommodation arrangements for labour. For women labourers and labours with family, contractor will provide for separate family.

S. No.	Activity	Potential Environmental & Social Impacts	Proposed Mitigation
			Awareness generation among migrant labours on gender-based violence; HIV/AIDS; etc. The contractor and labourers will sign code of conduct by contractors and workers to maintain good manners with the community and avoid GBV; Project will undertake awareness raising program for the workers and community on the risk of labour influx; and To the extent possible, local workforce will be engaged to minimize the influx of workers
8	Occupational Health and Safety for Workers	Accident risk and deterioration of health of workers due to exposure with pollution, chemicals, etc.	The Contractor will provide adequate good quality Personal Protective Equipment (PPE) to all the workers working at construction zones and Plant sites and will ensure that these PPEs are used by workers at all time during works. The Contractor will comply with the workers safety requirements as per the statutory norms and Environmental, Health, and Safety (EHS), Guidelines of the World Bank, April, 2007 to maintain workers safety during construction. The Contractor will provide regular safety training to their workers about the accident hazards and risk related to specific works and preventive measures for avoiding accidents at site

S. No.	Activity	Potential Environmental & Social Impacts	Proposed Mitigation
			The Contractor will develop emergency response system to handle accidents Adequate drainage, sanitation and waste disposal will be provided at workplaces. Proper drainage will be maintained around sites to avoid water logging leading to various diseases Adequate sanitation and waste disposal facilities will be provided at construction camps by means of septic tanks, soakage pits etc. A healthcare system will be maintained at construction camp for routine check-up of workers and avoidance of spread of any communicable disease Readily available First-Aid kit bearing all necessary first aid items will be proved at all the work sites and should be regularly maintained. Contractor will organize health check-up camps related to occupational health at least once in six months The Contractor will organize awareness program on HIV aids and sexually transmitted diseases (STDs) for workers on periodic basis
8	Waste Management	Land and water pollution due to indiscriminate waste	Preparation of a waste management plan covering the following aspects: Construction and commissioning of projects

S. No.	Activity	Potential Environmental & Social Impacts	Proposed Mitigation
		disposal	Temporary accommodation facilities for labour Waste generation from equipment maintenance / vehicles on-site. The scrap material generated from erection of structures and related construction activities will be collected and stored separately in a stack yard and sold to local recyclers. Hazardous waste viz. waste oil etc. will be collected and stored in paved and bounded area and subsequently sold to authorized recyclers. Applicability of the Hazardous Waste Management Rules
Operation Stage			
1	Generation of Used oil from Turbine maintenance and Transformer oil	Soil pollution and Water pollution	Used oil to be securely stored in appropriate containers over impervious platform and sold only to authorized venders by State Pollution Control Board. Catch drains to be provided around the storage platform to arrest accidental spillage of oil Transformer oil to be replaced and returned by the supplier of transformers Log book for storage and disposal of such oils to be maintained
2	Operation of wind turbine	Collison of Birds due to wind turbine	Standard practice on turbine blades shall be considered to enhance visibility.

S. No.	Activity	Potential Environmental & Social Impacts	Proposed Mitigation
			Marking overhead cables and transmission poles using deflectors and avoiding use of areas of high bird concentrations, especially for species vulnerable to collision. Where possible, installing transmission cables underground in accordance with existing best practice guidelines for underground cable installation. Otherwise if possible, install overhead cables with proper insulation to avoid bat and bird electrocution through body touch. Install bird defectors on overhead transmission cables at selected points wherever possible. The illumination within the project area should be bare minimum and be within the acceptable limits, particularly during night hours. This will help in undisturbed activities of nocturnal species like rodents, bats and owls. Some bird reflectors can be fitted at relevant places to divert low-medium and medium-high flying bird species during day time. Feasibility of fixing of bird deflector on the turbine to avoid perching of birds near blades can be worked out, especially raptor species which prefer to perch at higher points. An Avifaunal Expert to be appointed during operation stage for assessment of

S. No.	Activity	Potential Environmental & Social Impacts	Proposed Mitigation
			incidence of bird collision and train the staff at site to address the incidents of bird hit / injury.
		Man, Animal Conflict	Removal of bushes, tree, shrubs beyond the project limit to be strictly prohibited The site area to be properly fenced to avoid entry of wild animals within the project compound In case wild animals are recorded in close vicinity or within the project site, the same should be recorded and reported to the wildlife department to take suggestions for further measures Awareness development among the employees to conserve / protect the ecosystem Fire protection measures to be provided at site to avoid any fire due to project
3	**Cleaning of solar panel**	Wastage of water Generation of waste water	The use of water to be minimized through recycling of used of water for cleaning The waste water to be properly channelized through drains and stored in settling tank The unusable water can be utilized for irrigation purpose in landscaping or in neighbouring agriculture field. Rainwater harvesting facilities will be provided at site to collect the rainwater which

			should be utilized for ground water recharging and storing for cleaning purpose
4	**Handling and management of Battery Energy Storage System**	Land contamination Water Contamination Health Hazards due to random disposal of Battery wastes and E-wastes	All the non-functional batteries to be stored in a safe place following the norms stipulated in the batteries (Management and Handling) Rules, 2001. The waste batteries to be handed over to the authorised vendors/recyclers. A record of such practices to be maintained at site office. All the electronic wastes should be disposed of as per E-waste (Management) Rules, 2016. All the safety precautions in storage, handling and disposal of battery energy storage systems will be adopted as per safety code of World Bank, which is enclosed as Annexure.
Operational Stage TL			
1	Location of transmission towers and transmission line alignment and design	Exposure to safety related risks	Setback of dwellings to overhead line route designed in accordance with permitted level of power frequency and the regulation of supervision at sites.
2	Oil spillage	Contamination of land / nearby water bodies	Substation transformers located within secure and impervious sump areas with a storage capacity of at least 100% of the capacity of oil in transformers and associated reserve tanks

3	Inadequate Provision of staff/workers health and safety during operations	Injury and sickens of staff / workers	Careful design using appropriate technologies to minimize hazards Safety awareness raising for staff Preparation of fire emergency action plan and training given to staff on implementing emergency action plan
4	Electric shock hazards	Injury / mortality to staff and public	Careful design using appropriate technologies to minimize hazards Regular monitoring of faults and immediate repair/ replacement of damaged wires/ towers Issue of warning to the local public regarding the malfunctioning and scheduling of repairs/replacement Barriers to prevent climbing on /dismantling of transmission towers Appropriate warning signs on facilities Electricity safety awareness raising in project areas
5	Transmission line maintenance	Exposure to electromagnetic interference	Transmission line design to comply with the limits of electromagnetic interference overhead power lines

4.6 Environmental & Social Management Plan

A generic Environmental & Social Management Plan (ESMP) is presented here is focused on implementation stage. It ensures that the project impacts are minimized to an acceptable level during implementation of the sub-project. Thus, ESMP becomes the document for ensuring that all the preceding analysis is used to preserve/improve overall environmental quality within the influence area of the project.

The ESMP is generic in nature though the probable impacts and mitigation measures is based

on issues identified from the sample projects. The ESMP describes the probable adverse impacts, selected management measures to bring it to an acceptable level and timelines for implementing these measures. It also clarifies roles and responsibilities among the various stakeholders including developer, contractors, etc. A sub project specific ESMP will be prepared once sub projects are identified and that has to be integrated with the bidding document. The building blocks of an ESMP are:

- Potential adverse impacts identified and mitigation measures to be adopted, together with conditions within which one or other measure would apply and their integration with phases – Pre-construction, Construction/ Implementation and Operation;
- Enhancement plans for positive impacts;
- Monitoring Plan with indicators, mechanisms, frequency, locations;
- Budgetary allocations for all the above activities;
- Institutional arrangements for each activity and mitigation measures;
- Implementation schedules for each activity and its integration with the sub-project implementation timelines;
- Reporting procedures, including for redressing grievances related to environmental and social issues;

The site specific EMP would need to be prepared for specific sub-projects as and when identified based on ESIA. An EMP document should include:

- Lists of all project related activities and impacts, for each stage of the development of Projects, i.e., for the design, construction and maintenance stages;
- A list of regulatory agencies involved and their responsibilities;
- Specific remedial and monitoring measures proposed for each stage;
- A clear reporting schedule, including discussion of what to submit, to whom, and when;
- Cost estimates and sources of funding for both one-off costs and recurring expenses for implementation of the EMPs.

ESMP shall deal with the construction and operations stage of the sub-project. The extent and timing of mitigation actions should be based on the significance of the predicted impacts. Some mitigation measures can be incorporated into the design of the project and can largely resolve the potential impacts of a project, e.g., drainage, access roads. Other measures require an on-going implementation plan to ensure that proposed actions are carried out at the correct times, that environmental measures such as slope protection are maintained, and that prompt remedial actions are taken when the initial measures are not fully effective.

Based on the project components and the associated activities the environmental impacts on various environmental components have been identified for such project and the generic environmental and social management plan (ESMP) has been developed which is presented at **Annexure V**.

Annexure VI gives the Selection criteria of sub projects based on environmental parameters

4.7 Stakeholder Consultations

Stakeholder consultations are integral to development projects and need to be carried out all through the project life. These are an effective way to communicate about the priorities for both the SECI and the stakeholders should be used extensively as the project progresses. These consultations can provide insights that may elude designers and help unravel inexplicable responses to proposals effectively. Ensuring an open and transparent information exchange right from start is a key ingredient of successful project implementation. Recognizing this, SECI has begun consultations right from the start of the project.

Consultations with stakeholders across the spectrum are needed early and continuously in the project. The identified stakeholders include project affected people-with an emphasis on disadvantaged groups, youth, local NGOs, private sectors, local leaders, officials from other state government departments. Some sub projects may have special groups that may need to be sensitively handled like Scheduled Tribes and Castes. SECI should be geared up to carry out consultations from the Identification stage, through project planning and design, as well as during implementation.

At the identification stage of any sub project, the general public in the area would be informed regarding the possible sub-project interventions and feedback would be sought on the overall picture. This will also help the scoping of the EIA since the local information regarding environmental aspects may be more robust and relevant for identifying key issues.

Second round would start once iteration has happened with design response to the first round of inputs from stakeholders. There should be clarity regarding what is accepted, what is not accepted for consideration for integration with project design. There should be clear and convincing reasons for each choice made to maintain the integrity and sanctity of the process and to nurture trust among the stakeholders.

Where mandatory consultations are required, such as Public Hearing for clearance under the EIA notification, these would be led by the respective authorities and SECI would provide its full support. On other occasions, SECI would be in-charge and would seek to ensure that the

consultations are useful to the affected groups, are non-discriminatory by social status, and supplemented with timely and relevant information.

These consultations would:

- Make SECI aware of community needs and preferences for its sub-projects
- Identify what park design work best and have minimum adverse impact on the stakeholder resources; site identification is key for minimizing adverse impacts.
- Identify mitigation measures for adverse impacts and enhancement of positive impacts informing the selection of the measures in the EMP
- Identify any opportunities to involve local stakeholders in subsequent project activities, including providing feedback
- Disseminate information regarding avenues available for redressing grievances, including those about environmental quality.

4.8 Budget

Each sub-project will have its own budget to cover the EMP costs relating to mitigation measures, enhancements, wherever included in the plan, and monitoring costs. In addition, training and capacity building costs need to be added for specific issues that EIA and EMPs may bring out. For instance, there may be a need to have short courses on specific topics, experience exchanges on common issues, and so on.

5.0 ENVIRONMENT AND SOCIAL MANAGEMENT FRAMEWORK:

5.1 Social Management Framework

Social Management Framework (SMF) will help to identify and address the potential social concerns or impacts of a project throughout the project cycle. The objective of SMF is to help project in taking informed decisions and mainstream social concerns in the project design.

5.1.1 Need for Social Management Framework

Since specific sub project identification is in progress, the exact nature and scale of their impacts will be known later. Therefore, a social management framework (SMF) document is prepared to 'guide' the planning and design elements of the sub project activities. Such a guidance document or a framework would help in integrating and harmonizing the social management principles at the various stages of project preparation and execution.

This SMF forms part of the comprehensive social management approach that has been adopted for addressing the potential social impacts of the project. As said above, specific impacts will only be identified during the project preparation. This SMF defines (a) the approach for identifying the social issues associated with the project, (b) the requirements for conducting social screening and social assessment studies, and (c) measures to prevent, mitigate and manage adverse impacts and enhance positive ones. This SMF includes a simplified screening checklist, which will be used to determine the degree of social assessment. Based on screening results, Social Impact Assessment (SIA) will be carried out and Resettlement Action Plan (RAP) and Indigenous Peoples Development Plan (IPD) for specific initiatives will be prepared if required. This SMF includes a resettlement policy framework describing mechanisms for addressing the possible loss of land, livelihood, sources of livelihood, temporary disruption of services and income, and temporary restrictions on access to facilities while the construction work is ongoing in the project area. The SMF includes guidance on preparing of indigenous peoples development plan, gender action plan; consultation mechanism; capacity building measures and a monitoring mechanism.

5.1.2Objectives of Social Management Framework

The SMF seeks to:

- Establish clear procedures and methodologies for screening, reviewing and managing social issues.
- Consolidate and facilitate understanding of all essential policies and regulations of the GOI; GOUP as well as the World Bank's social safeguards regime that are applicable

to the Project

- Provide guidance on preparing mitigation plans for adverse impacts and implementation of the environmental and social management measures.
- Specify institutional arrangements, including appropriate roles and responsibilities for managing, reporting and monitoring social concerns.
- Provide a framework for consultation and information disclosure.
- Determine the other institutional requirements, including those related to training and capacity building, needed to successfully implement the provisions of the SMF.

The application and implementation of the SMF therefore, will:

- Support the integration of social aspects into the decision-making process at all stages related to planning and design by identifying, avoiding and/or minimizing adverse social impacts early-on in the project cycle.
- Enhance the positive/sustainable social outcomes through improved/appropriate planning, design and implementation.
- Build the capacity of SECI to take-up and coordinate responsibilities related to the application and implementation of the SMF, including preparation of Social Assessment and Management Plans (if required).
- Provide guidelines and procedures for further consultations during project implementation.
- Provide a systematic guidance to address potential risks and to enhance quality, targeting, and benefits to the neighbouring communities.
- Ensure that stakeholders, irrespective of whether they benefit from or are adversely affected by the project interventions, are well informed and are able participate in the decision-making process.
- Support compliance with applicable legal/regulatory requirements of GOI and state governments; as well as with the requirements set forth in the relevant Bank policies.
- Minimize adverse impacts on cultural property and other common property resources.

This social management framework includes (i) Resettlement Policy Framework; (ii) Indigenous Peoples Planning Framework (IPPF); (iii) Gender Assessment and Development Framework (GAD); and (iv) Consultation framework.

5.1.3 Social Assessment Process

The SA begins with the screening and identification of social issues and stakeholders and communities, including socially and economically disadvantaged communities, for each subproject. The SA focuses on (i) Identification of key social issues associated with the proposed subproject and specify the social development outcomes; and (ii) prepare based on available data the profile of the population and available infrastructure facilities for services (disaggregated by gender, ethnicity, vulnerable groups, socially and economically backward communities, youth and aged, economic aspects, etc.) in the project affected area.

(i) Social Screening Process

Screening is the first step in the SMF process. The purpose of screening is to get an overview of the nature, scale and magnitude of the issues in order to determine the need for conducting Social Impact Assessment (SIA) and preparing Resettlement Action Plan (RAP). Once issues are identified, the applicability of the Bank's environment and social safeguard policies will be established along with Government of India's and state government's regulatory requirements. Based on this, boundaries and focus areas for the SIA along with the use of specific instruments will be determined.

The outcome of the screening process will help prioritize the sub project and where required, start the social mitigation process in a timely manner. This will also assist in sequencing /phasing sub projects in overall project implementation. This shall help ensure that no sub-projects are dropped merely due to delay in the clearance procedures / land requirement. The social screening checklist is given in **Annexure VII**.

(ii) Establishing Impacts

Having identified the potential impacts of the relevant sub-projects, action plans to mitigate the impacts will be developed. This will require detailed social impact assessment. The Project Authority will undertake a survey for identification of the persons and their families likely to be affected by the project. Every survey shall contain the following municipality / ward or village-wise information of, the project affected families:

- Members of families who are residing, practicing cultivation, any trade, or any other vocation in the project affected area;
- Project Affected Families who are likely to lose their house, commercial establishment, agricultural land, employment or are alienated wholly or substantially from the main source of their trade occupation or vocation or losing any other immovable property.
- Agricultural labourers and non-agriculture labourers.

- Losing access to private property or common property resources
- Loss of common property resources

The project on completion of the survey will disseminate the survey results among the affected community. Based on the social impact assessment survey, will prepare an action plan to mitigate or minimize the adverse impacts as identified during the survey. The draft mitigation plan in form of resettlement action plan (RAP) will be again disseminated among the affected individuals / community. The feedback received from the affected groups will be incorporated to the extent possible before finalization of the RAP.

(iii) Sub-Project Approval

In the event that a subproject involves land acquisition against compensation or loss of livelihood or shelter, project shall:

- not approve the subproject until a satisfactory RAP has been prepared and shared with the affected person and the local community; and
- not allow works to start until the compensation and assistance has been made available in accordance with the framework.

(iv) Stakeholder Consultations

Stakeholder consultations are integral to development projects and need to be carried out all through the project life. These are an effective way to communicate about the priorities for both the SECI and the stakeholders should be used extensively as the project progresses. These consultations can provide insights that may elude designers and help unravel inexplicable responses to proposals effectively. Ensuring an open and transparent information exchange right from start is a key ingredient of successful project implementation. Recognizing this, SECI has begun consultations right from the start of the project.

Since this is a category A project, consultations with stakeholders across the spectrum are needed early and continuously in the project. The identified stakeholders include project affected people-with an emphasis on disadvantaged groups, youth, local NGOs, private sectors, local leaders, officials from other state government departments. Some sub projects may have special groups that may need to be sensitively handled like Scheduled Tribes and Castes. SECI should be geared up to carry out consultations from the Identification stage, through project planning and design, as well as during implementation.

At the identification stage of any sub project, the general public in the area would be informed regarding the possible sub-project interventions and feedback would be sought on the overall

picture.

Second round would start once iteration has happened with design response to the first round of inputs from stakeholders. There should be clarity regarding what is accepted, what is not accepted for consideration for integration with project design. There should be clear and convincing reasons for each choice made to maintain the integrity and sanctity of the process and to nurture trust among the stakeholders.

These consultations would:

- Make SECI aware of community needs and preferences for its sub-projects,
- Identify what park design work best and have minimum adverse impact on the stakeholder resources; site identification is key for minimizing adverse impacts.
- Identify mitigation measures for adverse impacts and enhancement of positive impacts informing the selection of the measures in the EMP
- Identify any opportunities to involve local stakeholders in subsequent project activities, including providing feedback
- Disseminate information regarding avenues available for redressing grievances, including those about environmental quality.

5.2 Resettlement Policy Framework (RPF)

Since sub projects are not known, RPF will help in conducting SIA and preparation of RAP. The project specific policy has been developed based on the Right to Fair Compensation and transparency in land Acquisition, Rehabilitation and Resettlement (RFCTLARR) Act, 2013 and subsequent supplements by state governments and World Bank Operational Policy 4.12 on involuntary resettlement.

Both the RFCTLARR Act 2013 and the World Bank Operation Policy on involuntary resettlement aim to ensure that involuntary resettlement should be avoided or minimized, wherever feasible, exploring all viable alternative project designs, and where displacement is unavoidable, people losing assets, livelihood or other resources shall be assisted in improving or at a minimum regaining their former status of living at no cost to themselves.

Also, World Bank safeguards policy requires consultation with PAPs during planning and implementation of resettlement action plan and tribal development plan and public disclosure of drafts. Once the draft is prepared it is to be made available at a place accessible to, and in a form, manner and language understandable to the displaced or affected people and local NGOs. Based on the detailed comparative analysis of RFCTLARR Act 2013 and the World

Bank Operation Policy on involuntary resettlement, **key differences** identified and addressed under the Resettlement Policy Framework (RPF) are listed in **Annexure VIII**.

5.2.1 Broad Principles

The Policy aims to resettle and rehabilitate the affected persons on account of its sub-projects in a manner that they do not suffer from adverse impacts and shall improve or at-least retain their previous standard of living, earning capacity and production levels. It is also the endeavour of SECI that the resettlement shall minimize dependency and be sustainable socially, economically and institutionally. Special attention will be paid for the improvement of living standards of marginalized and vulnerable groups. This policy recognizes that involuntary resettlement dismantles a previous production System and a way of life, all such rehabilitation programs will adopt a developmental approach rather than the welfare approach. These guidelines detail out the assistance in re-establishing the homes and livelihoods of the Project Affected People (PAP) during the course of projects.

a) All information related to resettlement preparation and implementation will be disclosed to all concerned, and community participation will be ensured in planning and implementation.

b) The principles of mutual consent and negotiated settlement will also be used for land acquisition as required.

c) The persons affected by the project who do not own land or other properties but who have economic interest or lose their livelihoods will be assisted as per the broad principles brought out in this policy.

d) Before taking possession of the acquired lands and properties, compensation and R&R assistance will be made to those who are available and willing to receive the entitlements in accordance with this policy.

e) There would be no/minimum adverse social, economic and environmental effects of displacement on the host communities, but if needed, specific measures would be provided.

f) Broad entitlement framework of different categories of project-affected people has been assessed and is given in the entitlement matrix. Provision will be kept in the budget. However, anyone moving into the project area after the cut-off date will not be entitled to assistance.

g) Three-tier appropriate grievance redressal mechanism would be established at project level to ensure speedy resolution of disputes.

h) All activities related to resettlement planning, implementation, and monitoring would

ensure involvement of women. Efforts will also be made to ensure that vulnerable groups are included.

i) All consultations with PAPs shall be documented. Consultations will continue during the implementation of resettlement and rehabilitation works.

j) As required, a Resettlement Action Plan will be prepared including a fully itemized budget and an implementation schedule.

The broad principles of the Resettlement and Rehabilitation (R&R) policy are as given below;

- All negative impacts including displacement should be avoided/ minimized wherever feasible by exploring all viable alternative project designs.
- Where negative impacts are unavoidable, efforts should be made either to improve the standard of living of the affected persons or at least assist them in restoring their previous standard of living at no additional cost to them. Support will be extended under the broad principles of this policy to meet the replacement value of the assets and loss of livelihood.
- Ensure peoples' participation during the course of the project cycle.
- Effort should be made towards the enhancement of the positive impact of the projects.
- The policy further recognizes extension of support to non-titleholders for the loss of livelihood and replacement value for assets other than land.
- The common property resources will be replaced as far as feasible and if not, then assistance will be provided at replacement value to the group.
- The implementation of solar projects would involve transportation of equipment during the installation phase and all efforts will be made during implementation to minimize any disturbance in the daily activities of the local people.
- Before taking possession of the acquired lands and properties, all compensation, resettlement and rehabilitation would be made in accordance with this policy.
- In case of displacement, resettlement sites will be developed as part of the project. In such circumstances care should be taken so that there is no/or minimum adverse social, economic and environmental effects of displacement on the host communities and specific measures would be provided in the Resettlement and Rehabilitation Action Plan (RAP) to mitigate any such impacts. Before taking possession of acquired land, sufficient time would be provided to harvest standing crop (if any).
- The implementation of the R&R Action Plan will be synchronized with the execution of

works under the project.

5.2.2 Definitions

The following definitions are used in the RPF:

Cut-off Date: In the cases of land acquisition affecting legal titleholders, the cut-off date would be the date of issuing the publication of preliminary notification u/s 11(I) of RFCTLARR Act, 2013 & for the Non-Titleholders cut-off date would be the date of Census Survey.

Project Affected Person: Person who is affected in respect of his/her land including homestead land and structure thereon, trade and occupation due to construction of the project.

Project Displaced Person: A displaced person is a person who is compelled to change his/her place of residence and/or work place or place of business, due to the project.

Projected Affected Family: Family includes a person, his or her spouse, minor children, minor brothers and minor sister's dependent on him. Provided that widows, divorcees and women deserted by families shall be considered separate families;

Explanation - An adult of either gender with or without spouse or children or dependents shall be considered as a separate family for the purpose of this Act.

Land Owner: Land owner includes any person –

- Whose name is recorded as the owner of the land or building or part thereof, in the records of the authority concerned;
- or Any person who is granted forest rights under the Scheduled Tribes and other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 or under any other law for the time being in force;
- or Who is entitled to be granted Patta rights on the land under any law of the State including assigned lands; or any person who has been declared as such by an order of the court or Authority.

Marginal Farmers: Marginal farmer means a cultivator with an un-irrigated land holding up to one hectare or irrigated land holding up to one half hectare, or as may be defined by the concerned state government.

Small Farmer: Small farmer means a cultivator with an un-irrigated land holding up to two hectares or irrigated land holding up to one hectare, but more than the holding of a marginal farmer, or as may be defined by the concerned state government.

Encroacher: A person who has trespassed Government/ private/community Land, adjacent to his or her land or asset to which he/she is not entitled and who derives his/her livelihood

and housing therefrom prior to the cut-off date.

Squatter: A squatter is a person who has settled on publicly owned land for housing or livelihood without permission or who has been occupying publicly owned building without authority prior to the cut-off date.

Landless/Agriculture Labour: A person who does not hold any agriculture land and has been deriving his main income by working on the lands of others as sub-tenant or as an agriculture labour prior to the cut-off date.

Below Poverty Line: A household, whose annual income from all sources is less than the designed sum as fixed by the Government of India, will be considered to be below poverty line (BPL).

Vulnerable Person: The Vulnerable group may include but not be limited to the following:

- Member of Scheduled caste/tribe community/other backward community.
- Households below poverty line
- Women Headed households.
- Senior citizen-person above the age of 60 years.
- Landless and Marginal Farmers
- Persons with disability

5.2.3 Social Impact Assessment Process

Based on screening results, the project will undertake a survey for identification of the persons and their families likely to be affected by the project. Every survey shall contain the following municipality / ward and / or village-wise information of, the project affected families:

- members of families who are residing, practicing cultivation, any trade, occupation or vocation in the project affected area;
- Project Affected Families who are likely to lose their house, commercial establishment, agricultural land, employment or are alienated wholly or substantially from the main source of their trade occupation or vocation or losing any other immovable property.
- Agricultural labourers and non-agriculture labourers.
- Families belonging to scheduled caste and scheduled tribe categories
- Vulnerable persons such as the disabled, destitute, orphans, widows, unmarried girls, abandoned women, or persons above the age of 50 years of age, who are not provided or cannot immediately be provided with alternative livelihood, and who are not

otherwise covered as part of a family;

- Families that are landless (not having homestead land, agriculture land or ether homestead or agriculture land) and are below poverty line, but residing continuously for a period of not less than three years in the affected area preceding the date of declaration of the affected area;
- Losing access to private property or common property resources
- Impact on women due to construction activities, loss of assets; loss of access; etc.

The project on completion of the survey will disseminate the survey results among the affected community. Based on the social impact assessment survey, project will prepare an action plan to mitigate or minimize the adverse impacts as identified during the survey. The draft mitigation plan in form of resettlement action plan (RAP) will be disseminated among the affected individuals/ community. The feedback received from the affected groups will be incorporated to the extent possible before finalization of the RAP.

5.2.4 Resettlement Action Plan: Broad Structure and Processes

In case the sub-project requires involves land acquisition against compensation or loss of livelihood or shelter, SECI shall ensure that a satisfactory RAP has been prepared and shared with the affected persons and the local community. The park developer shall not start the works until compensation and assistance has been made available in accordance with the framework.

The RAP document provides a link between the impacts identified and proposed mitigation measures to realize the objectives of involuntary resettlement. The RAPs will take into account nature and magnitude of impacts that is consistent with this framework for Bank approval before the sub-project is accepted for Bank financing. RAP will establish the cut-off date and anyone who encroach on the area after the cut-off date will not be entitled to compensation or any other form of resettlement assistance. In case, the

- Sub-projects that will affect more than 200 people due to involuntary land taking and/or physical relocation will require a full Resettlement Action Plan (RAP).
- Sub-projects that will affect less than 200 people will require an abbreviated RP (Resettlement -plan).
- The above plans will be prepared as soon as subproject is identified.
- Projects that are not expected to have any land acquisition or any other significant adverse social impacts; on the contrary, significant positive social impact and improved livelihoods are exempted from such interventions.

Every- **Resettlement Action Plan (RAP)** prepared shall contain the following:

- Baseline:
    - Village-wise or municipality-wise list of project affected families and likely number of displaced persons by impact category.
    - Family-wise and the extent and nature of land and immovable property in their possession indicating the survey numbers thereof held by such persons in the affected zone.
    - Socio-economic survey of affected people including income/asset survey of PAPs.
    - Information on vulnerable groups or persons for whom special provisions may have to be made
- Impact:
    - The extent of area to be acquired for the project, the name(s) of the corresponding village(s) and the method employed for acquiring land with the relevant documentation.
    - Adverse impact on common property resources including cultural properties
    - Impact on host community due to labour influx
    - Any indirect impact
- Quantification of impacts in terms of number of
    - agricultural labourers in such area and the names of such persons whose livelihood depend on agricultural land to be acquired;
    - persons who have lost or are likely to lose their employment or livelihood or who have been alienated wholly and substantially from their main sources of occupation or vocation consequent to the acquisition of land and / or structure for the project;
    - occupiers on the government land, if any;
    - number of public utilities, government buildings, cultural properties which are likely to be affected.
- Mitigation Measures and Entitlements:
    - Comprehensive list of benefits and packages which are to be provided to project affected families by impact category.

  - Measures to address impact on host community due to influx of migrant labour.
  - Gender Action Plan
- Relocation:
  - Details of the extent of land available which may be acquired in settlement area for resettling and allotting of land to the project affected families.
  - Details of the basic amenities and infrastructure facilities which are-to be provided for resettlement.
- Consultation Results and incorporation of community suggestions / feedback in project design
- Implementation Arrangements
  - Institutional mechanism for RAP implementation.
  - Consultation strategy; a disclosure plan and a capacity building plan
  - Grievance redressal mechanism
  - The time schedule for shifting and resettling the displaced families in resettlement zones.
- Monitoring and Evaluation
  - Mechanism for internal monitoring
  - Mechanism for external evaluation
  - Indicators for monitoring and evaluation; and
- Budget

The RAP will be developed based on the Right to Fair Compensation and transparency in land Acquisition, Rehabilitation and Resettlement Act, 2013 including subsequent amendments; other applicable state regulatory requirements and World Bank Operational Policy 4.12 on involuntary resettlement. States have formulated various legislations pertaining to direct purchase of land / land for land exchange options, etc. which shall be applicable depending upon the location of the sub-project.

5.3 Entitlement Framework

The resettlement and rehabilitation (R&R) benefits shall be extended to all the Project Affected Families (PAF) whether belonging to below poverty line (BPL) or non-BPL. The details are to be provided in the entitlement matrix (presented below). Contractor will ensure that access to

residences or business or agricultural land is not blocked during construction or subsequently.

The easement rights for the villagers shall be ensured while planning the layouts for the parks/projects. The agency responsible for RAP implementation and M&E consultants will bring it to the notice of project authorities if contractor fails to do so.

For tribal population the following provisions will be adhered to:

- Each Project Affected Family of ST category shall be given preference in allotment of land.
- Tribal PAFs will be re-settled close to their natural habitat in a compact block so that they can retain their ethnic/linguistic and cultural identity
- The Tribal Land Alienated in violation of the laws and regulations in force on the subject would be treated as null and void and-the R&R benefits would be available only to the original tribal land owner.

Table 5-1: Entitlement Matrix

(*This Entitlement matrix is only a guidance document & specific sub projects shall require their own Entitlement Matrix to be prepared)

(* The following table is not exhaustive & contains certain key provisions of relevant acts / guidelines & policies–SECI is not liable for their correctness/ applicability to any/all sub-projects & the table is to be read in context of applicable updated acts & rules made thereunder/ guidelines & policies)

S. No.	Application	Definition of Entitled Unit	Entitlement	Details
A.	**Loss of Private Agricultural, Home-Stead & Commercial Land**			
	Land for RE Project (Agriculture/Home Stead/ Commercial type)	Titleholder family and families with traditional land Right	Compensation at Market value, Resettlement and Rehabilitation	a) Land for land, if available. Or, Cash compensation for the land at replacement value, which will be determined as provided under section 26 of RFCTLARR Act 2013. b) The land if allotted will be in the name of both husband and wife. c) If post acquisition, residual land is economically unviable, the land owner will have the choice of either retaining or sell off rest of the land.

S. No.	Application	Definition of Entitled Unit	Entitlement	Details
				d) Refund of stamp duty and registration charges incurred for replacement land to be paid by the project; replacement land must be bought within a year from the date of payment of compensation to project affected persons. e) Subsistence allowance of Rs. 36000 as one-time grant f) One time grant of Rs. 500,000 or annuity g) Compensation at market value for loss of crops if any
	Residual land	Titleholder family and families with traditional land Right	Compensation at Market value, Resettlement and Rehabilitation	In case residual land is found to be economically unviable, PAPs have the choice of: a) selling off the residual land at the market value to the project b) take 25% of the compensation value and retain the land parcel.
B.	**Loss of Private Structures (Residential/Commercial)**			
	Loss of Structure	Title Holder/ Owner	Compensation at Market value, Resettlement & Rehabilitation Assistance	a) Cash compensation for the structure at Market value which would be determined as per as per section 29 of the RFCTLARR Act 2013. House under PM Awas Yojna in rural area or Rs 1,20,000 in lieu off and house under PM Awas Yojna in urban area or Rs 4,00,000 in lieu off. The house if allotted will be in the name of both husband and wife. b) Right to salvage material from the demolished structures. c) Three months' notice to vacate structures. d) Refund of stamp duty and registration charges for purchase of new alternative

S. No.	Application	Definition of Entitled Unit	Entitlement	Details
				houses/shops at prevailing rates on the market value as determined in (a) above. Alternative houses/shops must be bought within a year from the date of payment of compensation. e) In case of partially affected structures and the remaining structure remains viable, additional 10% to restore the structure. In case of partially affected structures and the remaining structure becomes unviable additional 25% of compensation amount as severance allowance. f) Subsistence allowance equivalent to Rs. 36000 as one-time grant. g) Each affected family getting displaced shall get a one-time financial assistance of Rs 50,000 as shifting allowance. h) Each affected family that is displaced and has cattle, shall get financial assistance of Rs. 25,000/- for construction of cattle shed. i) One-time grant of Rs. 50,000 as resettlement assistance j) Each affected person who is a rural artisan, small trader or self-employed person and who has been displaced (in this project owner of any residential-cum commercial structure) shall get a one-time financial assistance of Rs 25,000/-for construction of working shed or shop. k) One-time grant of Rs. 500,000 l) In case only part of the structure is demolished and rest of the structure becomes unsafe or economically unviable, project to compensate for the entire structure.

S. No.	Application	Definition of Entitled Unit	Entitlement	Details
	Structure	Tenants/ Lease Holders	Resettlement & Rehabilitation Assistance	a) Registered lessees will be entitled to an apportionment of the compensation payable to structure owner in case the lessee has erected any part of the structure as per applicable local laws. b) In case of tenants, three months written notice will be provided along with Rs 50,000 towards shifting allowance.
C.	**Loss of Trees and Crops**			
	Standing Trees, Crops in project land	Owners and beneficiaries (Registered/ Un-registered tenants, contract cultivators, leaseholders & sharecroppers	Compensation at market value	a) Three months advance notice to project affected persons to harvest fruits, standing crops and removal of trees. b) Compensation to be paid at the rate estimated by: i) The Forest Department for timber trees ii) The State Agriculture Extension Department for crops iii) The Horticulture Department for fruit/flower bearing trees. c) Registered tenants, contract cultivators & leaseholders & sharecroppers will be eligible for compensation for trees and crops as per the agreement document between the owner and the beneficiaries. d) Un-registered tenants, contract cultivators, leaseholders & sharecroppers will be eligible for compensation for trees and crops as per mutual understanding between the park/project owner and the beneficiaries.
D.	**Loss of Residential/ Commercial Structures to Non-Titled Holders**			
	Structures on Government land	Owners of Structures or Occupants of	Resettlement & Rehabilitation Assistance	a) All non-titleholders including encroachers and squatters will be compensated for the structure as described in section 29 of the RFCTLARR

S. No.	Application	Definition of Entitled Unit	Entitlement	Details
		structures identified as per Project Census Survey		Act 2013but not for the land. They will be given three months' notice to vacate occupied land. b) All squatters (other than kiosks) will be eligible for one-time grant of Rs 36000 as subsistence allowance. c) All squatters other than Kiosks will be given shifting allowance of Rs 50,000 per family as one-time grant for a permanent structure and Rs. 30,000 for a semi-permanent structure and Rs. 10,000 for a temporary structure. d) Each affected person who is a rural artisan, small trader or self-employed person assistance' of Rs 25,000/- for construction of working shed or shop. e) In case of Kiosks, only Rs. 5000 will be paid as one-time grant. f) In case only part of the structure is demolished and rest of the structure becomes unsafe or economically unviable, project to compensate for the entire structure.
E.	**Loss of Livelihood**			
	Families living within the project area	Title Holders/ Non-Title holders/ sharecroppers, agricultural labourers and employees	Resettlement & Rehabilitation Assistance	a) Subsistence allowance of Rs. 36,000 as one-time grant. (PAPs covered under 1(f), 2 (f) and 5 (e) above would not be eligible for this assistance). b) Training Assistance of Rs 10,000/- for income generation per family. c) Temporary employment in the project construction work to project affected persons with particular attention to vulnerable groups by the project contractor during construction, to the extent possible and preference in the

S. No.	Application	Definition of Entitled Unit	Entitlement	Details
				employment of semi-skilled and unskilled jobs in the project with adequate training for the job.
F.	**Additional Support to Vulnerable Families**			
	Families Within project area	As per definition of vulnerable	Resettlement & Rehabilitation Assistance	One-time additional financial assistance of Rs. 50,000. Squatters and encroachers already covered under section D are not eligible for this assistance.
G.	**Loss of Community Infrastructure/Common Property Resources**			
	Structures & other resources (e.g. land, water, access to structures etc.) within the project area	Affected Communities and groups	Reconstruction of community structure and common property resources	Reconstruction of community structure and Common property resources in consultation with the community.
H	**Temporary Impact During Construction**			
	Land & assets temporarily impacted during construction	Owners of land & Assets	Compensation for temporary impact during construction e.g. damage to adjacent parcel of land / assets due to movement of vehicles for transportation of equipment's, machinery and	Compensation to be paid by the contractor for loss of assets, crops and any other damage as per prior agreement between the 'Contractor' and the 'Affected Party'.

S. No.	Application	Definition of Entitled Unit	Entitlement	Details
			construction activities for Infrastructure development.	
I.	**Resettlement Site**			
	Loss of Residential structures	Displaced Titleholders and non-titleholders	Provision of resettlement site/ vendor market	Resettlement sites will be developed as part of the project, if a minimum of 25 project displaced families opt for assisted resettlement. Vulnerable PAPs will be given preference in allotment of plots/flats at the resettlement site. Plot size will be equivalent to size lost subject to a maximum of provision given in RFCTLARR Act 2013. Basic facilities shall be provided by the project at resettlement site as per the provisions given in the Third Schedule of RFCTLARR Act 2013. Similarly, if at least 25 displaced commercial establishments (small business enterprises) opt for shopping units, the Project Authority will develop the vendor market at suitable location in the nearby area in consultation with displaced persons. Basic facilities such as approach road, electricity connection, water and sanitation facility, will be provided in the vendor market by the project. Vulnerable PAPs will be given preference in allotment, of shops in vendor market. One displaced family will be eligible for only one land plot at resettlement site or shop in the vendor market.
J.	**Govt. Land on lease / assigned land**			
	Lessees/ Assignees	Land Owners/ usufruct right	Compensation	a) Cash compensation as per the circle rate

S. No.	Application	Definition of Entitled Unit	Entitlement	Details
				b) Provisions related to loss of structure/ trees/crops as per the provisions of section B and / or D as applicable.
	Agricultural Labour	Non-Title holders/ sharecroppers, agricultural labourers and employees	Annual Lease rental for use of land	Lease amount paid to land owner will be deducted from the compensation of land owner and returned to the lease holder. Will receive Rs. 36,000 as one time grant.

5.4 Gender equality and Social Inclusion Framework

Mainstreaming gender equity and empowerment will be an intrinsic aspect of the project. Its development objective and proposed activities related to local economic development as well as the provision of basic services pay special attention to address women and men as well as girls' and boys' specific needs.[5] Applying a gender lens to the project's preparation and implementation means that:

a) All data should be disaggregated by gender, caste, ethnicity, location and age.

b) Issues of division of labour, access to resources and decision making power (who is doing what, who has access to what, who makes the ultimate decision) have to be assessed for their gender differential impact on women and men of different social identity group.

c) Assessment of policies, programs, institutional arrangements, human resources

[5]The effectiveness and sustainability of any project relies substantially on its capacity to address the constraints on women's participation in its several stages from design, implementation, operation and maintenance to training and monitoring and evaluation. Successful projects have also focused on understanding the linkages between gender and poverty, by identifying, for example, households headed by females and with special needs. Experience shows that an adaptive, learning-by-doing, and process-oriented approach works better than a blue print approach; continuous dialogue between the project team and its target population is therefore important. Project target groups and individuals are likely to have a stronger sense of ownership when the project gives them enough time, design flexibility, and capacity to take corrective action. Therefore, consultative mechanisms are being proposed under the project to allow such two-way interactions between its target population and service providers.

issues and M&E system has to be done from a gender perspective of project, project authorities and community groups.

To this end, a Gender Development Framework that outlines the preparation of a Gender Assessment and Gender Action Plan is proposed under the project as part of this ESMF in order to provide SECI, the implementing entities and partners with the necessary guidance for the analysis of gender issues during the subproject preparation and later execution.

To gather data and ensure that subprojects are gender sensitive, gender analysis will be an integral part of the subproject screening. Any adverse gender issues identified will be further analyzed as part of the Social Impact Assessment of the subproject. This analysis will include gender specific queries both at primary data collection and review of available secondary data. This quantitative and qualitative analysis will bring out sex disaggregated data and issues related to gender disparity, needs, constraints, and priorities; as well as understanding of potential for gender based inequitable risks, benefits and opportunities.

The subproject further technical detailing (feasibility studies and DPR preparation) will address the findings and recommendations from the gender analysis as well as feedback from potentially affected groups and individuals.

In case of major gender issues identified beyond specific subprojects, SECI will promote the necessary dialogue with the concerned authorities, such as the Ministry of Women and Children, National Commission for Women, National Mission for Empowerment of Women, the Federation of the Indian Chambers of Commerce and Industry's Ladies Organization, to ensure national and state requirements are followed by the project.

5.4.1 Gender Assessment and Gender Action Plan

The gender assessment identifies the key gender issues in the project area as well as ways to mitigate any adverse effects. The assessment also provides an overview of the institutional or regulatory frameworks concerned with gender in the project area. The tasks to be carried out as part of the gender assessment include, but are not limited to, the following:

- Desk review that looks at all available information (e.g. statistics, other gender reports or documents of previous similar projects) in the project area and the socioeconomic profile of the target population. The review will identify the relevant legal policy and institutional frameworks and their gender implications as well as the government programs that encourage equal opportunities and participation of women in the project area.
- Primary qualitative and quantitative data collection including household surveys, focus group discussions, and random interviews with women and men in sub projects.

- Assessment of the most disadvantaged areas and sections of society (widows, female-headed households, disabled men and women) in terms of access to services and poverty level. Identification of major stakeholder groups that work on gender issues and assessment of women's participation in implementing entities, community organizations, and tender boards or other decision-making forums related to the planning, implementation, monitoring, and evaluation of subprojects.
- Identification of how renewable energy sector strategies, policies, or grievance mechanisms address gender issues. This can also include specific training, communication or gender sensitization workshops held for men and women in the SECI and implementing entities.

A **Gender Action Plan** (GAP) will be prepared at the earliest stage of subproject preparation and implementation. The GAP will help (i) guide how any potential adverse gender impacts will be addressed, (ii) set forth guidelines and plans for each subproject to ensure that men and women participate and benefit equally, and support gender-disaggregated data collection. The tasks to be carried out as part of the gender assessment include, but are not limited to, the following:

- Undertake quality social and gender analyses. Identify constraints to participating and benefiting men and women; develop strategies for each subproject to ensure that men and women participate and benefit equally.
- Revisit gender design strategies at inception. The plan needs to be tested and reviewed early in implementation; identify detailed activities, targets, resources, and responsibilities for implementation.
- Gender Action Plan must be fully owned and understood by the implementing agency. Use a participatory and flexible approach to developing the plan; a strong rationale that is directly linked to overall project objectives is needed for targeting and working with women.
- Identify realistic targets linked to subproject objectives. Targets and strategies should enable step-by-step progress, bringing incremental changes and challenging culture without threatening it; linking targets to loan objectives helps all stakeholders to understand the rationale for focusing on women and helps monitoring of participation and benefits.
- Include gender capacity building in the Gender Action Plan. Both formal training and ongoing support and mentoring are needed for developing skills, ownership, and commitment.

- Provide adequate skills and resources for implementation of Gender Action Plan. Long-term gender specialists in the implementing entities or project team and adequate resources for implementation of actions; nongovernmental organizations and other agencies contracted to implement project activities should have a demonstrated gender capacity.
- Monitor and follow up gender-related targets and activities. Systematic follow-up to ensure that policy reforms and gender actions are implemented; routine monitoring and reporting; gender-sensitive indicators and gender-related risks must be included in project logical frameworks.
- **Monitoring indicators**: The action plan must have process and outcome indicators that will help project monitor the actions and expected outcomes. The table below provides suggestive process indicators.

Checklist for preparing Gender Action Plan is given in **Annexure IX**.

5.5 Indigenous Peoples Planning Framework

The guiding principles enshrined in the constitution of independent India as also various plans and policies for safeguarding the interests of scheduled tribes notwithstanding, the benefits of development of free and shining India have by and large by-passed the scheduled tribes. This issue is source of anxiety and worry for the `administrators, implementers and researchers of the country. This anxiety and worry has to be understood in the context of all kinds of development projects that have been/are being carried out across country.

The Indigenous People (IPs) in India are categorized as tribal who often become vulnerable in development projects because of their cultural autonomy which is usually undermined and also because this group endure specific disadvantages in terms of social indicators of quality of life, economic status and usually as subject of social exclusion.

5.5.1 Objective

The objective is to design and implement projects in a way that fosters full respect for Indigenous Peoples' dignity, human rights, and cultural uniqueness and so that they: (a) receive culturally compatible, gender and inter-generationally inclusive social and economic benefits; and (b) avoid adverse effects during the development process, or if not feasible ensure that these are minimized, mitigated or compensated.

The term "Indigenous Peoples[6]" is used in a generic sense to refer to a distinct, vulnerable,

[6]As per Operational Policy 4.10 on Indigenous Peoples, World Bank.

social and cultural group possessing the following characteristics in varying degrees:

- self-identification as members of a distinct indigenous cultural group and recognition of this identity by others;
- collective attachment to geographically distinct habitats or ancestral territories in the project area and to the natural resources in these habitats and territories[7]
- customary cultural, economic, social, or political institutions that are separate from those of the dominant society and culture; and
- an indigenous language, often different from the official language of the country or region.

The Constitution of India, Fifth Schedule (Article 244) provides for the administration and control of Scheduled Areas[7]and Scheduled Tribes (areas and tribes needing special protection due to disadvantageous conditions).

The provisions of the Panchayats (Extension to the Scheduled Areas) Act, 1996 lays down process to be followed for acquisition of land in Scheduled V Areas. The Act under sub-section (1) of Section 4 provides for mandatory consultation with the Gram Sabha before any land acquisition proceedings can be undertaken. It further states that all Gram Sabhas in which even if one person is affected by the proposed project would have to be consulted before acquisition proceedings are initiated, by the procedure prescribed. Every Gram Sabha shall be competent to safeguard and preserve the traditions and customs of the people, their cultural identity, community resources and the customary mode of dispute resolution. The World Bank OP 4.10 emphasizes “a process of free, prior, and informed consultation with the affected Indigenous People’s communities at each stage of the project, and particularly during project preparation, to fully identify their views and ascertain their broad community support for the project.

Project shall avoid adverse impact on such areas to the extent possible. Where unavoidable, it will consult the concerned Gram Sabha / Panchayat for obtaining their broad support and resolution for initiating land acquisition as per the provisions of the Act and OP 4.10.

As mentioned earlier, the social screening survey will identify presence of IPs and any adverse or positive impacts on tribal people (Indigenous Peoples). In case such cases are found provisions of World Bank OP 4.10, and government regulations will be applicable. An

7Article 244 (1) and 244 (2) of the constitution of India enables the government to enact separate laws for the governance and administration of the tribal areas. In pursuance of these articles, the President of India had asked each of the states in the country to identify tribal dominated areas. Areas thus identified by the states were declared as Fifth Schedule areas.

indigenous Peoples Development Plan (IPDP) will be prepared, to provide specific benefits to the tribal people, as applicable.

5.5.2 Generic Issues / Concerns of Tribal Communities

Though no tribal settlement was identified in the case study sample projects, tribal issues were identified through review of secondary information. In order to have a more focused tribal development strategy, these issues have been grouped into (i) issues that are directly related to the project development for which measures will have to be taken up under the project to address them and (ii) issues which are outside the scope of the project but institutional collaboration could help the tribes in their development. These have been listed below:

Issues directly related to the project

- Loss of agriculture income
- Loss of employment of daily wagers in farms.
- Loss of shelter
- Physical displacement

Other Issues:

- Low level of agriculture productivity
- Lack of employment opportunities
- Low income levels
- Poor health
- Low level of education
- High levels of debt

Community level issues include:

- Loss of and / or access to institutions of importance to tribal population
- Loss of community facilities

5.5.3 Procedure for Preparing an Indigenous Peoples Development Plan (IPDP)

In order to prepare an IPDP the following steps will be taken:

- Social screening to establish the presence of tribes in the project area or have collective attachment to the project area
- based on a detailed social assessment, establish baseline data on the tribal people (subsistence, employment, community networks) in the project area;

- a process of free, prior, and informed consultation with the affected Indigenous Peoples' communities at each stage of the project, and particularly during project preparation, to fully identify their views and ascertain their broad community support for the project
- review Acts / policy guidelines applicable in the respective states regarding tribal groups and also the central Acts / Policies;
- identify the impacts (both positive and negative) and prepare an IPDP;
- disclose the draft IPDP

5.5.4 Screening

During the ESA stage of sub project, survey will be carried out based on group discussion with the communities in the sub project area in order to identify presence of any tribal group or any such group that have collective attachment to the project area. Apart from the consultation with the community members, consultations / in depth interviews will also be carried out with the NGOs working in the area and representative of local self-government. The screening will look into the details of tribal households, assessing the number of such households along the zone of influence of the proposed sub project. If the result shows that there are tribal households, the issues related to the community will be included in the social assessment (SA) survey.

5.5.5 Social Assessment

The park developer would be responsible for conducting SA and the development of an action plan with the help of indigenous community and organizations working for them. The SA will gather relevant information on demographic, social, cultural; economic and networking aspects of each household and needs of the community as a whole. The information on individual household will be collected through household survey whereas, community based needs will be assessed through group discussions with the community as a whole as well as in discussion with the community leaders and government and non-governmental officials working in the area on tribal issues. The discussion will focus on both positive and negative impacts of the sub project. The suggestion and feedback of the community on the design and planning of the sub project will also be documented.

5.5.6 Entitlement

Based on the Operational Policy 4.10 of the World Bank and as one of its significant R&R requirements; special provisions for the Scheduled Tribes (ST) has been made in the project R&R Policy (apart from the general compensation and assistance to be received as Project Affected Persons (PAPs)/Project Affected Households (PAHs)) of sub-project for loss of assets. Apart from compensation at replacement value and R&R assistance for any adverse impact, each IP family will be entitled for additional benefits as one time grant of INR 50,000/-

5.5.7 Monitoring & Evaluation

The park developer will set up an internal monitoring system comprising its own staff, tribal

people to monitor the IPDP implementation. Monitoring indicators will be established. In addition, an external independent monitoring agency will be employed by park developer. Some of the relevant indicators for monitoring are listed below as a guideline:

Table 5-2: indicators for monitoring

Sl. No.	Actions	Indicators
1	Tribal settlements identified	Number of consultations carried out
2	Participation of tribal community	Tribal issues identified IPDPs prepared
3	Implementation of IPDP	Budget allocated for implementation Institutional arrangement in place Grievance redress mechanism established

5.5.8 Suggested Format for IPDP

The suggested format for the IPDP is as follows

a) Description of sub projects and implications for the indigenous community Gender disaggregated data on number of tribal households by impact category

b) Social, cultural and economic profile of affected households

c) Land tenure information

d) Documentation of consultations with the community to ascertain their views about the project design and mitigation measures

e) Findings of need assessment of the community

f) Community development plan based on the results of need assessment

g) Modalities to ensure regular and meaningful consultation with the community

h) Institutional arrangement and linkage with other national or state level programmes

i) Institutional mechanism for monitoring and evaluation of IPDP implementation and grievance redress

j) Implementation Schedule and cost estimate for implementation

5.5.9 Participatory Approach for Preparation of IPDP

The main thrust of IPDP is to address the developmental issues of the project taking into consideration the marginality status of tribal community. The IPDP will offer developmental options addressing community based needs of indigenous people while respecting their

sociocultural distinctiveness. The IPDP aims at strengthening the existing capacity of the affected tribal community. The strategy of IPDP therefore would be to promote participation of the tribal people, initiating and identifying people's need, priorities and preferences through participatory approaches. Therefore, the action plan for a particular village will be prepared by the project in close consultation with the community themselves.

Participatory Rural Appraisal (PRA) initiates the process of people's participation, facilitating decision-making through mutual discussion and direct consultation. Participatory approach is intended to promote participation of all stakeholders creating development opportunities for the affected community. It is therefore, mandatory that appropriate PRA tools along with Focus Group Discussion (FGD) is employed to initiate participation in IPDP for collection of qualitative data.

The areas of enquiry would mainly include:

- Identification of tribal groups
- Access to natural resources, likely impact on land ownership and land distribution, share cropping and lease holder
- Participation in the livelihood security component of the project
- Employment and income generating opportunities in agriculture, trade and business and services
- Poverty
- Women and Gender relation
- Felt needs and community organization

With a view to assess the life patterns of the affected indigenous population and to prepare IPDP in consistent with community and region-specific background, pertinent baseline information shall be collected, compiled and analyzed. The baseline information on socio-economic characteristics including land tenure, land holding categories, occupational pattern, usual activity status, income – expenditure pattern, access to natural resources, health status, literacy level, age structure, gender, marital status, etc. shall be collected in order to facilitate the planning process. The baseline data shall be collected through pre-tested structured schedules.

The most important component of IPDP is to assess the type and magnitude of impacts, both positive and negative on the tribal communities. The assessment of impacts on tribal population in the projects shall focus on the probable consequences of the project according to specific criteria / indicators.

One major activity during the course of the survey would be to identify, various community specific developmental needs linked to their socio-economic and cultural life. The needs shall be identified for infrastructure development and community service facilities such as weekly markets, drinking water facility, sanitation, health facility, schools, community halls, post office, watershed structure, drainage, etc.

5.5.10 Implementation Issues and Strategy

It is envisaged that proper implementation of IPDP is possible only through community participation. The participatory approach will ensure:

- Promotion of community concern and involvement
- Proper organization and management of resources
- Setting up of criteria and fixing criteria and procedures for project execution are done at the grass root level
- Identification, selection and strengthening of implementing agency at the grass roots level

Steps will be taken to ensure that (i) tribal community participates in the project, (ii) is fully aware of their rights and responsibilities; and (iii) are able to voice their needs during IPDP preparation. The community would be encouraged to prepare their own plan that caters to the needs of the community.

Appropriate people's organization and forum need to be built up and strengthened to ensure effective peoples representation and empowerment in the process of selection of specific community development activities and their execution. The conventional top down approach to project implementation through prevailing bureaucratic framework, need to be reoriented for the framework of participative administrative structure to respond to bottom up initiatives based on participatory process for informed community participation and empowerment.

IPDP as a means of sustainable development is based on the strategy of using culturally appropriate, socially acceptable and economically viable opportunities for livelihood of the tribal community including farmers, agriculture and non-agriculture labour, women and wage earners.

The strategy includes:

- Participation of tribal community in plan preparation, formulation and implementation by strengthening their existing tribal social, political and community organizations through required legislative measures, positive administrative responses and people's mobilization.

- Strengthening women's traditional role in subsistence economy through organization, capacity building for leadership and skills improvement, access to non-timber forest produce (NTFP), while bringing about greater sharing of household responsibilities between men and women.
- Keeping in view the strong bondage of the tribal community with land and forest, subsistence practices, traditional culture and ways of life, the strategy may create space for innovative policy measures through appropriate legislation / executive actions. Such innovative policy responses may cover any aspect of their needs from food security, income generating activities, right over forest produce, community health measures or any such issue as generated by the community in course of their participation in the plan process.
- Involvement of non-governmental organization (NGO) as an interface between the government and the tribal community to "bind" and strengthen their organizations, develop a mechanism for redress of grievances and facilitate their being a "stakeholder" in the institutional arrangements for IPDP.
- To ensure the right institutional mechanism for this strategy, IPDP will be integrated with the existing structures of ITDP/DRDA wherever necessary.

Non- governmental organizations (NGO) are "secondary stakeholders" who can facilitate the participation of "primary stakeholders"-the tribal community. The NGOs must have a clear understanding of the socio-economic, cultural and environmental context of the project.

The social and community organizations of tribal population will be identified to strengthen and involve them in participatory process of IPDP. The IPDP will develop a linkage with the structure and the process of tribal development administration so that the tribal communities can enjoy more benefits. The NGOs will also provide the important interface between tribal administration and the community.

5.5.11 Grievance Redress Mechanism

Apart from project GRM, a specific grievance mechanism will be established for indigenous people. A district level grievance redressal cell will be constituted to address the grievances of the PAPs related to disbursement of compensation and resettlement. The space for the functioning of the cell will be provided in the concerned PIU office.

Members of GRC: The cell will be constituted by the SECI in the concerned project districts. The GRC will be headed by District Level Official from Tribal Development Department. The other members will include representatives of tribal community; NGOs contracted for the implementation of RAP; representative of contractor and social specialist of SECI.

Functions of the Cell: The grievance cell will conduct a meeting in the first week of every second month (unless any issue is to be sorted out on an urgent basis) to hear the grievances from the tribal community. The cell should resolve the issue within 15 days of hearing. In case issue cannot be sorted out at project level, it should be escalated to Tribal Welfare Department at the district level.

The cell shall submit a bi-monthly report to SECI for the reference regarding the issues received and the cases disposed and a copy should be forwarded to district level tribal welfare department. In case an aggrieved person / community is not satisfied by the verdict given by GRC and the tribal welfare department, he or she is entitled for approaching the judiciary. The agency responsible for implementing the RAP, will assist such PAP to approach the judiciary.

5.5.12 Gender Issues among Tribes

The tribal women play an important role in the community and family. Women normally constitute half of the total population in any project area and for survival tied themselves to land and forest. These women work as farm servants and attached labourers. Even in agricultural household, women share with men the burden of agricultural operations like transplanting, weeding, harvesting, threshing, winnowing, etc. The concentration of women in agricultural and allied activities is due to the decline of rural industries leading to large-scale reduction of labour force within non-agricultural sector.

In IPDP, therefore, efforts will be made to (i) create and institutional framework to make gender sensitive decisions. SECI / Contractor in consultation with Women and Child Welfare Department shall constitute Women Interest Groups (WIGs) within a village, (ii) women members would be trained for upgradation of skills to initiate viable income generation activities for their economic empowerment, (iii) through training, women members will be provided information to make them an active participant in various activities of WIGs. The activities include (a) provide information on developing a WIG sub plan, (b) linking with other women's development programs of line department, and (iv) NGO will focus on women's need for social development

5.6 Construction Labour Management Plan

The influx of workers and followers can lead to adverse social and environmental impacts on local communities, especially if the communities are rural, remote or small. Such adverse impacts may include increased demand and competition for local social and health services, as well as for goods and services, which can lead to price hikes and crowding out of local consumers, increased volume of traffic and higher risk of accidents, increased demands on the ecosystem and natural resources, social conflicts within and between communities,

increased risk of spread of communicable diseases, and increased rates of illicit behavior and crime. Such adverse impacts are usually amplified by local-level low capacity to manage and absorb the incoming labor force, and specifically when civil works are carried out in, or near, vulnerable communities and in other high-risk situations. While many of these potential impacts may be identified in a project's Environmental and Social Impact Assessment (ESIA), they may only become fully known once a contractor is appointed and decides on sourcing the required labor force. This means that not all specific risks and impacts can be fully assessed prior to project implementation, and others may emerge as the project progresses. Thus, measures defined in the project Environmental and Social Management Plan (ESMP) to address such problems sometimes may be insufficient. It is therefore important to develop site-specific measures before the contractor starts work, and update them as necessary to reflect project developments. Overall, adequate monitoring and adaptive management of the potential impacts from labor influx are key to properly addressing them and mitigating risks.

The proposed 160 MW hybrid (Solar + Wind) power project is in its preliminary phase of execution. It is envisaged that during construction phase of the project, labourers for various jobs such as civil, mechanical and electrical works will be hired through authorized manpower agencies. The labour requirement will range from 250-300 workers during normal operations which can reach upto 500 workers during peak construction activities. Therefore, it is also envisaged that many of the labourers will be employed from outside the region and will therefore, be migrant labourers and hence, accommodation will be provided. These migrant labourers will be accommodated in a temporary campsite within the project area. The construction of solar array, wind tower, sub-station and transmission line can start simultaneously which can lead to increase in migrant labour at a given point of time. This could result in stress on local resources, disruption in community relations, and movement of labourers.

5.6.1 Objectives

The influx of migrant labour will have both negative and positive impacts on the nearby community and local environment. The labour will be accommodated in temporary campsite within the project area which can have significant interface with the nearby community. However, the influx of migrant workers would lead to a transient increase of population in the immediate vicinity of the project area for a limited time. This would put pressure on the local resources such as roads, fuel for cooking, water etc.

Hence, a framework has been designed to demonstrate the:

- Potential impacts associated with influx on the host population and receiving environment are minimized; and

- Provision of safe and healthy working conditions, and a comfortable environment for migrant labour; and

5.6.2 General Requirements

All migrant workers are envisaged to be accommodated in temporary campsite within the project area. If migrant workers are accompanied by their families, provisions should be made accordingly. Guidance on Workers Accommodation developed by IFC and EBRD is also referred for inclusion of requirements for labour camp to be established by developers during construction phase of the project. Developer(s) shall ensure implementation of the following measures to minimize the potential negative impacts of worker accommodation and workers on local communities:

Cleanliness: Pest extermination, vector control and disinfection are to be carried out throughout the living facilities in compliance with local requirements and/or good practice.

Complaints and incident reporting: A formal Complaints Procedure will be implemented to ensure timely and transparent response to complaints as received from labour.

Labour education: The workforce will be sensitized to local social and cultural practices through provision of an induction course for all employees that stipulates expected behaviour;

Labour behaviour in campsite provided: A Code of Behaviour governing appropriate behaviour in the accommodation facilities to be kept in place and to be strictly enforced. The contractor shall ensure implementation of the “rules of engagement” between labourers living in campsite and community and shall be implemented by construction contractors for all engaged labourers. A code of conduct has been developed and has been annexed with the report.

Labour Compensation and Accommodation: Client shall ensure that labourers are provided with benefits such as annual leave, weekly rest day, etc. Accommodation to be provided for the construction labour which cover facilities (including catering facilities, dining areas, washing and laundry facilities etc.) and supporting utilities.

5.6.3 Hiring and Recruitment Procedure

The manpower contractor shall, wherever possible, locally recruit the available workforce and shall provide appropriate and requisite on job and EHS training as necessary. The following general measures shall be considered for the workforce during their employment tenure:

- Park Developer should include a code of conduct relating to the accommodation to be signed with the contract Document of developers.
- The contractor shall not employ any person below the age of 18 years nor will have any forced labour;

- The construction labourers will be provided with documented information regarding their rights under national labour and employment law such as but not limited to Factories Act, Minimum Wages Act, Trade Unions Act and Workmen's Compensation Act;
- First priority for employment of labour should be given those impacted by the project such as landowners who have lost land;
- No discrimination shall be done by the construction contractor with respect to recruitment and hiring, compensation (including wages and benefits), working conditions and terms of employment, access to training, job assignment, termination of employment or retirement, and disciplinary practices;
- The contractor to ensure that work hours are set at eight hours a day, 48 hours a week, with a weekly rest day for all engaged labour;
- Every labour is entitled for maximum of only two hours a day as Overtime (OT) work. OT pay is twice the hourly remuneration;
- Client shall ensure equal wages for male and female workers for work of equal nature or value is maintained;
- A grievance redress mechanism for workers shall be put in place by the contractor to raise workplace concerns. The workers will be informed about the grievance mechanism at the time of recruitment; and
- The Developer shall ensure that their contractors develop and implement a procedure to review the performance of their sub-contractors.
- The procedure developed should include regular inspection of the camp sites, maintaining information pertaining to labour sourced by sub-contractors;

5.6.4 Workers' Accommodation

(i) Dwelling Units

The Developer will supervise and monitor the activities performed by their contractor and accommodation facilities provided in campsite. The following measures shall be provided:

- The labour will be provided with accommodation on twin sharing basis made of insulated material and locally available building material, etc.;
- The migrant workers with families shall be provided with individual accommodation comprising bedroom, sanitary and cooking facilities;

- The units will be supported by common latrines and bathing facilities duly segregated for male and female labour;
- Adequate number of toilets shall be provided in the accommodation facilities. A minimum of 1 unit to 15 males and 1 unit for 10 females shall be provided;
- The contractor shall provide a canteen facility for the construction workers and the food will be of appropriate nutritional value and will take into account religious/cultural backgrounds;
- All doors and windows shall be lockable and mobile partitions/curtains shall be provided for privacy;
- Facilities for the storage of personal belongings for workers shall be provided within the campsite only;
- Dustbins shall be provided for collection of garbage and will be removed on a daily basis;
- It is also required to provide first aid box in adequate numbers; and
- Ventilation should be appropriate for the climatic conditions and provide workers with a comfortable and healthy environment to rest and spend their spare time.

(ii) Security

The contractors shall put in place the following security measures to ensure the safety of the workers. The following measures shall be incorporated:

- Access to the campsite shall be limited to the residing workforce;
- The contractor shall be responsible for deploying adequate number of guards;
- Adequate, day-time night-time lighting shall be provided;
- The security personnel shall be provided with training to respect the community traditions and in dealing with, use of force etc.; and
- The rental accommodation shall be provided with firefighting equipment and portable fire extinguishers.

(iii) Provisions for Drinking Water

Access to an adequate and convenient supply of free potable water is necessity for workers. The domestic water supply shall be made available by the contractor.

- Safe drinking water conforming to the IS 10500:2012 for drinking water shall be provided;
- Private tanks can be utilized for provision of drinking water for the migrant labours;
- The direct usage of water from bore well should not be allowed and water shall be adequately treated;
- The Developer(s) should regularly monitor the quality of drinking water available. In case of non-compliance with the Drinking Water Specifications, additional treatment shall be provided or alternative sources of water supply shall be arranged; and
- All tanks used for the storage of drinking water are constructed and covered as to prevent water stored therein from becoming polluted or contaminated.

(iv) Cooking Arrangements

The construction phase will involve engagement of large number of migrant people in the project area for a limited time. Hence, there shall be requirement of provision of cooking facilities (kitchen) as listed below:

- Places for food preparation are designed to permit good food hygiene practices, including protection against contamination between and during food preparation;
- Adequate personal hygiene including a sufficient number of washbasins designated for cleaning hands with clean, running water; and
- All kitchen floors, ceiling and wall surfaces adjacent to or above food preparation and cooking areas are built using durable, non-absorbent, easily cleanable, non-toxic materials;
- Food preparation tables are equipped with a smooth, durable, easily cleanable, non-corrosive surface made of non-toxic materials.

To ensure that the fuel need of labourers in the project area does not interfere with the local requirements, necessary arrangements for supply of fuel to the labourers shall be done by the contractor.

(v) Wastewater Generation

There will of generation of wastewater from the campsite. About 80% of water used shall be generated as sewage/wastewater. Developers shall ensure that the campsite are equipped with septic tank and soak pit for disposal of sewage. It is also recommended that the storm water and sewage system should be separate. The surface water drainage shall include all

necessary gutters, down pipes, gullies, traps, catch pits, manholes etc. Sanitary and toilet facilities are constructed of materials that are easily cleanable. Sanitary and toilet facilities are required to be cleaned frequently and kept in working condition.

(vi) Solid Waste Management

The municipal solid waste generated from campsite will mostly comprise of compostable wastes like vegetable matters (kitchen waste) and combustible waste like paper, cans, plastic and some non-degradable waste like glass/glass bottles. Improper disposal of solid waste will lead to environmental degradation and health hazards to labour as well as nearby community.

The following measures shall be adopted by contractors for ensuring effective management of solid waste:

- The solid wastes of domestic nature generated shall be collected and stored separately in appropriate containers with proper sealing on them;
- Separate bins with proper markings in terms of recyclable or non-recyclable waste shall be provided in the houses and kitchen premises in sufficient numbers for collection of garbage;
- Food waste and other refuse are to be adequately deposited in sealable containers and removed from the kitchen frequently to avoid accumulation; and
- The contractor shall identify the nearest municipal solid waste storage facility and tie up with the concerned urban local body for disposal of waste at frequent intervals.

(vii) Medical Facilities

Effective health management is necessary for preventing spread of communicable diseases among labour and within the adjoining community. The following medical facilities shall be provided by contractors for the construction workers:

- A first aid centre shall be provided for the labour within the construction site equipped with medicines and other basic facilities;
- Adequate first aid kits shall be provided in the campsite in accessible place. The kit shall contain all type of medicines and dressing material;
- Contractor shall identify and train an adequate number of workers to provide first aid during medical emergencies;
- Regular health check-ups shall be carried out for the construction labourers every six month and health records shall be maintained;

- Labours should have easy access to medical facilities and first aider; where possible, nurses should be available for female workers;
- First aid kits are adequately stocked. Where possible a 24/7 first aid service/facility is available.
- An adequate number of staff/workers is trained to provide first aid; and
- Information and awareness of communicable diseases, AIDS etc. shall be provided to workers.

(viii) Recreation Facilities

- Basic collective social/rest spaces are provided to workers.
- Facilities like a common television can be provided in labour camps

(ix) Inspection of Accommodation Facilities

Campsite shall be inspected at frequent intervals to ensure that the facilities are well organized and maintained to acceptable and appropriate standards by the Developer. The key areas are:

- Daily sweeping of rooms and houses shall be undertaken;
- Regular cleaning of sanitary facilities shall be undertaken;
- The kitchen and canteen premises shall be established under good hygiene conditions;
- Daily meal times shall be fixed for the labour;
- Smoking and alcohol consumption shall be prohibited in the workplace;
- Water logging shall be prevented at areas near the accommodation facilities and adequate drainage is to be provided; and
- Checklists pertaining to the daily housekeeping schedule shall be maintained and displayed at houses, toilets and kitchen.

To limit the impact due to cumulative labour onsite during construction phase, developers shall provide adequate labour camp which should be appropriate for its location and be clean, safe and, at a minimum, meet the basic needs of workers.

- Developers should assess the location of labour camp, that it should not be constructed in immediate vicinity of any drainage channel;
- It should be ensured that the labour camp(onsite)should have basic amenities such as electricity, drinking water, health& sanitation facility, kitchen and rest room;

- All tanks used for the storage of drinking water are constructed and covered as to prevent water stored therein from becoming polluted or contaminated and all the migrant workers will be instructed accordingly;
- Employers should ensure that accommodation which is provided is not overcrowded and does not pose a risk to the health and safety of workers;
- The labour camp will be equipped with sceptic tanks and soak pits and avoid presence of stagnant water is a factor of proliferation of potential disease vectors such as mosquitoes;
- Developers should ensure that the disruption of local communities is minimum, in particular local communities' transport infrastructures and if required limit the workers movements in nearby areas;
- Security staff have a clear mandate and have received clear instruction about their duties and responsibilities, in particular their duties not to harass, intimidate, discipline or discriminate against workers;
- Developers should ensure that workers and members of the surrounding communities have specific means to raise concerns about security arrangement and staff;

Where possible, an adequate transport system to surrounding communities will be provided. It is good practice to provide workers with free transportation to and from local communities

5.6.4 Contractor's responsibility

Within 30 days from the appointed date, the Concessionaire/Contractor shall prepare and submit 4 hard copies and 1 soft copy of Labour Influx and Worker's Camp Management Plan to [Executing Agency] that addresses specific activities that will be undertaken to minimize the impact on the local community, including elements such as worker codes of conduct, training programs on HIV/AIDS, etc. A Workers' Camp Management Plan addresses specific aspects of the establishment and operation of workers' camps

This Labour Influx and Worker's Camp Management Plan will include*:*

- *mandatory and repeated training and awareness raising for the workforce about refraining from unacceptable conduct toward local community members, specifically women;*
- *informing workers about national laws that make sexual harassment and gender-based violence a punishable offence which is prosecuted;*
- *introducing a Worker Code of Conduct as part of the employment contract, and including sanctions for non-compliance (e.g., termination), manual scavenging, engagement with local residents, child labour, non-discrimination, harassment of co-workers including*

women and those belonging to SC and STs and other minority social groups,

- *contractors adopting a policy to cooperate with law enforcement agencies in investigating complaints about gender-based violence.*
- *training programs on HIV/AIDS and other communicable diseases,*
- *workers' Camp Management Plan addressing specific aspects of the establishment and operation of workers' camps provided the ULB/ Executing Agency is unable to cater to the demand for affordable housing for this additional workforce in terms of rentals, hostels, apartments etc.; and*
- *compliant handling Mechanism at the project level*

Additional measures that aim to reduce incentives to engage with the local community by providing workers with the opportunity to spend their time off away from the host community, where feasible with a small transport allowance, ideally allowing workers to regularly return for brief visits to their families, spouses and friends, or to visit nearby urban centres that provide a variety of legal social opportunities. For workers who need to travel further it may be attractive to forego weekends off in exchange for longer breaks that would allow for such home leave travel.

While clear and decisive measures by the contractor are critically important, the effectiveness of these measures often depend on complementary actions by the Borrower. Those are typically focused on public administration and law enforcement, such as: (i) reinforcing local police in a remote setting, where services may not be sufficiently staffed or equipped to maintain public order after the influx, (ii) ensuring that complaints about gender-based violence are taken seriously by local law enforcement, which may be supported by (iii) deploying female officers to the project area, and (iv) participating in preventive training with workers to demonstrate the presence of government authority in the project area.

6. CONSULTATION; CONSULTATION FRAMEWORK AND INFORMATION DISCLOSURE

6.1 Sample Project Consultations- Solar parks

The FGDs / stakeholder consultations in selected villages in the sample sub-project locations were conducted in the respective project (Rewa 750MW solar park, Pavagada 2000 MW solar park, Mandsaur 250 MW solar park, NLC Wind project, NIWE wind project, NIWE hybrid project) involving the team of social experts, community mobilizer and other key experts to gauge the stakeholder perception about the sub-project. A total of 20 local level consultations were carried out in the selected 12 villages spread across three different projects. The stakeholders included land owners losing land, landless laborers and other villagers. Team ensured participation of women members in each of the consultations.

The key issues and concerns identified during the above consultations as raised by the local community included:

- Are these projects going to provide any benefits for the local people especially in terms of employment?
- Whether local people will get employment as skilled / semi-skilled / unskilled labourers?
- Whether solar panels/wind turbines will have any impact on the health of the people and the crops being grown in the area.
- What will be the rate for land payable to the land owners (in case of Rewa) as private land parcels falling within the government revenue land was being acquired through mutual consent policy.
- The villages in this area have inconsistent electric supply; kindly ensure 24-hour electric supply in all the project villages in lieu of the land being given on lease in case of Pavagada.
- What is the mechanism to ensure timely payment of lease rent for land being pooled for solar project (in case of Pavagada)?
- What will be the fate of agricultural labour that do not own land and are dependent on land owners for labour work on agricultural land owned by big farmers?
- In case the developer fails to honour the commitments, then what corrective steps will the government take to address the concerns of the local villagers during the

implementation or operations stage.

- How will the access be ensured for the villagers to the cultural properties located in vicinity / now falling within the proposed site. Will there be restriction on movement in these areas?
- How would the developer ensure that the noise / dust / labour camps setup during the construction phase of the project does not impact the local village community?
- Will the construction activity have any adverse impacts on our existing surface water resources?

The details of the consultations are provided in **Annexure X**.

6.2 Sub project consultations – wind projects / floating solar / hybrid

The floating solar and hybrid wind-solar projects are currently in its emerging stage of development. The existing hybrid as well as floating solar plants, visited by the consultant's team was installed, currently being operated on research / experimental basis. The power generated from these is supplied to the grid and does not support any battery backup.

(a) Floating solar PV projects

The two floating solar parks of 10kW each at Chandigarh and Kolkata were established around 2 -3 years back in a controlled environment.

- The access to lake is the only issue brought up by the community living close to the lake. The access to general public for these sites is restricted due to safety concerns.
- Incidents of stone pelting and subsequent damage to PV panels by the miscreants have been reported at Chandigarh.
- Interactions with the project proponents / developers and neighbouring community, reveals no adverse impacts on the lake water quality due to the floating structures.
- No adverse impacts on fisheries diversity or population reported due to these floating structures.

(b) Hybrid wind – solar project

Hybrid wind -solar facility is installed within the campus of NIWE, Kayathar, Tamil Nadu. Hence there is no community interface. In depth interview with the developer brought out following points:

- The hybrid facility at existing WTG stations should be planned is such a manner that, in case of major repairs / preventive maintenance requirements, the solar panels can be easily dismantled and reinstalled post the repairs. All wiring for panels should be underground for ease of dismantling / reinstalling as and when required.

- The installation of WTG's in existing Solar PV Parks (subject to technical feasibility) is expected to have more adverse social and environmental impacts as compared to installation of solar panels in existing WTG's. This is mainly due to the expected movement of heavy machinery / materials / components for installation of WTG's.
- The negative impacts due to flickering shadows also need to be considered while planning for hybrid solar-wind power plants.

(c) Wind farms

WTG installations, i.e. installations within NIWE campus wherein these have been installed for long term research and training activities; second being installed by NLC India Limited, through private developers on PPP mode. In the case of later, land is being procured directly by the developer as per the prevailing market rates / negotiations with the parcel owner, WTG installed and operated by the developer himself. Interactions with the local villagers / land parcel owners in a few of these locations in Tamil Nadu reveals that:

- There is no impact on livelihood as the developer in most of the cases have appointed the original owner of land as a security personnel on ground and paid a monthly salary. The income enhancement measures undertaken by the developer have been well accepted by the locals.
- The original land parcel owners continue to carry out agricultural activities in the remaining parcel of land available with them. Agricultural activities are being carried out in the land parcel sold by the original owner as sites are not fenced.
- None of the locals have reported any adverse impacts due to humming noise generated by WTG's and flickering shadow effects.

6.3 Consultation Framework

Public participation and community consultation is an integral part of environmental and social assessment. Public participation has been viewed as a continuous two-way process, involving promotion of public understanding of the processes and mechanisms through which developmental problems and needs are investigated and solved. Consultation is used as a tool to inform and educate stakeholders about the proposed action both before and after the development decisions are made. It assists identification of the problems associated with the sub projects as well as the needs of the population likely to be impacted. This participatory process enables the participation of the local people in the decision making process. The involvement of the various stakeholders ensures that the affected population and other stakeholders are informed, consulted and allowed to participate at various stages of project

preparation

The SECI and project developer will be responsible for ensuring participation of the community at sub-project level. Involvement of the community is not limited to interactions with the community but also disclosing relevant information pertaining to the project tasks. This however requires identification and mapping of stakeholders. Stakeholder mapping will be on going activity throughout the project cycle.

6.3.1 Stakeholder Mapping

Through the formal and informal consultation, following stakeholder mapping has been done, identifying their interests concerned with the project activities.

Table 6-1: Stakeholder Mapping

Stakeholder Category	Interests	Potential/Probable impacts
Primary stakeholders		
Project affected people	Access to the facility, Project entitlement, Time-bound delivery of benefits, enhanced quality of life	(+/-)
Beneficiaries	Access to the facility, Project entitlement, Time-bound delivery of benefits, enhanced quality of life	(+/-)
Secondary stakeholders		
SECI & PAPs	Project implementation, Contracting; Project management, Monitoring and evaluation	(+/-)
NGOs, CSOs, Local Administration	Development, Community participation, and Community welfare	(+/-)

This is a tentative mapping and is likely to change during the project implementation. Each of these stakeholders will be part of the consultation process and their views will be incorporated in to the project design. The key stakeholders can be grouped into two categories viz., primary and secondary. Their respective roles are presented below:

Primary Stakeholders: The primary stakeholders include project affected persons and direct beneficiaries.

Project Affected Persons (PAPs) have the following roles:

- Participate in public meetings and identify alternatives to avoid or minimize displacement

- Assist DPR consultants and NGOs in developing and choosing alternative options for relocation and income generation
- Participate in census survey and meetings with host population
- Provide inputs to entitlement provisions, thus assisting in preparation of the resettlement action plan
- Participate in grievance redress as members of grievance redress cells (GRC)
- Decide on relocation and management of common properties
- Labour and other inputs in the project
- Members of implementation committee

Beneficiaries and Host Population have the following roles:

- Assist DPR consultants and M&E Consultants in data collection and design
- Provide inputs to site selection
- Identify possible conflict areas with PAPs
- Identify social and cultural facilities needed at resettlement sites
- Help develop consultation process between hosts and PAPs.
- Manage common property
- Participate in local committees.
- Assist PAPs in integration with hosts.

Secondary Stakeholders

SECI has the following roles:

- Establish separate cell for social development
- Notification at various stages for land acquisition and joint measurement of land to be acquired along with the revenue department
- Design and approval of resettlement policy
- Coordinate with line departments such as telephone, state electricity board, public health engineering department and forest department for shifting of utilities and cutting of trees
- Participate with NGOs in verification survey of PAPs and categorization of PAPs

- Participate in consultations with PAPs and beneficiaries
- Designing and distribution of ID cards along with NGO
- Coordinate and facilitate relocation of displaced persons including designing and construction of resettlement colony / vendor market; provision of basic amenities; distribution of plots / houses / to residential and/or commercially displaced persons
- Coordinate with NGO in identifying land for relocation of common property resources
- Coordinate with civil construction contractor to relocate common property resources
- Permission and liaison with line departments for provision of basic amenities in resettlement colonies, land acquisition and income restoration schemes;
- Coordinate with revenue department and NGO for facilitating disbursement of compensation and resettlement and rehabilitation assistances
- Monitoring of physical and financial progress
- Approval of micro plans
- Participate in training programmes for income restoration organized by NGOs
- Consult with panchayat and block office to facilitate inclusion of PAPs name for poverty alleviation schemes of government of India.

NGOs have following roles:

- Develop rapport with PAPs and between PAPs and SECI/ Implementing Agency
- Verification of PAPs
- Consultations with the community
- Assess the level of skills and efficiency in pursuing economic activities, identify needs for training and organize programmes either to improve the efficiency and/or to impart new skills.
- Assist PAP in receiving rehabilitation entitlements due to them
- Motivate and guide AP for proper utilization of benefits under R&R policy provisions;
- Facilitate purchase of agriculture land in negotiating price and settling at a reasonable price or expedite through Land Purchase Committee.
- Assist PAPs in obtaining benefits from the appropriate development programmes.
- Help PAPs in increasing their farm income through provision of irrigation facility or

improving farm practices, and

- Ensure marketing of produce particularly those under self-employment activities.
- Complete the consultation at the community level and provide support by describing the entitlements to the entitled persons (EPs) and assisting them in their choices
- Accompany and represent the EPs at the Grievance Redress Committee meeting.
- Assist EPs to take advantage of the existing government housing schemes and employment and training schemes that are selected for use during the project, and
- Promote location specific Community Based Organizations (CBOs) of PAPs to handle resettlement planning, implementation and monitoring.
- Create awareness among PAPs of HIV/AIDS, trafficking of women and child, child labour and health and hygiene

6.3.2 Mechanism for Consultation

The Consultation Framework envisages involvement of all the stakeholders at each stage of project planning and implementation. Involvement of the community is not limited to interactions with the community but also disclosing relevant information pertaining to the project tasks. Community consultation will be a continuous process throughout the project cycle starting from the project inception to till the end of the project; namely (a) sub-project identification; (b) planning stage (c) implementing stage.

(i) Sub Project identification stage

- To sensitize the community about the sub-project and their role

(ii) Planning Stage

- For disseminating information pertaining to the sub-project, work schedule and the procedures involved; finalization of project components with identification of impacts, entitled persons, mitigation measures; and Grievance Redressal mechanisms to be adopted.
- Dissemination of project information to the community and relevant stakeholders is to be carried out by Project developer at this stage of the project initiative. The community at large shall be made aware of the project alternatives and necessary feedback is to be obtained. Community and other stakeholders should be involved in the decision-making to the extent possible. Information generated at this stage should be documented for addressal of queries arising out of the Right to Information Act, 2005.

- Consultations with Project Affected Persons and their profiling are mandatory as per the requirements of SIA and preparation of RAP. This needs to be done as socio-economic and census surveys as part of the ESA study. Consultations with respect to cultural aspects are to be carried out as part of the Social Impact Assessments for all alternatives and the selected alternative subproject option.

(iii) Implementation Stage

- Consultations as part of the implementation stage would be direct interactions of the implementation agency with the Project Affected Persons. These would comprise of consultations towards relocation of the PAPs, relocation of cultural properties, and towards addressing the impacts on common property resources (CPRs) such as places of religious importance, community buildings, trees etc.
- With the implementation of the R&R provisions in progress, consultations and information dissemination is to be undertaken to let the affected persons informed of the progress.
- Implementation stage also involves redressal of grievances in case of R&R aspects as well as relocation of common property resources through the grievance redressal mechanisms. These would usually be undertaken through one to one meetings of PAP or community representatives with the grievance redressal committee established for the project.

6.4 Information Disclosure Mechanism

The mechanism of information dissemination should be simple and be accessible to all. Two of the important means that have been followed until now include briefing material and organization of community consultation sessions. The briefing material (all to be prepared in local language) can be in the form of (a) brochures (including project information, anticipated environmental impacts, mitigation measures, land requirements and details of entitlements including compensation and assistance to be given to the PAPs) that can be kept in the offices of local self-government (municipal office in case of urban area and gram panchayat office in case of rural area), State Agency and SECI; (b) posters to be displayed at prominent locations and (c) leaflets that can be distributed in the impacted zone of the project. Consultation meetings should also be organized at regular intervals by the Implementing Agency to acquaint the PAPs of the following:

- Timeline and progress of the project;

- Information on compensation and entitlements;
- Information on land acquisition and market valuations of property;
- Time line for acquisition.

Also, opinion and consensus of the community needs to be sought for common and cultural property relocation. Information disclosure procedures are mandated to provide citizen centric information as well as all documentation necessary for addressing any queries under Right to Information Act that came into effect from October 2005. A computer based information management systems shall be employed to disseminate information pertaining to the project. Disclosure of information will enhance governance and accountability specifically with respect to strengthening of monitoring indicators to help the World Bank monitor compliance with the agreements and assess impact on outcomes.

Information shall be provided in a timely and regular manner to all stakeholders, affected parties, and the general public. Access by the public to information and documentation held or generated by SECI will facilitate the transparency, accountability, and legitimacy as well as operations overseen by it. As a part of its disclosure policy, all documents shall be made available to the public in accordance with relevant provisions of the RTI Act, except when otherwise warranted by legal requirements. A designated Information Officer shall be responsible for ensuring timely and complete dissemination in accordance with this policy.

6.4.1 Information to be disclosed

The Table 6.1 below specifies the type of additional information and frequency of dissemination for projects which are financed either from domestic or donors' funds. In addition to the information specified in the table, the following information shall also be displayed / disseminated, wherever applicable.

- Project specific information need to be made available at each contract site through public information kiosk
- Project Information brochures shall be made available at all the construction sites as well as the office of implementation agency and the office of Engineer in charge.
- Reports and publications, as deemed fit, shall be expressly prepared for public dissemination e.g., English versions of the ESIA and RAP and Executive Summary of ESIA and RAP in local language.
- Wherever civil work will be carried out a board will be put up for public information which will disclose all desired information to the public, for greater social accountability.
- All information will be translated into local language and will be disclosed to the public

through the Panchayat, District Magistrate's office, concerned offices of Implementing Agency, websites of SECI.

Table 6-2: Information to be disclosed

Topic	Documents to be Disclosed	Frequency	Where
Resettlement, Rehabilitation and Land Acquisition	ESDDR; Action Resettlement Plan (RAP).	Once in the entire project cycle. But to remain on the website and other disclosure locations throughout the project period.	World Bank's Infoshop On the website of SECI, RAP to be made available at a place accessible to affected persons and local NGOs, in a form, manner, and language that are understandable to the PAPs in the following offices: DM's Office State and District Libraries Local municipal and *gram panchayat* office Office of Implementing Agency Office of the contractor
	Resettlement & Rehabilitation Policy translated in local language	Once in the entire project cycle.	Distributed among Project Affected Persons (PAP)
	Information regarding impacts and their entitlements in local language	Once at the start of the project and as and when demanded by the PAP.	Through one-to-one contact with PAPs. Community consultation List of PAPs with impacts and entitlements to be pasted in the SECI office and website of SECI,
	R&R and LA monthly progress report.	10th day of every month	Website of, SECI. Hard copy in the office of contractor in local language
	RAP Impact Assessment Report	At midterm and end of the RAP implementation	SECI website in local language.
	Land Acquisition notifications	As required under the RFCTLARR Act 2013	SECI, website. Hard copy in the office of contractor in local language

Topic	Documents to be Disclosed	Frequency	Where
	Grievance redressal process.	Continuous process throughout the project cycle.	World Bank's Info shop. On the web sites of SECI Hard copies in local language in the following offices: DM's Office Local municipal and *gram panchayat* office Office of the contractor PAPs to be informed on one to one contact by SECI through NGO
Public Consultation	Minutes of Formal Public Consultation Meetings	Within two weeks of meeting	On the web sites of SECI Hard copies in local language in the following offices: DM's Office Local municipal and *gram panchayat* office Office of the contractor

6.5 Consultation on Draft ESMF

A stakeholder workshop was held on August 28, 2018 on draft ESMF. The objective of the workshop was to disseminate draft ESMF and invite comments on the content and structure of ESMF. The participants included representatives of civil society, developers and consultants. The issues raised by the participants and it's addressal in ESMF is given in the table 6.3 below:

Table 6-3: Issues Raised during consultation on draft ESMF

Sl. No.	Issues Raised	Response
1	Training of EPC contractors on environment and social issues	The same would be taken up at sub project level
2	Monitoring mechanism is not clear	The internal monitoring of physical and financial indicators will be carried out by SECI whereas external evaluation will be

		carried out by third party. The detailed mechanism has been discussed in chapter 8.
3	Learning and information dissemination: frequency and responsibility	The information dissemination will be an ongoing activity. SECI is primarily responsible for dissemination of project information. The mechanism is detailed out in section 6.4 of this chapter.
4	Mitigation plan for depletion of ground water not mentioned in ESMF	In case ground water depletion is identified as adverse impact, mitigation measures will be part of sub project specific ESMP.
5	Benefit sharing has not been mentioned	Benefit sharing will be part of sub project activity. The mechanism of benefit sharing will be detailed out in sub project specific RAP.
6	Community participation and engagement mechanism	Community consultations are integral to projects and will be carried out all through the project life. The mechanism for community consultation has been discussed in chapter 4.

7 INSTITUTIONAL STRUCTURE / IMPLEMENTATION

For successful implementation of Environmental and Social safeguards, Institutional setup plays a vital role. The sub-projects would be fully owned by SECI, a company under 100% ownership of the Government of India. The solar-wind hybrid project would be set up inside a hybrid power park, to be developed by PARK DEVELOPER, the state nodal agency under the State Government of Andhra Pradesh.

7.1 Sub-project Execution Structure and Responsibilities

Government of India has given its approval to the proposal "*Investment for innovation in Solar power and Hybrid technologies*". Under the proposal, the World Bank would finance USD 200 million (50% of project cost) for projects with innovative technologies, such as solar-wind hybrid, floating solar etc. to be developed by SECI. The counterpart 50% funding would be met by SECI through its equity and/or through domestic commercial borrowings.

As the first project under this proposal, a 160 MW solar-wind hybrid project with battery storage is being developed. SECI is the Project Implementation Agency (PIA) for the project. Other project options are being explored.

The solar-wind hybrid with storage project would be under the ownership of SECI. It would be set up on a land-lease basis inside a hybrid power park being developed by PARK DEVELOPER. Ownership of land remains with PARK DEVELOPER & shall be returned after 25 years Project would be set up in a turnkey EPC mode, with EPC contractor being determined through a transparent international competitive bidding process.

The implementation arrangement for the project is depicted in the figure 2 below:

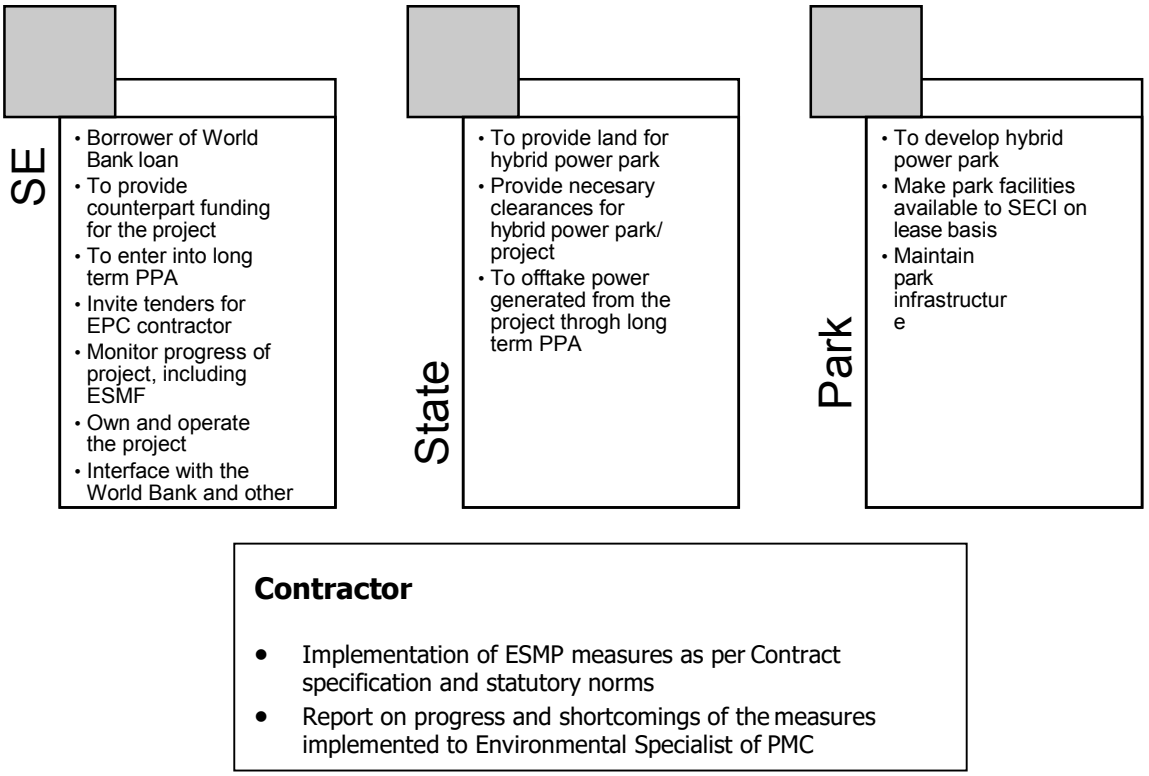


Fig. 7-1: Implementation structure

(a) Role of SECI

- SECI is the Project Implementation agency. It would develop the project under its ownership. SECI is the borrower of World Bank loan. Counterpart funding to the tune of 50% of project cost would be provided by SECI.
- As project developer, SECI would get the necessary technical, social and environmental due diligence done before project set-up. SECI would enter into long term power purchase agreements with Discoms/bulk consumers for ensuring offtake of power from the project.
- SECI would invite tenders for EPC contractor through international competitive bidding process. SECI would enter into contract with the selected bidder. During execution phase, SECI would monitor progress of project and ensure compliance with World Bank norms.
- SECI would own the project assets and operate it for the project life time. During operation phase, SECI would ensure compliance with World Bank norms.

(b) Role of State Government

- The State Government would provide land and necessary clearances for setting up of the project.

- The State Government would have to agree to offtake power generated from the project.

(c) Role of Hybrid Power Park Developer

- Developer would obtain necessary approvals for developing the hybrid power park at the designated site.
- Park developer would develop the land and infrastructure for the hybrid power park and make the facilities available for the project on lease basis.
- Developer would be responsible for maintaining the hybrid park infrastructure.

(d) Role of EPC Contractor

- EPC contracting mode has been envisaged in the project execution. This document's model EMP can be used as reference for projects but relevant inputs for specific projects shall be incorporated, the EMP for such subprojects including codes of practice shall be included in the Bid Document. EPC contractor shall ensure that the design conforms to the requirements of the World Bank policy. EPC Contractor shall follow all E&S requirements as mentioned in bid document & shall assign all resources including necessary staff for relevant project stages to mitigate any residual E&S risks.

The above-mentioned activities related to hybrid park development and project development are likely to have some adverse impacts on the environment which need to be mitigated and ensured that the appropriate mitigation measures are included as part of the EPC contract and O&M processes.

SECI, being the PIA for the project, would be overall responsible for monitoring the compliance of environmental and social norms for the project-related activities. Presently, SECI does not have an Environment and Social Management System (ESMS), however, same would be developed. SECI would designate Social & Environmental (s) Officer for the project.

(e) Roles and Responsibilities of Social & Environmental Officer - SECI

The project sites would be spread across several villages and remote areas. Project development may necessitate relocation of the people in those areas or affect their livelihood. For upliftment of people and community development, there is a need for Rehabilitation and Resettlement (R&R) of Project Affected People (PAP) with the objective that standards of living of the PAP improves or at least regain their previous standards of living.

The proposed organization structure for RAP/EMP implementation is presented in Figure below.

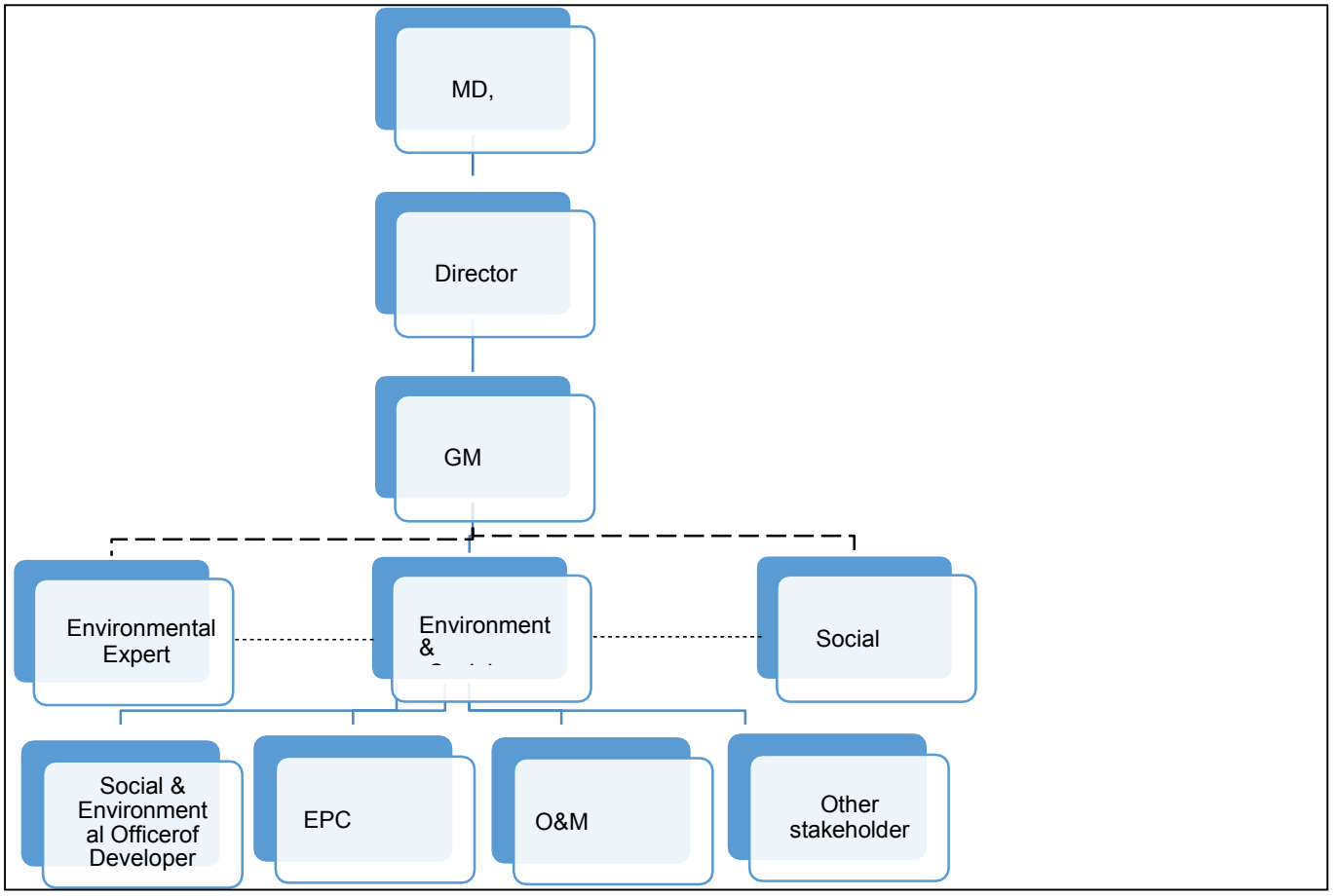


Fig. 7-2: Institutional arrangement in SECI

Managing Director, SECI will have overall responsibility for implementation of the project. Environmental and Social development expert(s) would be engaged by SECI as part of project development and will report to GM (Solar), SECI.

The Environmental & Social Development officer is overall responsible for EMP and RAP implementation, coordinating and liaising with PARK DEVELOPER, contractors and other agencies, as well as the World Bank, with respect to different social and environmental issues. The officer will also be responsible for progress monitoring of Environmental and social safeguards during project construction and execution stage and submission of monthly report (during construction stage) and quarterly report (during operations stage) on EMP compliance to the World Bank.

The roles and responsibilities of the Social and Environmental Officer shall be:

- Conduct Screening and Environmental and Social Due Diligence of the sub project
- Prepare TOR for any studies required and qualitative dimensions to the implementation of RAP/ ESMP;

- Participate in and facilitate consultations with stakeholders;
- Participate in project meetings and report on the issues related to environmental management and social safeguards to provide for any mid-course corrections that may be required based on situation on the ground;
- Assist PAPs to resolve their grievances;
- Coordinate on the training and capacity building initiatives;
- Review contract documents to ensure that EMP provisions related to works are included in the contract documents;
- Act as a resource person in trainings based on experience on implementing this project and previous relevant work;
- Oversee and report to management on implementation of EMP provisions included in the works contract for each sub-project in the state;
- Liaison with state administration for land acquisition/procurement and implementation of RAP;
- Report progress, highlighting social issues not addressed, to provide for mid-course correction;
- Assist PAFs in approaching the grievance redressal mechanism;
- Carry out other responsibilities as required from time to time.

SECI does not have prior experience of implementing World Bank financed projects. Till recently, it had one officer handling environmental matters, reporting to GM (Solar). However, presently the post is vacant. Recruitment process for hiring of Social and Environmental Officer is underway. The overall responsibility of safeguards would lie with GM (Solar).

7.2 Utilization of Grant

The expenditure on the development of the solar-wind with storage project will mainly constitute (a) solar power generation assets, (b) wind power generation assets, (c) energy storage assets and (d) interconnection upto pooling substation. CTF grant is available for the energy storage portion. SECI, responsible for development of the project, shall endeavour to optimize the total expenditure to be made for the development of the project, such that the power generated by the project is low and competitive.

7.3 Grievance Redressal Mechanism

Effective environmental grievance redressal mechanism gives an opportunity to the

organization to implement a set of specific measures to ensure good governance accountability and transparency in managing and mitigation of environmental and social issue of a particular project. This consists of defining the process for recording/receiving complaints and their redressal in respect of environmental and social matters.

An integrated system will be established with Grievance Redressal Cell (GRCs), with necessary officers, officials and systems, at the state as well as SECI. Grievances if any, may be submitted through various mediums, including in person, in written form to a noted address, e-mail, or through direct calls to concerned officials. The Social and Environmental Expert in the concerned agency shall be responsible for coordination of grievance/complaints received.

(a) Grievance redressal through web based mechanism

In case of grievances received through toll free number or web based system, a person will be made in-charge of screening and resolution of the same/communicating with the concerned divisions for resolution of the same. The person in-charge based on nature of complaint, will forward the same to the concerned official. A ticket or a unique number will be generated for all such complaints. The complainant will follow up based on that unique number. All calls and messages will be responded within two weeks. If response is not received within 15 days, the complaint will be escalated to project head. A sample template for submission of complaints on environmental and social issues of the project may be utilized as per **Annexure-X**.

Grievance Register:

It is also recommended to maintain a grievance register on action taken and disposal of grievance. A sample format for Grievance register is enclosed in **Annexure- XI.**

(b) Tier One: Site level Grievance Redressal Cell

A site level GRC will be set up that is easily accessible to the affected community. The staffing of GRC will include site level Environmental and Social officer of developer; contractor and two representatives from community / beneficiary / affected persons. The head of the cell can be a government officer not below the rank of Additional District Magistrate or a person of repute in the project area. The site level GRC should give its verdict within 15 days from the first hearing.

(c) Tier Two: Central Level Grievance Redress Cell

If the person affected is not satisfied with the verdict of the site level GRC, he or she can escalate the grievance to SECI. The General Manager (Solar) and Environmental and Social Officer of SECI will be responsible for resolving the grievance within 30 days of receiving the grievance.

(d) Tier Three: Judiciary

The aggrieved person if not satisfied with the verdict given by SECI, will have the right to approach the Judiciary. SECI will help the aggrieved person in all respects if person want to approach the judiciary.

8 MONITORING AND EVALUATION FRAMEWORK

8.1 Introduction

Environmental and Social safeguards monitoring is an essential tool to make necessary recommendations and adopt suitable control strategies so that menace of rising environmental degradation could be minimized and a relief be extended to the people including labours in case of any damage caused under occupational health hazards. The monitoring is necessary for the following reasons:

- To see what impacts have occurred;
- To evaluate the performance of mitigation measures proposed in the ESMF;
- To ensure that the conditions of approval are adhered to;
- To suggest improvements in management plan, if required;
- To see that benefits expected from the implementation of safeguard measures are achieved as the project proceeds; and
- To satisfy the legal and community obligations

Monitoring and evaluation is primarily required to ensure proper and timely implementation of environmental and social mitigation measures identified in the planning stage, based on the ESMF. Monitoring at regular intervals during implementation and for a specified period in the post implementation stages is necessary to identify and implement any change / improvement needed in the execution of the activity or in the mitigation measures. A monitoring and evaluation cell may be created at State level under the supervision of an official familiar with environmental and social issues of the sub-projects. He may be given suitable training if needed. In specific situations, one may consider appointing external agencies to carry out the monitoring and evaluation activities and report to the supervising official. The indicators to be monitored can be framed from the ESMF taking into consideration the activities involved. A list of indicators for monitoring and evaluation in the implementation and post implementation stages is given in the following section.

The physical, biological and social components, which are significant in affecting the environment as well as society, have been suggested as Performance Indicators. The following specific environmental parameters can be qualitatively measured and compared over a period of time and therefore selected as Performance Indicators for monitoring due to their regulatory importance and the availability of standardized procedures and relevant expertise.

- Environmental Performance Indicators
    - Soil contamination & Erosion indices
    - Air quality
    - Water quality
    - Noise levels around sensitive locations
    - Restoration of borrow pits
    - Construction camp management
    - Debris Clearance and disposal
    - Safety Aspects
    - Site Restoration
- Socioeconomic Performance Indicators:
- Employment of local population
- Labour standards at camp
- R&R Components:
    - Livelihood Restoration
    - Livelihood training
    - Change in Income
- Gender Issues:
    - Women employment (%)
    - Wages

8.2 Monitoring of Environmental Performance Indicator

(a) Monitoring of Statutory compliance:

The status of necessary permits and licenses including their renewals will be monitoring for each project to assess the statutory compliances.

(b) Air Quality (AAQ) Monitoring

Ambient air quality parameters which are recommended for monitoring of are PM_{10} (Particulate Matter having less than 10-micron size) or $PM_{2.5}$ (Particulate Matter having less than 2.5-

micron size), Sulphur Dioxide (SO_2), Oxides of Nitrogen (NOx) and Carbon Monoxide (CO) and Hydrocarbon (HC). These parameters are to be monitored at project construction and allied sites before commencement of work to compare the data with National Ambient Air Quality (NAAQ) Standards 2009.

(c) Ambient Noise Monitoring

The measurement for monitoring the noise levels to be carried out at the work site and near habitation area if any in accordance to the Ambient Noise Standards formulated by Central Pollution Control Board (CPCB). Sound pressure level would be monitored on twenty-four hourly basis. Noise shall be recorded at "A" weighted frequency using digitized noise monitoring instrument. The equivalent Noise Level will be recorded for comparison with prescribed limit.

(d) Water Quality

Water quality of local water body/ stream within or adjacent to the project site that is used by local community shall be monitored on downstream of the works and dumping area. The physical and chemical parameters recommended for analysis of water quality are pH, turbidity, total solids, total suspended solids, total dissolved solids, COD, BOD, DO, Oil and Grease, Iron, heavy metals, pathogens etc. Monitoring parameters will be as per as per CPCB Guidelines for used based surface water classification.

(e) Soil Quality

The soil quality of the surrounded fields close to the project and disposal site will be monitored to understand the impact of soil quality. The physio-chemical parameters recommended for analysis are physical Parameter: Soil Texture, Grain Size, Gravel, Sand, Silt and Clay and Chemical Parameter: pH, Conductivity, Calcium, Magnesium, Sodium, Nitrogen and Absorption Ratio, heavy metal, pesticides, etc.

(f) Erosion Control Measures:

Visual inspection of vulnerable locations such as embankment slopes, borrow areas, etc. will be carried out on periodical basis, especially before and after monsoon.

(g) Debris clearance and disposal

The contractor has to clear the debris material from all the site of activities on regular basis and the same will required to be disposed off at approved disposal sites. To ensure regular clearance and disposal of debris the monitoring will be required for the same. Visual monitoring of the site will be carried out on periodical basis especially in the section which is completed.

(h) Site Restoration

The restoration of all the temporary sites utilized for construction such as borrow areas, stock

yards, camp site, etc. will be monitored after completion of works to monitored restoration works to the satisfactory level before issuing completion certificate.

(i) Safety Aspects:

Visual inspection of safety at site is required to be checked on day to day basis by the site supervisor/ Engineer. The parameters to be checked on daily basis are:

- Number of laborer's working at site
- Number of PPEs used by the Labourers
- Safe access to worksite and safe working platform
- First Aid Kit

Apart from monitoring of above safety parameters the Record safety training for workers, Safety register, First Aid Register, incidence report are required to be checked on monthly basis

8.3 Monitoring of Socio-economic Performance Indicators

(a) Employment of local population:

Percentage of local and migrant labour engaged for different works will be assessed by checklist method on monthly basis to indicate total employment generated verses local employment of labourers.

(b) Labour standards at campsite:

Labour camps are provided by the contractors for their migrant labours including operators. The labour standards at campsite with respect to basic facilities provided to the labour at the labour camp and their maintenance will be checked visually on monthly basis through checklist method.

(c) Livelihood Restoration

In the project where displacement of population is involved, following components will be monitored on periodic basis. The major impacts associated with the displacement are livelihood loss which is required to be restored for the affected population. The following indicators will be monitored on periodical basis:

- Livelihood training
- Change in Income

(d) ESMF Monitoring Action Plan

The monitoring action plan covering various performance indicators, frequency and institutional arrangements of the project in the construction and operation stages is given in

the **Table 8.1**

Table 8-1: Monitoring Plan for Performance Indicators on ESMF Compliance

S. No	Environment & Social Parameters	Performance Indicators	Implementing Agency	Monitoring Agency	Frequency
1.	**Compliance to Statutory Norms**	Labour License	Contractor	Implementing Agency (IA) /SPPD	Quarterly
		Statutory permission for Borrow area (If the Contractor operate their own new borrow area)			
		Statutory permission for stone quarry (If the Contractor operate their own new stone quarry)			
		Explosive permit (In the project involving blasting)			
2.	**Air Quality**	Particulate matters PM10 and PM2.5, Oxides of Sulphur (SOx), Oxides of Nitrogen (NOx), Carbon Monoxide (CO) Hydrocarbon (HC)	Contractor through Approved Environmental Laboratory	IA	Quarterly
2.	**Noise Quality**	Leq Day and Night	Contractor through Approved Environmental Laboratory	IA	Quarterly

S. No	Environment & Social Parameters	Performance Indicators	Implementing Agency	Monitoring Agency	Frequency
3.	**Water Quality**	Suspended Solids (SS), Total dissolved solids (TDS), oil, grease, Heavy metals (Fe, Cr, Pb, etc) Biological Oxygen Demand (BOD), Total coliforms, Faecal coliforms	Contractor through Approved Environmental Laboratory	IA	Quarterly
4.	**Soil Quality**	Oil and grease, Heavy metals (Pb, Cr, Ni, Mn, Fe, etc.), N.P.K.	Contractor through Approved Environmental Laboratory	IA	Quarterly
5.	**Personnel Safety**	Total supply of PPEs vs number of workers working Number of workers working using PPEs Safe access Safe working platform for work site	Contractor	IA	Daily
6.	**Labour Standards**	Basic Facilities at labour camp	Contractor	IA and SPMU	Monthly
7.	**Site Restoration**	Visual Observation of Allied sites including plant site, borrow area, camp site	Contractor	IA	After completion of works & before demobilization of the contractor

S. No	Environment & Social Parameters	Performance Indicators	Implementing Agency	Monitoring Agency	Frequency
8.	**Debris Management**	Removal of debris from site (visual Observation)	Contractor	IA	After completion of works & before issuing completion certificate
9.	**Livelihood**	a. Number of people losing b. livelihood c.No. of women Headed Household d. Training for eligible persons	IA	IA Through third party	Before commencement of construction
10.	**Gender issues**	e. Percentage of women labours engaged f. Wages	IA	IA	Monthly
• **During Operation Stage**					
11.	**Ecological Issue**	g. Bird collision survey	IA through Expert	SECI	Quarterly during operation stage
12.	**Ground water level**	h. Monitoring of ground water level fluctuation	IA through External Agency	SECI	Yearly
13.	**Soil Quality**	i. Oil and grease, Heavy metals (Pb, Cr, Ni, Mn, Fe, etc.), N.P.K.	Contractor through Approved Environmental Laboratory	IA	Half yearly

(e) Monitoring Budget

A monitoring budget has been drawn up considering various environmental and social components. This provides cost for different mitigation measures of likely environmental/social impacts at sub-project level. Cost for environmental enhancement measures and monitoring

has also been included. The detailed budget is provided In **Table 8-2**

Table 8-2 Environmental and Social Monitoring Budget (Based on Current Market Estimates)

COMPONENT	ITEM	UNIT	UNIT COST (Rs.)	QUANTIT Y
(A) Mitigation Costs				
Air (dust suppression)	Dust Suppression with sprinkling of water, covers of the vehicles transporting construction material	Pert Tanker of 15000-20000 liters	1200-1600	Site Specific
(B) Monitoring Cost				
Ambient Air quality monitoring (during Construction Stage)	Quarterly Ambient air quality monitoring during construction period	Per sample	12000	Site Specific
Surface Water quality monitoring (during Construction Stage)	Quarterly Surface water quality monitoring during implementation period	Per sample	8000	Site specific
Ambient noise level monitoring (during Construction Stage)	Quarterly ambient noise level monitoring during implementation period near Gen-set/ batching plant	Per sample	4000	Site specific
Surface Water quality monitoring (during Operation stage	Surface water quality monitoring twice a year for three years	Per sample	8000	Site specific
Ambient noise level monitoring (during Operation stage)	Ambient noise level monitoring twice a year for three years	Per sample	4000	Site specific

COMPONENT	ITEM	UNIT	UNIT COST (Rs.)	QUANTITY
Soil quality	Oil and grease, Heavy metals (Pb, Cr, Ni, Mn, Fe, etc.), N.P.K.	Per Sample	8000	Near storage area
Ground water level monitoring	Ground water level	Lump Sum	500000	Project site near boring once in a year
(D) R & R Cost				
Included in R&R Framework				
Training on ESMP	Once in a year	Lump Sum	300000	-

(f) Monitoring and Reporting

SECI, through the EPC/O&M contractors, will monitor the project to ensure conformity to the requirements of the ESMF. The monitoring will cover all stages of planning and implementation. The monitoring will be carried out through the (a) environmental and social safeguard compliance reports that will form a part of Monthly Progress Reports (MPR) for the project, and (b) regular visits by the environmental and social specialists of SECI.

SECI will review these evaluation reports and identify technical, managerial, policy or regulatory issues with regards to the compliance of the RAP reports. The identified technical issues will be duly incorporated. Policy and regulatory issues will be debated internally by SECI and the need for appropriate interventions will be determined. These interventions could include appropriate revision of ESMF document / R&R Policy in consultation with the Bank or suitable analytical studies to influence policy or programs of the state, if found necessary / warranted.

An external evaluation of the RAP implementation prepared for the project will also be undertaken twice during the implementation of the project – mid-term and at the end of the implementation as per the terms of reference. During implementation, meetings will be organized by SECI inviting all stakeholders for providing information on the progress of the project work.

Project monitoring will be the responsibility of EPC contractor who will submit Monthly Progress Reports to SECI. The reports will compare the progress of the project to targets set up at the commencement of the project.

Tables 8.3 below present the Mitigation, Monitoring, Responsibility and Timeline for Environmental and Social Impacts

Table 8-3 Monitoring and Reporting

S. No.	Impact / Issues	Monitoring Measures	Responsible Agency
Environmental Indicators			
1	Handling / disposal of defected PV panels	Number of panels defective / number of panels replaced	EPC / O&M contractor
2	Extent of wash water reuse / recycling	Water used on a monthly basis / wash water recycled on a monthly basis	EPC / O&M contractor
3	Regulatory Compliance	Quarterly and annual compliance reports submitted to the regulatory authority / Park Developer	EPC / O&M contractor
4	Disposal of Batteries	Number of batteries disposed / new installed	EPC / O&M contractor
Social Indicators			
1	Land acquisition	Regular internal monitoring by the Park Developer and periodic evaluation	Park Developer
2	Acquisition of house/ structure	Regular internal monitoring by the Park Developer and periodic evaluation	Park Developer
3	Loss of livelihood or source of livelihood	Regular internal monitoring by Park Developer; midterm and end term evaluation	Park Developer
4	Loss of access to private and / or common property	Regular internal monitoring by Park Developer; midterm and end term evaluation	Park Developer
5	Displacement of Non-Titleholders	Regular internal monitoring by the Park Developer; midterm and end term evaluation	Park Developer
6	IPDP (If applicable)	Regular internal monitoring by the social development professional of SECI. Mid-term and end-term evaluation	Park Developer
7	Gender Action Plan	Regular internal monitoring by the social development professional of SECI. Mid-term and end-term evaluation	Park Developer

The list of above mentioned impact performance indicators will be used to monitor project objectives as depicted in table below along with the milestones.

Milestones	Objectives	Process	Responsibility	Decision/Target /Deliverable
i. **Project Appraisal**	To ensure satisfactory compliance with ESMF	Detailed appraisal (including EIA & EMP, RAP, GAP and IPDP where relevant), including site visits/ investigations if necessary assess suitability of site, adequacy of safeguard measures, risk analysis and regulatory clearances).	SECI	Review report and decide to - accept - accept with modifications - reject and instruct to resubmit
i. Implementation of EMP, RAP, GAP and IPDP Monitoring and Review	Ensure Implementation of agreed RAP, GAP and IPDP where applicable)	a. Prepare quarterly progress reports b. Schedule field visits as required c. Mid-term and end-term evaluation	SECI	Quarterly Progress Report

The assessment methodology and the expected outputs for the various stages of implementation process are given in **Annexure XIII**.

The terms of reference for concurrent monitoring & evaluation is given in **Annexure XIV**.

9 ENVIRONMENTAL AND SOCIAL MANAGEMENT BUDGET

The project will have its budget for implementation of EMP, RAP and IPDP. Most of the cost heads would be included within the hybrid power park charges on account of the project. The budget heads for planning and pre-construction stage will include cost towards

Compensation for immovable properties;

- R&R assistances;
- Implementation of labour management plan
- Cost towards relocation facilities if required;
- Training and capacity building;
- Implementation arrangement;
- Monitoring and evaluation and
- Cost incurred for day to day expenses on R&R issues.
- Environmental & Social plan preparation

The budget heads for construction and O&M stage will include cost towards

- Waste Water treatment and reuse
- Personal protective equipment
- Health & Safety
- Hazardous material handling, transportation & disposal

The sample budget format is as under:

Table 9-1: Estimated Costs for Resettlement Action Plan (RAP) as per Entitlement of Provisions of ESMF under SECI

Sl No.	Items	Unit	Quantity	Unit Rate (in INR)	Amount (in INR)
1	Implementation of EMP				
1	Land compensation	Acre			
2	Assistance for Vulnerable	Nos.			

	Families (as per EM)				
3	Training Assistance to PAPs (as per EM)	No. of families			
4	Hiring of agency for M & E of RAP and GAP implementation				
5	GRC establishment and operations	-			
6	Awareness Generation and continued consultation				
7	Livelihood and Capacity Building trainings	Eligible PAPs			
8	External Monitoring and Evaluation				
9	RAP Implementation Agency				
	Sub-Total				
10	Contingency @ 2 % of Total Cost				
	G.Total				

10 CAPACITY BUILDING REQUIREMENTS / ACTIVITIES

The Solar Energy Corporation of India is overall responsible for safeguards compliance. SECI will be supported by developers and contractors. Given that SECI is implementing a World Bank-financed project for the first time, the capacity to address environmental, social and cultural issues as per the World Bank safeguards policies is limited. To this end, SECI has already hired an experienced Environmental and Social Development Specialist to coordinate, review, support and monitor all respective safeguards aspects of the project. The specialist will also train and strengthen the capacities of specialists with the developers and contractors. SECI will also hire qualified civil society organizations for the implementation of a RAP as required.

Staff members of SECI, developer and contractor involved in the project will also continue to receive training in the management of safeguards issues. The training program is to be coordinated and anchored by the SECI with support from agencies/individuals experienced in safeguard aspects of renewable energy infrastructure investments for developing courses on conducting training programs. The course contents focus on the project's ESMF, concept, regulatory requirements, environment and social priority issues, project cycle of investments, outline of the ESIAs, management plans and report formats. It will also focus on the resettlement and rehabilitation and procedures, land acquisition process, identification of project affected people, social entitlement frameworks, social assessment, risk assessment and management skills.

The course outline for various modules, the duration and the participation envisaged are illustrated in Table below.

In addition to the above, SECI program will continue to mainstream the environmental and social issues within the solar programs. The program will be structured in such a way that it clearly brings out the value addition and enhancement benefits of proper management of environmental and social issues.

Table 10-1 - Capacity Strengthening Plan

Modules	Content	Duration	Participants
ESMF	Project Concept ESMF Concept Regulatory Requirements E&S Priority Issues	Half a day To be repeated every alternate year	Staff of: SECI / Developer / Contractor

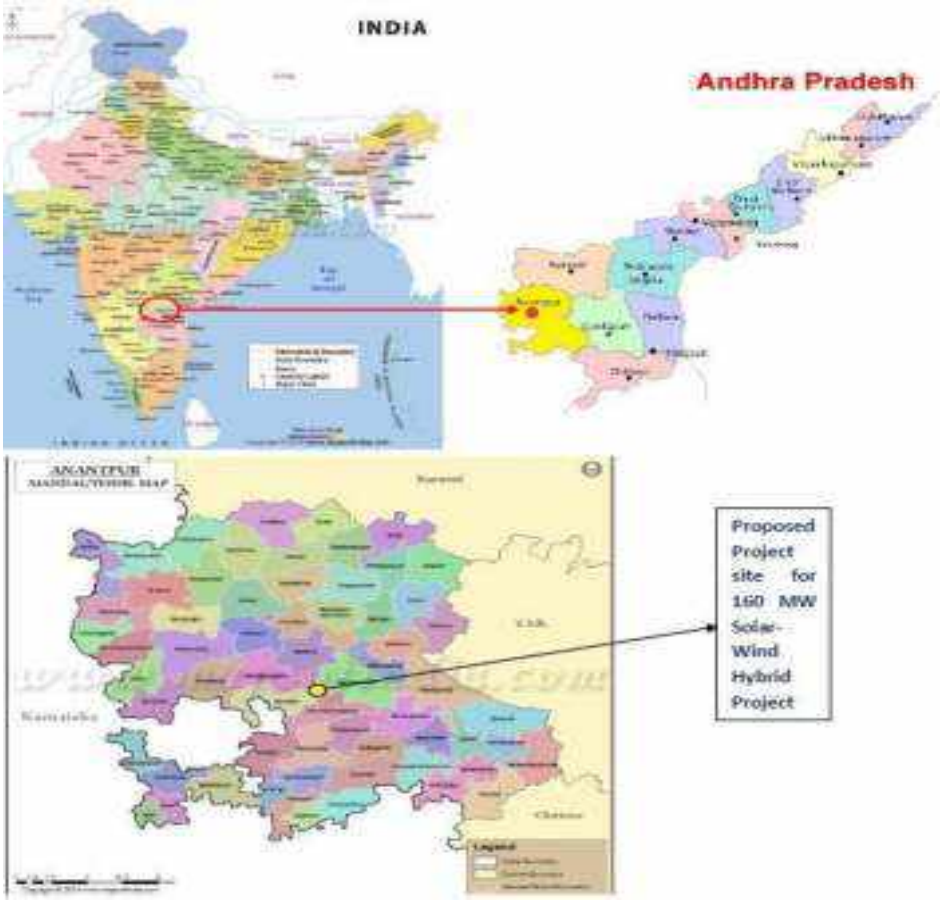
	Subproject types ESIA Process Outline Reporting		
Environmental Assessment Process	Environmental Laws & Regulations EIA process Identification of Environmental Impacts Impact Identification Methods Identification Mitigation Measures Formulation of Environmental Management Plan Implementation and Monitoring Institutional Mechanism	Full day class room training. Half a day field training.	
Social Assessment Process	Social Assessment process Description of project; RPF, gender frameworks; and National regulatory frameworks LA process Necessity for RAP/ ARAP, Gender plan and its preparation process Labour management plans Implementation and Monitoring Institutional Mechanism Grievance Mechanism	Half a day class room training. Half a day field training.	

ANNEXURE-I Anantapur Hybrid Park (Baseline)

Baseline Environmental and Social Status of Solar-Wind Hybrid Project, Ramagiri, Anantapur, Andhra Pradesh: (For reference purpose only)

Location Characteristics:

The proposed project area is located in Ramagiri and Muthavakuntla village, Anathapuramu district in the Rayalaseema region of Andhra Pradesh, India. The geographical location of the proposed solar-Wind Hybrid park project site is 14°21'29.7" N latitude and77°31'18.9" E longitude. –The proposed site located in Anantapur district of Andhra Pradesh (A.P). It is the largest district of Andhra Pradesh spanning an area of 19,130 square kilometres. It is bounded on the north by Kurnool District, on the east by Kadapa District, on the southeast by Chittoor District, and on the southwest and west by Karnataka state. The project is located 10 km away from National Highway no 44 (AH43).



Physiography and Soil:

Geomorphologically, Anantapur district forms the northern extension of Mysore Plateau. Northern and central portions of the Anantapur district are a high plateau, generally undulating, with large granite rocks or low hill ranges rising occasionally above its surface. In the southern portion of the district the surface is more hilly, the plateau there rising to 610 m above the sea. The project area has undulated terrain with elevation varying from 470 m to 517 m amsl. The land is uncultivated land. The project and have thin layer of soil over rocky strata. The soil in the project area is predominantly red gravely soil and black soil. The area lies over zone IV of seismic region, which is considered as stable zone.

Drainage Pattern and Water Bodies:

The Anantapur district is drained by six rivers namely Penna, Chithravathi, Vedavathi, Papagni, Swarnamukhi, and Thadakaleru. The area around the project is mainly drained by project area dendritic drainage pattern is observed at the project area. There are 6-7 local drains/streams spotted in the project area which carry water only during rains. There is one natural tank in Mutafacient village which is rainfed and stores water throughout the year. In this tank 3 of the drains converge.

Climatic Characteristics:

The area fall under has a semi-arid climatic zone of India with hot and dry conditions for most of the year. Summers start in late February and peak in May with average high temperatures around 37 °C. Monsoon starts in September and lasts until early November with about 250 mm of precipitation. A dry and mild winter starts in late November and lasts until early February; with little humidity and average temperatures in the 22–23 °C. Total annual rainfall is about 535 mm. The average annual rainfall of the district is 535 mm, September and October are the wettest months of the year. The mean seasonal rainfall distribution is 316 mm during southwest monsoon (June-September)

Groundwater characteristics:

The ground water is used for drinking, irrigation and other domestic purpose around the project area. The area falls under semi-critical zone and the water table varied between 60m to 100m below the ground level. The ground water contains high TDS and hardness.

Environmental Quality:

The proposed project area is away from habitation area and there are no significant human activities around the project area. There is no any industrial establishment around the project area. Due to lack of human activities around the project area, the environmental quality in general is fairly good.

Ecological Features:

The topography of the proposed site is undulated plateau with scanty vegetation. Mainly bushy vegetation is observed in the area. Cymbopogon procerus (Boda Grass), a species commonly used for cattle fodder is predominantly spotted in the project area. Beside that dispersed growth of plant species like Acacia catechu, Prosopis juliflora, Acacia nilotica, Cassia auriculata, Agave Americana, Palm tree etc. are also spotted. Spotted deers and black bucks are spotted around the project area which roam around for the fodder. The reptiles and hare are also seen around the land. The project area does not encounter any migratory route for wild animals and birds as confirmed by the Local forest Office. The area does not fall in migratory route of birds.

Two Reserve Forest patches i.e. Ramagiri West RF (at 1.4 Km distance) and Ramagiri East RF (at 3.5 km Distance) is located at south-west and North-East side of proposed project site respectively.

No notified Protected Area (under Wildlife Protection Act, 1972) such as Wildlife Sanctuary, national parks, tiger reserves, Bird Sanctuary etc. is located in and around the project area within 10 Km radius of the proposed project site.

There is no any archaeological site, protected/ historical monument within 10 Km radius of the project area.

Socio-economic Environment:

Although the project area falls in the extent of revenue village Ramagiri (Mandal - Ramagiri) and Mutafacient (Mandal - Kanaganapalle) of Anantapur District of Andhra Pradesh State, there is no settlement in the vicinity of the project area. The nearest settlement is Ramagiri village which is about 200 m away from south west boundary. The other settlements areas are Talimadugula, Balepalyam, Konapuram, Ramagiri, Mutafacient located within 5 Km radius of the project area.

Nearest Railhead from the site location is Dharmavaram (31 Km) and the nearest Airport is Bangalore (187 Km). The district headquarter Anantapur is located about 61 Km away from proposed site.

State Profile: Andhra Pradesh

Andhra Pradesh is one of India's Southern states and is situated on the south-eastern coast of the country. Also known as the Rice Bowl of India, because of being one of the highest producers of rice in the state. The population of Andhra Pradesh as per Census 2011, before the formation of Telangana as a separate state was 84,580,777 of which male and female are 42,442,146 and 42,138,631 respectively. In 2001, total population was 76,210,007 in which males were 38,527,413while females were 37,682,594. The total population growth in this

decade was 10.98 percent while in previous decade it was 13.86 percent. The population of Andhra Pradesh forms 6.99 percent of India in 2011. In 2001, the figure was 7.41 percent. The state covered an area of 275,045 sq. km before formation of Telangana. But now, the state is spread across 160,205 sq. km and has a population of 49,378,776. Following Table depicts details about the districts of the state:

S No.	District	Population (Census 2011)	Sex Ratio (per 1000)	Average Literacy
1	Anantapur	4,081,148	977	63.57%
2	Chittoor	4,174,064	997	71.53%
3	East Godavari	5,154,296	1006	70.99%
4	Guntur	4,887,813	1003	67.4%
5	Krishna	4,517,398	992	73.74%
6	Kurnool	4,053,463	988	59.97%
7	Prakasam	3,397,448	981	63.08%
8	Sri Potti Sriramulu Nellore	2,963,557	985	68.9%
9	Srikakulam	2,703,114	1015	61.74%
10	Visakhapatnam	4,290,589	1006	66.91%
11	Vizianagaram	2,344,474	1019	58.89%
12	West Godavari	3,936,966	1004	74.63%
13	YSR (Kadapa)	2,882,469	985	67.3%

Source: Census of India, 2011

District Profile: Anantapur

The district has five divisions namely Anantapur, Dharmavaram, Kadiri, Kalyandurga and Penukonda divisions. These revenue divisions are further classified into 63 mandals.

Anantapur district stands 1st position in terms of area with 19,130 Sq. Kms. and ranks 7th in terms of population with 40,81,148 persons in the State. Project district stands 7th in terms of urban area with 376.89 Sq. Kms. and ranks 9th in terms of urban population with 11,45,711 persons in the State while it stands 1st in terms of rural area with 18,753.11 Sq. Kms. and ranks 6th in terms of rural population with 29,35,437 persons in the State.

Project Influence Area

The proposed project is covering 20 Census villages of Ramagiri and Kanaganapalle Mandal of District Anantapur (Andhra Pradesh). The study area for this proposed project has been considered both the Mandal of the project area. Further, to achieve an informative result the total area has been segregated into two different mandals namely Ramagiri and Kanaganapalle.

(I) Demographic Profile of the Study Area

The study area for the project has been considered as 5 km radius of the proposed solar-wind hybrid park. The demographic profile around the project area has been consolidated for all the villages falling within 5 Km radius of the project area.

Table: Demographic Profile of the Study Area

S. No.	Name of Villages	HH	Population			Literates			Main Workers			Marginal Workers			Non Workers		
			Total	M	F	Total	M	F	Total	M	F	Total	M	F	Total	M	F
Ramagiri Mondal																	
1.	Perur	1752	7234	3652	3582	3922	2276	1646	3341	1993	1348	369	131	238	3524	1528	1996
2.	Makkinavaripalle	92	371	190	181	207	131	76	196	98	98	6	2	4	169	90	79
3.	Kondapuram	338	1543	781	762	836	499	337	721	419	302	153	28	125	669	334	335
4.	Motarchintalapalle	1095	4868	2500	2368	2630	1558	1072	2198	1395	803	652	108	544	2018	997	1021
5.	Nasanakota	1528	6482	3275	3207	3232	1913	1319	2602	1605	997	606	305	301	3274	1365	1909
6.	Ramagiri	865	3778	1933	1845	2093	1246	847	1177	866	311	674	261	413	1927	806	1121
7.	Ganthimarri	554	2210	1165	1045	1158	741	417	871	525	346	394	146	248	945	494	451
8.	Kuntimaddi	823	3271	1688	1583	1633	977	656	1484	886	598	423	168	255	1364	634	730
9.	Seshadribhatra Halli	201	856	458	398	420	277	143	526	281	245	5	0	5	325	177	148
10.	Polepalle	815	3388	1722	1666	1960	1122	838	1219	818	401	507	139	368	1662	765	897

S. No.	Name of Villages	HH	Population			Literates			Main Workers			Marginal Workers			Non Workers		
			Total	M	F	Total	M	F	Total	M	F	Total	M	F	Total	M	F
Sub-Total		**8063**	**34001**	**17364**	**16637**	**18091**	**10740**	**7351**	**14335**	**8886**	**5449**	**3789**	**1288**	**2501**	**15877**	**7190**	**8687**
Ramagiri Mondal																	
1.	Thumucherla	1090	4515	2319	2196	2124	1234	890	2253	1292	961	465	145	320	1797	882	915
2.	Thogarakunta	964	4059	2088	1971	2213	1328	885	1777	1055	722	458	167	291	1824	866	958
3.	Maddalacheruvu	1497	6426	3280	3146	3326	1938	1388	2647	1479	1168	1022	422	600	2757	1379	1378
4.	Konetinayanipalyam	683	2820	1478	1342	1565	932	633	1294	801	493	18	7	11	1508	670	838
5.	Narasampalle	370	1562	808	754	863	510	353	575	361	214	290	111	179	697	336	361
6.	Elakkuntla	733	3094	1577	1517	1681	997	684	982	613	369	841	330	511	1271	634	637
7.	Muthavakuntla	601	2634	1376	1258	1397	826	571	1278	713	565	292	112	180	1064	551	513
8.	Kanaganapalle	1702	6965	3647	3318	3755	2288	1467	2948	1738	1210	721	257	464	3296	1652	1644
9.	Mukthapuram	985	4093	2136	1957	2369	1440	929	1919	1086	833	394	161	233	1780	889	891

S. No.	Name of Villages	HH	Population			Literates			Main Workers			Marginal Workers			Non Workers		
			Total	M	F	Total	M	F	Total	M	F	Total	M	F	Total	M	F
10.	Dadalur	856	3505	1820	1685	1837	1112	725	1298	853	445	447	154	293	1760	813	947
Sub-Total		9481	39673	20529	19144	21130	12605	8525	16971	9991	6980	4948	1866	3082	17754	8672	9082
G. Total		**17544**	**73674**	**37893**	**35781**	**39221**	**23345**	**15876**	**31306**	**18877**	**12429**	**8737**	**3154**	**5583**	**33631**	**15862**	**17769**

Source: Census of India, 2011

Baseline Data of the Study Area

In the table below an attempt has been made to provide salient features of socio-economic features of the study area:

Table: Demography, Literacy and Occupational details of people living in Study Area

S. No.	Description	Number	% to total
1	**Total Population - Gender wise**	73,674	100
	Male	37,893	51.43
	Female	35,781	48.57
	Sex ratio (No. of females per 1000 males)	944	
2	**Total Population (0-6 years) - Gender wise**	7,899	100.00
	Male	4,191	53.06
	Female	3,708	46.94
	Sex ratio (No. of females per 1000 males)	885	
3	**Total Population (Sector Wise)**	73,674	100
	Rural	73,674	100
	Urban	0	0
4	**Total no. of households**	17,544	-
	Average House hold size	4	-
	Lowest Household size	4	-
	Highest Household size	5	-
5	**Total SC & ST Population**	16,597	22.53
	Total Population (SC)	13,861	18.81

S. No.	Description	Number	% to total
	Total Population (ST)	2,736	3.71
6	**Total Literates – Gender wise**	39,221	53.24
	Male Literacy (with respect to the male population)	23,345	61.61
	Female Literacy (with respect to the female population)	15,876	44.37
	Literacy gap between male and female	-	17.24
7	**Total Literates – Sector wise**	47,524	--
	Rural (Number and % to total literates)	47,524	100
	Urban (Number and % to total literates)	0	0
9	**Total Workers & Work Participation Rate**	40,043	54.35
	Male (Number and % with respect to the male population)	22,031	58.14
	Female (Number and % with respect to the female population)	18,012	50.34
	Gender gap in workforce (in percentage)	-	7.80
10	**Total Main Workers & percentage to total worker**	31,306	78.18
	Male (Number and % with respect to the male working population)	18,877	85.68
	Female (Number and % with respect to the female working population)	12,429	69.00
a)	Main Worker as Cultivator (Number and Percentage)	11,905	38.03
b)	Main Worker as Agricultural Labour (Number and Percentage)	14,306	45.70
c)	Main Worker as Household Industry Worker (Number and Percentage)	628	2.01
d)	Main Worker as Other workers (Number and Percentage)	533	1.70

S. No.	Description	Number	% to total
11	**Total Marginal Workers & percentage to total worker**	8,737	39.66
	Male (Number and % with respect to the male working population)	3,154	17.51
	Female (Number and % with respect to the female working population)	5,583	46.90
a)	Marginal Worker as Cultivator (Number and Percentage)	953	10.91
b)	Marginal Worker as Agricultural Labour (Number and Percentage)	6,908	79.07
c)	Marginal Worker as Household Industry Worker (Number and Percentage)	149	1.71
d)	Marginal Worker as Other workers (Number and Percentage)	727	8.32
12	**Number and Percentage of Marginal Worker (3-6 Months)**	8,180	93.62
13	**Number and Percentage of Marginal Worker (0-3 Months)**	557	6.38

Demographic Composition

Population:

According to Census of India 2011, the total population of the study area is 73,674 in which 51.43% are males and 48.57% are females. An average gender ratio of the study area is approx. 944 females per 1000 males, which is much better than national average of 933 females per 1000 males. Total study area comes under rural settlement. Approx. 10.72% of the total population belongs to 0-6 age group. The sex ratio of this age group is 885 female children per 1000 male children, which is much below than average sex ratio of the study area. The break-up of population data for the study area is given in Table.

Households and Household Size:

The entire population of the study area has been grouped into 17,544 households and the average size of household is approx. 4 persons/ household.

During site visit it was observed and noted that most of the houses of the study area are semi-pucca and approximately 21% are kachcha houses. Nearly every respondent reported that they were living in their own houses. The area of the house structure was varying from 300-

600 square metres. Approx. 35% households have toilet facility but 75% people of the study area defecate outside due to lack of water.

Mandal-wise break up of Population in Study Area

S. No.	Study Area	House-holds	House hold Size	Population				Population (06 years)			
				Total	M	F	Gender Ratio	Total	M	F	Gender Ratio
1	Ramagiri	8063	4.22	34001	17364	16637	958	4255	2267	1988	877
2	Kanaganapalle	9481	4.18	39673	20529	19144	933	3644	1924	1720	894
Total		**17544**	**4.20**	**73674**	**37893**	**35781**	**1891**	**7899**	**4191**	**3708**	**885**

Source: *Census of India, 2011*

With reference to the Tables above, approx. 18.81% of the total population of the study area belongs to Schedule Caste and Schedule Tribes. Among the total population, Scheduled Caste constitutes of 15.10% and 3.71% belongs to Schedule Tribe community. Reddy, Rao, Vaishya, Chaudhari, Setty, Rao, Lingabaleja etc. are comes under general category (O.C.); Kurma, Valamiki, Boya, Pinjari, Dudekula, Yadaya, Kurva, Kumbari, Golla, Dukula, Chakali, Mangala, Wadde, Uppare etc. comes under Backward Caste (B.C.); Madiga, Mala, Harizana, Dasari etc. comes under Schedule Caste (SC) and Yerukala, Nayak comes under Scheduled Tribes of social group in the study area. As per primary survey, standard of life of people of the study area is below average. Though the composition of the people of higher caste (approx. 10% as per our site visit observation) is very low but they are dominating to the whole society. Approx. 70% people come under Backward Caste (B.C.).

The population composition of SC is 15.10% and ST is 3.71% in the villages of study area and they come under vulnerable groups of family. Their livelihood depends on agriculture and agricultural labour. None of the SC/ST family is directly affected due land procurement process. During construction period, they will be given employment opportunity and in PARK Developer's CSR activity skill development training will be provided to them on the basis of their hobbies and employment opportunity in the region.

The break up distribution of scheduled caste and scheduled tribe population in the project area is shown in below Table

Mandal-wise Distribution of SC and ST Population in Study Area

S. No.	Village	Schedule Caste Population				Schedule Tribe Population			
		Total	M	F	Percentage	Total	M	F	Percentage
Ramagiri Mandal									
1	Perur	1205	621	584	16.66	31	14	17	0.43
2	Makkinavaripalle	156	77	79	42.05	0	0	0	0.00
3	Kondapuram	468	231	237	30.33	0	0	0	0.00
4	Motarchintalapalle	1374	692	682	28.23	20	11	9	0.41
5	Nasanakota	2127	1066	1061	32.81	121	54	67	1.87
6	Ramagiri	644	349	295	17.05	255	128	127	6.75
7	Ganthimarri	238	127	111	10.77	0	0	0	0.00
8	Kuntimaddi	284	148	136	8.68	460	231	229	14.06
9	Seshadribhatra Halli	57	29	28	6.66	17	10	7	1.99

10	Polepalle	392	198	194	11.57	144	71	73	4.25
Sub-Total		6945	3538	3407	20.43	1048	519	529	3.08
Kanaganapalle Mandal									
11	Thumucherla	852	434	418	18.87	6	3	3	0.13
12	Thogarakunta	382	202	180	9.41	362	185	177	8.92
13	Maddalacheruvu	1397	727	670	21.74	557	273	284	8.67
14	Konetinayanipalyam	481	254	227	17.06	29	16	13	1.03
15	Narasampalle	324	167	157	20.74	4	1	3	0.26
16	Elakkuntla	443	212	231	14.32	2	1	1	0.06
17	Muthavakuntla	586	308	278	22.25	165	83	82	6.26
18	Kanaganapalle	976	514	462	14.01	27	14	13	0.39
19	Mukthapuram	988	493	495	24.14	36	18	18	0.88
20	Dadalur	487	236	251	13.89	500	274	226	14.27

Sub-Total	6916	3547	3369	17.43	1688	868	820	4.25
G. Total	13861	7085	6776	18.81	2736	1387	1349	3.71

Source: Census of India, 2011

Literacy and Literacy Rate:

The average literacy rate of the study area is 53.21% (18.091) in which male's literacy is 61.85% with respect to the male population as against 44.18% for females with respect to the female population, creating a gender gap of 17.67%. Though the state govt. has facilitated every village with at least Govt. Primary Schools, Upper Primary Schools and Anganwadi Centres but the quality of education in the study area is very poor. As per our observation and consultation with villagers, it was found out that most of the villagers above 50 years of age are literate but they do not have any educational certificates. In core zone, 90% of literate females are educated only up to primary level and only 8- 10% of the females are educated up to secondary levels. Dropout rates especially for girl child are very high in these villages and also in the study area. This is mostly because of poor economic conditions of the study area and less independence of women. Hence, instead of attending schools, these small girls/boys help their parents in household works, or in daily paid labour jobs. Few villagers left their houses with their family members for more than 4 to 6 month every year in search of jobs in nearby villages, towns and cities, therefore schooling education of children are affected. The break up distribution of literate population in the project area is shown in Table below

Mandal-wise Distribution of Literacy in the Study area

S. No.	Study Area	Number of Literates			Literacy Rate			
		Total	M	F	Total	M	F	Gender Gap
1	Ramagiri	18091	10740	7351	53.21	61.85	44.18	17.67
2	Kanaganapalle	21130	12605	8525	53.26	72.59	47.12	25.47
Total		39221	23345	15876	53.24	61.61	44.37	17.24

Source: Census of India, 2011

The literacy rate of the project area has been compared with the literacy rate of district, state and national level which shows that literacy rate of the study area is below than the literacy rate of the district, state and national level. This figure reflects that a little more than the half of the total population of the study area is literate. Literate people can bargain better and put interest of the community during project planning land procurement stage. Literate people can get employment opportunity during project construction and operation phase as per their skill and qualification. They can assess positive and negative impact of the project and give their suggestions during project planning and construction phase better than others.

Workers and Work Participation Rate:

The total number of workers in the study area is 40,043 and the WPR is 54.35% in which male are 58.14% with respect to the male population and females are 50.34% with respect to female population. Among the total workers 85.30% are main workers and the remaining 14.70% are marginal workers. The percentage of male in the main workers is 85.68% with respect to male working population, while it is only 14.32% in the case of marginal workers. On the other hand, the percentage share of female in the main workers is 69.00 % with respect to female working population; it is 17.51% in the case of marginal workers. As per the table below, it appears that most of the people (male & female) are engaged in main workers while in overall male workers dominate to female workers because less opportunity of work, unawareness of women rights, lack of education, lack of skill development opportunity and male dominating tradition to female workers.

Work Participation Rate of the Study area

S. No.	Category	Total	M	F
1.	Total Worker	54.35	58.14	50.34
2.	Non-Worker	45.65	41.86	49.66
Total			**100.00**	**100.00**
1.	Main Worker	78.18	85.68	69.00
2.	Marginal Worker	21.82	14.32	31.00
Total			100.00	100.00

Source: Census of India, 2011

Categorization of Main Workers on the basis of Occupation:

Following tables reflects that 45.70% of main worker are involved as agricultural labourers followed by cultivators 38.03%, household industry 2.01 % and only 1.70% are involved in other workers.

Table: Categorization of Main Workers on the basis of Occupation

S. No.	Zone	Types of Main Workers			
		Cultivators	Agricultural Labourers	Household Industrial Workers	Other Workers

		Nos.	Percentage	Nos.	Percentage	Nos.	Percentage	Nos.	Percentage
1	Ramagiri	6595	38.86	7741	45.61	308	1.81	2327	13.71
2	Kanaganapalle	5310	37.04	6565	45.80	225	1.57	2235	15.59
	Total	**11905**	**38.03**	**14306**	**45.70**	**533**	**1.70**	**4562**	**14.57**

Source: Census of India, 2011

Categorization of Marginal Workers on the basis of Occupation:

Following tables reflects that 79.07% of marginal worker are involved as agricultural labourers followed by cultivators 10/91, other workers 8.32% and only 1.71% are involved in household industry.

Table: Categorization of Marginal Workers on the basis of Occupation

S. No.	Zone	Types of Marginal Workers							
		Cultivators		Agricultural Labourers		Household Industrial Workers		Other Workers	
		Nos.	Percentage	Nos.	Percentage	Nos.	Percentage	Nos.	Percentage
1.	Ramagiri	349	7.05	4116	83.19	105	2.12	378	7.64
2.	Kanaganapalle	604	15.94	2792	73.69	44	1.16	349	9.21
Total		**953**	**10.91**	**6908**	**79.07**	**149**	**1.71**	**727**	**8.32**

Source: Census of India, 2011

Considering the work culture of the study area, it appears that most of the workers in both the category main and marginal are engaged in agricultural labourers. In the study area most of the Workers are either main/marginal agricultural labourers or cultivators or other workers. The daily paid labourers work in the nearby villages, towns or cities as agricultural labours, industry, iron ore mine or earn their livelihood by working as labourers in various construction sites/building etc.

Culture and Religion:

The field survey has revealed that majority of the persons living in the villages are Hindus with approx. 10 % of population in the study area are Muslim and Christian. Most part of the study area has been occupied by Hindus and they play a vital role in making cultural and religious activities. Out of total population in the study area, approximately 80% population are general and Backward Caste category, 20% are SC and ST. Men of the study area generally wear Lungi and kamiz/shirt, pant and shirt and women wear saris and suits. Yugadi, Dashahara, Deepawali, Sankranti, Vinayak Festival, Muharram, Eid ul Fiter, Christmassy are the main festivals celebrated by the people of the study area. They worship Lord Shiva, Anjaney, Rama, Durga and Shiva etc.

House Types:

Houses in the study area are generally semi-pacca. There are pacca and temporary types of structures have also been observed. The houses are generally made by bricks and stones. Although 35% households have facility of toilet and state government is also providing financial donation in making toilets in rural area but approximately 75% of people defecate outside due to lack of water and unawareness. Tap water supplied by village panchayat with government assistance and hand pumps are the main source of drinking water and other domestic use.

Occupation and Economy:

The main occupation of the study area is agriculture and more than 75% people depend on agriculture or as agricultural labourers. Main crops grown in the region are cotton, ground nut, onion, makka, corn etc. which depends on rain water. Few people are engaged in their paternal profession like barber, carpentry etc. There are very few opportunities of livelihood except agriculture and agricultural labours. Average land holding size of the study area is 3 to 30 acres per family. The average income of the family of the study area is INR 5,000 to 10,000 per month while the income of BPL family is < INR 5,000 per month and most part of the income is spent on food. There is requirement of skill development training so that local villagers may get more option to earn their livelihood.

Infrastructures Facilities

Roads

The study area of the proposed solar/wind power project is well connected with state highway and inter village road which are in good in good condition. The internal roads of the villages which link one village to another are also pucca and semi-pucca.

Education:

Considering the educational facilities in the study area, Govt. Primary School, Upper Primary School and Anganwadi is available in every village of core zone. Govt. Senior Secondary School is available in Aspari and Pattikonda villages. Government Degree Colleges are available in Pattikonda and Adoni. In every school and college there is facility of toilets for girls and boys separately but it is observed that it is not in a good condition. Although local panchayat provides water supply through pipeline connection but they are not good for drinking as there is a contamination of fluoride. In spite of government infrastructure facility and support (facility of mid-day meal, free books distribution and two pairs of uniform to every student) for education, the literacy rate is very poor in the study area. Although, there is support for girl child education, but it is only up to junior level. Very few people are able to provide higher education to their girl child.

Health:

As per Rural Health Statistics 2015, there are 576 sub-centres, 83 PHC, 18 CHC, 1 Sub divisional Hospital and 1 District Hospital is running in Anantapur District. In of the study area there are two governments Primary Health Centre working properly, one is in Ramagiri village and another is in Kanganapalle village. Government Community Health centre is available in Penukunda town which is 15 km. from the project site. In this hospital all the facility with advance technology is available. There are so many Private Hospitals are also working with better facility. There is no any epidemic or chronic disease have been reported in the study area during consultation with local villagers except general fever, cough, cold and bone related pains due to contamination of fluoride in ground water.

Drinking Water Facility:

As reported during consultation, there is acute shortage of water in the villages of the study area and ground water level is 400 to 500 feet. Every village, there is water tank constructed. Water is supplied for drinking and other domestic use to each house via pipe line with the assistance of government and village panchayat.

Communication:

The villages in the study area are well connected via mobile, telephone and internet. Government post office is also available in most of the village panchayat of the study area. Means of communications such as internet, telephone and television has made a vital role in changing the conservative thoughts of the people of the study area and brought awareness for development in every dimension of life.

Electricity Facility:

The study area is good in terms of electricity supply. Generally, 20 to 22 hours' electricity is available in most of the villages of the study area. Proposed 200 MW Wind power project may reduce demand-supply gap of the state. Thus, in future, power cut will be reduced. They utilize power in establishing household industry, irrigation etc. The implementation of the proposed wind power plant project will throw opportunities to local people for both direct and indirect employment. The project will provide impetus to industrialization of the area. Further, the occupational pattern of the people in the area will change making more people engaged in industries and business. With this, occupational shifting of people from tertiary sector to industry, trade and business will get going. Thus, proposed project will improve socio-economic status of the study area.

ANNEXURE II- TOR FOR ESIA CONSULTANT

Broad Scope of Work

Environmental and Social Impact Assessment (ESIA) Scope would include:

Identification and review of the applicable local, State, National and International Environmental legislation and regulatory framework;

Conduct visits to sites for the purpose of site reconnaissance and establishing study area, baseline and collecting data from the local concerned authorities.

Describe the environmental and social settings by collecting of baseline information through primary field surveys, monitoring and secondary data/documents with respect to topography, land cover, geology, geomorphology, climate, meteorology, ambient air quality, noise quality, soil quality, traffic pattern, hydrology including surface and ground water quality, Ecology-terrestrial and aquatic flora and fauna, environmental sensitive areas, archaeological resources, Socio- cultural and economic environment.

Assessing the natural resource consumption for project activities.

Prediction and identification of environmental and social impacts of the project in construction and operation phase of project followed by evaluation of significance of the predicted impacts;

Assess risks and hazards associated with the project activities, environment, health & safety.

Suggesting appropriate mitigation/ enhancement measures for identified environmental and social impacts;

Comparison and analysis of the alternatives considered for the project with respect to location and power generation technology;

Perform effective and efficient public consultation process as per requirement. Develop proper communication plan and specific actions to be taken to ensure good representation and good attendance of affected communities and stakeholders in the planned Public consultation meetings/events.

Formulation of ESIA, Environmental and Social Management Plan (ESMP), Resettlement action plan (RAP) in accordance with World Bank Safeguard Requirements with management tools and techniques including monitoring and reporting requirements for effective implementation. Develop summary reports in local languages.

Attend meetings, presentations as per requirement.

Submission of action plan/inception report, progress reports, ESIA, ESMP, RAP reports in soft and hard copies (draft and final reports).

List out the required clearances, NOCs for Project activity.

The consultant shall be responsible for supplying all the environment and social related information required by the World Bank and other agency/authority through the SECI. The consultant is also required to justify the findings in the ESIA and ESMP during the meeting with SECI, WB expert's team and any other agency/authority through SECI.

Any other scope as per requirement of Environmental and Social Impact Assessment Framework, World Bank Safeguard Requirements and project activity.

Preparation of final reports after incorporating of suggestions/comments on reports made by SECI, WB.

Objective of the Study

It is understood that Large-Scale Solar/Hybrid Projects may have Environmental and Social impacts and these impacts need to be avoided as far as possible. The impacts which cannot be avoided, needs to be mitigated or managed. The overall objective of this study is to conduct Environmental and Social Assessment (ESA) with a view to identify any critical environmental and social concerns of the subject Project and address them as an integral part of project design.

The consultant shall also confirm the extent to which regulatory clearances other than under the EIA notification are required for the proposed project including, but not limited to those listed below:

Under Green category and requires consent to establish and operate under the Water (Prevention and Control of Pollution) Act 1974 and Air (Prevention and Control of Pollution) Act 1981.

To establish the requirement of clearances from MoEFCC/CPCB/SPCB/CGWB/Any other.

Establishing clearance requirements related to the transmission lines for transfer of generated Solar power to National and State grid.

Usual clearances will be required if land acquisition is involved.

The specific objective includes:

To assess the existing status of bio-physical environment and social conditions in the study area and its vicinity (5 km radius) and to identify threats and issues which have potential to adversely impact important environmental and social features of the project influence area.

Carry out environmental and social analysis of project area in relation to activities under the project.

Analyse the various options available for ancillary facilities like water supply, with special reference to sources – whether local groundwater or water from distant sources would be used, in case of the later situation conveyance facilities will also be analyzed for impacts, drainage, access, etc. to minimize adverse impacts and enhance positive impacts, where feasible.

Identification of the project affected families; assessment of loss of land / livelihood / common property resources for people living within the proposed site. The consultants however will carry out consultations with community members in its immediate vicinity (5 km) in addition to consultations with project affected persons (PAP).

Assess impacts on the indigenous/marginalized communities within the proposed site and its immediate vicinity (5 km).

Prepare a site specific environmental and social assessment report by documenting environmental features of the project area, socio-economic and cultural status of community in and around the project site (5kM) and PAPs. This assessment should also include considerations of safety – both for the workers in the site and related facilities, as well as of nearby residents, especially those that live close to ancillary facilities like borrow areas, for instance.

To identify the environmental and social issues associated with implementation of project and develop environmental codes of practices for common activities like site preparation, installation of panels, management of waste, occupational health and safety, etc. and social exclusion list that need to be followed during various stages such as planning, construction and operation & maintenance.

To undertake consultations with potentially affected people and other community members to understand their views, obtain their input regarding environmental and social issues, and to take these into account during the preparation of the management framework and plans that would be executed before start of work at site.

To prepare an Environment and Social Management Framework (ESMF) including well-defined performance indicators for addressing the identified issues, through various activities/tasks under the proposed project, and strategy for its implementation to achieve sustainable environmental benefits.

To identify portions of the codes of practice/management framework that need to be integrated with the bidding documents to ensure that the prospective bidders are aware of what all will be required during project implementation and operation from an environmental, health and safety, as well as social perspective.

To prepare an Environmental & Social Management Plan (EMP); Resettlement Action Plan (RAP); Gender Action Plan (GAP) and /or Indigenous Peoples Development Plan (IPDP) for the mitigation/enhancement activities that is to be undertaken by SECI. The ESMP / RAP / GAP / IPDP will include the description of relevant activities, institutional responsibilities, budgetary allocations, timelines and reporting arrangements for the same.

2. Scope of Study

Project Description; Providing a Project description with focus on understanding the environmental and social setting and sensitivities for the proposed Solar power project, including an overview of the land acquisition and resettlement requirements and its impacts on indigenous peoples, if any. This would also include any related facilities that may be required (e.g., access roads within the project area, water supply arrangements, housing, raw material and Transmission lines[1] etc.). The project area of influence would also be determined on the basis of the activities involved.

Laying down Policy, legal, and administrative framework: Discussing the policy, legal and administrative framework within which the assessment is carried out, national and state specific regulations (including permits and licenses), and the World Bank's Operational Policies and Best Practices and Performance Standards. Reviewing the Social & Environmental compliance requirement with respect to the above; present an overview of *Government of India's and State Government's social policies, legislations, regulatory and administrative frameworks* in conjunction with the World Bank's safeguard policies and Performance Standards. Where gaps exist between these policies, make recommendations to bridge the gaps in the context of the proposed project.

Generating Data for Environmental and Social Assessment and Management Framework: Collection and generation of relevant social and environmental (physical, biological) data (primary & secondary) within the study area. This data should be relevant to decisions about project location, design, construction, operation, or mitigation measures.

The data generation should specifically focus on issues related to

Water- its quality, availability and adequacy vis-à-vis the requirements during different phases of the project life cycle

Land and physical environment

Physiographic characteristics

Prepare Socio-economic profile in terms of demographic characteristics, land use pattern, economic profile, occupational pattern and other socio-economic parameters.

Identify and analyze the issues of vulnerable communities and gender

Land, access requirements, land use, and involuntary resettlement

Assess the likely impacts of the sub-project, in terms of land acquisition/ transfer (loss of lands, houses, livelihood, etc.), and resultant involuntary resettlement extent and undertake the census of potential project affected people;

Based on the assessment of potential social and economic impacts, should establish criteria that will assist in the formulation of strategies; to the extent possible maximize project benefits to the local population and minimize adverse impacts of the project interventions on the affected communities;

The consultants would study the living patterns of vulnerable population (including tribal, scheduled castes, women, landless, households below poverty line, etc.) in the project area.

Identify likely loss of community assets including the religious structures and common property resources (e.g. forest, grazing land, drinking water source, etc.) within project site; the impacts of their loss on the local population, and prepare mitigation plans

Ecology or biodiversity

Physical or cultural heritage (if any)

Flooding and seismic risk

Hazardous and domestic waste management, etc.

Review of the land take/lease process to assess any legacy or current/existing issues (like informal settlers, livelihood dependence, other usage etc) on the allotted land. It will also look at current and proposed development activities within the project's area of influence, including those not directly connected to the project

Information Disclosure, Consultation and Participation: Describe the consultation and participation mechanisms adopted, including the activities undertaken to disseminate project and resettlement information during project design and engaging stakeholders. The results of consultations with affected persons, the host communities, civil society organizations and other stakeholders, raised will be summarized.

Conduct *stakeholders' consultation:* that ensures that all key stakeholders are aware of the objectives and potential environmental and social impacts of the proposed project, and that their views are summarized in a structured manner. Stakeholders' will include all those who are directly or indirectly dependent on the project site(s). Therefore, identify the key stakeholders (Government, NGOs, CSOs, Academicians, etc.) in the project area; analyze

their perspectives of the project. The analysis shall be carried out for both primary and secondary stakeholders at project level through structured discussions on the (a) importance of addressing social issues (b) impressions of past efforts, if any (c) suggestions for what to do differently in future (d) key issues (goals and safeguards) to be addressed; and

(e) issues of co-ordination and / or conflict among various stake holders. The analysis shall be summarized in a structured manner and shall clearly bring out the implications for project design.

Review of negotiated land acquisition, if any: The consultant, based on documentation provided, site visits and consultations with the affected people, will review the following processes followed for land procurement including an assessment of the adequacy of information disclosed to the landowners and the bargaining power of landowners to negotiate for fair compensation, Policies and laws (if any) that are applicable for negotiated settlements in the area, Confirmation of third party validation of the negotiations carried out, (iv) mechanisms adopted for calculating the replacement costs of land and other assets impacted, and (v) record keeping requirements of the negotiation process.

Analyzing the Alternatives: For the proposed project site compare reasonable alternatives to technology in terms of their potential social environmental impacts; the feasibility of mitigating these impacts; their capital and recurrent costs; their suitability under local conditions; and their institutional, training, and monitoring requirements. It would also state the basis for selecting the particular site and project design justifying recommended approaches to pollution prevention and abatement.

Assessing Social and Environmental Impacts and Mitigation Measures:

Assessing the Social and Environmental impacts (both positive and negative) of solar energy project, with potential assessment of cumulative impacts (linked to development or other solar projects and the overall park), if relevant and as appropriate. Identify mitigation measures and any residual negative impacts that cannot be mitigated. Also evaluate impacts and risks from associated facilities and other third-party activities. The mitigation measures shall be presented in the form of Environmental and Social Management Plan (ESMP), which shall include but not limited to:

Water Management including transportation, storage, recycling for use in the plant as well as rainwater harvesting

Occupational health and safety

Labour working conditions

Construction labour management

Waste Management including for Hazardous waste

Disaster management plan

Develop an R&R entitlement framework in consultation with the affected people and other stakeholders and prepare a resettlement action plan (RAP) which is acceptable to the project affected people;

Description of the entitlements for various categories of impacts, mitigation measures to address livelihood impacts, etc.

Interventions needed for skill development and overall social upliftment of the communities in the project influence area

To develop a consultation framework for participatory planning and implementation of proposed mitigation plan;

Assess the capacity of institutions and mechanisms for implementing social development aspects of the project implementation including the social safeguard plans and recommend capacity building measures; and,

Develop monitoring and evaluation mechanism to assess social development outcomes

Preparation of Gender Action Plan and Indigenous Peoples Development Plan (if required)

Assessment and mitigation measures for health and safety issues of the workforce and community, as well as compliance with national labour laws, and World Bank Group EHS Guidelines

Environmental monitoring plan

The ESMP shall include an adequate institutional structure and resources including financial budget to undertake measures identified in it, and report on the same to stakeholders on a regular basis.

Grievance Redress Mechanism: Description of the community grievance redress framework/mechanism (both informal and formal channels), setting out the time frame and mechanisms for resolving complaints about environmental and social performance.

Draft inputs for inclusion in the Bidding Documents: These would essentially operationalize the ESMP measures that would need to be implemented by the private sector partner – concessionaire. These would include contractual requirements, specific indicators that would

be monitored during implementation and operation by the successful bidder, and (dis)incentives for compliance with requirements as well as how any disputes relating to performance on these aspects would be managed.

Conclusion and Recommendation - Providing conclusions drawn from the assessment and providing recommendations.

Note: The consultant must provide monthly updates and also make presentations to the Solar Energy Corporation of India Limited on the status of the project and deliverables.

Management of the ESIA process

The consultant will manage the overall ESIA process and will be responsible for the compilation and presentation of the ESIA Report. The consultant will plan, coordinate and execute all activities of the ESIA process and will assist SECI in the planning and execution of the public scoping meeting and public hearing if required. The consultant will provide updates to WB, SECI and other relevant agencies on the ESIA process.

Report structure:

ESIA Summary Report

Introduction: Introduction to the Project and ESIA methodology;

Project Description: Project description and applicable standards (Local, Regional, National, International), Site assessment, Study area, Technical description of the Project and activities & related infrastructure and activities:

Administrative Framework: Applicable environmental and social regulatory framework and its relevance for Project;

Environmental and Social Baseline: Outlines Environmental and Social Baseline in the study area of the project;

Stakeholder Mapping and Analysis: An overview of the stakeholder engagement activities undertaken during the ESIA;

Impacts Assessment and Mitigation Measures: Environmental and Social Impact Assessment and mitigation measures;

Environmental and Social Management Plan: Detailed Environmental and Social Management Plan (ESMP) in accordance to WB/ADB/IFC Performance Standard

Resettlement Action Plan (RAP)

Conclusions and Recommendations

Deliverables

The following output is expected during the course of the assignment. In consultation with Office of the Commissioner (New & Renewable Energy), Consultant will prepare a monthly progress report covering progress against the work plan agreed in the inception report.

Report Title	Printed Copies	Soft Copies	Time Frame from Start of Assignments	Payment as % of the Total Cost of Assignment
Inception Report	3	6	3 weeks	10
Draft ESIA and Consultations Report	3	6	9 weeks	35
Final ESIA and Consultations Report	3	6	13 weeks	40
Inputs to the Bidding documents for developers	6	12	15 weeks	15
Monthly Progress Report & Review Presentation at SECI office			Every 4 weeks	

In addition, the consultant should have their team ready to make presentations to the regarding the progress of the assignment, and significant findings. These are expected to be in advance of submission of the Draft and Final reports, as well as finalization of inputs to bidding documents for developers.

Submission of Deliverables

The submission of deliverables will be as defined in clause 7. The printed copies as per clause 7 shall be submitted in neatly bounded in standard format as approved by the nodal office

Eligibility Criteria

General Eligibility Criteria

The Bidder should be a body incorporated in India under the Companies Act, 1956 or 2013 including any amendment thereto, Government owned Enterprises & Limited Liability

Partnership Firms.

Any kind of Technical or Financial JV/Consortium is not allowed under this Tender Document.

The offers submitted without documentary proof shall not be evaluated and will be liable for rejection without any further correspondence in any manner. However, SECI may seek clarifications from the Bidders so as to ascertain the correctness of facts & documents as presented by the Bidder.

Canvassing or offer of an advantage or any other inducement by any person with a view to influencing acceptance of a tender will be an offence under laws of India. Such action will result in the rejection of the tender, in addition to other punitive measures.

Technical Eligibility Criteria

The Consultant must have the following experience:

The consultant should have completed at least 03 (Three) EIA/ESIA studies in last 03 (Three) financial years preceding to the Bid Deadline date for large Scale/Power/Infrastructure.

(Document Required: Copy of final Environmental Clearance for all such Projects/Successful Project completion confirmation from client side for all such Projects)

Experience of at least 03 (Three) completed Consultancy Projects in conducting ESIA, preparing an Environmental Management Plan (EMP)/Resettlement Action Plan (RAP)/Gender Action Plan (GAP) or Indigenous Peoples Development Plan (IPDP) for large Scale/Power/Infrastructure/Renewable funded by multilateral agencies (World Bank/ADB/IFC etc).

(Document Required: Proof of documentation conforming above experience details/Client work order copies/Recommendation letter/ Successful Project completion confirmation from client side for all such Projects)

Desirable Criteria

The consultant having certificate of “Accredited EIA consultant” with MoEFCC/NABET for Power/Renewable Energy Sector will be preferred (Document Required: Document certifying Accreditation from MoEFCC/NABET).

NOTE: EIA is not required for RE projects & consequently NABET accreditation (required for EIA as per MOEFCC) is a desirable criteria to ensure quality of report

Team Composition:

The Consultant must have the following Team Composition:

Team Leaders

- A post-graduate / doctoral degree holder in Environmental or Social Sciences or a related field with at least 15 years of experience in delivering ESIAs for development projects
- S/he should have demonstrated experience of working with and leading multi- sectoral teams
- S/he should be conversant with relevant regulations and multilateral funding agencies like the World Bank
- S/he should be fluent in English and similar level of competency in Hindi would be an advantage.

Social Experts

- A post-graduate/doctoral degree holder in Social Sciences, or a related field with at least 10 years of undertaking (E)SIA studies, preferably for development projects, with funding support from multilateral agencies like World Ban
- S/he should have experience of organizing consultations with potentially affected persons
- Familiarity with the relevant regulations would be an advantage Fluency in English & Hindi languages.

Environmental Experts

A post-graduate/doctoral degree holder in Environmental science/engineering/ Planning or related field with at least 10 years of experience in undertaking E(S)IA studies, preferably for development projects, with funding support from multilateral agencies like World Bank

- S/he should have experience of organizing environmental surveys, covering pollution as well as biodiversity aspects where relevant, analyzing results and incorporating the findings into the report.
- Familiarity with contracting procedures, especially in the PPP mode would be an advantage
- Prior experience of developing codes of practice and other tools for management of generic issues would be an asset.

Renewable Energy Expert

- Renewable Energy expert with relevant post graduate qualification and experience of 10 years with at least 5 years in India

Dam Safety Expert (For projects involving dams – Floating Solar)

- Civil Engineer with at least 15 years of experience in Water Resource Engineering with focus on water retaining structures
- Familiarity with World Bank policy OP4.37 – Safety of Dams – at conceptual and operational level

Support staff (As per requirements)

The proposed team shall necessarily be the employees of the bidding company.

Any entity, which has either been directly barred by the Central/State Government in India, or any entity controlled by them, from participating in any project, and the bar subsists as on the date of Proposal, would not be eligible to submit the Proposal; and

A Bidder should have, during the last three (3) years, neither failed to perform on any agreement (as evidenced by imposition of a penalty by an arbitral or judicial or regulatory authority or a judicial pronouncement or arbitration award against the Bidder) nor been expelled from any project or agreement nor have had any agreement terminated for breach of contract by such Bidder.

ANNEXURE III CHECKLIST FOR ENVIRONMENT AND SOCIAL SCREENING

Sub project activities affecting the natural physical environment

S. No.	Information/Checklist confirmation	Status	Detailed Information
1	Preliminary secondary data related to soil quality and its bearing strength		
2	State /National Boundaries		
3	Anticipated change in Topography (Cut and Fill activity)		
4	Clearance of land, vegetation, any other physiographic feature (number and type specify)? Specify area under each feature (in Hectare)		
5	Addition of new features to topography due to project		
6	Anticipated underground works		
7	Anticipated changes in existing drainage pattern		
8	Land Reclamation works		
9	Water source identified for activities		
10	Identification of erosion prone areas		
11	Change in Land cover due to project		
12	Site prone to any natural hazard		
13	Activities changing hydrology or water courses or aquifers		
14	Abstraction / transfers of water from ground or surface waters		

S. No.	Information/Checklist confirmation	Status	Detailed Information
15	Water quality characteristics and its availability		
16	Other activities impacting the physical environment		
17	Water body identified for floating solar is reservoir / backwater/ any other (specify)		
18	Does the identified water body is used for water supply?		
19	Is water body used for fishing activities?		
20	Is water body used for any other human activity?		
21	Will project activity restrict access to the water body		
22	Any order/policy specific to the site		

Project activities affecting the biological environment

S. No.	Information/Checklist confirmation	Status	Aerial distance (within 10 km) of proposed-project location boundary
1	Vicinity to National Park, Wildlife Sanctuary, Reserved forests, woodland, protected forests		
2	Vicinity to Migratory bird routes		
3	Site in vicinity to congregatory areas (nesting, roosting, breeding, foraging)		
4	Vicinity to sensitive flora, fauna		
5	Areas already subjected to pollution or environmental damage		
6	Vicinity to eco-sensitive areas (wetlands, CRZ, water course, mountains etc)		

S. No.	Information/Checklist confirmation	Status	Aerial distance (within 10 km) of proposed-project location boundary
7	Presence of endangered species / habitat areas		
8	Vicinity to island, coastal marine or underground water		
9	Loss of any native species or genetic diversity		
10	Any season specific issues with site regarding ecological functions		

Project activities affecting the visual environment

S. No.	Information/Checklist confirmation	Status	Aerial distance (within 10 km) of proposed-project location boundary
1	Area with Outstanding Natural Beauty (ANOBs) or Natural Heritage sites		
2	Area with Archaeological importance		
3	Area with high scenic value		
4	Existing viewpoints/ pause points		

Project activities affecting the settlement / infrastructure

S. No.	Information/Checklist confirmation	Status	Details thereof (quantification wherever possible) with source of information data
1	Settlement area/Built up environment in vicinity / distance		
2	Agricultural land/land under livelihood (area in Hectare)		
3	Type of crops grown / number of crops		

S. No.	Information/Checklist confirmation	Status	Details thereof (quantification wherever possible) with source of information data
	grown in a year		
4	Source of Irrigation		
5	Drinking water sources		
6	Area of sensitive receptors		
7	Religious –Physical Resources		
8	Community-Physical Resources		
9	Underground utility lines like electricity lines, pipelines for gas, etc		
10	Defence Installations / Airport Routes		
11	Likely damage to existing infrastructure, public utilities, amenities etc.		
12	Presence of Indigenous / vulnerable communities		
13	Major Movement Corridors /Traffic		
14	Anticipated waste generation & Waste Disposal Facility		
15	Potential Water sources for project activities		
16	Source of energy including electricity and fuel for various purposes for the project (amount of fuel in MT & electricity in MW)		
17	Facilitates for transportation of construction materials		

S. No.	Information/Checklist confirmation	Status	Details thereof (quantification wherever possible) with source of information data
18	Facilities for storage of construction goods & materials		
19	Facilities for storage of any hazardous material		
20	Facilities for long term housing for operational workers		
21	List of construction works (Permanent &Temporary)		
22	Facilities for construction workers (temporary labour camp, drinking water, waste disposal, etc.)		
23	Facilitates for disposal of waste (dry or wet)		
24	Facilitates for disposal liquid waste/effluents		
25	New Road, rail etc during construction or operational phase		
26	Any closure or diversion to the current movement pattern due to the project during construction or operational phase		
27	New or diverted transmission lines due to the project		
28	Is there a risk of long term build-up of pollutants in the environment from storage of hazardous material, disposal of effluents and waste disposal?		

S. No.	Information/Checklist confirmation	Status	Details thereof (quantification wherever possible) with source of information data
29	Cumulative effects due to proximity to other existing or planned projects with similar impacts		

ANNEX IV SCREENING CRITERIA FOR FLOATING SOLAR PV SUB-PROJECTS

1. The currently proposed ISHTP plans to invest in about 1-2 FSPV sub-projects totaling approximately 100 MW of installed power generation. The objective of the sub-projects is to demonstrate the operational and economic feasibility of this innovative solution in particular for states in India facing land resource constraints to meeting their renewable power deployment goals. The Government of India has invited the World Bank and the Clean Technology Fund to support the ISTHP to introduce scalable innovations that help it meet its ever growing clean energy ambitions.

2. Practice suggests that on average approximately 1.7-2 hectares of reservoir area is required for each 1 MWp installed. Based on this assumption, the ISTHP target of 100 MWp installed generation capacity would cover approximately 170-200 hectares or 1.7-2.0 square kilometers (km2) of reservoir surface area. Currently, the Solar Energy Corporation of India (SECI), the implementing agency and borrower of the ISTHP, is looking at 2 sites in Jharkhand and 3 in Tamil Nadu.

Benefits

3. There are many benefits associated with FSPV:

4. Critically, suitable land for meeting India's RE targets will become scarce – sites with the 'best' RE resources and with easy access to land are being taken up. Yet, land acquisition requirements for stand-alone solar (ground mounted about 2 hectares / MWp) suggest vast land needs to meet RE targets. Preliminary studies suggest that utilization of just 10 percent of India's water bodies would allow for the development of about 300 GW of FSPV generation capacity.8

5. Additional advantages of the technology include optimizing utilization of existing power evacuation infrastructure, improved efficiencies of PV panels due to a surface water cooling effect, lowering PV panel cleaning requirements, potentially reducing evaporation, and improving the habitat for aquatic life, i.e. by reducing water temperatures.

6. For example, Floating Solar PV Projects (FSPV) were observed to reduce water evaporation up to 1000 liters per m2 per year saved in Spain (M. R. Santafé, P. S. Ferrer Gisbert, F. J. Sánchez Romero, J. B. Torregrosa Soler, J. J. Ferrán Gozálvez, and C. M. Ferrer Gisbert, "Implementation of a photovoltaic floating cover for irrigation reservoirs," Journal of Cleaner Production, vol. 66, pp. 568-570, 2014.) and also there is increase in the quality of water with reduction in Algae growth (www.waterworld.com/articles/2011/09/floating-solar-systems-provide-power-environmental-benefits.html) formation which will help to protect the environment.

[8] According to a preliminary assessment of Renewable Energy College, Kolkata.

Potential Environmental Impacts

7. The area of potential impact of a FSPV sub-project will be its footprint and the associated areas of electrical evacuation infrastructure. Environmental impacts associated with the construction and operation of solar PV plants and their mitigation measures are well known. When the sub-project is expected to complement generation output with an existing hydropower plant there may be potential environmental impacts associated with any changes to the hydropower plant's operation, i.e. water levels and associated water flows. These associated impacts and mitigation measures are also well understood in the practice. There may also be well understood risks associated with the upstream construction and operation of evacuation infrastructure.

8. Potential environmental impacts that are somewhat novel to FSPV are their impacts to water quality and aquatic-supported biodiversity. These include but are not limited to:

- Impacts on temperature stratification and on dissolved oxygen levels due to shading of water
- Impacts on aquatic habitat resulting from shading
- Impacts on water quality and aquatic fauna/flora due to leaching from materials
- Impacts on water quality and aquatic fauna/flora from accidental release of oils and or lubricants of boats used during maintenance activities or detergents in panel washing
- Impacts on aquatic habitat as a results of installations in shallower (littoral zone) and benthic zone (bottom of reservoir) due to mooring systems or disturbances from placement/movement of underwater electrical cables (i.e. increased turbidity)
- Impacts that could occur from exposure to EMF associated with underwater electrical cables
- Impacts on water feeding and surface diving birds while hunting at the water surface or pursuing fish or foraging underwater.
- Impacts from the creation of waste (replacement parts)

9. The probability and scale of any of these impacts are site specific. For example, reservoir characteristics vary widely, including from where there is practically no aquatic-supported biodiversity (i.e. coal mine/quarry reservoirs), reservoirs that are used for drinking water supply, and natural ponds/lakes.
Following measures would be among the list of options to be considered in a comprehensive Environment Management Plan (EMP) for the sub-project, based on the specific environmental and social impacts that have been identified in the ESIA.

1. Water quality studies, if not available with reservoir owner, shall be conducted.
2. Avoiding /minimising use of motorised boats. Manual operating boats may be used while performing operations & Maintenances activities. Walkways/Platforms may be constructed wherever possible.
3. Cleaning by using water without detergents or methods of dry cleaning may be explored.
4. Cable mostly installed on the cable trays above the water surface. Only Mooring arrangement shall be done under water.
5. The material to be used in the power plant, shall be recyclable

ISTHP Screening Criteria and Procedures

10. SECI shall make a determination of the suitability of the proposed sub-project site on a case by case basis.

11. While there is over 1 GW of FSPV installations worldwide, studies on environmental impacts of these sites are currently limited. Therefore, a site-specific ESIA will be required for each sub-project site and shall be consistent with applicable World Bank safeguards policies for the ISTHP (as defined in the ISTHP ESMF). The findings of the ESIA and the robustness of recommended mitigation measures will be used as the basis for the suitability of the site.

12. As the objective of the ISTHP is to achieve effective demonstration impacts and the limited number of sub-projects envisioned to achieve this objective, SECI shall be guided by the following principles in screening potential sites:

- identify and prioritize sites that minimize potential negative environmental and social impacts
- avoid all legally protected areas whether on land or water. These include various degrees of protection such as National parks, Sanctuaries, Conservation Reserves, Community Reserves that are specified in the Indian Laws governing Wildlife Protection.
- avoid areas that are being proposed for such legal designation, where finalization is not yet done
- avoid areas identified as important areas for conservation using IBAT, a tool that the World Bank Group has internalized for screening of projects for their impact on biodiversity.
- In a case where an existing hydropower plant with evacuation infrastructure exists in a protected area as defined above, SECI shall assess the likelihood and scope of potential incremental environmental impacts and consult with relevant authorities to determine whether the site is suitable and consistent with these screening principles.
- For locations that meet all the criteria above, SECI would ascertain presence of important fish species – either ask local experts or fishermen whether any species listed in Tables 1, 2 or 3 of the Publication "Threatened Freshwater Fishes of India" (available at http://www.nbfgr.res.in/pdf/ThreatenedFreshwaterFishes.pdf).
- Follow the 'do no harm' principle in assessing site suitability – because experience with FSPV is relatively limited, mitigate potential impacts by aiming to limit the footprint of the sub-project on a specific reservoir where aquatic flora and fauna exist.
    - Based on this principle, favorable go/no go decisions are more likely if the subproject's footprint is limited to ten percent of the average surface area of such a proposed reservoir over the last decade.
    - Subprojects larger than ten percent can be considered on such a reservoir provided that SECI can have reasonable assurance that the ESIA consultant would be able to collect sufficient data of satisfactory quality to assess the environmental and social impacts of a larger subproject on such a reservoir.
    - For reservoirs where no significant aquatic flora or fauna exist, the size of the footprint of the sub-project can be made on a case by case basis, following the above-mentioned principles.

13. SECI shall prepare a recommendation with a FSPV Site Suitability Report based on its initial screening, including references to supporting documentation, as appropriate, and a proposed Terms of Reference for the scope of the site-specific ESIA (informed by SECI's inquiries above). SECI shall submit it to the Bank for its review and no objection. A Bank no objection on SECI's recommendation is required prior to taking a go/no go decision on ISTHP support and subsequent ESIA preparation.

ESIA Preparation and Sub-Project Appraisal

14. The scope of work in the ESIA in addition to assessing impacts on such selected sites, would also analyze the potential measures to minimize, mitigate, compensate identified unavoidable adverse impacts – on water quality, ecology and any other environmental features deemed to be important in the particular context of that waterbody.

15. SECI shall be responsible for the hiring of high quality consultants to conduct the ESIA (and associated preparation of the EMP or other instruments as may be needed), for quality control and eventually ensuring the EMP is appropriately implemented following obligations spelled out in the ISTHP legal agreements.

16. SECI's sub-project appraisal will assess the likelihood and scale of environmental and social impacts and whether the proposed mitigation measures are likely to be effective, there is sufficient capacity to implement them and that they are appropriately resourced.

17. Following the ISTHP's ESMF, WB/CTF resources supporting the ISTHP shall be used only if the Dam Safety Report confirms there are no major issues associated with the relevant Dam (that resulted in the formation of the waterbody) as defined by the Dam Safety Policy of the Bank. SECI shall follow the ESMF wherever relevant to ensure the Dam Safety Report is prepared by a qualified dam safety expert following terms of reference agreed with the Bank.

18. SECI's appraisal findings and recommendations will be submitted to the World Bank for its no objection, which would include SECI's recommendation for a go/no go decision on investing in the project with partial WB/CTF financing.)

Implementation and Monitoring

19. Following the ISTHP's ESMF, SECI shall also monitor safeguards compliance accordingly during implementation.

20. SECI shall task its environmental and social safeguards staff to monitor emerging literature and studies on FSPV. New studies may inform future sub-project preparation and development of appropriate ecosystems required to help sustainably scale up FSPV in India.

21. SECI shall also explore opportunities to have its sub-projects participate in long-term studies that aim to fill knowledge gaps on environmental and social impacts, such as partnering with universities, scientific research institutes, etc.

ANNEXURE V GENERIC ENVIRONMENTAL MANAGEMENT PLAN

Generic Environmental and Social Management Plan for Pre-Construction and Construction Stage

Sr. No	Activities	Potential Impact	Mitigation Measures	Time Frame	Institutional Responsibility	
					Implementation	Supervision
A: Design & Preconstruction Stage						
1	Project Location: Land Acquisition & R&R Issues	Loss of land / properties and livelihood; shelter due to land acquisition for development of Solar/wind/Hybrid park and associated sites	• Identify appropriate government site to avoid land acquisition and resettlement impacts. • The affected persons/families to be identified in advance and should be compensated at replacement value for the lost asset as per prevailing rules and policy of the state government and the World Bank . • The affected person must be compensated before taking physical possession of the asset. • Any displaced person to be resettled • Loss of livelihood to be compensated monetarily as well as in form of alternative livelihood • Any loss of sources of livelihood to be compensated	Design and Pre-Construction Stage	Park developer	Developer/SECI
		Loss of forest land and resources due to location of the project in forest areas	• As far as forest area to be avoided for establishing the project • If the project is passing through forest area, the necessary permission/ clearance to be obtained from the Forest department prior to start of construction activities.	Design and Pre-Construction Stage	Park developer	Developer/SECI

Sr. No	Activities	Potential Impact	Mitigation Measures	Time Frame	Institutional Responsibility	
					Implementation	Supervision
			• Tree felling for the project should be avoided to the possible extent. However, if tree felling is unavoidable, then permission for felling of trees to be obtained from the forest department. • Compensatory plantation to be done against the tree felling as per rule • The condition of the forest clearance/ tree felling permission to be strictly complied.			
B: Construction Stage						
1	Site Clearance /Excavation and grubbing operation	a) Air/ Noise Pollution	• The Contractor will take every precaution to control dust nuisance at all the construction zones and allied sites where works are under progress. • Every equipment and machinery will be fitted with dust suppression devices such as water sprinklers, dust bags, cyclone etc. As appropriate. • Dust generating activities from construction to be avoided/ minimized by suitable water sprinkling • Equipment's/ machinery to be properly maintained to minimize smoke in the exhaust emissions. • Machinery to be turned off when not in use. • Housekeeping of the area to be maintained	Construction Stage	Contractor	Developer/SECI

Sr. No	Activities	Potential Impact	Mitigation Measures	Time Frame	Institutional Responsibility	
					Implementation	Supervision
			• Vehicles transporting materials will be covered by tarpaulin sheets • Mixing equipment will be well sealed and equipped as per PCB norms • Vehicle speed to be restricted to minimum speed at site to minimize potential for dust generation in the surroundings • The Contractor will submit PUC certificates for all vehicles/ equipment/machinery used for the project. • Periodical monitoring of fine Particulate Matters (PM_{10} and $PM_{2.5}$) will be carried out as per Environmental Monitoring Plan. • Only well-maintained equipment conform to the MoEFCC/CPCB/APPCB noise standards will be operated on site. • DG sets shall be used for emergency power/ backup (if any). • Provision of rubber paddings/noise isolators at equipment/machinery used for construction • Construction vehicles to be well maintained (Pollution Under Control Certificate- PUC is a Certification Mark issued to certify that motor			

Sr. No	Activities	Potential Impact	Mitigation Measures	Time Frame	Institutional Responsibility	
					Implementation	Supervision
			vehicles in India meet emission and pollution control norms) and minimise idling time for vehicles when not in use. • Loud, sudden noise emissions to be avoided wherever possible. • Information about blasting activities (if any) to be provided as per standard practice. • Site workers working near high noise equipment use personal protective devices to minimize their exposure to high noise levels.			
		b) Soil Erosion/ Loss of Top Soil & Soil Compaction	• The removal of soil cover and vegetation should be restricted to the area necessary for project development. • Top soil shall be stripped from all the area that is to be utilized during construction and were permanent structure and access is required. • It should be preserved at suitable place at a height of 2m with proper sloping (1: 1.5). • Once the construction activity is over all the preserved top soil shall be utilized for rehabilitation of the disturbed areas, borrow areas and landscaping.	Construction Stage	Contractor	Developer/SECI

Sr. No	Activities	Potential Impact	Mitigation Measures	Time Frame	Institutional Responsibility	
					Implementation	Supervision
			• Localized sprinkling of water in applicable affected areas where vegetation is removed shall be undertaken for the entire duration of construction. • Use of existing track for transport of man and material to the extent possible • Loose soil to be protected from wind and runoff by covering/ watering/ other means of covering • All construction material to be kept within the footprint of the area acquired. • Loose construction material should be taken care to avoid being carried into adjoining area by wind. • To avoid soil erosion, it is recommended growing turf grass beneath the solar panel. • Appropriate contour bunding/ field bunding measures coupled with recharge pits may be undertaken in the entire project area to ensurethat soil & water are conserved within the project area.			
		c) Soil Contamination	• Impervious platform and oil and grease trap for collection of spillage from construction equipment vehicle maintenance platform will be appropriately provided at construction camp, servicing area and liquid fuel and lubes at storage areas	Construction Stage	Contractor	Developer/SECI

Sr. No	Activities	Potential Impact	Mitigation Measures	Time Frame	Institutional Responsibility	
					Implementation	Supervision
			• Re-fueling of machinery at site to be undertaken over paved/ suitable surface. • In case of any accidental spill, the soil to be cut and stored securely for disposal with hazardous waste			
		d) Loss of vegetation	• Vegetation will be removed from the construction zone before commencement of construction. All works will be carried out such that the damage or disruption to flora other that those identified for cutting is minimum. • Only ground cover/shrubs that impinge directly on the permanent works or necessary temporary works will be removed with prior approval from the Environmental Expert. • The Contractor, under any circumstances will not cut or damage trees. • Trees identified under the project will be cut only after receiving clearance from the Forest Department and after the receipt of written permission from Engineer. • Access to areas of the natural vegetation that are to be considered must be prohibited. A temporary	Construction Stage	Contractor	Developer/SECI

Sr. No	Activities	Potential Impact	Mitigation Measures	Time Frame	Institutional Responsibility	
					Implementation	Supervision
			fence should remain on site until all construction activities have completed. • Construction vehicles, machinery and equipment will move or be stationed in the designated area only to prevent compaction of vegetation outside the construction area. • Collection of firewood is prohibited. • No fires may be ignited with the intent to destroy the flora on the site and surrounding			
2	Internal Access Road Construction		• Mitigation measures same as 1 a)	Construction Stage	Contractor	Developer/SECI

Sr. No	Activities	Potential Impact	Mitigation Measures	Time Frame	Institutional Responsibility	
					Implementation	Supervision
		B. Soil Erosion/ Loss of Top Soil/ Compaction	• Mitigation Measures same as 1 b)	Construction Stage	Contractor	Developer/SECI
		C. Soil Contamination	• Mitigation Measures same as 1 c)	Construction Stage	Contractor	Developer/SECI
		D. Loss of vegetation	• Mitigation measures same as 1 d)	Construction Stage	Contractor	Developer/SECI
3	Storage of Construction Material	a) Air / Noise Pollution	• Mitigation measures same as 1a)	Construction Stage	Contractor	Developer/SECI

Sr. No	Activities	Potential Impact	Mitigation Measures	Time Frame	Institutional Responsibility	
					Implementation	Supervision
		b) Soil Contamination/ Compaction	• Mitigation Measures same as 1 b) & 1 c)	Construction Stage	Contractor	Developer/SECI
		b) Water Pollution (Surface Water) including Increased erosion and sediment load impounding of local depressions Change in micro level drainage pattern	• All necessary precautions will be taken to construct temporary or permanent devices to prevent water pollution due to increased siltation and turbidity. • The Contractor will take all precautionary measures to prevent the wastewater generated during construction from entering into water bodies or the irrigation system and avoid construction works close to water bodies / waterways during monsoon. • All wastes arising from the project will be disposed off, so as not to block the flow of water. • No construction materials/ spoils will be stored along the water bodies/ natural waterways and adequate provision will be made for preventing spillage of materials into these water bodies. • Wastes must be collected, stored and taken to approve disposal site. • Water quality to be monitored periodically as per Environmental Monitoring Plan.	Construction Stage	Contractor	Developer/SECI

Sr. No	Activities	Potential Impact	Mitigation Measures	Time Frame	Institutional Responsibility	
					Implementation	Supervision
		c) Loss/Damage to vegetation	• Mitigation measures same as 1 d)	Construction Stage	Contractor	Developer/SECI
4	Heavy machinery	a) Air / Noise Pollution	• Mitigation Measures same as 1 a)	Construction Stage	Contractor	Developer/SECI
		b) Soil Pollution/ Compaction	• Mitigation measures same as 1 b) & 1 c)	Construction Stage	Contractor	Developer/SECI
5	Concrete mixture and heavy pumps	a) Air / Noise Pollution	• Mitigation Measures same as 1 a)	Construction Stage	Contractor	Developer/SECI
		b) Soil Pollution/Compaction	• Mitigation Measures same as 1 b) & 1 c)	Construction Stage	Contractor	Developer/SECI
6	Tree felling/ vegetation clearance	a) Landscape Degradation	• Plantation work on open sites may be done • Waste along settlement or access route may not be dumped • Quarry & borrow area rehabilitation program may be framed • Green belts along approach road may be developed	Construction Stage	Contractor	Developer/SECI

Sr. No	Activities	Potential Impact	Mitigation Measures	Time Frame	Institutional Responsibility	
					Implementation	Supervision
			• On completion of the works all the temporary structures shall be cleared away.			
		b) Impact on flora	• All works will be carried out such that the damage or disruption to flora other that those identified for cutting is minimum. • Only ground cover/shrubs that impinge directly on the permanent works or necessary temporary works will be removed with prior approval from the Environmental Expert. • The Contractor, under any circumstances will not cut or damage trees in the project locations without the receipt of written permission from Engineer. The engineer before giving permission may get clearance from forest department/ any other authority as the case may be • Access to areas of the natural vegetation that are to be considered must be prohibited. A temporary fence should remain on site until all construction activities have completed. • Construction vehicles, machinery and equipment will move or be stationed in the designated area so	Construction Stage	Contractor	Developer/SECI

Sr. No	Activities	Potential Impact	Mitigation Measures	Time Frame	Institutional Responsibility	
					Implementation	Supervision
			as to avoid compaction of vegetation outside the construction area. • No fires may be ignited with the intent to destroy the flora on the site and surrounding			
		c)Soil Erosion	• Mitigation measures same as 1 b)	Construction Stage	Contractor	Developer/SECI
7	Transportation of machinery	a) Air / Noise Pollution	• Mitigation Measures same as 1 a)	Construction Stage	Contractor	Developer/SECI
		b) Soil Contamination / Compaction	• Mitigation Measures same as 1 b) & 1 c)	Construction Stage	Contractor	Developer/SECI
8	Debris Disposal	a) Air / Noise Pollution	• Mitigation Measures same as 1 a)	Construction Stage	Contractor	Developer/SECI
		b) Water Pollution (Surface Water)	• All necessary precautions will be taken to construct temporary or permanent devices to prevent water pollution due to increased siltation and turbidity. • The Contractor will take all precautionary measures to prevent the wastewater generated during construction from entering into water bodies or the			

Sr. No	Activities	Potential Impact	Mitigation Measures	Time Frame	Institutional Responsibility	
					Implementation	Supervision
			irrigation system and avoid construction works close to water bodies / waterways during monsoon. • All wastes arising from the project will be disposed off, so as not to block the flow of water. • No construction materials/ spoils will be stored along the water bodies/ natural waterways and adequate provision will be made for preventing spillage of materials into these water bodies. • Wastes must be collected, stored and taken to approve disposal site. • Water quality to be monitored periodically as per Environmental Monitoring Plan.			
		c)Soil Pollution/Compaction	• Mitigation measures same as 1 a) & 1 b)			
9	Transportation of Construction material	a) Air / Noise Pollution	• Mitigation measures same as 1 a)	Construction Stage	Contractor	Developer/SECI
		Soil Pollution/Compaction	• Mitigation measures same as 1 b) & 1 c)	Construction Stage	Contractor	Developer/SECI

Sr. No	Activities	Potential Impact	Mitigation Measures	Time Frame	Institutional Responsibility	
					Implementation	Supervision
10	Movement of Construction Vehicles	• Movement of heavy vehicles leading to congestion and accidents • Improper parking of vehicles used by workers and for movement of material can lead to discomfort to other users. • Damage to road and related structure from heavy vehicle	**Construction traffic:** a. Construction routes and required access roads may be clearly defined; b. Only trained drivers with valid license shall be recruited by the construction contractor. c. The access of all construction and material delivery vehicles especially during wet weather shall be strictly controlled to avoid compaction and damage to the topsoil structure; d. Speed of all project vehicles shall be restricted to minimum on internal village roads e. Delivery hours shall be scheduled to avoid peak hour traffic, weekends and evenings; f. Wheel washing and damping down of un-surfaced roads shall be implemented to reduce dust and nuisance; g. Vehicles and equipment shall be regularly serviced to avoid the contamination of soil from oil and hydraulic fluid leaks, etc. Servicing of vehicles and equipment must be done off-site and on an impermeable surface such as concrete;	Construction Stage	Contractor	Developer/SECI

Sr. No	Activities	Potential Impact	Mitigation Measures	Time Frame	Institutional Responsibility	
					Implementation	Supervision
			Access: h. Temporary access roads shall be rehabilitated prior to the Demobilization contractor from the site; i. Entry and exit points shall be positioned strategically to ensure minimal effects on traffic; j. Primary routes to the site shall be clearly signposted and communicated to all suppliers and Sub-Contractors.			
11	Labour Camps/	• Influx of migrant laborer's • additional pressure on the local resources and social infrastructures • Risk of social conflict	• The contractor will preferably engage local labour force except for the laborer's requiring special skills and non-availability of such skilled labourers from local area. • Project to assess and manage labor influx risk based on risks identified in the ESIA. Depending on the risk factors and their level, appropriate site-specific Labor Influx Management Plan and/or a Workers' Camp Management Plan. • Project will incorporate social and environmental mitigation measures into the civil works contract. The responsibilities for managing these adverse impacts will be clearly reflected as a contractual	Construction Stage	Contractor	Developer/SECI

Sr. No	Activities	Potential Impact	Mitigation Measures	Time Frame	Institutional Responsibility	
					Implementation	Supervision
			obligation, with a mechanism for addressing non-compliance. Worker's Accommodation • For migrant laborers the contractor will provide labour camps with all basic facilities sufficiently away from local habitation • No labour camp will be provided within 1 km from Forest area, Wildlife Sanctuary, National Park or any other protected area. • Provisioning adequate arrangements of drinking water, lighting, ventilation, bedding, bathing and other basic facilities in the labour camps; • Ensuring proper health-check-ups of all laborer's employed at the project site; • Providing separate toilet facilities for men and women at the accommodation as well as site; and • Facilitating healthcare services and medical care in case of sickness. • Locate handling sites away from populated areas • Follow proper operation and handling measures to minimize exposure			

Sr. No	Activities	Potential Impact	Mitigation Measures	Time Frame	Institutional Responsibility	
					Implementation	Supervision
			• Provide prior warning /signals for blasting • Provide sirens in vehicles to avoid any collision with human/animals • Organize awareness programs on environmental resource management • Organize Health camps • Use of child labour will be strictly prohibited. Contractor will maintain a labour register with name, age and sex with supporting document (preferably copy of Aadhar card or voter's ID card). This will be monitored by Environmental and Social office of contractor and SECI. • Provide signage near construction sites and approach roads Avoiding Gender Based Violence • Contractor will prepare and implement robust measures to address the risk of gender-based violence that include (i) mandatory and repeated training and awareness raising for the workforce about refraining from unacceptable conduct toward local community members, specifically women; (ii)			

Sr. No	Activities	Potential Impact	Mitigation Measures	Time Frame	Institutional Responsibility	
					Implementation	Supervision
			informing workers about national laws that make sexual harassment and gender-based violence a punishable offence which is prosecuted; (iii) introducing a Worker Code of Conduct as part of the employment contract, and including sanctions for non-compliance (e.g., termination), and (iv) contractors adopting a policy to cooperate with law enforcement agencies in investigating complaints about gender-based violence. • Additional measures can aim to reduce incentives to engage with the local community by providing workers with the opportunity to spend their time off away from the host community, where feasible with a small transport allowance, ideally allowing workers to regularly return for brief visits to their families, spouses and friends, or to visit nearby urban centers that provide a variety of legal social opportunities. For workers who need to travel further it may be attractive to forego weekends off in exchange for longer breaks that would allow for such home leave travel.			

Sr. No	Activities	Potential Impact	Mitigation Measures	Time Frame	Institutional Responsibility	
					Implementation	Supervision
		Impact on Human health, especially workers working at construction sites (Labour Camps)	• Routine medical checkup of Field staff and labourers • Provision of potable drinking water at site • Provision of proper sewage and waste disposal system. Sanitation facilities have to be provided at the camp sites. • Awareness program on HIV aids and other communicable disease may be provided to the work force. • First aid facilities to be provided at the construction camps. Any case of disease outbreak may be immediately subjected to medical treatment. Mosquito repellant to be provided to the labors such as odomos, coil and sprays. The camps may maintain cleanliness and hygienic condition. • Proper ventilation may be provided in labour camps	Construction Stage	Contractor	Developer/SECI
		Impact of labour influx/ migrant workforce	• Provisioning adequate arrangements of drinking water, lighting, ventilation, bedding, bathing and other basic facilities in the labour camps; • Ensuring proper health-check-ups of all labourers employed at the project site; • Providing separate toilet facilities for men and women at the accommodation as well as site;	Construction Stage	Contractor	Developer/SECI

Sr. No	Activities	Potential Impact	Mitigation Measures	Time Frame	Institutional Responsibility	
					Implementation	Supervision
			• Contractor and labourers will sign code of conduct to maintain good manners with the community and avoid GBV • Project will undertake awareness raising program for the workers and community on the risk of labour influx; and • To the extent possible, local workforce will be engaged to minimize the influx of workers			
12	Borrow materials/ Quarry area	a) Air / Noise Pollution	• Mitigation measures same as 1 a)	Construction Stage	Contractor	Developer/SECI
		b) Soil Pollution / Compaction	• Mitigation measures same as 1 b) & 1 c)	Construction Stage	Contractor	Developer/SECI
		c)Soil Erosion	• Mitigation measures same as 1 b)	Construction Stage	Contractor	Developer/SECI
13	Occupational Health and Safety	Increased accident risks and health hazards	• The Contractor will comply with the requirements of the Environmental, Health, and Safety (EHS), Guidelines of the World Bank, April, 2007 and the statutory norms of safety during construction.	Construction Stage	Contractor	Developer/SECI

Sr. No	Activities	Potential Impact	Mitigation Measures	Time Frame	Institutional Responsibility	
					Implementation	Supervision
			• The Contractor will provide adequate good quality Personal Protective Equipment's (PPE) to all the workers working at construction zones and Plant sites and will ensure that these PPEs are used by workers at all time during works. • The facility should have firefighting system, Proper ventilation system, first aid facilities • Provide persons working in the site with appropriate training, equipment and the information necessary to ensure their safety. • Material Safety Data Sheet (MSDS) should be placed in public area and near the Storage. • Unauthorized access should be strictly prohibited. • Emergency contact name and number should be displayed in front of the storage • • Adequate drainage, sanitation and waste disposal will be provided at workplaces. • Proper drainage will be maintained around sites to avoid water logging leading to various diseases			

Sr. No	Activities	Potential Impact	Mitigation Measures	Time Frame	Institutional Responsibility	
					Implementation	Supervision
			• Adequate sanitation and waste disposal facilities will be provided at construction camps by means of septic tanks, soakage pits etc. • A health care system will be maintained at construction camp for routine checkup of workers and avoidance of spread of any communicable disease • Readily available First Aid kit bearing all necessary first aid items will be proved at all the work sites and should be regularly maintained. • The Contractor will organize awareness program on HIV aids and sexually transmitted diseases (STDs) for workers on periodic basis			

Generic Environmental and Social Management Plan for Operation Stage

Sr. No.	Activities	Potential Impact	Mitigation Measures	Time Frame	Institutional Responsibility	
					Implementation	Supervision
1	Generation of Used oil from Turbine maintenance and Transformer oil	Soil pollution and Water pollution	• Used oil to be securely stored in appropriate containers over impervious platform and sold only to authorized venders by State Pollution Control Board. • Catch drains to be provided around the storage platform to arrest accidental spillage of oil • Transformer oil to be replaced and returned by the supplier of transformers • Log book for storage and disposal of such oils to be maintained	Operation and Maintenance stage	EHS Engineer of O & M Contractor	SECI
2	Operation of wind turbine	Collison of Birds due to wind turbine	• Standard practice on turbine blades shall be considered to enhance visibility. • Marking overhead cables and transmission poles using deflectors and avoiding use of areas of high bird concentrations, especially for species vulnerable to collision. • Where possible, installing transmission cables underground in accordance with existing best	Operation and Maintenance stage	O & M Contractor	SECI

Sr. No.	Activities	Potential Impact	Mitigation Measures	Time Frame	Institutional Responsibility	
					Implementation	Supervision
			practice guidelines for underground cable installation. Otherwise if possible, install overhead cables with proper insulation to avoid bat and bird electrocution through body touch. Install bird deflectors on overhead transmission cables at selected points wherever possible. • The illumination within the project area should be bare minimum and be within the acceptable limits, particularly during night hours. This will help in undisturbed activities of nocturnal species like rodents, bats and owls. • Some bird reflectors can be fitted at relevant places to divert low-medium and medium-high flying bird species during day time. • Feasibility of fixing of bird deflector on the turbine to avoid perching of birds near blades can be worked out, especially raptor species which prefer to perch at higher points. • An Avifaunal Expert to be appointed during operation stage for assessment of incidence of bird collision and train the staff at site to address the incidents of bird hit / injury.			

Sr. No.	Activities	Potential Impact	Mitigation Measures	Time Frame	Institutional Responsibility	
					Implementation	Supervision
		Man, Animal Conflict	• Removal of bushes, tree, shrubs beyond the project limit to be strictly prohibited • The site area to be properly fenced to avoid entry of wild animals within the project compound • In case wild animals are recorded in close vicinity or within the project site, the same should be recorded and reported to the wildlife department to take suggestions for further measures • Awareness development among the employees to conserve / protect the ecosystem • Fire protection measures to be provided at site to avoid any fire due to project	Operation and maintenance stage	O&M engineers of contractor at site in consultation with Wildlife Department	SECI
3	**Cleaning of solar panel**	Wastage of water Generation of waste water	• Necessary permits for use of water, including groundwater where applicable, shall be obtained in advance of beginning of operations. • The use of water to be minimized through recycling of used of water for cleaning • The waste water to be properly channelized through drains and stored in settling tank	Operation and maintenance stage	O&M engineers at site	SECI

Sr. No.	Activities	Potential Impact	Mitigation Measures	Time Frame	Institutional Responsibility	
					Implementation	Supervision
			• The unusable water can be utilized for irrigation purpose in landscaping or in neighbouring agriculture field. • Rainwater harvesting facilities will be provided at site to collect the rainwater which should be utilized for ground water recharging and storing for cleaning purpose			
4	**Handling and management of Battery Energy Storage System**	Land contamination Water Contamination Health Hazards due to random disposal of Battery wastes and E-wastes	• All the non-functional batteries to be stored in a safe place following the norms stipulated in the batteries (Management and Handling) Rules, 2001. The waste batteries to be handed over to the authorised vendors/recyclers. • A record of such practices to be maintained at site office. • All the electronic wastes should be disposed of as per E-waste (Management) Rules, 2016. • All the safety precautions in storage, handling and disposal of battery energy storage systems will be adopted as per safety consideration, which is enclosed as **Annexure XV**.	Operation and maintenance stage	O&M engineers at site	SECI

Generic Environmental and Social Management Plan for Transmission Line

Sr. No.	Activities	Potential Impact	Mitigation Measures	Time Frame	Institutional Responsibility	
					Implementation	Supervision
• **DESIGN & PRE-CONSTRUCTION STAGE**						
1	Land Acquisition & R&R Issues	Loss of land / properties and livelihood due to land acquisition	• Careful route selection to avoid existing settlements • Minimize need to acquire agriculture land and other immovable properties • Compensation to be paid for temporary/ permanent loss of productive land including land under ROW as per state policy on transmission line • Compensate and assist for loss of livelihood or sources of livelihood as per the agreed entitlement framework of RPF	Design and Pre-Construction Stage	State Power Transmission Agency	SECI
		Loss of precious ecological values/damages to precious species	• Avoid encroachment by careful site and alignment selection. If the project is passing through forest area, the necessary permission/ clearance to be obtained from the Forest department prior to start of construction activities.	Design and Pre-Construction Stage	State Power Transmission Agency	SECI

Sr. No.	Activities	Potential Impact	Mitigation Measures	Time Frame	Institutional Responsibility	
					Implementation	Supervision
			• Tree felling for the project should be avoided to the possible extent. However, if tree felling is unavoidable, then permission for felling of trees to be obtained from the forest department. • Compensatory plantation to be done against the tree felling as per rule • The condition of the forest clearance/ tree felling permission to be strictly complied.			
2	Transmission line through forestland	Loss of forest land Deforestation and loss of biodiversity	• Avoid forest area by careful site and alignment Selection • Obtain statutory forest clearances from the Government • Compensatory plantation to be done against the tree felling as per rule • The condition of the forest clearance/ tree felling permission to be strictly complied.		State Power Transmission Agency	SECI
3	Encroachment into farmland	Loss of agricultural productivity	• Minimise encroachment into farm land by careful alignment selection. • Farmers / land owners compensated for significant trees that need to be trimmed / removed along ROW. • Statutory approvals for tree trimming / removal		State Power Transmission Agency	SECI

Sr. No.	Activities	Potential Impact	Mitigation Measures	Time Frame	Institutional Responsibility	
					Implementation	Supervision
4	Interference with drainage patterns/Irrigation channels	Flooding hazards / loss of agricultural production	Appropriate siting of towers to avoid channel interference	Construction Stage	State Power Transmission Agency	SECI
5	Escape of polluting materials	Environmental pollution	Transformers designed with oil spill containment systems, and purpose-built oil, lubricant and fuel storage system, complete with spill cleanup equipment. Substations to include drainage and sewage disposal systems to avoid offsite land and water pollution		State Power Transmission Agency	SECI
	B. CONSTRUCTION STAGE					
1	Construction of roads for accessibility	Increase in airborne dust particles	Existing roads and tracks used for construction and maintenance access to the line wherever possible	Construction Stage	Contractor	State Power Transmission Agency/ SECI
2	Site clearance	Loss of vegetation	• Clearance activities to be restricted to pegged area only Marking of vegetation to be removed prior to clearance, and strict control on clearing activities to ensure	Construction Stage	Contractor	State Power Transmissio

Sr. No.	Activities	Potential Impact	Mitigation Measures	Time Frame	Institutional Responsibility	
					Implementation	Supervision
			• minimal clearance			n Agency/ SECI
3	Equipment layout and installation	Noise and vibration	• Construction techniques and machinery selection seeking to minimize ground disturbance	Construction Stage	Contractor	State Power Transmission Agency/ SECI
4	Foundation works for tower legs and concrete foundations	Interference with cropping season and disturbance/damage to the field crop	Construction activities on cropping land to be scheduled to avoid cultivation period preferably after one month of harvest wherever possible Movement of man and machines in designated area only to avoid compact of land Top soil	Construction Stage	Contractor	State Power Transmission Agency/ SECI
		Loss of top soil due to excavation for foundation work	• The removal of soil cover and vegetation should be restricted to the area necessary for project development. • Top soil shall be stripped from all the area marked for foundation and preserved separately	Construction Stage	Contractor	State Power Transmission Agency/ SECI

Sr. No.	Activities	Potential Impact	Mitigation Measures	Time Frame	Institutional Responsibility	
					Implementation	Supervision
			• Once the construction activity is over all the preserved top soil shall be utilized for rehabilitation of the disturbed areas • Use of existing track for transport of man and material to the extent possible • Loose soil to be protected from wind and runoff by covering/ watering/ other means of covering • All construction material to be kept within the footprint of the area acquired. • Loose construction material should be taken care to avoid being carried into adjoining area by wind.			
5	Trimming /cutting of trees within Row	Fire hazards	Trees allowed growing up to a height within the RoW by maintaining adequate clearance between the top of tree and the conductor as per the regulations.	Construction Stage	Contractor	State Power Transmission Agency/ SECI
		Loss of vegetation and deforestation	Trees that can survive pruning to comply should be pruned instead of cleared. Felled trees and other cleared or pruned vegetation to be disposed of as authorized by the statutory bodies	Construction Stage	Contractor	State Power Transmission Agency/ SECI

Sr. No.	Activities	Potential Impact	Mitigation Measures	Time Frame	Institutional Responsibility	
					Implementation	Supervision
6	Nuisance to nearby properties	Losses to neighboring land uses/ values Social inequity	• Contract clauses specifying careful construction practices. • The Contractor shall take all the precaution not to disturb the neighboring land use and properties • As much as possible existing access ways will be used • Productivity land will be reinstated following completion of construction • The Contractor will pay compensation to the owner of the affected land/property for the loss caused by the construction activities including crop loss, if any	Construction Stage	Contractor	State Power Transmission Agency/ SECI
7	Pollution Control Measures		Ensure that the site is kept tidy at all times and managed to reduce the risks of pollution (noise, water, dust etc.)	Construction Stage	Contractor	State Power Transmission Agency/ SECI

Sr. No.	Activities	Potential Impact	Mitigation Measures	Time Frame	Institutional Responsibility	
					Implementation	Supervision
8	Conductor stringing	Accident Hazards and injury to workers	• Towers shall be complete in all regards before starting stringing operation • All the precautionary measures to be adopted by the Contractor against the safety hazards • Only • No workers shall be allowed to work on towers without proper PPES, such as hard hat, safety gloves, safety shoes, safety belts, and safe working lift with safe working platforms, etc • Only trained persons shall be allowed to work stringing works • First Aid Kit with all necessary first aid items must be available site during works. • The Contractor will make arrangement with nearby health center to deal with any accident. • Regular safety awareness training to be organized by the Contractor	Construction Stage	Contractor	State Power Transmission Agency/ SECI
9	Public Safety	Installation of towers and stringing	• The trespassing inside the work zone to be restricted • Information and caution to general public	Construction Stage	Contractor	State Power Transmissio

Sr. No.	Activities	Potential Impact	Mitigation Measures	Time Frame	Institutional Responsibility	
					Implementation	Supervision
		activities	through caution boards and sign boards • the schedule for stringing activities to be communicated to the public • All safety precaution to be taken during construction at the location where the alignment is passing through roads, rivers/streams and other public facility. • Deployment of well-trained flag man and warning signs at locations, where there is public movement.			n Agency/ SECI
10	Surplus earthwork / soil	Runoff to cause water pollution, solid waste disposal	Soil excavated from tower footings to be disposed of at designated place or nearby house blocks if requested by landowners.	Construction Stage	Contractor	State Power Transmission Agency/ SECI
11	Waste Management	Land contamination and loss of aesthetics	• All the waste and debris materials must be cleared periodically from the site immediately after completion of tower works and stringing. • All the debris must be disposed of at designated site	Construction Stage	Contractor	State Power Transmission Agency/ SECI

Sr. No.	Activities	Potential Impact	Mitigation Measures	Time Frame	Institutional Responsibility	
					Implementation	Supervision
12	Labour Camps/	• Influx of migrant labourers • additional pressure on the local resources and social infrastructures • Risk of social conflict	The contractor will preferably engage local labour force except for the laborer's requiring special skills and non-availability of such skilled labourers from local area. Project to assess and manage labor influx risk based on risks identified in the ESIA. Depending on the risk factors and their level, appropriate site-specific Labor Influx Management Plan and/or a Workers' Camp Management Plan. Project will incorporate social and environmental mitigation measures into the civil works contract. The responsibilities for managing these adverse impacts will be clearly reflected as a contractual obligation, with a mechanism for addressing non-compliance. **Worker's Accommodation** For migrant labourers the contractor will provide labour camps with all basic facilities sufficiently away from local habitation No labour camp will be provided within 1 km from Forest area, Wildlife Sanctuary, National Park or any other protected area.	Construction Stage	Contractor	Developer/ SECI

Sr. No.	Activities	Potential Impact	Mitigation Measures	Time Frame	Institutional Responsibility	
					Implementation	Supervision
			Provisioning adequate arrangements of drinking water, lighting, ventilation, bedding, bathing and other basic facilities in the labour camps; Ensuring proper health-check-ups of all laborer's employed at the project site; Providing separate toilet facilities for men and women at the accommodation as well as site; and Facilitating healthcare services and medical care in case of sickness. Locate handling sites away from populated areas Follow proper operation and handling measures to minimize exposure Provide prior warning /signals for blasting Provide sirens in vehicles to avoid any collision with human/animals Organize awareness programs on environmental resource management Organize Health camps Use of child labour will be strictly prohibited.			

Sr. No.	Activities	Potential Impact	Mitigation Measures	Time Frame	Institutional Responsibility	
					Implementation	Supervision
			Contractor will maintain a labour register with name, age and sex with supporting document (preferably copy of Aadhar card or voter's ID card). This will be monitored by Environmental and Social office of contractor and SECI. Provide signage near construction sites and approach roads **Avoiding Gender Based Violence** Contractor will prepare and implement robust measures to address the risk of gender-based violence that include (i) mandatory and repeated training and awareness raising for the workforce about refraining from unacceptable conduct toward local community members, specifically women; (ii) informing workers about national laws that make sexual harassment and gender-based violence a punishable offence which is prosecuted; (iii) introducing a Worker Code of Conduct as part of the employment contract, and including sanctions for non-compliance (e.g., termination), and (iv) contractors adopting a policy to cooperate with law enforcement agencies in investigating complaints about gender-based violence.			

Sr. No.	Activities	Potential Impact	Mitigation Measures	Time Frame	Institutional Responsibility	
					Implementation	Supervision
			Additional measures can aim to reduce incentives to engage with the local community by providing workers with the opportunity to spend their time off away from the host community, where feasible with a small transport allowance, ideally allowing workers to regularly return for brief visits to their families, spouses and friends, or to visit nearby urban centers that provide a variety of legal social opportunities. For workers who need to travel further it may be attractive to forego weekends off in exchange for longer breaks that would allow for such home leave travel			
13	Occupational Health and safety	Injury and sickness of workers	The Contractor has to follow all the safety precaution during works Contract provisions specifying minimum requirements for construction camps. All the workers must be provided with appropriate PPEs to the workers during works. Contractor to arrange for health and safety training sessions for workers.	Construction Stage	Contractor	State Power Transmission Agency/ SECI

Sr. No.	Activities	Potential Impact	Mitigation Measures	Time Frame	Institutional Responsibility	
					Implementation	Supervision
14	Storage of chemicals and materials	Contamination of receptors (land, water, air)	Fuel and other hazardous materials securely stored above high flood level.	Construction Stage	Contractor	State Power Transmission Agency/ SECI
15	Traffic and Vehicle movement and maintenance	Soil Pollution/Compaction	• Impervious platform and oil and grease trap for collection of spillage from construction equipment vehicle maintenance platform will be appropriately provided at construction camp, servicing area and liquid fuel and lubes at storage areas • Re-fueling of machinery at site to be undertaken over paved/ suitable surface. • In case of any accidental spill, the soil to be cut and stored securely for disposal with hazardous waste	Construction Stage	Contractor	Developer/ SECI
	C. OPERATION AND MAINTENANCE (O&M) STAGE					
1	Location of transmission towers and transmission line alignment and	Exposure to safety related risks	Setback of dwellings to overhead line route designed in accordance with permitted level of power frequency and the regulation of supervision at sites.	O&M Stage	State Power Transmission Agency	SECI

Sr. No.	Activities	Potential Impact	Mitigation Measures	Time Frame	Institutional Responsibility	
					Implementation	Supervision
	design					
2	Oil spillage	Contamination of land / nearby water bodies	Substation transformers located within secure and impervious sump areas with a storage capacity of at least 100% of the capacity of oil in transformers and associated reserve tanks	O&M Stage	State Power Transmission Agency	SECI
3	Inadequate Provision of staff/workers health and safety during operations	Injury and sickens of staff / workers	(a) Careful design using appropriate technologies to minimize hazards (b) Safety awareness raising for staff (c) Preparation of fire emergency action plan and training given to staff on implementing emergency action plan	O&M Stage	State Power Transmission Agency	SECI
4	Electric shock hazards	Injury / mortality to staff and public	Careful design using appropriate technologies to minimize hazards Regular monitoring of faults and immediate repair/ replacement of damaged wires/ towers Issue of warning to the local public regarding the malfunctioning and scheduling of repairs/replacement Barriers to prevent climbing on /dismantling of transmission towers	O&M Stage	State Power Transmission Agency	SECI

Sr. No.	Activities	Potential Impact	Mitigation Measures	Time Frame	Institutional Responsibility	
					Implementation	Supervision
			Appropriate warning signs on facilities Electricity safety awareness raising in project areas			
5	Transmission line maintenance	Exposure to electromagnetic interference	Transmission line design to comply with the limits of electromagnetic interference overhead power lines	O&M Stage	State Power Transmission Agency	SECI

ANNEXURE VI CRITERIA FOR SUB-PROJECT SELECTION

S. No.	Environmental Feature	Category Assigned (High/Medium/Low)	Significance (based on extent of area of the park and length of transmission line)	Remark/Explanation
Physical Environment				
	Drainage Conditions			
	Surface Water Resources			
	Erosion Prone stretches			
	Construction Material			
	Topography			
Biological Environment				
	National Park / Wildlife Sanctuary			
	Non-NP/WLS areas			
	Migratory routes			
	Reserved Forests			
	Green Tunnels/ Large Trees			
	Protected Forests			
Human Environment				
	Settlement			
	Sensitive Receptors			

S. No.	Environmental Feature	Category Assigned (High/Medium/Low)	Significance (based on extent of area of the park and length of transmission line)	Remark/Explanation
	Drinking Water sources			
	Physical cultural Resources – Religious			
	Physical cultural resources – community			
	Utilities like electricity lines, pipelines for gas, etc			

ANNEXURE VII SOCIAL SCREENING CHECKLIST

S. No.	Screening Criteria	Assessment of Category (High/ low)	Remarks /Explanatory note for categorization
1	Is the project in an eco-sensitive area or adjoining an eco-sensitive area? (Yes/No) If Yes, which is the area? Elaborate impact accordingly.		
2	Will the project create significant/ limited/ no social impacts?		
a	Land acquisition resulting in loss of income from agricultural land, plantation or other existing land-use.		
b	Land acquisition resulting in relocation of households.		
c	Any reduction of access to traditional and river dependent communities (to river and areas where they earn for their primary or substantial livelihood).		
d	Any displacement or adverse impact on tribal settlement(s).		
e	Any specific gender issues.		
3	Will the project create significant / limited / no Social impacts during the construction stage?		
a	Flooding of adjacent areas	Low Impact	
b	Improper storage and handling of substances leading to contamination of soil and water		
c	Elevated noise and dust emission.		
d	Disruption to traffic movements		

S. No.	Screening Criteria	Assessment of Category (High/ low)	Remarks /Explanatory note for categorization
e	Damage to existing infrastructure, public utilities, amenities etc.		
f	Failure to restore temporary construction sites		
g	Possible conflicts with and/or disruption to local community		

ANNEXURE VIII KEY DIFFERENCES BETWEEN RFCTLARR ACT 2013 AND WORLD BANK OPERATIONAL POLICY

Sr.l No.	Topics/Issues /Areas	World Bank OP4.12	RFCTLAR&R	Remarks / Measures taken to address in ESMF
1	Application of LA	Direct economic and social impacts that both result from Bank-assisted investment projects. Applies to all components of the project that result in involuntary resettlement, regardless of the source of financing.	***Section 2*** Applicable to projects where government acquires land for its own use, hold and control, including PSU and for public purpose; for PPP where ownership of land continues to vest with govt; private companies where 80% of **land owners**[9] have given consent or 70% in case of PPP.	
	Principle of avoidance	Involuntary resettlement should be avoided where feasible, or minimized, exploring all viable alternative project design	Alternatives to be considered as Act in chapter II, point # 4 (d) says "extent of land proposed for acquisition is the absolute bare minimum needed for the project; and (e) says land acquisition at an alternate place has been considered and found not feasible.	In line with bank OP 4.12
	Linkages with other projects	OP 4.12 applies to all components of the project that result in involuntary resettlement, regardless of the source of financing. It	No such provision	The ESMF will be applicable for all components of the project that or any linked project

[9] Land Owner – whose land and immovable property acquired and land assigned by state or central govt. under any scheme (Section 3 c (i) and (v))

		also applies to other activities resulting in involuntary resettlement that inthe judgment of the Bank, are (a) directly and significantly related to the Bank-assisted project, (b) necessary to achieve its objectives as set forth in the project documents; and (c) carried out, or planned to be carried out, contemporaneously with the project.		necessary to achieve its objective.
2.	Application of R&R	Same as above	In addition to the above, ***Section 2(3)*** land purchased by private company as prescribed by Govt. or when part acquired by govt	Provision of OP 4.12 to apply.
3.	Affected area	Involuntary take of land resulting in loss of shelter, loss of assets or access to assets, loss of income sources or means of livelihood	***Section3(b)***: Area notified for 'acquisition'	Provisions of OP 4.12 will be applicable
4.	Family		***Section 3(m)*** includes person, his and her spouse, minor children, minor brothers and sisters dependent. Widows, divorcees, abandoned women will be considered as separate family.	The definition of family given in RFCTLAR&R Act 2013 will be followed for both titleholders and non-titleholders.

5.	Affected family for eligibility	All adversely affected people whether have formal legal rights or do not have formal legal rights on land	***Section 3 (a)***: whose land and other immovable property acquired. ***(b)&(e)***: Family residing in affected area such as labourers, tenants, dependent on forest and water bodies, etc. whose primary source of livelihood is affected due to acquisition ***(c)***Scheduled tribes and other forest dwellers whose rights recognized under the Forest Dwellers Act 2006. ***(f)*** Family assigned land by state or central government under any schemes ***(g)*** Family residing on any land in urban area that will be acquired or primary source of livelihood affected by acquisition.	
6.	Cut-Off date	Date established by the borrower and acceptable to the Bank. It is the date of census.	***Section 3 c (ii), (iv) (vi)***: Families residing for preceding 3 yrs or more prior to "acquisition of land".	Provisions of OP 4.12 will be followed as RFCTLAR&R Act has no such provision for people living on public land. Moreover, RFCTLAR&R Act requires proof of residing in the project area at least

				three years prior to initial notice on LA.
7.	Non-application of Chapter II	Stand-alone SIA for all investments	***Section 6(2):*** Irrigation projects where EIA is required under other laws, provisions of SIA not applicable.	Provision of OP 4.12 will be followed.
7.	Consultation – Phase I during preparation	Consultation a continuous process during planning and implementation	***Section 4(1)*** date issued for *first consultation* with PRIs, Urban local bodies, Municipalities, etc. to carry out SIA. ***Section 5***: Public hearing of SIA in affected area. Provide adequate publicity of date and time.	Provisions of OP 4.12 will be followed. The draft and final SIA will be disclosed in public as per the provision given in RFCTLAR&R Act, 2013.
8.	Time duration to prepare SIA and SIMP	Draft Social Assessment, Resettlement Action Plan and or Social Management Framework prepared before appraisal.	***Section 4 (2)***: ***within six months*** from the date of its commencement.	No gap found. RFCTLAR&R Act specifies a timeframe which is followed by the client.
9.	Disclosure – Stage I	To be disclosed before appraisal.	***Section 6(1)***: Translated in local language available in PRI institutions and local urban government bodies; district administrative offices and websites of concerned government agency.	No gap found.
10.	Formation of Expert Group to appraise SIA and SIMP	Appraised by Bank staff	***Section 7(1):*** Constitute a multi-disciplinary Expert Group include members of	No gaps found.

			decentralized govt Institutes (PRIs, ULBs).	
11.	Time stipulated for Group to submit its report	Before the decision meeting for appraisal	***Section 7(4):*** Submit its report ***within two months from the date of its constitution***	No gaps found.
12.	Scope of work of the Expert group	Social Assessment, resettlement action Plan reviewed and appraised by Bank staff and approved by Regional safeguard advisor	***Section 7 (4) (a&b)***: assess whether it serves any public purpose or not; if social costs outweigh potential benefits then should be abandoned; ***Section 7 (5) (a&b)***: if serves public purpose, then it has considered minimum land acquisition, and alternate options to minimize displacement; potential benefits outweigh social costs	No gap found.
13.	Consultation – Phase II during appraisal	In practice consultation workshops are organized in project affected areas at district and state level.	***Section 2 (2):*** Prior consent of 80% and 70% of land owners in PPP and where private company has approached the govt to acquire balance land has been obtained,	No gap found.
14.	Disclosure – Stage II	Information dissemination through the planning and implementation	Section 7 (6): recommendations of expert group under 7(4&5) to be made public in local language in district and block administrative office and PRIs	No gap found.

15.	Minimize impact on multi-crop land	Select feasible design that has minimal adverse impact.	***Section 10:*** In case multi-crop land is to be acquired under exceptional circumstances, the area to be acquired cannot exceed aggregate of land of all projects in district or state. The area to be acquired cannot exceed the total net sown area of the district or state. Wasteland equivalent to twice the area acquired will be developed.	No gap found.
16.	Information dissemination of preliminary notice	Continuous part of the preparation and participation	***Section 11 (1), (2) & (3)***: Notice published in local language and meetings called of gram sabhas, municipalities to provide full information about the purpose of the project, summary of SIA and particulars of administrator appointed for R&R' summary of R&R scheme	No gap found.
17.	Updating land records	To be part of RAP	***Section 11 (5)***: Once established that the land is required for public purpose, accordingly notice to be issued ***under section 19 following which land records to be updated within two months***	No gap found.

18.	Census and preparation of R&R schemes	To be part of RAP including both titleholders and non-titleholders	***Section 16 (1) (2)***: carry out census of affected people and their assets to be affected, livelihood loss and common property to be affected; R&R scheme including time line for implementation.	RFCTLAR&R Act takes only titleholders into account. Provision of OP 4.12 to be followed.
19.	Information dissemination and Public hearing - Stage III	Consultation throughout the process is mandatory	***Section 16(4) & (5)***: mandatory to disseminate information on R&R scheme including resettlement area and organize public hearing on the Draft R&R scheme in each Gram Sabha, Municipality and consultations in Scheduled area as required under PESA.	Provisions of OP 4.12 to be followed.
20.	Approval of R&R Scheme	As part of RAP prior to appraisal	***Section 17 & 18***: Draft R&R Scheme to be finalized after addressing objections raised during public hearing and approved.	No gap found
21.	Final declaration of R&R Scheme	Approved RAP including budgetary provisions to implement it	***Section 19 (2)***: Only after the requiring body has deposited the money will the govt issue the notice along with **19(1)**.	No gap found.
22.	Time period stipulated.	Included in RAP - Time line synchronized with Government's procedures or adopts innovative methods to reduce the time which is based operated on	***Section 19 (2):*** the entire process to update land records, disseminate information, preliminary survey, census, hearing of objections, preparation of R&R schemes and approval,	No gap found.

		the principles of participation and transparency.	deposit of money must ***complete within 12 months*** from the date on which section 11, the preliminary notice issued. ***Section 19 (7)***: If the final declaration not made within 12 months of section 11 (1), the process will lapse, except under special circumstances.	
23.	Preparation of land acquisition plans	Included in RAP.	***Section 20:*** Land marked, measured for preparation of acquisition plans.	No gap found.
24.	Hearing of claims		***Section 21(1) (2)***: Notices issued indicating govt's intension to take possession of land and claims on compensation and R&R can be ***made not less than one month and not more than six months*** from the date of issue of section 21(1).	
25.	Time period stipulated for declaring the award		***Section 25:*** It is required to announce the award ***within 12 months of issue of Section 19 (final declaration to acquire land, approved R&R scheme)*** after completing land acquisition plans, hearing of objection, settling individual claims for declaration of the award. If award not made within the	

			stipulated time, the entire proceedings will lapse.	
26.	LA Act 1984 deem to lapse and RFCTLAR&R is applicable		***Section 24***: where award is not declared under section 11, or where made five years ago but land not taken in possession or where award declared but money not deposited in the account of majority of beneficiary.	No gap found.
27.	Methodology for determining market value for land	Full replacement Cost	***Section 26 and First Schedule:*** Recognizes 3 methods and whichever is higher will be considered which will be multiplied by a factor given in Schedule First; compensation given earlier will not be considered; if rates not available floor price can be set; steps to be taken to update the market value.	No gap found.
28.	Valuation of structures	Full Replacement cost	***Section 29 (1)*** without deducting the depreciated value.	Provisions of OP 4.12
29.	Solatium and interest		***Section 30(1)*** 100% of the compensation amount ***Section 30(3)***: 12% per annum on the market rate from the date of notification of SIA to the date of ward or land taken over	No gap found.
30.	R&R Award	Total cost included in RAP to resettle and rehabilitate the	***Section 31, Second Schedule***: A family as a unit will receive R&R grant over	No gap found

		affected persons and assist in their efforts to improve their livelihoods and standards of living or at least to restore them, in real terms, to pre-displacement levels or to levels prevailing prior to the beginning of project implementation, whichever is higher	and above the compensation and those who are not entitled to compensation. ***Second Schedule:*** Homeless entitled to constructed house, land for land in irrigation projects in lieu of compensation, in case of acquisition for urbanization 20% of developed land reserved for owners at a price equal to compensation' jobs or onetime payment or annuity for 20 years' subsistence grant, transportation, land and house registered on joint name husband and wife, etc.	
31	Transparency		***Section 37(1):***Information of each individual family including loss, compensation awarded, etc. will be available on the website.	No gap found.
38.	Possession of land	Taking of land and related assets may take place only after compensation has been paid and, where applicable, resettlement sites and moving allowances have been provided to the displaced persons.	***Section 38(1)***: Land will be taken over by the government within three months of compensation and 6 months of R&R benefits disbursed; infrastructure facilities at resettlement sites will be completed within 18 months from the date of award made under section 30 for compensation; in case of irrigation and hydel projects	No gap found.

			R&R completed six months prior to submergence.	
39.	Multiple displacement		***Section 39:*** Additional compensation equivalent to compensation determined will be paid to displaced	No gap found.
31.	Acquisition for emergency purpose	Not permeable in bank funded projects	***Section 40 (5)***: 75% additional compensation will be paid over and above the compensation amount	Provisions of OP 4.12 will be followed.
32.	Prior consent before acquisition and alienation	Mandatory to carry out Free, Prior, Informed Consultation with Indigenous people.	***Section 41(3)*** Mandatory to get consent from Gram Sabha, Panchayat, Autonomous Councils in Scheduled areas.	No gap found.
33.	Development plans for SC and ST	Indigenous Peoples' Development plan required along with RAP. Land for land for is an option across all sectors.	***Section 41:*** Separate development plans to be prepared, settle land rights before acquisition; provision of for alternate fuel fodder, non-timber produce on forest land to be developed within 5 years; 1/3rd compensation amount to be paid as first instalment and rest at the time of taking possession; ST to be resettled within Scheduled area; land free of cost for community purpose; land alienation will be null and void and ST and SC considered for R&R benefits; fishing rights restored in irrigation and hydel projects; if wish to settle outside the	No gap found.

			district additional benefits to be provided in monetary terms; all rights enjoyed under other laws will continue. ***Second Schedule***: additional provisions for SC&ST for land for land in irrigation projects, additional sum over and above the subsistence grant,	
34.	Institutional arrangement	Institutional arrangement must be agreed upon and included in RAP, IPDP.	***Section 43-45:*** Appointment of administrator, R&R Commissioner, when more than 100 acres of land is to be acquired, R&R Committee will be formed at project level, social audit to be carried out by Gram Sabha and Municipalities.	No gap found.
35.	Change of land use	Compensation and R&R assistance should be disbursed before taking physical possession of land.	***Section 46(4):*** Land will not be transferred to the requisitioning authority till R&R is not complied with in full	No gap found.
36	Monitoring and Evaluation	Indicators and monitoring system included in RAP and IPDP	***Section 48-50:*** Set up National and State level Monitoring Committee to review and monitor progress	No gap found
37.	Authority to settle claims		***Section 51-74:*** The Authority will be set up settle any legal disputes that arise from acquisition and R&R, the aggrieved party can	No gap found

			move to the high court thereafter.	
38.	Exempt from tax and fee	Project to bear all taxes and other expenses if new assets are purchased by the PAP	***Section 96:*** Compensation and agreements will not be liable to tax	No gap found
39.	No change in status of land acquired		***Section 99***: Once the land is acquired for a particular purpose, its purpose cannot be changed	No gap found
40.	Return of unutilized land		***Section 101:*** If the acquired land remains unutilized for 5 years, then it will be returned to original owner, heir or included in land bank	No gap found
41.	Distribution of increased value of land transferred		***Section102***: 40% of appreciated value of acquired land will be distributed to owners provided no development has taken place.	No gap found

ANNEXURE IX CHECKLIST FOR PREPARING GENDER ACTION PLAN

Focus of intervention	Data to be collected	Data source
Policy checklist	i. What are the requirements of the national gender equality policy, if any, and the executive support provided to it? ii. Which ministry focal point or unit is responsible for advocacy and gender inclusion at the policy and project level? iii. Does the Energy sector strategy address gender issues (labour issues, e.g. promotion of gender in labour-based work, participation of women in prioritization and design of works, measures to eliminate discriminatory labour or contracting practices, HIV/AIDS prevention and treatment) in its works and contracts? iv. Do solar policy and planning procedures explicitly take gender into account: identification of gender gaps and gender-specific needs, capacities, constraints, and opportunities inclusion of socio-economic empowerment as an integral element? v. Are women and men civil society stakeholders consulted on policies and programs; included in teams analysing policy and strategy; included in decision making? vi. Is there a system for monitoring the implementation of gender and other components of sector policies and strategies? vii. Sex disaggregation of beneficiary data and key gender indicators outreach and capacity building on gender and other social dimensions grants for addressing gender issues? viii. Are there training sessions on gender including gender-sensitive planning? ix. Is stakeholder consultation facilitated? x. Is there participation of implementing agencies or community organizations?	Contract documents; Ministry of New and Renewable Energy; Ministry of Women and Child Development; Park developer

Focus of intervention	Data to be collected	Data source
	xi. Are gender sensitization workshops held for men and women of power ministry / department staff and implementing agencies, and do they consider knowledge gaps in gender elements in the sector? xii. How many women are represented on gender boards and in works prioritization and decision-making forums related to the planning, implementation, monitoring, and evaluation of projects?	
Project cycle: Project identification, preparation, and design	i. Conduct a rapid assessment to identify and quantify potential gender-related issues and impacts affecting access, risks, benefits, and participation ii. Identify disadvantaged or vulnerable groups, including who they are, where they live, and their socioeconomic characteristics (scheduled castes, women-headed households, widows, disabled) iii. Examine the impacts of project on these groups iv. Identify the gender-specific implications of land acquisition and resettlement v. Identify gender-specific implications of employment opportunities to be created under the project vi. Identify gender-specific constraints in receiving information and providing feedback and complaints on the project vii. Discuss identified gender and other social issues in the project viii. Include both females and males affected by the project in stakeholder consultations ix. Use separate focus groups to enable women to voice their views separately from men x. Analyse the data collected to highlight gender differences in uses and the underlying causes of women's and men's project related problems	Stakeholder and beneficiary assessments: user satisfaction survey, project concept note, social assessments (household surveys and focus group discussions in project influence area), mid-term and end term evaluation surveys

Focus of intervention	Data to be collected	Data source
	xi. Examine relevant inter-sectoral linkages, such as access to health services, HIV/AIDS prevention, and access to markets and schools xii. Ensure that analysis of gender differences in needs, use, constraints, and access are included in the terms of reference for the social assessment xiii. Identify the gender-related issues that need to be addressed to ensure the effectiveness and sustainability of the project xiv. Develop approaches for addressing the gender-related issues identified and creating opportunities for equal access to project benefits for men and women, including training, organizational capacity building, grants programs, targets for women's participation xv. Develop indicators for measuring progress on gender-related issues within the relevant project components (e.g. construction works, institutional arrangements, land acquisition and resettlement benefits, privatization, livelihood restoration, awareness building, consultations, complaint handling)	
Project cycle: Methodology	i. Desk review (secondary literature) ii. Review available information (e.g. statistics, gender analysis, documents of previous solar projects, if available or other projects involving acquisition for non-linear projects) in the project area and the socioeconomic profile of the target population iii. Review the relevant legal framework (e.g. inheritance law), policy framework (e.g. resettlement and rehabilitation), and institutional framework (e.g. current administrative system for land acquisition, compensation disbursement, grievance handling, awareness creation) and their gender implications iv. Review government programs for encouraging equal opportunities and participation of women in the project influence area v. Household surveys (primary survey)	Other projects in the country/state and gender policy documents, household surveys, national sample survey, latest census data, participatory rapid appraisal of target area,

Focus of intervention	Data to be collected	Data source
	vi. Draw up gender-disaggregated socioeconomic and cultural profiles and identify the problems faced by and needs of the target population vii. Conduct group discussions, random interviews, and transect walks to study the activity pattern viii. Collect quantitative information ix. Participatory methodologies (e.g. participatory rapid appraisal) x. Collect qualitative information that cannot be collected through surveys (socio cultural norms, behavioural questions) xi. Define ways in which men and women beneficiaries and other stakeholders, especially poor women, can equally participate in the project xii. Map out the target areas and assess which are the most disadvantaged areas and sections of society (widows, female-headed households, disabled men and women) in terms of access to services and poverty level xiii. Identify major stakeholder groups and their positions xiv. Staffing xv. Ensure adequate gender balance in field teams xvi. Select field team members with gender awareness, local knowledge, cultural understanding, and willingness to listen	focus group discussions, consultations with beneficiaries
Project cycle: Data collection	i. Socioeconomic profile: Gender-disaggregated data ii. Demographic: Gender, sex ratio, caste, marriageable age, female-headed households, migration trend, household size iii. Economic: Income level and source, expenditure pattern and decision making, access to land and resources iv. Health: Population growth rate, infant and adult mortality rate, availability of medical facility, reproduction-related decision making, HIV/AIDS awareness v. Education: Literacy, school enrolment and dropout ratio, child labour	District, block, and village census data, national sample survey data, health survey data, household surveys, focus group

Focus of intervention	Data to be collected	Data source
	vi. Status of women: Political representation and awareness, socio cultural perceptions and practices of men and women, domestic violence, trafficking, gender-discriminatory policies and laws, gender roles, responsibilities and gender division of labour in productive areas (e.g. agriculture, income-generating activities) and reproductive areas (e.g. household chores, child care), and time allocation for each responsibility vii. Fuel, fodder, water and sanitation viii. Availability, quantity, and quality of fuel and fodder, who collects fuel, fodder, and water for the family, sources of drinking and agricultural water, how men and women store and use water collected, dry season management, how far away these resources are located, time spent on collection of the resources, mode of transport used to collect the resources, availability of sanitation service (chargeable or not, who runs it) ix. Access, control, constraints x. How men and women differ in their access to and control of land, agricultural inputs, extension, markets, employment opportunities, and credit xi. Whether external assistance is provided to improve access and control, and by whom xii. Participation xiii. Factors affecting the level of participation of men vs. women, incentives and constraints, means of information dissemination about the project preferred by men vs. women, labour demand for men vs. women, which modes of participation men and women favour (e.g. decision making in planning, cash contribution, labour contribution for construction, training, financial management, organizational management) xiv. Perception of benefits and impacts xv. Men's and women's perceptions of positive and negative impacts of the project, how negative effects can be mitigated	discussions, behavioural surveys, observation

Focus of intervention	Data to be collected	Data source
Project implementation : Gender action plan	i. Prepare gender action plan. Under this: ii. Undertake quality social and gender analyses. Identify constraints to participating and benefiting men and women; develop strategies for each component to ensure that men and women participate and benefit equally iii. Revisit gender design strategies at inception to develop a detailed gender action plan. The plan needs to be tested and reviewed early in implementation; identify detailed activities, targets, resources, and responsibilities for implementation iv. Gender action plan must be fully owned and understood by the executing agency. Use a participatory and flexible approach to developing the plan; a strong rationale that is directly linked to overall project objectives is needed for targeting and working with women v. Identify realistic targets linked to loan objectives. Targets and strategies should enable step-by-step progress, bringing incremental changes and challenging culture without threatening it; linking targets to loan objectives helps all stakeholders to understand the rationale for focusing on women and helps monitoring of participation and benefits. vi. Include gender capacity building in the gender action plan. Both formal training and ongoing support and mentoring are needed for developing skills, ownership, and commitment. vii. Provide adequate skills and resources for implementation of gender action plan. Long-term gender specialists in the executing agency or project team and adequate resources for implementation of actions; nongovernmental organizations and other agencies contracted to implement project activities should have a demonstrated gender capacity. viii. Monitor and follow up gender-related targets and activities. Systematic follow-up to ensure that policy reforms and gender actions are implemented; routine monitoring	Gender expertise, Discussion and participation with beneficiaries, separate focus group discussions with men and women, government departments, labour and employment laws, provisions in project and budget, learning approaches from good practice cases

Focus of intervention	Data to be collected	Data source
	and reporting; gender-sensitive indicators and gender-related risks must be included in project logical frameworks.	
Project implementation : Participation strategy	i. Develop a participation strategy for men and women during project implementation and monitoring and evaluation: ii. Avoid overly high expectation of women's participation and develop a practical schedule for participation iii. Planning: Conduct women-specific consultation to take their views and suggestions on the design. Any mechanism established during the project design, such as grievance mechanisms, should have adequate representation of women iv. Construction: Ensure workconditions that are conducive to women's participation (e.g. gender-equal wage rates, construction season, toilet and child care facilities) v. Training options: Identify ways to link up with income generation, literacy, and other activities to support an integrated approach to poverty reduction and women's empowerment vi. Staffing, scheduling, procurement, and budgeting: Hire female project staff vii. Consider seasonal labour demand in scheduling civil works viii. If appropriate, set a minimum percentage of female labourers and prohibit the use of child labourers in the civil works contract ix. Ensure adequate and flexible budgeting to allow a learning approach (e.g. training budget, consulting service budget for women's organizations)	Gender expertise, Discussion and participation with beneficiaries, separate focus group discussions with men and women, government departments, labour and employment laws, provisions in project and budget, learning approaches from good practice cases
Project cycle: Impact	i. Establish whether men and women perceive positive and negative impacts of the project differently, and assess how the negative effects can be mitigated ii. Consider whether the benefits are likely to be distributed equitably	Project monitoring reports, audits, group discussions,

Focus of intervention	Data to be collected	Data source
	iii. For disadvantaged or vulnerable groups, find out who they are, where they live, what are their socioeconomic characteristics (scheduled castes, women-headed households, widows, disabled), and how the project will affect them iv. Assess the gender-specific implications of the following: - land acquisition and resettlement: extent of land being acquired - utility relocation: what and where - tree cutting: how many and local dependence - diversion of forest land: how much and local dependence	household survey, land tenure details
Monitoring and Evaluation: Feedback mechanism	i. Develop a feedback mechanism in which both males and females have a voice ii. Disaggregate all relevant indicators by gender, such as number of women gaining access to credit, increase in women's income, and career prospects for project-trained women iii. Integrate sex-disaggregated beneficiary data and relevant measures of gender equality into the baselines and other routine monitoring and evaluation processes iv. Measure the impacts of the project components on women and men v. Assess the value added by women's participation in the project	Focus group discussions, project monitoring reports
Monitoring and Evaluation: Gender informed indicators	i. Develop gender-informed results indicators for monitoring. These include: ii. Increased income, employment, and entrepreneurship. Number of women and men employed in sector, number of women and men employed in solar power project; increased women's and men's income from produce marketed using project services. iii. Time saving and increased productivity. Reduced women's and men's time for domestic work (collection of	Review of gender-informed results indicators

Focus of intervention	Data to be collected	Data source
	water, fuel wood, food crop collection, fodder, etc.); increased productive time used for economic activities. iv. Improved affordability. Percentage increase of income among women and men; increased participation in decision making; number of women and men participating in community decision meetings; reduced incidence of harassment, crime, and human trafficking; increased awareness of HIV/AIDS transmission and prevention; number of women and men leading committees; number of women and men managers in agencies; women control their income and establish bank accounts in their names; increased recognition of women's contributions to the household and community	

ANNEXURE X CONSULTATIONS IN SAMPLE PROJECTS

Location for Consultation	Issues Covered / Raised by Participants	How it would be Addressed
Proposed Solar Park Site – Pavagada		
Selected five villages: Thirumani, Balasamudra, Vollur, Kyathaganacherlu, Rayacharlu	Opportunity for employment generation for the village land owners and the agricultural labour - Semi-skilled / unskilled	The local community members will be preferred for employment during construction. Those losing livelihood will be provided opportunities for alternative livelihood.
	Opportunities for employment generation for women and girls. Improved health, education and transport services Economic and social empowerment of women and girls	Vocational centres, establishment of home-based income generation activities Development of health centres, health camps and up gradation of schools for secondary and higher education Formation of self-help groups, linkages with markets and banking facilities, awareness campaigns to address issues of child marriage and other social ills.
Number of stakeholders consulted: 70 stakeholders	The annual lease rate is low in comparison to adjoining areas for similar projects	Rates will be finalized in consultation with the local community and district administration. Additional public disclosure about the criteria for calculation etc to be made known to stakeholders.
	What other benefits for the village / land owners	Developers will carry out developmental activities in the villages as part of CSR. The activities will be identified in consultation with the community.
	Stakeholder expects better power supply	The government may consider to include a small percentage of power produced by

Location for Consultation	Issues Covered / Raised by Participants	How it would be Addressed
	situation in villages after the implementation of solar power plant	the developer to be allocated for the local population or alternatively, the conditions could be included in the agreements for the developer to install roof-top solar power panels for the local villagers as part of the CSR budget of the company
	What would be the payment schedules and how will the timely payments be ensured	The lease will be paid annually with an increment of 5% every two years. Project to make community aware about the mechanisms to be put in place for ensuring timely payment of lease rentals payable to them.
	Impact of dust on standing crops during construction phase	Contactor will ensure watering of construction site / tracks on regular basis.
Proposed Solar Park Site – Rewa		
Selected five villages: Badwar, Barseta Desh, Barseta Pahar, RamNagarPahar and Etar Pahar	What will be the rate for acquiring land	The land owners will be paid double the circle rate as per the provisions of the state policy.
	Opportunities for employment for women and girls Access to water, sanitation, health and education services Economic and social empowerment of women and girls	Vocational centres and home-based employment generation activities Installation of hand pumps, active participation in implementation of government schemes like 'Swachh Bharat' for effective roll out and improved access to health facilities and higher education. Formation of self-help groups, linkages with markets and banking facilities, awareness campaigns to address issues of

Location for Consultation	Issues Covered / Raised by Participants	How it would be Addressed
		child marriage and other social ills.
Number of stakeholders consulted: 55 stakeholders	What impact the project will have on the surrounding areas due to radiation.	The solar panels do not have any adverse impacts on the health due to radiations. The Project will undertake awareness campaigns about the solar panels and how it works on regular basis.
	How will the access to the private land parcels ensured which are not included in the solar park	The easement rights shall be ensured while preparing the detailed layout plans for the solar park.
	Impact on surface water sources	Ensure that the existing drainage and surface water bodies are not altered during construction stage. Water from such sources should only be withdrawn after getting NOC from local panchayat.
	What will happen to houses falling within the proposed site?	Project will prepare a resettlement action plan which will provide for mitigation measures for all adverse impacts including relocation. The impacted structures will be compensated at replacement value.
	Access to forest area for collection of NTFP	Project to ensure that community has access to forest areas.
Proposed Solar Park Site – Mandsaur		
Project Villages: Gujarkhedi(uninhabited) and Runija Villages;	What kind of employment opportunities would be available for the semi-skilled and unskilled labourers during the	RUMSL (solar park developer) has taken the initiative and prepared a list of unemployed youth along with their qualifications and contact numbers. The same is shared with the EPC / NTPC for

Location for Consultation	Issues Covered / Raised by Participants	How it would be Addressed
	construction and operations stage	potential requirement during the construction and operations stage activities.
	Opportunities for employment for women and girls Access to water, sanitation, health and education services Economic and social empowerment of women and girls	Vocational centres and home-based employment generation activities Installation of hand pumps, active participation in implementation of government schemes like 'Swachh Bharat' for effective roll out and improved access to health facilities and higher education. Formation of self-help groups, linkages with markets and banking facilities, awareness campaigns to address issues of child marriage and other social ills.
Number of Stakeholder consultations conducted: 50 stakeholders / villagers including women	The setting up of the proposed plant would lead to blocked access to a locally known cultural site and loss of grazing land for animals.	Of the 553 ha only 8 ha of land is given on patta, rest all is government land. The 9 families who have been allotted patta would be provided with alternative land parcels on Patta. Access to the proposed site would be blocked due to safety concerns. Access can be provided through the plant premises on request if required. The villages in vicinity of the proposed project sufficient grazing lands.
	Some of the major water bodies falling within the proposed site are being used by locals to meet their water demands for various activities.	The developer/EPC contractor has confirmed the local community that no water would be drawn from these surface water bodies for solar park related activities and these have also been excluded from the site fencing based on the consultation inputs. The project boundaries have undergone changes post

Location for Consultation	Issues Covered / Raised by Participants	How it would be Addressed
		the start of the project implementation.
	The approach road to site passes through a cluster of houses mainly belonging to the SC category on the outskirts of the village. This can have serious safety concerns due to movement of heavy machinery and vehicles	The developer in coordination with the EPC contractor has agreed to provide additional signage and other safety measures near the cluster. The EPC contractors shall also undertake development works i.e. construction of public toilets etc. from their CSR budgets near these housing clusters.

ANNEXURE XI- GRIEVANCE REDRESSAL FORMATS

ENVIRONMENTAL AND SOCIAL GRIEVANCE FORM

Complainant Name	
Contact Details	Address Contact No.:
Location of Complaint	
Details of Complaints	
Directions	
Confidentially Requested	Yes ☐ ☐
Signature of Complainant	**Date:**
Reference No.:	*For official use only*
Date Received:	*For official use only*
Complaint taken by:	*For official use only*
Complaint assigned	*For official use only*
Date of complaint Acknowledged:	*For official use only*
Complaint referred to	*For official use only*

ANNEXURE XII FORMAT FOR GRIEVANCE REDRESSAL MECHANISM REGISTER

Sl. No.	Name of the Complainant	Unique complaint number	Address & Contact No.	Gist of the Complaint	Forwarded to whom	Whether grievance redressed or not	If yes, Gist of disposal	If rejected, gist of reasons	If not attended reasons

Monthly status Report on Environmental and Social Grievance Redressal: -

Sl. No.	Name of the unit	No. of pending complaints at the end of previous month	No. of complaint received during the month	Action initiated during the month	Completed during the month	No. of complaints pending at end of month	No. of grievance redressed	No. of dismissal	Total	Remarks

ANNEXURE XIII PERFORMANCE INDICATORS- ASSESSMENT METHODOLOGY AND EXPECTED OUTPUTS

Monitoring process

Monitoring Project Implementation Process, Input and Output

Progress	Assessment Methodology	Expected Output
Implementation Progress		
Notices under land acquisition process	Structured Schedule, informal and formal discussion	Timely notices to the affected families
Dissemination of information on project and social issues	Check the registers with contractors for queries	Adequate knowledge on project and its various components
Consultations conducted under the project with PAPs and others	Check the minutes of meetings registers with the PAPs. Verify copies on agreements made on issues raised and discussed.	Awareness and information on the project and participation in the project.
Consultations on R&R Policy and Distribution of R&R Policy of the project	Check the registers with the PAPs. Verify copies on agreements made on issues raised and discussed.	Awareness on R&R Benefits
Information on modes of valuation of assets, payment schedules and disbursement modes	Check the registers with the PAPs. Structured Schedule, informal and formal discussion	Awareness on methods of valuation, satisfaction with the payment schedules, disbursement modes
Needs assessment and training programs for income generation	Structured Schedule, informal and formal discussion	Awareness and satisfaction with the training programs for income restoration
Services of the NGO	Structured Schedule, informal and formal discussion	Proper knowledge, guidance and assistance in rehabilitation and resettlement

Progress	Assessment Methodology	Expected Output
Functioning of the Grievance redressal mechanism	Check the records of the NGO, State Nodal Agency and contractors for the complaints registered	Appropriate and timely action on the grievances of the affected people
Consultations for the identification of the Community Development Works	Check the minutes of meetings registers with the PAPs. Verify copies on agreements made on issues raised and discussed.	Participation in decision making process and satisfaction with the identified areas of development
Financial progress		
Amount disbursed for acquisition of land, structure, trees, etc.	Structured Schedule, informal and formal discussion	PAPs purchased land equivalent or more than land loss of same quality
Amount disbursed for R&R assistance.	Structured Schedule, informal and formal discussion	New house constructed, new land purchased, new productive assets purchased, created some income source to offset the loss of income
Amount disbursed for extension of development programmes, training and capacity building.	Structured Schedule, informal and formal discussion	Alternative income restoration programs initiated and lost income restored.
Fees paid to NGO for implementation of RAP and consultants for M&E activities	Structured Schedule, informal and formal discussion	Timely implementation
Physical progress		
Total land Acquired	Structured Schedule	Progress of land acquisition
Number of PAFs relocated	Structured Schedule	Progress of resettlement
Number of PAFs R&R Assistance	Structured Schedule	Progress on Economic Rehabilitation

Progress	Assessment Methodology	Expected Output
Social well being		
Area and type of house and facility in case of relocation	Core Rapid Appraisal	Resettlement
Health conditions, morbidity and mortality rates, if relocated or pollution due to construction	Structured Schedule	Social well being
Communal harmony if relocated in another revenue village	Rapid Appraisal	Resettlement
Women time disposition and decision making power for women groups trained for alternative livelihood	Participatory Appraisal	Women Empowerment
Increase in literacy level due to project intervention; drinking water, schools, health facilities, and other community infrastructures if relocated and enhanced by the project	Structured Schedule	Social well and improved social status.
Increased annual Household income and expenditure due to project intervention	Structured Schedule	Improved income Economic Status

ANNEXURE XIV TERMS OF REFERENCE FOR CONCURRENT MONITORING AND EVALUATION

a. Aim and Objectives

The aim of the monitoring is not only to ensure smooth implementation of the R&R program, but also to ensure that the implementing authority/contractor have followed the steps provided in RAP and approved policy of the project authority. The monitoring and evaluation will provide an assessment of RAP implementation to enable timely adjustments of implementation setup and also to verify whether the objectives of resettlement have been achieved or not.

Individual Consultant can be hired by project implementing agency for concurrent monitoring and evaluation of the project.

b. Scope of work

The scope of work for M&E consultant would be:

(a) to ensure timely implementation of Resettlement Action Plan (RAP) without deviation

(b) to assess whether the implementation of the RAP is as per the R&R policy and RAP document

(c) to evaluate whether the social development objectives of the project have been achieved

c. Consultant Qualification

He/She should be a post-graduate, preferably in social sciences, and should have experience of working in international funding projects. He/She should have about 5 years' experience in implementing R&R and rural development works. He/She should have held management position in previous assignments should possess participatory management skills and must have good knowledge of the local language. The team leader should have working knowledge of land acquisition process.

d. Duration of Service

The consultant will be contracted for a period of twelve months from the date of appointment.

Data, Services and Facilities to be provided by the Client

The client will provide the copies of the social assessment report, RAP, R&R policy, the list of the PAFs, the land acquisition plan and any other relevant reports/data. All facilities and support required in the performance of the assignment shall be extended to the consultants.

e. Deliverables

The consultant shall provide following deliverables:

S. No.	Output	Timeframe
1	Monthly progress report	1st week of Every month

2	Project Completion Report	At the end of 12th month from the date of signing of contract

ANNEXURE XV BATTERY ENERGY STORAGE SYSTEM CONSIDERATION

SAFETY CONSIDERATION FOR BESS

Safety consideration has two aspects. First, which could be included in all projects (e.g. risk analysis and incident preparedness) and second are those that are specific to technology type or application environment and other project specific factors. Safety consideration should be given due consideration during entire span of project from planning to commissioning and until decommissioning; by creating processes and procedures that will ensure a safe life cycle for energy storage deployments.

A. Addressing Safety in Planning

One of the first steps in development of Battery Energy Storage System (BESS) is identifying and quantifying the need for energy storage. When assessing the identified need for services on a given electrical system, consider the environments where an energy storage device could be installed. Factors such as population density, available footprint, local weather, electrical power constraints, proximity to the nearest fire station, and availability of water may be accounted for when evaluating a site. If there are insufficient resources or non-ideal conditions at any one site, multiple sites can be considered for smaller systems with aggregated functionality. Identified needs could include a short list of unacceptable outcomes. Many unacceptable outcomes can be derived from environmental and safety regulations like, events such as arc flash or blast in excess of the available worker PPE, or chemicals spilling into nearby river in excess of EPA regulations. Additional unacceptable outcomes can be derived from the associated level of financial risk or potential for loss of reputation such as in the event of a fire that spreads to nearby structures. Understanding these boundaries helps to contextualize specifications and make safety requirements meaningful.

B. Addressing Safety in Procurement

Along with information about physical dimensions, performance, and cost, a set of requirements to procure and install an energy storage system and then operate that system should also include requirements that ensure that the system is safe and that its operation over time remains safe. The requirements should also address potential safety related incidents and the specific actions that must be taken if they should occur. These specifications afford users an opportunity to mitigate risk and will aid in ensuring that equipment supplied is safe, that the system is effectively commissioned and deemed safe, and that the user can ensure system is continued to be operated safely.

Functions and the associated performance of equipment is captured in two areas that can be referenced for ease in developing specifications.

1. Codes, Standards and Regulations (CSR): Mature CSRs are effective ways of reducing and eliminating risk. Compliance with CSRs is considered evidence of a safe ESS installation.

2. Analysis of Safety: It is used wherever there is gap in the field of applicable CSRs. There are many techniques available for analyzing safety in complex technological systems including Failure Modes

and Effects Analysis (FMEA) and Systems Safety Analysis (SSA). When applied correctly, a safety analysis can provide a complete picture of how a devices or system will operate under normal, abnormal, and foreseeable abuse conditions. This information allows project developers and designers to make informed decisions about what safety critical functions.

C. Addressing Safety in Deployment and Integration

Key aspect to ensuring a safe installation is commissioning, which entails verification that the ESS and all associated controls, detection devices, shutoffs, etc. are functional and will operate under all anticipated conditions. Developer and supplier should be asked to provide a defined set of commissioning requirements for review and approving. Commissioning Plan should address following issues.

Documentation of completed Control Assurance Plan (CAP). Verification that safety critical control points are within compliance. CAP should include accuracy and delay compliance thresholds, recorded values, and testing interval. Simulated out-of-range inputs should be used to verify appropriate input or signal sanitization. The CAP should also stipulate data recording requirements and how stale data is handled for each point.

Documentation of completed Measurement Assurance Plan (MAP). Verification that safety critical measurements are within compliance. The MAP should include accuracy and delay compliance thresholds, recorded values, and testing interval. Simulated out-of-range measurements should be used to verify appropriate alarms and warnings before operation. MAP should also stipulate data recording requirements and how stale data is handled for each point.

Internal or External Communication Loss. If there is a loss of safety critical measurement or control, the system should gracefully shut down (e.g. loss of temperature measurement). If measurement or control is not safety critical (As determined in the FMEA and System Safety Analysis) then the system can continue to operate (e.g. loss of connection to off-site data backup).

D. Addressing Safety in Operations and Maintenance

Plans for inspecting, servicing, repair and renovation as well as any addition to the system (e.g. installation of additional storage capacity). Procurement specification should require Energy Storage supplier, developer, or integrator to deliver a complete operation and maintenance manual. This manual should provide instructions for all required operating and maintenance activities, the timing for these activities, and who will perform them. This manual should also include conditions under which the system will have met end of warranty, service life, and operational life.

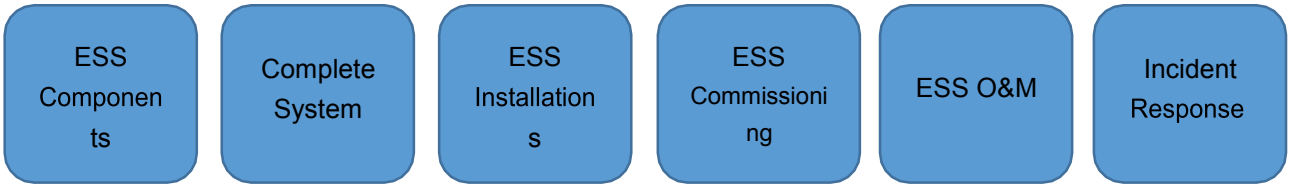
E. Addressing Safety in Decommissioning

After the system has reached the end of its operational life, system has to be decommissioned, disposed of or materials can be recycled. For this reason, it is recommended that the energy storage supplier, developer, or integrator be required to develop a decommissioning and disposal plan. This plan should explain the procedure for decommissioning, including any hazards it may present, as well as the steps to disconnect the system from external automated control systems. It should elaborate

who is responsible for disposal and recycling, what costs this will incur, how articles should be packaged for disposal, and who is responsible for shipping the materials to the disposal or recycling site.

Reference Codes, Standards and Regulations (CSR) **for Battery Energy Storage System** (BESS)

Following CSRs should be considered for the integration of energy storage to the distribution system and when preparing specifications and other documents necessary planning, design, construction, installation, commissioning, operations, maintenance and decommissioning of ESS. Additionally, these documents should be considered for providing for safety of personnel and property during these activities and responding to incidents that may occur that are attributable to or could affect the system. Partial potential CSR sources for applicability are shown in figure below



ESS System Safety Prescription

1 Energy Storage System(Individual Components)

Safety criteria for ESS components (e.g., battery, inverter, controls, etc.) are intended to ensure the design and construction of each individual component meets the relevant safety-related metrics. The supplier of each component should design and construct the respective component to the standard and subject it to whatever testing is required by the relevant standard for that component. If the component satisfied the provisions of the standard and related testing criteria, then the individual component should be considered in compliance with the standard. Standards covering ESS components are of primary relevance to component manufacturers in deploying the component and to developers in specifying and procuring safe components. Manufacturers of complete ESS “products” or those that assemble an ESS on site from various components would benefit when using components that comply with relevant standards. Standards for Energy Storage System Components are listed in

Standards for ESS Components (Source: EPRI)

Energy Storage System Components	Standard
Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker	UL 489

Enclosures	
Electrochemical Capacitors	UL 810A
Lithium Batteries	UL 1642
Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources	UL 1741
Batteries for Use in Stationary Applications	UL 1973

2 Energy Storage System (Integrated Components)

Considering ESS as an assembly of components, a standard for a complete ESS “product” is likely to refer to various components and component standards. The complete ESS standard then simply ties together lower level requirements with industry best practices for safe system design. One approach these standards take is to specify that the components meet relevant component standards and specify documentation as to the acceptability of their combination as a safe ESS. Another is to consider the ESS “product” as a black box and evaluate the entire ESS against a holistic standard. If the ESS “product” satisfies the provisions of the standard and related testing criteria and metrics, then the components of the ESS is considered in compliance with the standard. A standard for the product would provide both prescriptive design and construction requirements as well as testing requirements for specific issues with certain allowable limits.

Those issues would include but not be limited to:

Documentation of thermal management system adequacy

Documentation of thermal abuse limits

Documentation of adequate enforcement of thermal limits (including below freezing)

Documentation of electrical shock and arc flash hazards, required clearances, etc.

Documentation of electrical abuse limits

Documentation of adequate enforcement of electrical limits

Documentation of mechanical abuse limits (vibration, and shock)

Documentation of adequate enforcement of mechanical limits

Thermal run-away propagation prevention adequacy

A complete system standard will document the safety of the ESS as a delivered product and its intended uses. Third-party certification programs inspect the initial design and ongoing

production of the ESS to ensure compliance is both established and maintained. In addition, certification programs would review and assess the administrative and quality control aspects associated with the manufacturer of safety critical components. A system standard will reference and impose the requirements of applicable component standards. This will help the customer determine whether the operational environment imposed by the system is consistent with predictable and safe component behaviour.

Standards for ESS Types (Source: EPRI)

Energy Storage System Type	Standard
Stationary Energy Storage Systems with Lithium Batteries – Safety Requirements (under development)	IEC 62897
Recommended Practice and Requirements for Harmonic Control in Electric Power Systems	IEEE 519
Recommended Practice and Procedures for Unlabeled Electrical Equipment Evaluation	NFPA 791-2014

3 Installation

The installation of an ESS, as pre-packaged equipment, a matched set of components, or a mix-matched assembly of components involves two key topical areas: procedures and physical requirements. Procedures cover worker safety, transportation, handling, and functions associated with the act of installing the ESS and its component parts. Physical requirements cover the safety of the final installation in terms of the surrounding environment, buildings, and other systems, electrical protection, access, egress and other safety-related issues. Below Standards for ESS Installation lists standards for Energy Storage Project Design, Deployment and Operations.

Standards for ESS Installation (Source: EPRI)

Energy Storage System Installation	Standard
Transportation Testing for Lithium Batteries	UN 38.3
Safety of primary and secondary lithium cells and	IEC 62281

batteries during transport.	
Shipping, receiving and delivery of ESS and associated components and all materials, systems, products, etc. associated with the ESS installation.	DOT Regulations
Competency of Third Party Field Evaluation Bodies	NFPA 790
Fire and smoke detection	NFPA 1, NFPA 101, NFPA 5000, IBC, IFC, state and local codes
Fire suppression	NFPA 1, NFPA 13, NFPA 15, NFPA 101, NFPA 850, NFPA 851, NFPA 853, NFPA 5000, IBC, IFC, state and local codes
Fire and smoke containment	NFPA 1, NFPA 101, NFPA 5000, IBC, IFC, state and local codes
Fire alarm	NFPA 72
Protection of Electronic Computer/Data Processing Equipment	NFPA 75
Clean Agent Fire Extinguishing Systems	NFPA 2001
Ventilation, exhaust, thermal management and mitigation of the generation of hydrogen or other hazardous or combustible gases or fluids	NFPA 1, IEEE/ASHRAE 1635, IMC, UMC, state and local codes
Egress (operating and emergency)	NFPA 1, NFPA 101, NFPA 5000, IBC, IFC, state and local codes
Access (operating and emergency)	NFPA 1, NFPA 101, NFPA 5000, IBC, IFC, state and local codes
Working space	OSHA 29 CFR 1910.305(j)(7) and OSHA 29 CFR 1926.441 (if applicable), NFPA 70E, Article 320

Physical security	NFPA 1, NFPA 101, NFPA 5000, IBC, IFC, state and local codes
Illumination (operating and emergency)	NFPA 1, NFPA 101, NFPA 5000, IBC, IFC, state and local codes
Fire department access	NFPA 1, NFPA 101, NFPA 5000, IBC, IFC, state and local codes
Anchoring and seismic protection	NFPA 5000, IBC, state and local codes
Buildings, enclosures and protection from the elements	IEC 60529, UL 96A, NFPA 5000, IBC, state and local codes
Signage	ANSI Z535, IEEE C-2, NFPA 1, NFPA 70E, NFPA 101, NFPA 5000, IBC, IFC, state and local codes
Emergency shutoff	IEEE C-2, NFPA 1, NFPA 101, NFPA 5000, IBC, IFC, state and local codes
Spill containment, neutralizing and disposal	NFPA 1, IPC, UPC, IFC, IEEE1578, state and local codes
Electrical safety	IEEE C-2 (National Electrical Safety Code), NFPA 70E, FM Global DS 5-10, DS 5-1, DC 5-19
Communications networks and management systems	IEC 61850, DNP3, Modbus
Seismic Requirements, Design, and Testing	IBC (International Building Code), IEEE 693, ACI 318-05, ACSE 7-10

4 Commissioning

The commissioning of an ESS occurs after installation and inspection to ensure it operationally

complies with the applicable codes, standards, rules, and regulations in addition to any contractual obligations for performance of the ESS (e.g., efficiency, delivered power, availability, life, etc.). Essentially, commissioning ensures that the system operates as expected.

Commissioning plan can be developed along the lines of Standards given in Table below

Standards for ESS Commissioning (Source: EPRI)

Energy Storage System Commissioning	Standard
Recommended Practice for Commissioning of Fire Protection and Life Safety Systems	NFPA 3
Building and Systems Commissioning	ICC 1000

5 Operations and Maintenance

The operations and maintenance of an ESS involves two key topical areas: qualification of operators, and the operations and maintenance (O&M) manual. Qualification of operators involves training and certification associated with those personnel who will be working with the ESS. The O&M manual dictates the processes and technical requirements for working on ESS during operation as well as the schedule and instructions for maintenance.

The energy storage supplier and developers may consider re-commissioning the system on a regular basis to verify the safe operation, control, and shutdown of the system under normal and incident response situations. In order to ensure efficient operation, the customer may consider requiring that the energy storage provider develop a qualification program to train operation and maintenance personnel. Standards for ESS O&M lists down Standards for operations and Maintenance.

Standards for ESS O&M (Source: EPRI)

Energy Storage System Operations & Maintenance	Standard
Hazardous materials storage, handling and use	NFPA 400
Standard on Maintenance of Electrical Equipment	NFPA 70B

6 Incident Preparedness

The ability to respond to an incident associated with an ESS involves two key topical areas: procedures,

and automated systems. Standards for Incident Preparedness lists down standards ensuring the competency of those personnel doing response and then those standards and related documents associated with facilitating the response activity itself.

Standards for Incident Preparedness (Source: EPRI)

Incident Preparedness	Standard
Standard for Technical Rescuer Professional Qualifications	NFPA 1006
Standard for Fire Fighter Professional Qualifications	NFPA 1001
Standard for Fire Department Occupational Safety	NFPA 1500
Standard System for the Identification of the Hazards of Materials for Emergency Response	NFPA 704
Guide for Substation Fire Protection	IEEE 979
Fire Fighting	Emergency Planning and Community Right-to-Know Act (EPCRA)
Fire and Explosion Investigations	NPFA 921
Fire Safety Concepts Tree	NFPA 550

ANNEXURE-XVI 100 MW(AC) Solar PV Project (200MWp DC capacity) along with 50MW/150 MWh Battery Energy Storage System at Rajnandgaon, Chhattisgarh (Baseline)

Location Characteristics:

Solar Energy Corporation of India (SECI) Limited is proposed to develop 100MW Solar Photo Voltaic Project with up to 150MWh Battery storage project at District Rajnandgaon, Chhattisgarh. The Coordinates of the Project Location is Lat: 21°5'32.89"N, Long 80°50'30.37"E. The total land area identified at this stage is 377.423 ha. The power generated through the project is propose to be evacuated through overhead 132kV transmission line of length 33 km approx. to the nearest 132 kV CSPTCL's Substation at Thelkadi, Chhattisgarh.

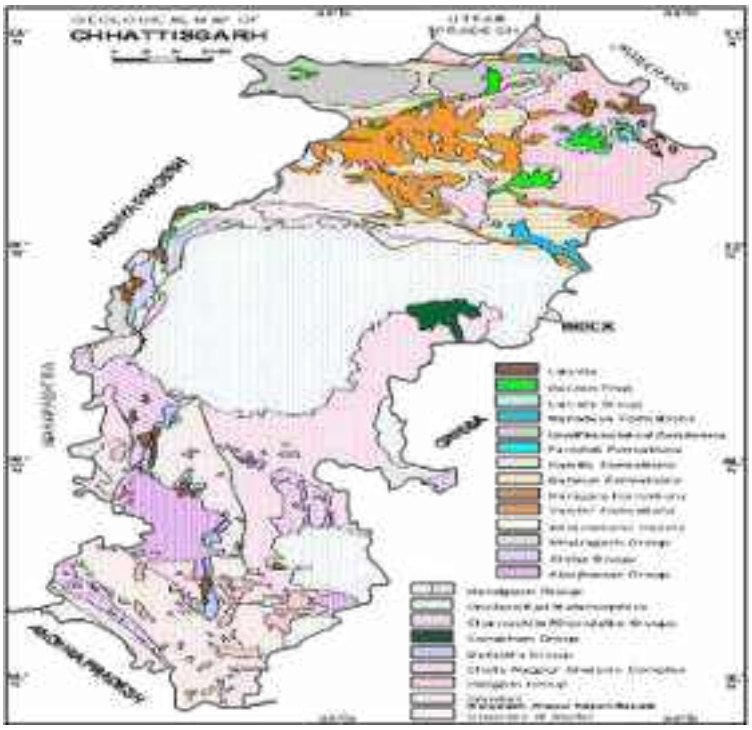
1.1 Description of Environment

Rajnandgaon district is situated in the western part of newly created Chhattisgarh state, the district lies between latitude 20°70"- 22°29" North latitude and 80°23" to 81°29" East longitude covering an area of 8172.33 sq.kms. Its greatest length in the north-south is about 185 kms, while its width in the east-west extends about 80 kms. It is surrounded by Kawardha district in north, Durg district in the east; Bastar district is the in south and Garchiroli, Bhandara (Maharashtra) and Balaghat (Madhya Pradesh) districts in the west. The District headquarter Rajnandgaon is on the Mumbay - Howrah line of southeastern railways. The National Highway no. 6 (Great Eastern Road) also passes through the town of Rajnandgaon. The nearest airport to the District is at Mana (Raipur), about 80 kms away. All-important places within the district are well connected by a network of the state highways and all weather roads. The district is divided into 8 tehsils and 9 blocks for its administrative functioning and revenue collections. It is further divided in 1 Nagar Palik Nigam, 2 Nagar Palika , 5 Nagar Panchayat , 9 Janpad Panchayat , 692 Gram Panchayat. Rajnandgaon town (N 21°5' E 81°2') is the district Headquarters.

1.2 Topography, Physiography and Geology

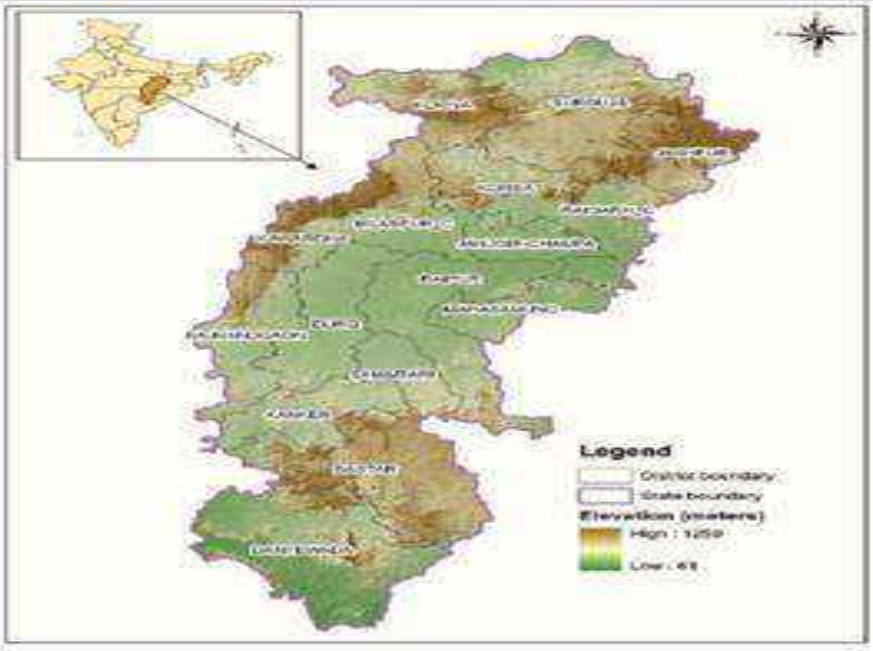
Based on regional topography Chhattisgarh region is divided into three regions, the Northern Hills, the Central Plains and the Bastar Plateau. The central Chhattisgarh basin is characterised by two major landform types, the gently sloping Chhattisgarh Plain and the undulating land. The elevation of the plain ranges from about 250 m on the eastern margin to about 330 m in the west. The gentle gradient of the Chhattisgarh Plain is largely due to its geological structure with flat to gently dipping Cuddapah sedimentary formations. The geological structure of Chhattisgarh state mainly consists of Achaean and Cudappah rocks but Dharwad, Gondwana, Deccan Trap and old Alluvial Laterite rock systems are also found in some pockets of the State. Geological and elevation maps of Chhattisgarh State are given in

Map 1 and Map 2, respectively. The Rajanadgaon District can be divided into three district parts, plateau, Hilly terrain and undulating plain. Most of the north western and southern hilly track of the district measuring 3,892 Sq.km is occupied by protected and reserved forests. Nearly 73% of area falls under Mahanadi river basin, 21% under Godavari basin and 6% area in the northern part of the district falls under Narmada basin.



Map 1: Geological Map of Chhattisgarh

Source: Mines Department, Government of Chhattisgarh



Map 2: Elevation Map of Chhattisgarh

Source: Water Policy for Drought Proofing Chhattisgarh, S. Gupta, Institute for Human Development, 2002

Soil of various types found in the area can be broadly be placed under three groups (i) deep black soil (ii) yellow soil and (iii) red lateritic soil.

1.3. Seismicity

Chhattisgarh has very low rates of seismic activity. In recent years, tremors from earthquakes in neighboring states have been felt, most notably in 1969. The Bureau of Indian Standards (BIS) updated he seismic hazard map of India in 2000[3]. The main change was merging of Zones I & II. As per this updating, the entire Chhattisgarh state falls in Zone II as shown in **Map 3**. It reveals that the project region falls in Zones II low to moderate risk zone.

Map 3: Seismic Zone Map

Source: IS 1893 (Part 1) 2002

1.4 Rainfall

Rainfall data was collected for Raipur IMD station, which is the nearest IMD station in the project area. On an average, 1289 mm of rainfall is received annually mainly from south-east monsoon in the project area (**Table 4**). The region is classified as heavy rainfall area. Normally rains start in June and continue up to October. Nearly 94.5 % of annual rainfall is received during June to October months. About 2.3% of the normal rainfall is received during the winter season. On an average, there are about 62.3 rainy days in a year.

Table 4 : Rainfall in the Project Area

Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
6.7	12.3	24.6	15.7	18.8	189.8	381.0	344.7	230.2	53.9	7.4	3.7	1288.8
(0.8)	(1.0)	(1.7)	(1.6)	(1.9)	(9.3)	(16.0)	(15.7)	(9.7)	(3.6	(0.6)	(0.4)	(62.3)

Note: Values given in parentheses are no. of rainy days

Source: IMD Station Raipur, (1951 to 1980)

1.5 Groundwater Hydrology

Ground water is the dominant water source in the area. The sources of recharging of ground water are mostly from precipitation (rainfall) and partly from flowing water bodies and ponds. Hand pumps are commonly used to draw the water from ground in the villages. Static water levels vary along the stretch of project area. First or upper ground water aquifer lies in the range of 5 to 15 m below ground level (bgl). The ground water level in the area show a decline of 1.2 m to 1.5 m from post monsoon to pre monsoon period.

1.6 Climatology

The climate of the project area is characterized by intensely hot dry summer and well distributed rainfall, in south-west monsoon season and winter. Generally, the project area experiences the following four seasons in a year:

- The summer season (also known as pre-monsoon season) starts around Holi festival in March but the mercury rises to the peak in May and first week of June with the mean daily maximum temperature at about 40°C, and the mean daily minimum at about 26°C.

- The rainy season starts around mid-June and continues up to September.
- The winter season starts around the last week of November and continues up to February.
- The intervening period October and November, is the Post-monsoon season or retreating monsoon period.

a) Temperature and Relative Humidity

The mean daily maximum temperature varies from 27.3oC to 42.0oC, while the mean daily minimum temperature varies from 13.2oC to 28.3oC. Data collected from IMD indicates that May is hottest month. Relative humidity is highest during July to September months (85 to 87% at 8:30 hr and 76 to 78% at 17:30 hr) and lowest during April and May months (39% at 8:30 hr and 23% at 17:30 hr).

b) Wind Pattern

Wind pattern in the area along the project road is given in **Table 5**. Along the project road, the prevailing winds are blown from SW – W sector towards NE – E sector during morning and evening hours from March to September. During February to October months, wind blow from NE and E direction to SW and W direction. Calm period is low and observed for 6 to 57% of the time.

Table 5 Wind Pattern

Sl. No.	Months		N	NE	E	SE	S	SW	W	NW	Calm
1	January	I	21	22	8	4	6	3	2	3	31
		II	22	11	5	2	4	7	6	5	38
2	February	I	20	18	7	5	9	7	3	6	25
		II	20	8	3	2	5	11	14	12	25
3	March	I	16	15	6	5	10	13	10	7	18
		II	16	7	4	2	5	15	19	14	28
4	April	I	7	6	4	4	11	25	21	9	13
		II	9	5	3	3	7	16	26	16	15
5	May	I	9	4	4	3	11	25	24	14	6
		II	13	6	3	4	7	13	22	23	9
6	June	I	3	2	1	2	7	36	34	9	6
		II	9	3	3	4	10	25	27	14	5

7	July	I	1	1	2	1	8	43	33	4	7
		II	3	2	3	2	10	33	34	7	6
8	August	I	2	2	2	2	9	37	35	6	5
		II	2	3	3	2	6	31	36	8	9
9	September	I	8	7	5	3	8	20	23	10	16
		II	11	10	6	4	6	19	19	10	15
10	October	I	17	22	10	5	7	6	4	5	14
		II	13	26	14	6	4	4	3	3	27
11	November	I	26	27	9	3	3	2	2	1	27
		II	17	24	7	3	2	1	1	2	43
12	December	I	20	22	7	5	5	1	0	2	38
		II	17	15	4	2	1	1	1	2	57

All values are percentage of the total time. Source: IMD Station Raipur (1951 to 1980)

Note: I and II indicate observations at morning (8.30 hrs) and evening hours (17.30 hrs), respectively.

1.7 Flora and Fauna

FLORA : The floral species found in around the Project area are reported below:

Table 6 Floral Species

Sn.	Botanical Name	Vernacular Name	Occurrence
I.	**Trees**		
1.	*Acacia nilotica*	Babool	Very Frequent
2.	*Acacia leucophloea*	Reunjha	Frequent
3.	*Acacia catechu*	Khair	Frequent
4.	*Aegle marsupium*	Bel	Occasionally
5.	*Azadirachta indica*	Neem	Very Frequent
6.	*Albizzia procera*	Safed sirish	Very Frequent
7.	*Albizzia lebbeck*	Kala sirish	Very Frequent
8.	*Ailanthus excelsa*	Maharukh	Very Frequent
9.	*Butea monosperma*	Palash	Occasionally
10.	*Cassia fistula*	Amaltas	Frequent

11.	*Careya arborea*	Kumbhi	Occasionally
12.	*Diospyros melanoxylon*	Tendu	Abundant
13.	*Emblica officinalis*	Amla	Occasionally
14.	*Eucalyptus sp*	Nilgiri	Frequent
15.	*Ficus glomerata*	Gular	Frequent
16.	*Lagerstroemia parviflora*	Senha	Frequent
17.	*Leucaena leucocephala*	Subabul	Abundant
14.	*Mangifera indica*	Aam	Frequent
15.	*Madhuca indica*	Mahua	Occasionally
16.	*Shorea robusta*	Sal	Occasionally
17.	*Syzygium cumini*	Jamun	Frequent
18.	*Terminalia arjuna*	Arjun	Abundant
19.	*Terminalia tomentosa*	Saja	Frequent
20.	*Tamarindus indica*	Imli	Occasionally
21.	*Tactona grandis*	Sagun	Occasionally
22.	*Zyziphus jujuba*	Ber	Abundant
II.	**Herbs and Shrubs**		
23.	*Achyranthes aspera*	Apmarga	Very Frequent
24.	*Asparagus racemosus*	Satavari	Occasionally
25.	*Argemone mexicana*	Satyanashi	Abundant
26.	*Abrus precatorius*	Gunja	Abundant
27.	*Careya herbacea*	Chhoti kumbhi	Occasionally
28.	*Calotropis procera*	Ark	Frequent
29.	*Datura metel*	Dhatura	Occasionally
30.	*Ipomoea batata,*	Besharam	Occasionally
31.	*Lantana camara,*	Raimunia	Frequent
32.	*Sida acuta*	Baraira/Bala	Occasionally
33.	*Solanum surattense*	Mokoi	Occasionally
34	*Urena lobata*	Lotloti	Occasionally

MAMMALS		
Latin name	**Common name**	**WPA Schedule**
Bandicota indica	Large bandicoot Rat	V
Funambulus palmarum	Three striped squirrel	IV
Herpestes edwardsi	Indian grey mongoose	IV
Lepus nigricollis	Indian hare	IV

Mus booduga	Common Indian field mouse	V
Mus musculus	Home Mouse	V
Nosokia indica	Bandicoot rat	V
Rattus rattus	Common Indian rat	V
Suncus murinus	House shrew	V
AMPHIBIANS		
Bufo melanostictus	Common toad	IV
Fejervarya limnocharis	Rice field frog	IV
Hoplobatrachus tigerinus	Indian Bull frog	IV
Rana cyanophlyctis	Skipper frog	IV
Hyla arborea	Tree frog	IV
Polypedates maculatus	Common tree frog	IV
Bungarus caeruleus	Common Indian Krait	IV
Chameleo zeylanicus	Chameleon	IV
Chrysopelea taprobanica	Tree Snake	IV
Calotes versicolor	Garden lizard	IV
Dryphis nasutus	Whip Snake	IV
Eutropis carinata	Indain grass Skink	IV
Eutropis multifasciata	Common skink	IV
Hemidactylus flaviviridis	Indian wall lizard	IV
Ptyas mucosa	Dhaman / Indian Rat snake	IV

Typhlops diardii	Giant Blind Snake	IV
BIRDS		
Acridotheris tristis	Common myna	IV
Actitis hypoleucos	Common Sandpiper	IV
Aegithinia tiphia	Common Iora	IV
Artamus fuscus	Ashy Woodswallow	IV
Bubulcus ibis	Cattle Egret	IV
Caprimulgus affinis	Savanna Nightjar	IV
Chalcophaps indica	Emerald Dove	IV
Charadrius dubius	Little Ringed Plover	IV
Charadrius hiaticula	Common Ringed Plover	IV
Columba livia	Blue rock pigeon	IV
Coracias benghalensis	Indian roller	IV
Corvus splendens	House crow	V
Coturnix coturnix	Common Quail	IV
Cuculus canorus	Common Cuckoo	IV
Cuculus micropterus	Indian Cuckoo	IV
Cypsiurus balasiensis	Asian Palm Swift	IV
Dendrocitta vagabunda	Indian tree pie	IV
Dendrocopus marhatensis	Maratha Woodpecker	IV
Egretta garzetta	Little egret	IV

Elanus caeruleus	Black-winged Kite	IV
Eudynamys scolopaceus	Common Koel	IV
Falco tinnunculus	Common Kestrel	IV
Halcyon pileata	Black-capped Kingfisher	IV
Halcyon smyrnensis	White-Breasted King fisher	IV
Haliastur indus	Brahminy Kite	IV
Hierococcyx varius	Common Hawk Cuckoo	IV
Himantopus himantopus	Black-winged Stilt	IV
Hydrophasianus chirurgus	Pheasant-tailed Jacana	IV
Ictinaetus malaiensis	Black Eagle	IV
Lalage melanoptera	Black-headed Cuckoo shirke	IV
Lanius cristatus	Brown Shrike	IV
Merops orientalis	Little Green Bee Eater	IV
Microcarbo niger	Little Cormorant	IV
Milvus migrans	Common Black kite	IV
Motacilla alba	White wagtail	IV
Passer domesticus	House sparrow	IV
Perdicula asiatica	Bush quail	IV
Pericrocotus cinnamomeus	Small Minivet	IV
Pericrocotus roseus	Rosy Minivet	IV
Psilopogon haemacephalus	Coppersmith Barbet	IV

Psittacula cyanocephala	Blossom headed Parakeet	IV
Pycnonotus cafer	Red-vented bulbul	IV
Rhipidura albicollis	White-throated Fantail	IV
Saxicolodies fulicata	Indian robin	IV
Streptopelia capicola	Ring-necked dove	IV
Streptopelia chinensis	Spotted dove	IV
Streptopelia tranquebarica	Red Collared Dove	IV
Streptopelia tranquebarica	Spotted-necked Dove	IV
Sturnus contra	Pied myna	IV
Butterflies		
Precis lemonias lemonias	Lemon pansy	IV
Precis hierta hierta	Yellow Pansy	IV
Tros aristolochiae	Common rose	IV
Euploea corecor	Common Crow	IV
Dananus aglea	Glassy Blue Tiger	IV
Precis orithya	Blue pansy	IV
Neptis hylas	Common sailor	IV
Papilio demoleus	Lime butterfly	IV
Catopsilia crocale	Common emigrant	IV
Other insects		
Anax imperator	Emperor Dragonfly	Not listed

Tettigonia viridissima	Common Grasshopper	Not listed
Hieroglyphus banian	Rice grasshopper	Not listed
Pecilocerus pictus.	Common painted	Not listed
Nephotettix apicalis	Paddy Jassids	Not listed
Hyblea purea	Skeletonizer or Teak Defoliator	Not listed
Spodoptera mauritia	Swarming caterpillar	Not listed
Rhopalosiphum maidis	Aphids	Not listed

Table 7 Fauna Species

FAUNA

The faunal species found in around the Project area are reported below:

It is also evident from the lists that there were no endemic or endangered species of flora and fauna around the Project site.

1.8 Socio - Economic

Rajnandgaon district is situated in the western part of newly created Chhattisgarh state, the district lies between latitude 20°70"- 22°29" North latitude and 80°23" to 81°29" East longitude covering an area of 8172.33 sq.kms. Its greatest length in the north-south is about 185 kms, while its width in the east-west extends about 80 kms. It is surrounded by Kawardha district in north, Durg district in the east; Bastar district is the in south and Garchiroli, Bhandara (Maharashtra) and Balaghat (Madhya Pradesh) districts in the west. The District headquarter Rajnandgaon is on the Mumbay - Howrah line of southeastern railways. The National Highway no. 6 (Great Eastern Road) also passes through the town of Rajnandgaon. The nearest airport to the District is at Mana (Raipur), about 80 kms away. All-important places within the district are well connected by a network of the state highways and all weather roads. The district is divided into 8 tehsils and 9 blocks for its administrative functioning and revenue collections. It is further divided in 1 Nagar Palik Nigam, 2 Nagar Palika , 5 Nagar Panchayat , 9 Janpad Panchayat , 692 Gram Panchayat. Rajnandgaon town (N 21°5' E 81°2') is the district Headquarters.

1.8.1 DEMOGRAPHIC PROFILE OF RAJNANDGOAN DISTRICT

Literacy Rate

The total literacy rate of Rajnandgaon district was 75.96% in 2011 which is greater than average literacy rate 70.28% of Chhattisgarh. Population-wise, out of total 1,008,379 literates, males were 561,355 while females were 447,024. Also the male literacy rate was 85.4% and the female literacy rate was 66.7% in Rajnandgaon district.

Sex Ratio

The Sex Ratio of Rajnandgaon district is 1,015. Thus for every 1000 men there were 1,015 females in Rajnandgaon district. Also as per Census 2011, the Child Sex Ration was 986 which is less than Average Sex Ratio (1,015) of Rajnandgaon district.

Population Density

The total area of Rajnandgaon district is 8,070 km^2. Thus the density of Rajnandgaon district is 190 people per square kilometer. As per the initial provisional data of Census 2011, around 159 sq. km. area is under urban region while 7,911 sq. km. is under rural region.

Urban/Rural Population

As per the Census 2011 out of total population of Rajnandgaon, 17.73% people lived in urban regions while 82.27% in rural areas. The total figure of population of urban population was 272,512 out of which 136,643 were males while remaining 135,869 were females. In rural areas of Rajnandgaon, male population was 626,212 while female population was 638,409.

1.9 Land Requirement

The state of Chattisgarh experiences a power deficit during the peak hours of the day. The rationale for developing the solar PV power plant with BESS is to meet this deficit by installing reliable solar power. The land under consideration is government owned(Department of Energy, Chhattisgarh) and may be transferred/ leased to SECI through CSPDCL to develop the Solar PV project. The proposed project falls under the villages listed in Table 8. It is also proposed to construct a transmission line of length 33 km approx. the exact route shall be determined at later stage by conducting a detailed route survey analysis.

Table 8 List of Villages

Sl. No	Name of Village	Name of Block	Land in Hectare
1	Dhaba	Dongragaon	63.042
2	Khoka	Dongragaon	44.414
3	Rangakhetra	Dongragaon	8.079
4	Amlidih	Dongragaon	40.560
5	Dhundera	Dongragarh	25.111
6	Oredabandh	Donragaon	53.336
7	Girgaon	Dongragaon	52.878
8	Tolagaon	Dongragaon	51.092
9	Margaon	Dongragaon	19.668
10	Dhudwa	Rajnandgaon	19.243
Total			**377.423**

1.10 Demographic Profile of Project Affected Villages

1.10.1 Dhaba Village

Dhaba is a medium size village located in Dongargaon Tehsil of Rajnandgaon district, Chhattisgarh with total 276 families residing. The Dhaba village has population of 1284 of which 648 are males while 636 are females as per Population Census 2011.

In Dhaba village population of children with age 0-6 is 177 which makes up 13.79 % of total population of village. Average Sex Ratio of Dhaba village is 981 which is lower than Chhattisgarh state average of 991. Child Sex Ratio for the Dhaba as per census is 1082, higher than Chhattisgarh average of 969.

Dhaba village has higher literacy rate compared to Chhattisgarh. In 2011, literacy rate of Dhaba village was 79.40 % compared to 70.28 % of Chhattisgarh. In Dhaba Male literacy stands at 88.81 % while female literacy rate was 69.67 %. Details are presented in **Table 9**.

Table 9 Demographic profile of Dhaba Village

Particulars	Total	Male	Female
Total No. of Houses	276	-	-
Population	1284	648	636
Child (0-6)	177	85	92
Schedule Caste	88	36	52
Schedule Tribe	527	273	254
Literacy	79.40%	88.81%	69.67%
Total Workers	681	364	317
Main Worker	277	-	-
Marginal Worker	404	180	224

1.10.2 Kohka Village

Kohka is a medium size village located in Dongargaon Tehsil of Rajnandgaon district, Chhattisgarh with total 283 families residing. The Kohka village has population of 1334 of which 639 are males while 695 are females as per Population Census 2011.

In Kohka village population of children with age 0-6 is 192 which makes up 14.39 % of total population of village. Average Sex Ratio of Kohka village is 1088 which is higher than Chhattisgarh state average of 991. Child Sex Ratio for the Kohka as per census is 1043, higher than Chhattisgarh average of 969.

Kohka village has higher literacy rate compared to Chhattisgarh. In 2011, literacy rate of Kohka village was 81.09 % compared to 70.28 % of Chhattisgarh. In Kohka Male literacy stands at 90.28 % while female literacy rate was 72.70 %. Details are presented in **Table 10**.

Table 10 Demographic Profile of Kohka Village

Particulars	Total	Male	Female
Total No. of Houses	283	-	-
Population	1334	639	695
Child (0-6)	192	94	98
Schedule Caste	212	102	110
Schedule Tribe	363	175	188
Literacy	81.09%	90.28%	72.70%
Total Workers	747	372	375
Main Worker	318	-	-

1.6.3 Renga Kathera Village

Renga Kathera is a medium size village located in Dongargaon Tehsil of Rajnandgaon district, Chhattisgarh with total 217 families residing. The Renga Kathera village has population of 1096 of which 535 are males while 561 are females as per Population Census 2011.

In Renga Kathera village population of children with age 0-6 is 130 which makes up 11.86 % of total population of village. Average Sex Ratio of Renga Kathera village is 1049 which is higher than Chhattisgarh state average of 991. Child Sex Ratio for the Renga Kathera as per census is 1281, higher than Chhattisgarh average of 969.

Renga Kathera village has higher literacy rate compared to Chhattisgarh. In 2011, literacy rate of Renga Kathera village was 79.09 % compared to 70.28 % of Chhattisgarh. In Renga Kathera Male

literacy stands at 88.49 % while female literacy rate was 69.88 %. Details are presented in **Table 11.**

Table 11 Demographic Profile of Renga Kathera Village

Particulars	Total	Male	Female
Total No. of Houses	217	-	-
Population	1096	535	561
Child (0-6)	130	57	73
Schedule Caste	80	28	52
Schedule Tribe	635	320	315
Literacy	79.09%	88.49%	69.88%
Total Workers	639	322	317
Main Worker	90	-	-
Marginal Worker	549	272	277

1.10.4 Amlidih Village

Amlidih is a medium size village located in Dongargaon Tehsil of Rajnandgaon district, Chhattisgarh with total 206 families residing. The Amlidih village has population of 1160 of which 587 are males while 573 are females as per Population Census 2011.

In Amlidih village population of children with age 0-6 is 154 which makes up 13.28 % of total population of village. Average Sex Ratio of Amlidih village is 976 which is lower than Chhattisgarh state average of 991. Child Sex Ratio for the Amlidih as per census is 1000, higher than Chhattisgarh average of 969.

Amlidih village has higher literacy rate compared to Chhattisgarh. In 2011, literacy rate of Amlidih village was 79.03 % compared to 70.28 % of Chhattisgarh. In Amlidih Male literacy stands at 87.84 % while female literacy rate was 69.96 %. Details are presented in **Table 12**.

Table 12 Demographic Profile of Amlidih Village

Particulars	Total	Male	Female
Total No. of Houses	206	-	-
Population	1160	587	573
Child (0-6)	154	77	77
Schedule Caste	12	7	5
Schedule Tribe	0	0	0
Literacy	79.03%	87.84%	69.96%
Total Workers	550	337	213
Main Worker	460	-	-
Marginal Worker	90	47	43

1.10.5 Odarbandh Village

Odarbandh is a medium size village located in Dongargaon Tehsil of Rajnandgaon district, Chhattisgarh with total 83 families residing. The Odarbandh village has population of 409 of which 202 are males while 207 are females as per Population Census 2011.

In Odarbandh village population of children with age 0-6 is 51 which makes up 12.47 % of total population of village. Average Sex Ratio of Odarbandh village is 1025 which is higher than Chhattisgarh state average of 991. Child Sex Ratio for the Odarbandh as per census is 1040, higher than Chhattisgarh average of 969.

Odarbandh village has higher literacy rate compared to Chhattisgarh. In 2011, literacy rate of Odarbandh village was 77.37 % compared to 70.28 % of Chhattisgarh. In Odarbandh Male literacy stands at 87.57 % while female literacy rate was 67.40 %. Details are presented in **Table 13.**

Table 13 Demographic Profile of Odarbandh Village

Particulars	Total	Male	Female
Total No. of Houses	83	-	-
Population	409	202	207
Child (0-6)	51	25	26
Schedule Caste	5	3	2
Schedule Tribe	202	92	110
Literacy	77.37%	87.57%	67.40%
Total Workers	277	134	143
Main Worker	229	-	-
Marginal Worker	48	21	27

1.6.6 Girgaon Village

Girgaon is a medium size village located in Dongargaon Tehsil of Rajnandgaon district, Chhattisgarh with total 167 families residing. The Girgaon village has population of 841 of which 433 are males while 408 are females as per Population Census 2011.

In Girgaon village population of children with age 0-6 is 108 which makes up 12.84 % of total population of village. Average Sex Ratio of Girgaon village is 942 which is lower than Chhattisgarh

state average of 991. Child Sex Ratio for the Girgaon as per census is 770, lower than Chhattisgarh average of 969.

Girgaon village has higher literacy rate compared to Chhattisgarh. In 2011, literacy rate of Girgaon village was 84.04 % compared to 70.28 % of Chhattisgarh. In Girgaon Male literacy stands at 91.94 % while female literacy rate was 75.90 %. Details are presented in **Table 14**.

Table 14: Demographic Profile of Girgaon Village

Particulars	Total	Male	Female
Total No. of Houses	167	-	-
Population	841	433	408
Child (0-6)	108	61	47
Schedule Caste	11	6	5
Schedule Tribe	322	165	157
Literacy	84.04%	91.94%	75.90%
Total Workers	460	244	216
Main Worker	278	-	-
Marginal Worker	182	4	178

1.6.7 Tolagaon Village

Tolagaon is a medium size village located in Dongargaon Tehsil of Rajnandgaon district, Chhattisgarh with total 113 families residing. The Tolagaon village has population of 585 of which 286 are males while 299 are females as per Population Census 2011.

In Tolagaon village population of children with age 0-6 is 67 which make up 11.45 % of total population of village. Average Sex Ratio of Tolagaon village is 1045 which is higher than Chhattisgarh state average of 991. Child Sex Ratio for the Tolagaon as per census is 861, lower than Chhattisgarh average of 969.

Tolagaon village has higher literacy rate compared to Chhattisgarh. In 2011, literacy rate of Tolagaon village was 83.78 % compared to 70.28 % of Chhattisgarh. In Tolagaon Male literacy stands at 90.80% while female literacy rate was 77.24 %. Details are presented in **Table 15**.

Table 15 Demographic Profile of Talagaon Village

Particulars	Total	Male	Female
Total No. of Houses	113	-	-
Population	585	286	299
Child (0-6)	67	36	31
Schedule Caste	145	78	67
Schedule Tribe	83	39	41
Literacy	83.78%	90.80%	77.24%
Total Workers	392	192	200
Main Worker	330	-	-
Marginal Worker	62	26	36

1.6.8 Margaon Village

Margaon is a medium size village located in Dongargaon Tehsil of Rajnandgaon district, Chhattisgarh with total 332 families residing. The Margaon village has population of 1769 of which 848 are males while 921 are females as per Population Census 2011.

In Margaon village population of children with age 0-6 is 284 which makes up 16.05 % of total population of village. Average Sex Ratio of Margaon village is 1086 which is higher than Chhattisgarh state average of 991. Child Sex Ratio for the Margaon as per census is 1152, higher than Chhattisgarh average of 969.

Margaon village has higher literacy rate compared to Chhattisgarh. In 2011, literacy rate of Margaon village was 74.88 % compared to 70.28 % of Chhattisgarh. In Margaon Male literacy stands at 85.75 % while female literacy rate was 64.76 %. Details are presented in **Table 16**.

Table 16: Demographic Profile of Margaon Village

Particulars	Total	Male	Female
Total No. of Houses	332	-	-
Population	1769	848	921
Child (0-6)	284	132	152
Schedule Caste	338	165	173
Schedule Tribe	506	250	256
Literacy	74.88%	85.75%	64.76%
Total Workers	848	484	364
Main Worker	802	-	-
Marginal Worker	46	20	26

1.6.9 Dundera Village

Dundera is a medium size village located in Dongargarh Tehsil of Rajnandgaon district, Chhattisgarh with total 370 families residing. The Dundera village has population of 1917 of which 951 are males while 966 are females as per Population Census 2011.

In Dundera village population of children with age 0-6 is 290 which makes up 15.13 % of total population of village. Average Sex Ratio of Dundera village is 1016 which is higher than Chhattisgarh state average of 991. Child Sex Ratio for the Dundera as per census is 921, lower than Chhattisgarh average of 969.

Dundera village has higher literacy rate compared to Chhattisgarh. In 2011, literacy rate of Dundera village was 71.42 % compared to 70.28 % of Chhattisgarh. In Dundera Male literacy stands at 82.63 % while female literacy rate was 60.58 %. Details are presented in **Table 17**.

Table 17: Demographic Profile of Dundera Village

Particulars	Total	Male	Female
Total No. of Houses	370	-	-
Population	1917	951	966
Child (0-6)	290	151	139
Schedule Caste	100	54	46
Schedule Tribe	578	277	301
Literacy	71.42%	82.63%	60.58%
Total Workers	1129	565	564
Main Worker	1042	-	-
Marginal Worker	87	28	59

FIRST ANGLE PROJECTION

ALL DIMENSIONS ARE IN mm

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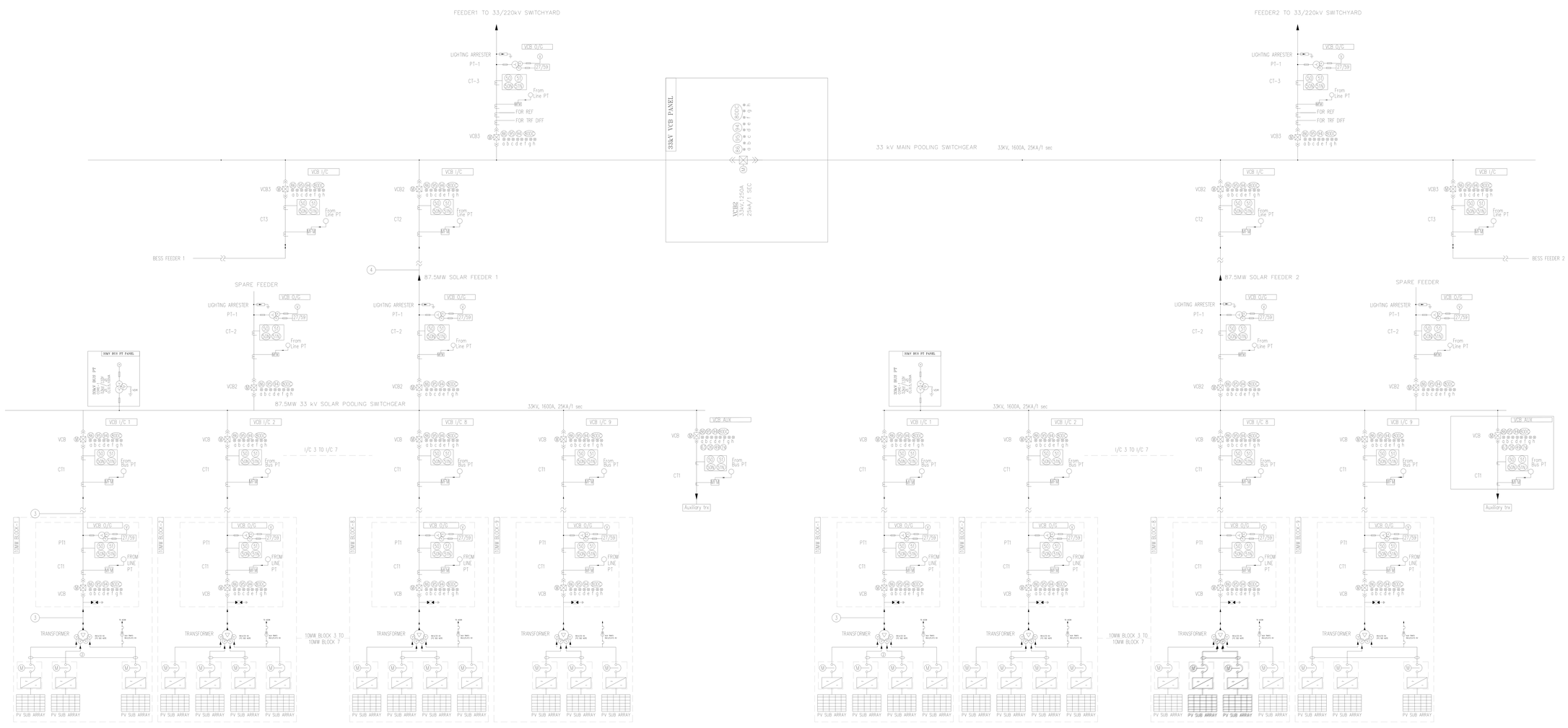

LEGEND DETAILS

SL. NO.	SYMBOL	DESCRIPTION
1		INVERTER TRANSFORMER
2		VCB
3		SF6 BREAKER
4	86	MASTER TRIP RELAY
5	90 195 295	TRIP CIRCUIT SUPERVISION RELAY
6	94	ANTI PUMPING RELAY
7	63	BUCHHOLZ RELAY
8	26	MAGNETIC OIL LEVEL GAUGE
9	49	WINDING TEMP INDICATOR AND OIL TEMP INDICATOR
10	74	PRESSURE RELIEF DEVICE
11	50	INST OVER CURRENT RELAY
12	51	IDMT OVER CURRENT RELAY
13	50N	NEUTRAL INSTANTANEOUS OVER CURRENT RELAY
14	51N	IDMT EARTH FAULT RELAY
15	MFM	MULTI FUNCTION METER
16		CURRENT TRANSFORMER
17	27	UNDER VOLTAGE RELAY
18	59	OVER VOLTAGE RELAY
19		POTENTIAL TRANSFORMER

SL. NO.	SYMBOL	DESCRIPTION
20		FUSE
21	ABT	ABT TARIFF ENERGY METER
22	60DC	DC FAILURE INDICATION
23		INVERTER
24	M	ACB
25		LIGHTENING ARRESTER
26	64RLV	RESTRICTED EARTH FAULT RELAY (LV SIDE)
27	87T	TRANSFORMER DIFFERENTIAL RELAY
28	30	ANNUNCIATOR RELAY
29	50LBB	LOCAL BREAKER BACKUP PROTECTION
30	95	TRIP CIRCUIT SUPERVISION RELAY
31	87L	LINE DIFFERENTIAL PROTECTION RELAY
32	67	DIRECTIONAL OVER CURRENT RELAY
33	21	DISTANCE PROTECTION RELAY
34		ISOLATOR WITH DOUBLE EARTH SWITCH
35		ISOLATOR WITH SINGLE EARTH SWITCH
36		ISOLATOR

1 2 1.1kV XLPE Armored Al Cable

3 4 33kV XLPE ARMOURED AL. CABLE

NOTE:

VCB

33kV,630A
25kA/1SEC

VCB2

33kV,1600A
25kA/1SEC

VCB3

33kV,1250A
25kA/1SEC

TRANSFORMER

10MVA,ONAN, Dy11y11
33kV/XXXV-XXXV

INVERTER

TP,EDO ACB
2500A, 50kA
2500 kW
3Ph, XXX V

PT-1

33kV/110V/110V
√3 / √3 / √3

Core 1: Metering Core 2: Protection
CL0.5,50VA CL3P,50VA

CT-1

180/1/1A
Core-1: CL-5P20, 5VA Core-2: CL-0.5S, 5VA

CT-2

1500/1/1
CORE-1:CL-0.2S, 5VA CORE-2:CL-5P20, 5VA

CT-3

1500/1/1
CORE-1:CL-0.2S, 5VA CORE-2:CL-5P20, 5VA

CT-4

1500/1/1/1/1
CORE-1:CL-0.2S, 5VA; CORE-2:CL-5P20, 5VA;
CORE-3:CL-PS,Vk = 20Rct+14V IMag < 30 mA at Vk/ 2;
CORE-4:CL-PS,Vk = 20Rct+14V IMag < 30 mA at Vk/ 2;

Note:

The ratings and number of equipment are indicative and shall be finalised during detailed engineering.

This is the indicative SLD for tender purpose only.

REV.	DATE	ALTERED / CHECKED / APPROVED
00		FIRST ISSUE

	NAME	SIGN	DATE
DRAWN	SAN		121020
CHECKED	RK		121020
APPROVED	BNR		121020

DISTRIBUTION OF PRINTS

DEPT. CODE

PROJECT : 100MW SOLAR POWER PLANT
CUSTOMER : SECI

BHARAT HEAVY ELECTRICALS LIMITED.
ELECTRONICS DIVISION, BANGALORE

TITLE: SINGLE LINE DIAGRAM

No. OF SHEETS 02
SHEET No. 01
REV. 00

BHEL DRG. No. 3-SK-SECI-SLD-100

A0 SIZE

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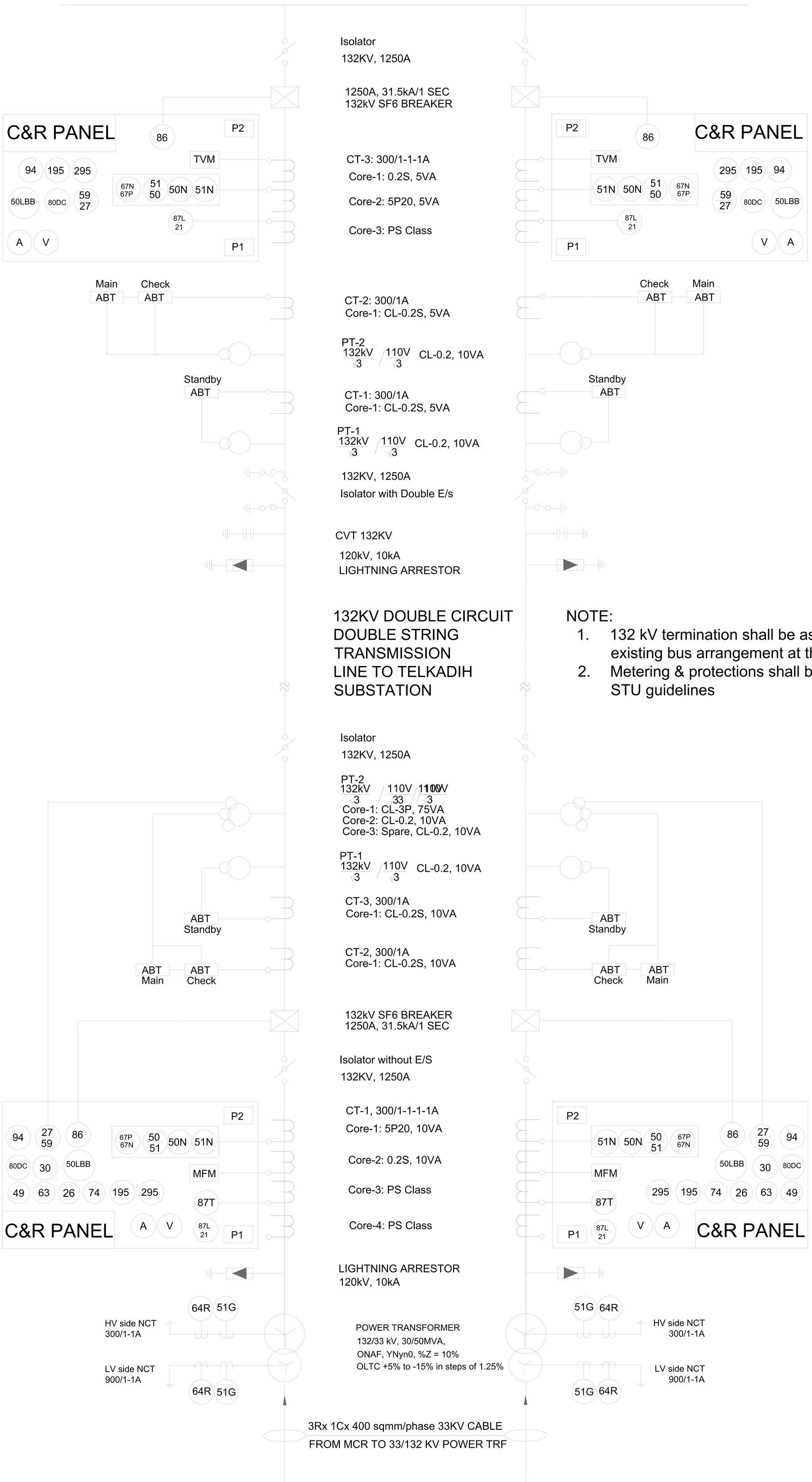
SIGN & DATE

REF DRG.NO.

INVENTORY NO.

EXISTING 132KV BUS



132KV DOUBLE CIRCUIT DOUBLE STRING TRANSMISSION LINE TO TELKADIH SUBSTATION

NOTE:

1. 132 kV termination shall be as per the existing bus arrangement at the sub station
2. Metering & protections shall be as per the CTU/ STU guidelines

PROJECT : 100MW SOLAR POWER PLANT
CUSTOMER : SECI

BHARAT HEAVY ELECTRICALS LIMITED.
ELECTRONICS DIVISION, BANGALORE

TITLE: SINGLE LINE DIAGRAM

BHEL DRG. No. 3-SK-SECI-SLD-100

No. OF SHEETS 02 | SHEET No. 02 | REV 00

	NAME	SIGN	DATE
DRAWN	SAN		121020
CHECKED	RK		121020
APPROVED	BNR		121020

DISTRIBUTION OF PRINTS

REV	DATE	ALTERED	CHECKED	APPROVED
00				FIRST ISSUE
02	08.03.19			

DRAWING NO. 3-SK-SECI-SLD-100

FIRST ANGLE PROJECTION

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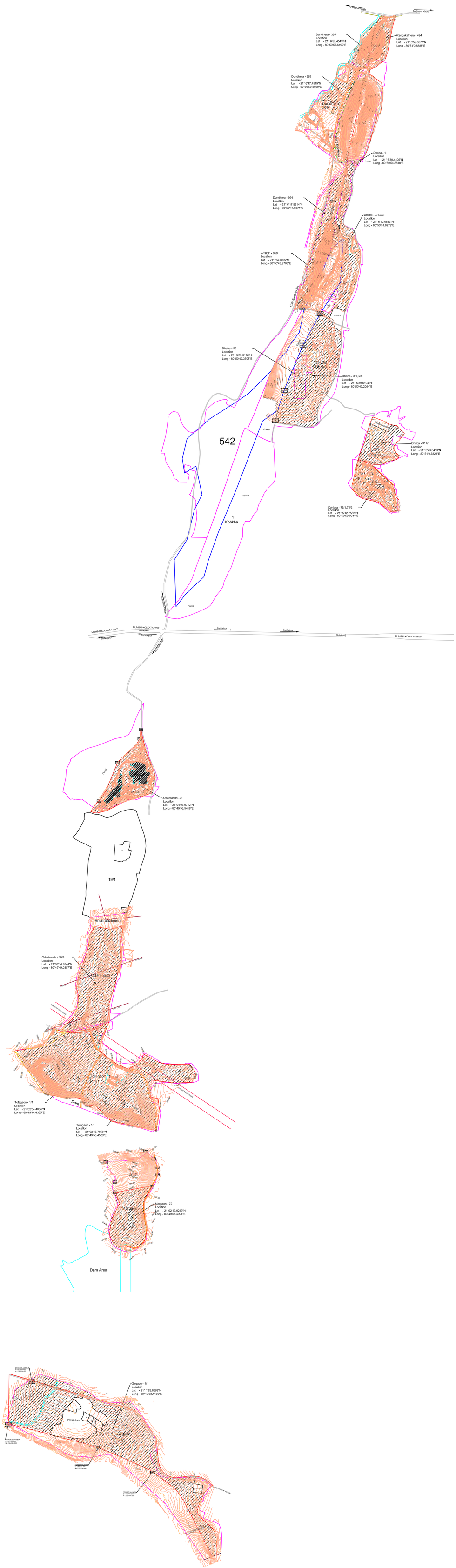
INVENTORY NO. | SIGN & DATE | REF. DRG.NO.



Legend			
Khasra Line		Electric Line	
Forest Line		Highway	NH-AH46
Forest Munara	FOREST MUNARA	Fencing Line	
Solar Project Area		OFC Line	
Cart Track		Cont - MJR	
Nallah		Cont - MNR	
Pond	Pond	Cont - Text	0.00
Road			

TITLE : -

100 MW (AC) Solar PV Project (200MWp DC Capacity) with 50 MW/150 MWh Battery Energy Storage System at Rajnandgaon, Chhattisgarh

PROJECT COORDINATE SYSTEM & UTM ZONE		N	DRAWN	CHKD.	APPR.	SHEET
DATUM	PROJECTION		DATE	DATE	DATE	REV.
WGS-84	44N	SCALE NTS	PART/DWG NUMBER			SHEET SIZE

SECTION - E

ATTACHMENTS

ATTACHMENT – 1: DETAILS OF QUALIFICATION REQUIREMENT

We confirm that we meet the Qualification Requirements specified in Section – B (Pre Qualification requirement).

In this regard we declare that

"*We have successfully completed Design, Engineering, Procurement, Construction, Installation, Testing and Commissioning of Grid Connected Battery Energy Storage System (BESS) of at least 03 (Three) Grid connected BESS Plants, each having an individual capacity of 5 MWh (Five Mega Watt Hour) or above in last Five years. Also, such BESS Plant capacity must have been in satisfactory operation for at least 12 (Twelve) months from the date of commissioning*

The make of Battery & BMS, EMS and PCS offered for the project shall be same as at least one of the reference plant of minimum capacity 5 MWh running satisfactorily for at least 12 (Twelve) months from the date of commissioning in last 5 years."

The details of which are given below:

Sl.No.	Item Description	Plant 1	Plant 2	Plant 3
1.	Name of Project (Including Location and Address)			
2.	Name of the Owner of Project with full Address Fax. No. Telephone No. e-mail address			
3.	Name of Package/Contract along with Order/LOA No. & Date (Un-Priced)			
4.	Name & Address of the Contractor on whom the order for executing the reference BESS System was placed by the Owner of the reference plant			
5.	In case the Bidder is not the Contractor at Sl. No. 4, Name & Address of the Organisation			

which placed order for reference
BESS on the Bidder

6. BESS System Rating (MWh)

8 Scope of work for BESS
(Battery & BMS, EMS, PCS etc.,)
included in the bidder's order includes

(a)	Design/ Engineering	*Yes/No
(b)	Procurement/ Supply/ Construction	*Yes/No
(c)	Installation, Testing & Commissioning	*Yes/No

9 Actual date of commissioning

7. Make of the system supplied as part of the reference plant
Battery & BMS
EMS
Power Conditioning System

8. Is Make of the system proposed for current tender same as
That at Sl. No. 7 for

Battery & BMS	*Yes/No
EMS	*Yes/No
Power Conditioning System	*Yes/No

9. Following documents are enclosed in support
of meeting the stipulated Qualifying Requirements

(a)	End User (Employer/ Client) Certificate without any adverse remark as per PQR criteria	*Yes/No
(b)	Relevant portion of Letter of Award / Contract Agreement / Order enclosed (Unpriced)	*Yes/No
(c)	Technical Write up/ details of the reference plant Along with make of the system, year of supply, year Of commissioning, data sheet/ technical particulars.	*Yes/No
(d)	Other Reference details along with name of project, year of supply, year ofcommissioning, make of system	*Yes/No

**Strike off whichever is not applicable*

Seal & Signature of Bidder with Date
Business Address
Regd. Office Address

ATTACHMENT – 2: DECLARATION OF SYSTEM INTEGRATION AND SPARES/ SERVICES SUPPORT

We hereby confirm that, we are an Original Equipment Manufacturer (OEM) of BESS and shall be solely responsible for Engineering, selection of components, erection, testing & commissioning, Performance demonstration, warranty and operation & maintenance requirements as per the stipulations of the tender requirements for 50 MW/ 150 MWh Battery Energy Storage System having 10 years of plant O&M.

We further confirm support/ availability of service, spares for a minimum of 10 years from the date of operational acceptance.

OR

We hereby confirm that, we are a system integrator with proven experience details as per Attachment – 1 (meeting the specified Qualification Requirement) and shall be solely responsible for Engineering, selection of components, erection, testing & commissioning, Performance demonstration, warranty and operation & maintenance requirements as per the stipulations of the tender requirements.

Further we have hereby enclosed the authorization letter from OEM for Engineering, selection of components, erection, testing & commissioning, Performance demonstration, warranty and operation & maintenance of 50 MW/ 150 MWh Battery Energy Storage System having 10 years of plant O&M.

We further confirm support/ availability of service, spares for a minimum of 10years from the date of operational acceptance. A Certificate from OEM is hereby enclosed for support of spares in this regard.

**Strike off if not Applicable*
Enclosures:
- *Details of the OEM for BESS.*
- *BESS OEM Authorization letter(Appendix to Attachment 2)*
- *OEM Certificate for support of spares for 10 years from the date of operational acceptance.*

Seal & Signature of Bidder with Date
Business Address
Regd. Office Address

Appendix to Attachment 2: Manufacturer's Authorization(For BESS)

Date: _____
RFB No.: _____

To: _____

WHEREAS

We _____ *(OEM Name and Address),* who are official manufacturers of_____ *(BESS Component Description),*
having factories at _____, do hereby authorize _____*(Bidder Name)* to submit a Bid the purpose of which is to provide the following goods, manufactured by us _____ *(BESS Component Description),* and to subsequently negotiate and sign the Contract.

We hereby authorize M/s ---------- (Bidder Name) for Design, Engineering, Manufacture, Testing, Supply, Erection & Commissioning and O&M for "*50MW/150MWh Battery energy storage system having 10 years of plant O&M for 100 MW (AC) Solar PV Project (200MWp DC capacity) of M/s SECI".*

We hereby confirm our full guarantee & warranty including support of spares & services for a minimum period of 10 years from operational acceptance.

Note: The above OEM authorization is to be provided for major BESS components viz., Battery & BMS, EMS and Power Conditioning System (PCS).

Seal & Signature of with Date
Business Address
Regd. Office Address

ATTACHMENT – 3: DETAILS OF DESIGN/ MANUFACTURING, QUALITY ASSURANCE & PROJECT MANAGEMENT CAPABILITIES & CAPACITIES

It is clearly understood that the bid is submitted for consideration of award on the strength of the credential / experience of the Bidder as specified in the Qualifying Requirements of the subject Tender.

We hereby confirm that we do not anticipate any change in ownership during the proposed period of execution of work. We further confirm that even in case of any change in our ownership the new / successor entity shall honour all our obligations under the Contract for the Package.

The following adequate details/ write up are furnished:

Sl. No.	**Details of capacity/ capability**	**Enclosed at Annexure—to Attachment 3**
1.	Design and EngineeringOrganization and facilities/capabilities	
2.	Manufacturing & TestingOrganization and facilities available	
3.	Field Organization and resources forerection, testing & commissioningetc.	
4.	Quality Assurance, Organization and Capabilities for Construction, Engg.,Manufacturing & Field Installation, Operation & Maintenance	
5.	Established Project Management	
6.	Details of Manpower / Division ofCompany	

Seal & Signature of Bidder with Date
Business Address
Regd. Office Address

ATTACHMENT – 4: CERTIFICATE OF COMPLIANCE TO PROVISIONS OF BID DOCUMENT

1. With reference to our Bid Proposal No..... dated ..... for *50MW/150MWh Battery energy storage system having 10 years of plant O&M of 100 MW (AC) Solar PV Project (200MWp DC capacity)*, we hereby confirm that all the provisions of Bidding Documents read in conjunction with Amendment (s) / Clarification(s) / Addenda / Errata (if any) are acceptable to us and the same has been taken into consideration while quoting our bid price and we declare that we have not taken any deviation in this regard.

2. We further confirm that any deviation / variation / additional conditions etc or any mention, contrary to Bidding Documents read in conjunction with Amendment (s) / Clarification(s) / Addenda / Errata found anywhere in our Bid Proposal, implicit or explicit shall stand unconditionally withdrawn, without any cost implication whatsoever to Employer.

Seal & Signature of Bidder with Date
Business Address
Regd. Office Address

ATTACHMENT – 5: TECHNICAL DOCUMENTS TO BE SUBMITTED ALONG WITH THE BID

a. Bill of Quantities (To include minimum list of items as per Table-1)
b. BESS System architecture drawing, EMS networking drawings.
c. BESS Electrical SLD
d. BESS Capacity calculations with formulas considering all applicable parameters. Calculations/ Data on BESS SoC, PCS/ PCU efficiency, round trip efficiency and throughput etc.,
e. Technical write up/ data sheets/ Catalogues of cell/modules , sensors, transducers, Battery pack, PCS, EMS, HVAC, Fire Fighting ,auxiliary systems, AC/DC Electrical panel of BESS.
f. Applicable Test certificates and reports for all major BESS components as per Cl. 1.5.6 of Section C and Cl. 2.3 of Annexure III.
g. Rating and type/ specification of BESS step up transformer, Protection and Metering equipment.
h. Rating and type/ specification of MV/ LV switchgear, Protection and Metering equipment
i. Rating and type/ specification of transformer breaker, Protection and Metering equipment
j. BOQ of Instrumentation, Control and Power Cable
k. Weights and dimensions of the BESS Equipment
l. Battery disposal plan
m. Mile stone completion schedule
n. Site Organization, Construction schedule, contractor's equipment, personnel.
o. Environment & Social Management Strategies and Implementation Plans (Refer Commercial Specification for more details)
p. Code of Conduct for Contractor's Personnel (ES) (Refer Commercial Specification for more details)

Note: Documents that are required to be submitted for detailed engineering shall be finalized post award of the contract in consultation with customer SECI.

Sl. No.	ITEM DESCRIPTION	MAKE/ MODEL/ RATING	CATALOGUE ATTACHED (YES/NO/NA)	Qty.	PRICE (To be filled in Price Schedule)
1	Battery Energy Storage System (BESS) of required power and energy capacity including battery Packs with Battery Management System (BMS)				
2	Bidirectional Power Conditioning Systems (PCS) with Isolation transformer.				
3	Energy Management System (EMS)				
4	Step-up transformers				
5	Electrical LT & HT switchgear panels				
6	Electrical Protection & metering system for LT & HT switchgear panels				
7	Auxiliary Power supply system				
8	DC & AC power cables				
9	Control and communication cables				
10	RTU and related accessories for communication with the Plant Energy Management System (EMS)				
11	HVAC system				
12	Fire-fighting system				
13	IP based CCTV system with storage (For BESS as per tender specification)				
14	Aux. power electrical equipment, UPS , Protection & Metering system for BESS				
15	Protection switchgear and other related accessories to be coupled with the Solar PV system at the AC bus				
16	Lightning arrestors				
17	HDPE pipes, cable conduits, cable trays and accessories/trenches				
18	Earthing as per relevant standards				
19	Misc. items specifically not mentioned but required for making the system complete.				
20	Testing instruments for maintenance and monitoring of equipment				
21	Freight, Un-loading, Storage, Handling & Insurance				
22	Civil works for BESS covering pedestal, equipment foundations for transformer/ switchgear panels etc., supports etc.				
23	Installation and interconnection including cable laying/ trenching and Pre-commissioning checks & tests for all equipment.				

24	Spares, Consumables and Tools & Tackles				
25	Commissioning and operational acceptance of the complete BESS system.				
26	10 (Ten) years comprehensive Operation & maintenance (O&M) from the date of Operational Acceptance				

ಭಾರತ್ ಹೆವಿ ಎಲೆಕ್ಟ್ರಿಕಲ್ಸ್ ಲಿಮಿಟೆಡ್
भारत हेवी इलेक्ट्रिकल्स लिमिटेड
Bharat Heavy Electricals Ltd.,
(A Government of India undertaking)
Electronics Division
PB 2606 , Mysore Road Bangalore , 560026 INDIA

CE: PR: 003- Rev 02

SPECIAL COMMERCIAL CONDITIONS OF CONTRACT

Reference is brought to BHEL's Instructions to Bidders (Document Ref: CE: PR: 001- Rev 03) and General Commercial Conditions for Contract (Document Ref: CE: PR: 002- Rev 02).
These two documents along with Special Conditions of Contract annexed to this RFQ will form an integral part of the contract as and when the RFQ culminates into a MOU/Purchase Order.

RFQ No. : MGRM0000366/Pre-Bid Tie-up/BESS

RFQ Date : 26/11/2020

RFQ Due Date : 03/12/2020

Customer/Project : M/s. Solar Energy Corporation of India (SECI)

Tender Description : Site survey, Design, Engineering, Manufacturing, Testing, Supply, Erection, Commissioning followed by 10 years Operation & Maintenance of 50MW/ 150MWH Battery Energy Storage System.

Type of Bid : Three-Part Bid (Pre-Qualification Bid: Part-I; Techno-commercial bid: Part-II; Price-bid: Part-III)

The Evaluation currency for this tender shall be INR.

Corresponding Executives : Clarifications with regard to the tender shall be addressed to following e-mail IDs:
srinivasulu@bhel.in
alokmandal@bhel.in
mounishg@bhel.in
kamathnk@bhel.in
vpshyam@bhel.in

Splitting of tendered quantity to MSE vendors: Not Applicable.

Destination: For Indigenous scope of supply, items are to be directly despatched to 100 MW (AC) Solar PV Project (200MWp DC capacity) in Rajnandgaon district, Chhattisgarh state, India. Consignee details will be issued by BHEL along with Despatch Clearance.

Customer-BHEL-Supplier back-to-back arrangements/commitments

This MOU is proposed to valid for a period of 01 year, with the stipulation that in the event of price-reduction during negotiation by BHEL with the customer, corresponding reduction will be passed to the supplier.

Within 30 days of signing the MOU, 1% of the value of MOU shall be provided by contractor to BHEL as bid bond in the form of bank guarantee /security deposit etc. in order to ensure the supplier's continued commitment during the validity period of the MOU.

MOU may be converted into purchase order on receiving the order from customer, without going through the tender procedure. After the issuance of Purchase Order on pre bid tie-up partner, the Bid Bond (Bank Guarantee) shall be released after receipt of Contract Performance Security (CPS-1) for 10% Value as detailed in Clause: 23 below.

Terms of Delivery:

- **Indigenous scope of supply:** FOR, customer designated location (including Packing & Forwarding charges but excluding Taxes).

However, the Pre-Bid tie-up tender scope is for complete BESS system on turnkey basis including associated civil works, Erection & Commissioning and 10 Years of O&M.

Under-mentioned details shall be provided against indigenous supplies and services:

a. GSTIN (no.) of place of supply: _____

b. HSN (Harmonized System of Nomenclature) code: _____
Applicable tax and Rate: _____&_____

c. SAC (Service Accounting Code) no.:_____
Applicable tax and Rate: _____&_____

d. GSTIN (no.) of place of supply of service: _____

I. Bidder to note that Deviations shall not be permitted for the below mentioned terms and are deemed to be complied. In case of non-compliance/deviation, offer shall be liable for rejection:

(1) The contract shall be on turn-key basis. The entire work shall be completed within **18 months** (including delivery of materials and installation/civil works & commissioning) from the date of entering into contract. However, BHEL may in case of urgency ask to complete the work earlier, with the mutual consent of the contractor.

(2) Delivery of materials: All the materials as specified in the purchase order should be delivered at the site of installation within **15 months** of issuance of firm Purchase order. Delay in contractual delivery will attract Penalty as per GCC Clause no.04.b.

Transit insurance and storage insurance till the handing over of all materials will be within the scope of vendor. It shall be the sole responsibility of the vendor to get verified the quality and quantity of the supplied material at the site of delivery.

Warehousing and storage of all components will be in the scope of vendor till the commissioning of all systems as per the contract agreement.

(3) The time and the date of installation of system stipulated in the Purchase Order shall be the essence of Contract, and installation/ civil works and successful commissioning must be completed within 18 months of issuing PO.

(4) In case the vendor fails to execute the said work within the stipulated time, 'BHEL' will be at liberty to get the work executed from the open market without calling any tender/e-tender but with a prior notice to the vendor, at the risk and cost of the vendor (with proof of actual cost incurred).

Any additional cost incurred by 'BHEL' in the process of executing the work from third party shall be recovered from the vendor. If the cost of executing the work as aforesaid shall exceed the balance due to the vendor, and the vendor fails to make good the additional cost, 'BHEL' may recover it from the vendor pending claims against any work in 'BHEL' or in any lawful manner.

(5) The vendor will have the sole responsibility to execute order placed as per time schedule, and to ensure quality parameters, specifications and other requirements provided in the tender document and purchase order terms. The vendor should provide the manufacturer's warranty certificate for all components supplied.

(6) **Warranty period**: The material supplied shall be under on-site warranty for the period up to issuance of operational acceptance certificate by M/s.SECI. During warranty period, the total responsibility of the BESS lies with vendor and all the repairs and replacements have to be made without any additional cost to BHEL/SECI.

The Bidder will be responsible to operate and maintain the Plant after Commissioning till the Operational acceptance of Plant Facilities, without any additional cost to the Employer.

For warranty period, after system installation, the vendor shall be responsible for any defects that may occur due to faulty materials, design or workmanship. During the Warranty period, the repair works will have to be carried out at the premise except in exceptional circumstances where the equipment or any component may be required to be taken out for repair, for which specific written permission should be obtained from BHEL/SECI. In such cases, standby arrangements are required to be made by vendor so that the BESS remains in functional state. All products have valid product warranty and hence on-site repair and maintenance service needs to be provided after getting replenishment of spares from respective product manufacturer.

The vendor shall provide to its service station all normal tools and testing equipment needed for all preventive & breakdown maintenance and repair activities associated with Battery Energy Storage System, at its own cost.

If the work of the vendor is found unsatisfactory or if the vendor dishonors the purchase order or fails to perform as per purchase order terms, BHEL shall be entitled to terminate the purchase order after discussion with the vendor and BHEL's decision will be final and binding on the vendor. In that case, the payment of last invoice amount will not be done in addition to forfeiting the Performance Security or any other remedial measures as been deemed fit by BHEL.

(7) <u>Inspection</u>:

a) The 'BHEL' / 'SECI' or their representative shall have the right to anytime inspect and/or to test the goods to confirm their conformity to the purchase order/contract.

b) The 'BHEL' / 'SECI' or their duly authorized representative shall have at all reasonable times access to the vendor premises or works and shall have the power at all reasonable time to inspect and examine the materials and workmanship of the works during its manufacturing or assembling stage.

c) The vendor shall give the 'BHEL', 15 days prior written notice of any material being ready for testing. Such tests shall be on the vendor's accounts/ expenses except for the expenses of the inspector. 'BHEL' reserves the full rights, to waive off inspection of material.

d) The vendor is required to get the entire lot of the ordered material inspected, before the supply of the materials.

e) All arrangements for the inspection of materials will be done by vendor.

(8) <u>Replacement of rejected material</u>: Any material supplied against order placed on basis of this tender and found to be defective at any time during the project life on inspection or differing from approved samples or make or specifications will be replaced by the vendor free of cost or full refund made for the amount paid by BHEL.

(9) <u>Road permit and entry taxes:</u> To be facilitated and arranged by vendor.

(10) The vendor shall have to comply with all the rules, regulations, laws and by-laws for the time being in force and the instructions if any, of the organization, in whose premises the work has to be done. 'BHEL' shall have no liability in this regard.

(11) <u>Insurance</u>: Transit Insurance, storage insurance and erection insurance of the materials and equipment's for setting up the BESS shall be arranged by the vendor for the total supply. The goods supplied under the purchase order shall be fully insured till the end of O&M period of 10 years against loss or damage incidental to manufacture or acquisition, transportation, storage during transportation. Complete BESS has to be insured and insurance copy stating indemnification to be furnished by the vendor before release of supply payment. In case of any damage/ loss/ pilferage/ non-delivery during transit, the vendor shall lodge and settle the claim with the insurance agency. The vendor shall also arrange replacement of the damaged/ lost/ pilfered items expeditiously pending settlement with insurance agency, if any, so as not to hamper the erection and commissioning work of the BESS. The resultant loss if any due to failure of sub-vendor of the vendor to comply with the above shall be to the account of vendor. The insurance copy is required to be submitted along with the invoices.

(12) <u>Labour Engagement</u>: The vendor shall be responsible to provide all wages and allied benefits (including PF/ESI etc.) to the labour engaged for execution of the project work.

The vendor shall remain liable to the authorities concerned for compliance of the existing rules and regulations of the government for this purpose including regulations against employing child labour, etc. and shall also remain liable for any contravention thereof. The vendor shall submit the proof of PF /ESI paid to the employees along with invoices.

(13) **Safety Codes and Regulation:** The vendor shall adhere to safe construction practices and guard against hazardous and unsafe conditions and shall comply with safety rules of the Government of India and adhere to standards mentioned in the tender specification. In addition, the vendor shall adhere to and be bound by the applicable safety codes, rules and regulation for the work to be carried out. A separate log to be maintained by vendor.

(14) The vendor shall not, without the consent in writing of 'BHEL', transfer, assign or sublet the work under the purchase order or any substantial part thereof to any other party.'SECI' and 'BHEL' shall have at all reasonable time access to the works being carried out by the vendor under the purchase order. All the work shall be carried out by the vendor to the satisfaction of BHEL and 'SECI' in-line with mutually agreed contractual terms.

(15) BHEL may at any time by notice in writing to the vendor either stop the work all together or reduce or cut it down. If the work is stopped all together, the vendor will only be paid for work done and expenses distinctly incurred by him as on preparation or the execution of the work up to the date on which such notice is received by him. Such expenses shall be assessed by 'BHEL', whose decision shall be final and bidding on the vendor. If the work is reduced, the vendor will not be paid any compensation what so ever for the loss or profit which he might have made if he had been allowed to complete all the work included in the purchase order.

(16) **Risk, Accident and Damages**: The vendor shall take due precaution to avoid damages to any pipelines, Railway lines, roads, canals, cables, culverts, bridges, drains, sewer, telegraph and telephone lines, water mains, dykes, poles, pillars, fences, wires, supports and embankments and other underground or over ground works, structural or constructions whatsoever and shall at his own cost and initiative forthwith restore and repair any damage thereto the satisfaction of SECI and / or the person or authority concerned relative to the line, pipe or other works, construction of installation as the case may be.

(17) **Observation of Environmental Regulations and Protection**: The vendor shall ensure that its servants and agents and sub-vendors and their servants and agents shall duly comply with all environmental laws, applicable rules and regulations and the conditions of any permit, permission, consent and or no-objection granted in this behalf by any authority with respect to or concerning the work and shall independently so organize and conduct their operations as not to cause any hazard or pollution to health, life, property or environment including (but not limited to) discharge of any noxious substance or effluent into the atmosphere or into the earth or into any drain, canal, stream, river, pond, lake or other water body.

(18) **Compliance with regulations**: The vendor shall comply with all applicable laws or ordinances; codes approved technical standards, rules and regulations and shall procure

all necessary Government permits & licenses etc. at its own cost. All compliances (State Govt. /Central Govt. /Local - VAT/WCT/ESI/PF/Labour law etc.) is to be met by the vendor and the same is to be produced by the vendor at the time of payment.

(19) **Dismantling**: At the end of the life of batteries, final dismantling, removing and recycling batteries from the site is the complete responsibility of vendor.

(20) **Recycling**: Once batteries have reached the end of its useful life, it is the complete responsibility of vendor to remove batteries and recycle the batteries. Batteries should be in completely discharged condition prior to their disposal and disposed as per the brief plan presented at the time of quality assurance program. The DC connection terminals of the batteries must be insulated with electric tape to prevent accidental contacts. Incineration must be performed by an approved and permitted waste treatment facility that handles lithium ion batteries. It shall be the responsibility of vendor to

- ensure that used batteries collected are sent to the registered recycling agencies or for disposal
- ensure that necessary arrangements are made for safe transportation from site to the premises of recyclers or for disposal
- ensure that no damage to the environment occurs during transportation;
- ensure that batteries are recycled according to relevant guidelines prevailing at the time of disposal.

(21) Demurrage Wharfage etc.: All demurrage, wharfage and other expenses incurred due to delayed clearance of the material or any other reason shall be to the account of the vendor.

(22) Indemnity: Vendor shall indemnify and at all times keep BHEL indemnified and hold SECI and BHEL harmless against any direct loss to it or any claims by any third person, for any personal injury to anybody or loss to property, movable or immovable, caused by or attributable to any act or omission of the vendor or any of his officer, employee, agent or professional etc. in connection with this purchase order. The vendor shall be responsible for the safety of the BESS systems installed at site and shall indemnify SECI and BHEL for any direct or indirect loss due to any fire, explosion or any other safety issue arising due to operation of BESS systems.

(23) **Performance Security**: Within 28 days of receipt of PO from BHEL, the vendor shall furnish a Contract Performance Security (CPS-1) in the form of a Bank Guarantee (BG-1) with a validity period of 20 months (+ claim period of 03 months) from the date of PO and for the value equaling 10% of the purchase order price which will include all components of the purchase order and will exclude only taxes/duties and O&M charges. Any delay in submission of CPS-1 shall be deemed as accruing of financial benefit to the supplier and BHEL shall take necessary interest penalty recovery action (interest @ State Bank of India's MCLR + 2%) from the payments due to the supplier for the period of delay.

BHEL shall at its discretion have recourse to the said Bank Guarantee for the recovery of any or all amount due from the bidder in connection with the contract including of Warranty obligations.

In case operational acceptance does not take place within 20 months of PO placement, the Performance Security has to be initially extended for a period of 06 months. BHEL is however liable to return 10% Performance Security within 15 days after successful completion of 03 months post operational acceptance of plant facilities provided contract Performance Security (CPS-2) in the form of a Bank Guarantee (BG-2) amounting to 05% of the purchase order price (which includes all components of the purchase order and will exclude only taxes/duties and O&M charges) is submitted to BHEL. The BG-2 shall be valid till the end of 10th year of the O&M period with claim period of 03 months. Envisaging the difficulty in obtaining the longer tenure of CPS-2 in the form of BG, the successful bidder can submit Contract Performance Security in the form of Bank Guarantee with an initial validity period of 36 months and the same may be extended for the balance period or further 36 months, just prior to expiry of the original CPS-2.

Contractor needs to furnish the revised Contract Performance Security (CPS-2) in the Second Stage amounting to 5% of the total Contract Value as mentioned above within the validity period of the Contract Performance Security (CPS-1) submitted at First Stage. In case the Contractor fails to furnish the Contract Performance Security (CPS-2) mentioned under the Second Stage within the due validity period of the CPS-1, BHEL at their sole discretion will forfeit the Contract Performance Security furnished at the respective stage.

The Contract Performance Guarantee/s shall be returned to the supplier, without payment of any interest, on successful completion of all the contractual formalities.

Refer Clause “H” of Instructions to Bidders. Also note that PBG should be in the format specified in Annexure VII of ITB and no deviation to this format will be allowed. The bank guarantee shall be issued in favor of BHEL.

(24) Installation/ civil works & commissioning and operation & maintenance of the system shall be done by vendor as per contract specifications.

(25) **Termination**: BHEL by written notice, may terminate this Order for default, in whole or in part, if the vendor: (a) fails to make a delivery in accordance with the Order’s schedule, (b) fails to comply with any of the terms of this Order, (c) fails to make progress so as to endanger performance of this Order, (d) fails to provide adequate assurances of future performance, (e) ceases to conduct its operations, or (f) has any proceeding or lawsuit under bankruptcy, liquidation, or insolvency law brought against it.

(26) **Warranty:** The vendor shall warrant as per standards for quality that anything to be furnished shall be new, free from all defects and faults in material, workmanship and manufacture, shall be of the highest grade and consistent with established and generally

accepted standards for material of the type ordered, shall be in full conformity with the specifications, drawing or samples, if any and shall if operable, operate properly.

(27) <u>Force majeure</u>:

a) Notwithstanding the provisions of clauses contained in this purchase order, the vendor shall not be liable for forfeiture of its performance security, liquidated damages, termination for default, if he is unable to fulfill his obligation under this deed due to event of force majeure circumstances.

b) For purpose of this clause, 'Force majeure' means an event beyond the control of the vendor and not involving the vendor's fault or negligence and not foreseeable. Such events may include, but are not restricted to, acts of Government either in its sovereign or contractual capacity, wars or revolutions, fires, floods, epidemics, pandemics, quarantine restrictions, and freight embargoes.

c) However, if a force majeure situation arises, the vendor shall immediately notify 'BHEL' in writing. Any time extension on delivery or project completion to the extent of delay due to force majeure may be granted to the vendor based on mutual discussion and agreement. The decision of the competent authority of BHEL in above conditions shall be final.

(28) <u>Others :</u>

a) The vendor in consultation with BHEL will conduct training programme for users, focusing on main features, operation and maintenance of the systems.

b) The vendor shall continue to provide spare parts during warranty and O&M period at their own cost to keep the systems in good operating conditions. After the expiry of O&M period, the vendor shall continue to provide spare parts at the users cost till the product life. If the vendor fails to continue to supply spare parts and services to users, BHEL shall take appropriate action against the vendor.

c) The supplies of battery cells/modules/pack shall be supported by an extended producer responsibility certificate as and when available, authorization from the battery manufacturer. 'Extended Producer Responsibility' (EPR) means responsibility of any producer of batteries for their products beyond manufacturing until environmentally sound management of their end-of-life products; for channelization of waste batteries to ensure environmentally sound management of such waste.

   Extended Producer Responsibility may comprise of implementing take back system or setting up of collection centres or both and having agreed arrangements with registered recycler either individually or collectively through a Producer Responsibility Organization recognized by producer or producers in their Extended Producer Responsibility.

d) All batteries that have completed the useful life (battery waste) at the location installed shall be managed in an environmentally sound manner. 'Environmentally sound management of battery waste' means taking all steps required to ensure that batteries are managed in a manner which shall protect health and environment against any adverse effects, which may result from hazardous substance contained in such wastes.

(29) PAYMENTS:

The payments shall be effected as per the following terms and conditions:

a) 85% supply payment (excluding I&C and O&M) with taxes and freight will be paid in 45 days from the date of dispatch or 15 days from the date of submission of complete set of documentation, whichever is later.

Following documents need to be submitted to BHEL for processing of 85% supply payment:

1. Invoice (02 sets of original) for complete material supplied along with proof of delivery at site (sign and stamp of person who has received and verified the materials)
2. Delivery challan(s) & E way bill
3. Packing list and Consignee copy of Lorry Receipt (Packing List shall be detailed indicating package-wise content details along with Net weight & Gross weight of each package).
4. Inspection report/ Test Reports issued by the inspection authority
5. NIL Short-Shipment Certificate
6. Warranty Certificate
7. Insurance policy (covering insurance scope as mentioned in clause: 11 above).

b) Balance 15% supply retention payment (excluding I&C and O&M) will be paid in 15 days from the date of submission of supplementary invoice against proof of completion of first year of O&M of plant. It shall be noted in this context that O&M will start from the Operational acceptance of the Plant Facilities.

Payment term for I&C charges: 100% I&C charges along with tax as applicable, will be paid in 15 days from the date of submission of supplementary invoice against proof of completion of Installation/ civil works & Commissioning of the BESS.

Following documents need to be submitted to BHEL for processing of respective Service payments:

(i) The warranty certificates for complete system (as per Purchase Order):

(a) Complete system warranty certificate.

(b) Manufacturer warranty card / letter for all components and data sheet for lithium ion/various technologies battery cells/modules, inverter and PCS.

(c)All reports should be stamped and signed by the vendor / authorized representative of the vendor.

(d) Insurance copy of the complete system.

(e) Proof for the establishment of service center at the site.

(f) Proof of submission of PF/ESI.

(g) Extended Producer will provide proof of document for EPR and share the waste battery handling report. (As per the Ministry of Environment, Climate and Forest Change released the Draft Battery Waste Management Rules, 2020. The Draft Rules seek to replace the Batteries (Management and Handling) Rules, 2001, which provide details for handling and management of batteries under the Environment (Protection) Act, 1986)

(ii) Original certificate issued by SECI confirming Installation, testing and commissioning of material at site and acceptance of the same by Site In charge.

(iii) Commissioning and handover certificate / Operational Acceptance declaration, counter-signed by SECI/ BHEL.

c) After expiry of warranty period (Operational acceptance by SECI), Operation & Maintenance charges will be paid in 15 days from the date of submission of supplementary invoice/documents against proof of completion of O&M on quarterly basis; invoice certification shall be done by project In-charge.

(a) Detailed complaint log of all the complaints received during the period.

(b) Rectification log of all complaints attended and remedial measures taken.

(c) Verification report signed by user / SECI representative.

(d) If the documents are not submitted within the specified stipulated time period, (at quarterly frequency) the purchase order will deem to be completed and the vendor will not have any claim for the payment.

(e) Complete records for complaint and rectification log should be maintained and available during any visit.

(f) Category wise quarterly monitoring report.

Payment terms for O&M charges: 100% O&M charges along with tax as applicable, will be paid in 15 days from the date of submission of supplementary invoice/documents against proof of completion of O&M on quarterly basis.

Penalty for delay for Delay in Completion: Applicable rate for Penalty shall be 0.5% per Week for delay in delivery/ completion of facilities from the Schedule Date of Completion/Contract Period. Maximum deduction for penalty for delay shall be 10% of the contract value. Further, refer GCC Clause no.04.b.

No bonus will be given for earlier Completion of the Facilities or part thereof.

Liquidated Damages for Functional Guarantees (FGs): Functional Guarantees for Performance Ratio (82%), Capacity Utilization Factor (36.5%) and BESS Availability (99%) shall be applicable for the project. Further, refer Cl. 1.8/ Section C.

(30) Materials –Quality & Workmanship:

a) Immediately on award of contract, the vendor shall submit a detailed project report along with valid external ISO audit report of the company and Implementation plan report within 20 working days having planning and testing strategy with provisions for quality check performance at various stages of the project. The report shall also furnish details of method of checking and inspection and acceptance standards / values.

b) The vendor has to provide quality assurance certificates to BHEL/SECI for required components of BESS and shall comply with appropriate codes & standards. Failure to abide by the same may result in rejection of purchase order by BHEL. BHEL reserves the right to request for any additional information and also reserves the right to reject the proposal of any vendor, if in the opinion of BHEL, the data in support of tender requirement is incomplete.

c) The vendor shall comply with the purchase order terms in all respects to the satisfaction of SECI and BHEL.

d) For a period of 10 years, after system installation, the vendor shall be responsible for any defects that may occur due to faulty materials, design or workmanship. If it becomes necessary for the vendor to replace or repair any defective portion of the system, the vendor shall address the issues within 2 working days and any replacements or renewals can be completed within 10 working days of intimation without any extra cost to SECI/ BHEL. However, the system must be in running condition within 2 working days of intimation.

e) It has to be noted by vendor that prior to expiry of this agreement which is 10 years from the date of operational acceptance of BESS, the health assessment of the asset shall be carried out to assess the performance of associated components (i.e. cells, modules, PCS etc.) during last six months of the O&M.

(31) Validity of offer: The offer will be valid for a period of 90 days from the date of part-I bid opening and in case of Negotiation/Counter-offer/Reverse Auction, price validity will apply afresh for a period of 30 days from the date of according final price by bidder (or) up to original validity period, whichever is later.

(32) Inland transportation including loading, un-loading, insurance and other costs incidental to delivery (demurrage, wharfage, etc.): The supplier is required under the Contract to transport the Goods to place of destination defined as Site. Transport to such place of destination in India including insurance, as shall be specified in the Contract, shall be arranged by the supplier, and the related cost shall be included in the Contract Price. Vendor shall book the consignment through vendor's approved Road carriers on "Freight pre-paid" basis & to be claimed from BHEL through a separate invoice against proof of acknowledged L/R.

(33) Evaluation criteria for tendered item/s: Items will not be split on item-wise lowest offer. Items shall be evaluated and procured as a combined package.
Note: No margin of domestic preference shall apply.

(34) Reverse Auction: BHEL shall be resorting to Reverse Auction (RA) (Guidelines as available on www.bhel.com) for this tender. RA shall be conducted among all the techno-commercially qualified bidders. Price bids of all techno-commercially qualified bidders shall be opened and same shall be considered as initial bids of bidders in RA. In case any bidder(s) does not participate in online Reverse Auction, their sealed envelope price bid along with applicable loading, if any, shall be considered for ranking.

(35) Integrity Pact: The IP as enclosed with the tender is to be submitted (duly signed by authorized signatory) along with Pre-Qualification bid (Part-I).

Following independent External Monitors (IEMs) on the present panel have been appointed by BHEL with the approval of CVC to oversee implementation of IP in BHEL.

1. Shri Arun Chandra Verma,IPS (Retd.)

   Email: acverma1@gmail.com

2. Shri Virendra Bahadur Singh,IPS (Retd.)

   Email: vbsinghips@gmail.com

Only those Bidders who have entered into such an IP with BHEL would be competent to participate in the bidding. In other words, entering into this Pact would be a preliminary qualification.

(36) Installation/Civil works and Commissioning :
In case the quoted total Installation/Civil works & Commissioning value is less than 02% of the basic material value (excluding taxes/duties, in-land freight), BHEL shall evaluate Bidders Price deducting differential amount from main supply price and apportioning towards Installation/Civil works & Commissioning charges.

(37) Operation & Maintenance for 10 years: In case the quoted total O&M value is less than 05% of the basic value (which will include all components of the purchase order and will exclude only taxes/duties), BHEL shall evaluate Bidders Price deducting differential amount from main supply price and apportioning towards O&M charges. It shall also be noted that year-wise O&M charges shall be either quoted uniformly/in increasing trend.

(38) Tax/ Duty Benefits: Bidders may like to ascertain availability of tax/duty exemption benefits available in India. They are solely responsible for obtaining such benefits which they have considered in their bid and in case of failure to receive such benefits for reasons whatsoever, the Employer will not compensate the bidder (contractor). The bidder shall furnish along with his bid a declaration to this effect in the Declaration Format provided in attached 'Appendix' to the bidding documents. Where the bidder has quoted taking into account such benefits, it must give all information required for issue of certificates in terms of the Government of India's relevant Notifications as per the declaration format. In case the bidder has not provided the required information or has indicated to be furnished later, the same shall be construed that the goods/plant and equipment for which certificate is required is Nil. If the bidder has considered the tax/duty exemption for materials/plant and equipment to be bought for the work, the bidder shall confirm and certify that the Employer will not be required to undertake any responsibilities of the Government of India Scheme or the said exemptions being available during the contract execution, except issuing the required certificate. The bids which do not conform to the above provisions or any condition by the bidder which makes the bid subject to availability of tax/duty exemption for materials/plant and equipment or compensation on withdrawal of any variations to the said exemptions will be treated as non-responsive and rejected. Any delay in procurement of the materials/plant and equipment as a result of the above shall not be a cause for granting any extension of time.

Custom Duty for Solar Photo Voltaic Power Generation Projects: As per relevant Notifications of Govt. of India, the benefits of concessional rate of custom duty (applicable for Solar Photo Voltaic Power Generation Projects) may be available for the import of raw materials, components, sub-assemblies and Equipments, if any, required for manufacture of equipment/ plant/ spares to be supplied under the contract. Bidder may appraise itself of the relevant policies and quote accordingly. The Employer shall issue the requisite certificate as specified in the relevant policy of Govt. of India. However, if the certificate is required to be issued by any department/ministry of Government of India or State Government where the Project is located other than Employer, the Bidder shall itself be responsible for obtaining such certificate from the concerned department/ministry. In such a case, the Employer may issue recommendatory letter to the bidder. To enable the Employer to issue such certificate / recommendatory letter, the Bidder shall furnish the requisite data. In addition, the Bidder may also like to ascertain availability of Custom Duty benefits available for import of construction equipment, if any, as per the extant Customs Acts & Notifications of Govt. of India. Where the bidder has quoted taking into account the Custom Duty benefits available for import of Construction Equipment, he must give all information required for issue of relevant Certificate by Employer along with its bid. However, the bidders shall themselves be solely responsible for availing such benefits, which they have considered in their bid. In case of failure of the bidder to receive the benefits partly or fully from the Govt. of India and/or in case of delay in receipt of such benefits and/or withdrawal of such benefits by the Govt. of India, the Employer shall neither be responsible nor liable in this regard in any manner whatsoever.

Exemption of GST or any other taxes and duties (if applicable) on Items Manufactured for Grid Connected Solar Photo Voltaic Power Generation Projects. As per extant guidelines of Department of Revenue, Ministry of Finance, Govt. of India, the benefits of exemption of GST or any other taxes and duties (if applicable on items manufactured for grid connected Solar Photo Voltaic Power Generation Projects) may be available for the items to be supplied under the contract, Bidder may appraise itself of the relevant policies and

quote accordingly. The Employer shall issue the requisite certificate (if required) as specified in the relevant policy of Govt. of India. However, if the certificate is required to be issued by any department/ ministry of Government of India or State Government where the Project is located other than Employer, the Bidder shall itself be responsible for obtaining such certificate from the concerned department/ministry. In such a case, the Employer may issue recommendatory letter to the bidder. The Bidder shall be solely responsible for obtaining the benefits of exemption on excise duty GST or any other taxes and duties (if applicable) on the items to be supplied under the contract from the Govt. of India. In case of failure of the bidder to receive the benefits partly or fully from Govt. of India or in case of delay in receipt of such benefits, the Employer shall neither be responsible nor liable in this regard in any manner whatsoever.

(39) ESMP, EHS AND CODE OF CONDUCT

Contractor's Environmental and Social Management Plan (C-ESMP)

In line with the environmental and social norms requirements of the Projects, the contractor will appoint/hire suitable Environmental and social development officers/Experts (as described in "Contractor's Representative and Key Personnel", so as to execute the laid down ESMP effectively. The contractor will be overall responsible for ESMP implementation, coordinating and liaising, sub-contractors and other agencies, with respect to different social and environmental issues.

The Contractor shall not carry out mobilization to Site unless the Project Manager gives approval, an approval that shall not be unreasonably delayed, to the measures the Contractor proposes to address environmental and social risks and impacts including the code of conduct. The Contractor shall submit, to the Project Manager for Review, any additional Management Strategies and Implementation Plans as are necessary to manage the ES risks and impacts of the Facilities. These Management Strategies and Implementation Plans collectively comprise the Contractor's Environmental and Social Management Plan (C-ESMP). The Contractor shall review the C-ESMP, periodically (but not less than every six (6) months), and update it as required to ensure that it contains measures appropriate to the Facilities. The updated CESMP shall be submitted to the Project Manager for its approval. The Contractor shall provide appropriate training to relevant Contractor's Personnel on ES aspects of the Contract, including appropriate sensitization on prohibition of SEA and health and safety training. As stated in the Employer's Requirements or as instructed by the Project Manager, the Contractor shall also allow appropriate opportunities for the relevant Contractor's Personnel to be trained on ES aspects of the Contract by the Employer's personnel and/or other personnel assigned by the Employer.

Code of Conduct for Contractor's Personnel (ES)

The Bidder shall submit its Code of Conduct that will apply to the Contractor's Personnel) employed for the execution of Installation Services at the Site (or other places in the country where the Site is located), to ensure compliance with the Contractor's Environmental and Social (ES) obligations under the Contract.

The Bidder shall submit Management Strategies and Implementation Plans (MSIPs) to manage the Environmental and Social (ES) risks ((including Sexual Exploitation and Abuse (SEA), and Sexual Harassment (SH)) as elaborated in Contractor's C-ESMP and Sexual Exploitation, and Abuse (SEA) prevention and response action plan. These strategies and plans shall describe in detail the actions, materials, equipment, management processes etc. that will be implemented by the Contractor, and its subcontractors.

Environmental and Social Management Framework (ESMF) of Innovation in Solar Power and Hybrid Technologies (ISHTP) Project:
http://documents1.worldbank.org/curated/pt/406541534751743414/pdf/SFG4529-REVISED-EA-P160379-PUBLIC-Disclosed-11-16-2018.pdf

WBG Safeguard Policies / Performance Standards:
https://policies.worldbank.org/sites/PPF3/Pages/Manuals/Operational%20Manual.aspx

WBG Guidance Note on Project Induced Labor Influx:
http://pubdocs.worldbank.org/en/497851495202591233/Managing-Risk-of-Adverse-impact-from-project-labor-influx.pdf

EHS Guidelines: The Contractor (or whatever is the Term in the Contract) shall follow the World Bank Group Environmental, Health and Safety Guidelines (WBGEHSG) during the execution of the Contract to the extent that their activities are covered in these operations. These are available at:

https://www.ifc.org/wps/wcm/connect/554e8d80488658e4b76af76a6515bb18/Final%2B%2BGeneral%2BEHS%2BGuidelines.pdf?MOD=AJPERES;

https://www.ifc.org/wps/wcm/connect/66b56e00488657eeb36af36a6515bb18/Final%2B%2BElectric%2BTransmission%2Band%2BDistribution.pdf?MOD=AJPERES&id=1323162154847

In developing these strategies and plans, the Contractor shall have regard to the EHS provisions of the Contract Agreement including those as may be more fully described in the following:

a. ESMF

b. Environmental and Social Due Diligence Report (ESDDR) which also includes Environmental and Social Management Plan (ESMP).

Note:
1. The vendor is mandatorily required to open service center to carry out on-site warranty services at site.

2. Non-tearable Logo (BHEL) pasting has to be done on each BESS Unit.

With this, we hereby confirm that all the terms & conditions as indicated in Instructions to Bidders (Document Ref: CE: PR: 001- Rev 03) & General Commercial Conditions for Contract (Document Ref: CE: PR: 002- Rev 02) are accepted without any deviation.

Vendor's Signature with Seal

Note: This document has to be mandatorily filled & furnished as part of Part-II bid.

Appendix to Technical Part

(Name of the Project)

(*Declaration regarding tax/ duty exemption for plant/equipment/construction equipment bought for the work)*[8]

(*Bidder's Name and Address*)

To: ……..

(*Name of the Employer & address*)

Dear Sir:

Re: [*Name of Work*]…….

RFB No…….

Certificate for Import/Procurement of Plant and Equipment/Construction Equipment

7. Government Order/Circular Number under which tax/duty Exemption is being sought: …1. We confirm that we are solely responsible for obtaining tax/ duty waivers which we have considered in our bid and in case of failure to receive such waivers for reasons whatsoever, the employer will not compensate us. We are furnishing below the information required by the Employer for issue of the necessary certificates in terms of the Government of India's relevant Notifications. The goods/construction equipment for which certificates are required are as under:

Items *(modify the list suitably for each specific work)**	Make/ Brand Name	Capacity [*where applicable*]	Quantity	Value	State whether it will be procured locally or imported [*if so from which country*]	Remarks regarding justification for the quantity and their usage in works.
Plant and Equipment						
[a] _____						
[b] _____						
[c] _____						

[8] This declaration refers to ITB 17.5.2 and shall be retained only if ITB 17.5.2 is retained. The format may be modified as per the latest instructions of Government of India.

Construction Equipment						

7. 4. We agree that no modification to the above list is permitted after bids are opened. We agree that the certificate will be issued only to the extent considered reasonable by the Employer for the work, based on the Employer's Requirements and the construction program and methodology as furnished by us along with the bid. We confirm that the above plant, equipment and construction equipment will be exclusively used for the construction of the above work and the construction equipment will not be sold or otherwise disposed of in any manner for a period of five years from the date of acquisition.

Date: _____ (*Signature*) _____

Place: _____ (*Printed Name*) _____

(*Designation*)_____

(*Common Seal*) _____

[***This certificate will be issued within 60 days of signing of contract and no subsequent changes will be permitted.***]

**** Modify the above to suit the requirements given in Government of India's Notifications as current of date of bidding.***

ಭಾರತ್ ಹೆವಿ ಎಲೆಕ್ಟ್ರಿಕಲ್ಸ್ ಲಿಮಿಟೆಡ್
भारत हेवी इलेक्ट्रिकल्स लिमिटेड
Bharat Heavy Electricals Ltd.,
(A Government of India undertaking)
Electronics Division
PB 2606 , Mysore Road Bangalore , 560026 INDIA

CE:PR:001- Rev 03

INSTRUCTIONS TO BIDDERS

Bidder is requested to read the instructions carefully and submit their quotation taking into consideration of all the points:

A. GENERAL INSTRUCTIONS:

1. Any Purchase Order resulting from this enquiry shall be governed by the Instructions to Bidders (document reference: CE: PR: 001 – Rev 03), General Conditions of Contract (document reference: CE: PR: 002 - Rev 02) and Special Conditions of Contract, if any, of the enquiry.
2. Any deviations from or additions to the "General Conditions of Contract"or "Special Conditions of Contract" require BHEL's express written consent. The general terms of business or sale of the bidder shall not apply to this tender.
3. Regret letter (either through post or by mail or by EPS) indicating reasons for not quoting must be submitted without fail, in case of non-participation in this tender. Supplier shall be liable for removal as a registered vendor of BHEL when the supplier fails to quote against four consecutive tender enquiries for the same item or all enquiries in last two years for the same item, whichever is earlier.
4. Procurement directly from the manufacturers is preferred. However, if the OEM/ Principal insist on engaging the services of an agent, such agent shall not be allowed to represent more than one manufacturer/ supplier in the same tender. Moreover, either the agent could bid on behalf of the manufacturer/ supplier or the manufacturer/ supplier could bid directly but not both. Agent/Representative authorized by the OEM/Principal in turn cannot further sub authorize any other firm for submitting the offer or for placement of order.

   In case bids are received from the manufacturer/ supplier and his agent, bid received from the agent shall be ignored.
5. Consultant / firm (and any of its affiliates) shall not be eligible to participate in the tender/s for the related goods for the same project if they were engaged for consultancy services for the same project.
6. If an Indian representative/associate/liaison office quotes on behalf of a foreign based bidder, such representative shall furnish the following documents:
   a. Authorization letter to quote and negotiate on behalf of such foreign-based bidder.
   b. Undertaking from such foreign based bidder that such contract will be honored and executed according to agreed scope of supply and commercial terms and conditions.
   c. Undertaking shall be furnished by the Indian representative stating that the co-ordination and smooth execution of the contract and settlement of shortages/damages/replacement/repair of imported scope till the equipment is commissioned and handed over to customer will be the sole responsibility of the Indian representative/associates/agent/liaison office.
   d. Refer **Annexure I** on "Guidelines for Indian Agents".

7. In case of imported scope of supply, customs clearance & customs duty payment will be to BHEL account after the consignment is received at Indian Airport /Seaport. Bidders must provide all original documents required for completing the customs clearance along with the shipment. Warehousing charges due to incomplete or

missing documentation will be to supplier's account. All offers for imported scope of supply by air, must be made from any of the gateway ports (within the country) indicated **(Refer Annexure II).**

8. The offers of the bidders who are on the banned list and also the offers of the bidders, who engage the services of the banned firms, shall be rejected. The list of the banned firms is available on BHEL website: http://www.bhel.com/vender_registration/vender.php
9. Business dealings with bidders will be suspended if they are found to have indulged in any malpractices/misconduct which are contrary to business ethics like bribery, corruption, fraud, pilferage, cartel formation, submission of fake/false/forged documents, certificates, information to BHEL or if they tamper with tendering procedure affecting the ordering process or fail to execute a contract, or rejection of 3 consecutive supplies or if their firms / works are under strike/lockout for a long period. Bidder may refer "Guidelines for Suspension of Business Dealings with Suppliers/ Contractors" available on www.bhel.com for more details.
10. The bidder along with its associate/collaborators/sub-contractors/sub-vendors/consultants/service providers shall strictly adhere to BHEL Fraud Prevention Policy displayed on BHEL website http://www.bhel.com and shall immediately bring to the notice of BHEL Management about any fraud or suspected fraud as soon as it comes to your notice.
11. Offers to be submitted in English language only.
12. For this procurement, the local content to categorize a supplier as a Class-I local supplier/ Class-II local supplier/ Non-local supplier and purchase preference to Class-I local supplier, is as defined in Public procurement (Preference to Make in India), Order 2017 dated 04.06.2020 issued by DPIIT. In case of subsequent Orders issued by the Nodal Ministry, changing the definition of local content for the items of the NIT, the same shall be applicable even if issued after issue of this NIT, but before opening of price bid/s against this NIT.

    Any Indian Bidder intending to avail the benefits shall submit the requisite documents as per the aforesaid orders.
13. The Bidder shall mandatorily submit Declaration as mentioned below, under Rule 144(xi) of General Financial Rules, 2017 amendment dt 23.07.2020 issued by Ministry of Finance, Govt. of India. The declaration to be submitted on Company Letter head duly signed and sealed by authorised signatory, for ascertaining the eligibility of offer in the tender.

    "I have read the clause regarding restrictions on procurement from a bidder of a country which shares a land border with India; I certify that this bidder is not from such a country or, if from such a country, has been registered with the Competent Authority. I hereby certify that this bidder fulfils all requirements in this regard and is eligible to be considered."

    (Where applicable, evidence of valid registration by the Competent Authority shall be attached).

    The Competent Authority for the purpose of registration under this Order shall be the Registration Committee constituted by the Department for Promotion of Industry and Internal Trade (DPIIT).

    Refer Annexure-X for 'Restrictions under Rule 144(Xi) of General Financial Rules,2017 amendment dt: 23.07.2020'.

B. <u>GUIDELINES FOR PREPARATION OF OFFER:</u>

1. Quotation shall be submitted in Single Part Bid, Two Part Bid or Three Part Bid, as called for in the tender:

- **SINGLE PART BID**: Technical and Commercial Bid with prices along with price summary & filled in BHEL Standard Commercial terms and conditions in a single sealed envelope.

- **TWO PART BID**: Unpriced offer i.e. "Techno-commercial Bid" with filled in BHEL Standard Commercial terms and conditions in a sealed envelope **along with the copy of the "Price Bid"without the prices** should be enclosed in one cover and the cover must be super scribed **"Techno-commercial offer)** and Priced offer i.e. "Price Bid"containing price summary in a separate sealed envelope and must be super scribed **"Price Bid"**.Both these envelopes shall be enclosed in a single sealed envelope superscribed with enquiry number, due date of tender and any other details as called for in the tender document.

- **THREE PART BID**: Pre-qualification Bid (Part-I), Techno Commercial Bid with filled in BHEL Standard Commercial terms and conditions (Part-II), and Price Bid (Part-III). All three envelopes shall be enclosed in a single sealed envelope superscribed with enquiry number, due date of tender and any other details as called for in the tender document.

If any of the offers (Part I, Part II or Part III) are not submitted before the due date and time of submission (or) if any part of the offer is incomplete, the entire offer of the bidder is liable for rejection.

2. Supplier shall ensure to superscribe each envelope with RFQ number, RFQ Date, RFQ Due date and time, Item Description and Project clearly & boldly. Also mention on the envelope whether it is "Techno Commercial Bid" or "Price Bid" or "Pre-Qualification Bid". Please ensure complete address, department name and purchase executive name is mentioned on the envelope (before dropping in the tender box or handing over) so that the tender is available in time for bid opening.
3. BHEL standard Commercial Terms and Conditions (duly filled, signed & stamped) must accompany Technical-Commercial offer without fail and should be submitted in original only.

   The above indicated submission of Offers in "sealed envelope/hard copy" as mentioned in points B.1-B.3 is applicable for tenders that are not floated through E-Procurement System (EPS).

4. Validity: Unless otherwise specified in SCC (special commercial conditions of contract), the offer will be valid for a period of 90 days from the date of part-I bid opening and in case of Negotiation/Counter-offer/Reverse Auction, price validity will apply afresh for a period of _60_ days from the date of according final price by bidder (or) upto original validity period, whichever is later.

5. Any of the terms and conditions not acceptable to supplier, shall be explicitly mentioned in the Techno-Commercial Bid. If no deviations are brought out in the offer it will be treated as if all terms and conditions of this enquiry are accepted by the supplier without deviation.
6. Deviation to this specification/item description, if any, shall be brought out clearly indicating "DEVIATION TO BHEL SPECIFICATION" without fail, as a part of Techno-Commercial Bid. If no deviations are brought out in the offer it will be treated as if the entire specification of this enquiry is accepted without deviation.
7. Suppliers shall submit one set of original catalogue, datasheets, bill of materials, dimensional drawings, mounting details and/or any other relevant documents called in purchase specification as part of Technical Bid.
8. "Price Bid" shall be complete in all respects containing price break-up of all components along with all applicable taxes and duties, freight charges (if applicable) etc. Once submitted no modification / addition / deletion will be allowed in the "Price Bid." Bidders are advised to thoroughly check the unit price, total price to avoid any discrepancy.
9. In addition, bidder shall also quote for erection & commissioning charges/erection supervision & commissioning charges (E&C service charges), documentation charges, testing Charges (type & routine),

training charges etc. as applicable along with corresponding tax. The price summary must indicate all the elements clearly.

10. Wherever applicable, bidders should indicate "lumpsum" Erection and Commissioning (or) Erection Supervision and Commissioning charges, as applicable (including To & Fro Fare, Boarding, Lodging, Local Conveyance etc.) for carrying out E&C activity and further handing over to customer. The quotation shall clearly indicate scope of work, likely duration of commissioning, pre-commissioning checklist (if any).
11. Wherever bidders require PAC (Project Authority Certificate)/applicable certificates for import of raw materials, components required for DECC,EPCG Power Projects, Export Projects or other similar projects wherein supplies are eligible for customs duty benefits, lists and quantities of such items and their values (CIF) has to be mentioned in the offer. Prices must be quoted taking into account of such benefits.
12. Prices should be indicated in both figures & words**.** Bid should be free from correction/overwriting, using corrective fluid, etc. Any interlineation, cutting, erasure or overwriting shall be valid only if they are attested under full signature(s) of person(s) signing the bid else bid shall be liable for rejection. Any typographical error, totalling mistakes, currency mistake, multiplication mistake, summing mistakes etc. observed in the price bids will be evaluated as per **Annexure III** "Guidelines for dealing with Discrepancy in Words & Figures – quoted in price bid" and BHEL decision will be final.
13. Documents submitted with the offer shall be signed and stamped in each page by authorized representative of the bidder. However, this requirement is not mandatory for offers uploaded through E-Procurement System (EPS).

C. <u>GUIDELINES FOR OFFER SUBMISSION:</u>

The under-mentioned clauses 1, 2&3 will not be applicable for EPS tenders.

1. Offers / Quotations must be dropped in tender box before 13.00 Hrs. on or before due date mentioned in RFQ.The offers are to be dropped in the proper slot of the Tender Box kept in our reception area with caption "CE, SC&PV, DEFENCE". Tenders are opened on 3 days in a week (Monday/Wednesday/Friday). Tender must be deposited in the slot corresponding to the day (Monday - Box no.4/Wednesday - Box no. 6 /Friday - Box no.8) while depositing the offer.

2. E-Mail/ Internet/EDI offers received in time shall be considered only when such offers are complete in all respects. In case of offers received through E-mail, please send the offer to the email ID specified in the SCC document of the tender.

3. Offers of Vendors who already have a valid Technical/Commercial MOU with BHEL-EDN for the items of the RFQ shall mention the relevant MOU reference no. and give only such other details not covered in the MOU.

4. In cases where tender documents are bulky, or due to some reasons tender documents are required to be submitted by hand or through posts/couriers, the offers are to be handed over either of the two purchase officers whose names are mentioned in the SCC document of tender RFQ.
5. Tenders will be opened on due date, time and venue as indicated in the RFQ in the presence of bidders at the venue indicated in the RFQ. For EPS tenders, e-mail notifications will be automatically generated and forwarded to registered e-mail ID/s of bidders during opening of tenders.
6. Bidder will be solely responsible:
   a. For submission of offers before due date and time. Offers submitted after due date and time will be treated as "Late offers" and will be rejected.

   b. For submission of offers in the correct compartment of the tender box based on the day of due date (Monday/Wednesday/Friday). Please check before dropping your offer in the correct tender box.

c. For depositing offers in proper sealed condition in the tender box. If the bidder drops the tender in the wrong tender box (or) if the tender document is handed over to the wrong person, BHEL will not be responsible for any such delays.

d. For offers received through email etc., suppliers are fully responsible for lack of secrecy on information and ensuring timely receipt of such offers in the tender box before due date & time (This clause will not be applicable for EPS tenders).

The above indicated submission of Offers as mentioned in points 6.a-6.d is applicable for tenders that are not floated through EPS.

e. In case of e-tender, all required documents should be uploaded before due date and time. Availability of power, internet connections, system/software requirements etc. will be the sole responsibility of the bidder. Wherever assistance is needed for submission of e-tenders, help-line numbers as available in the web-site of service provider of BHEL may be contacted.

Purchase Executive/ BHEL shall not be responsible for any of the activities relating to submission of offer.

D. <u>PROCESSING OF OFFERS RECEIVED:</u>

1. Any discount/ revised offer submitted by the supplier on its own shall be accepted provided it is received on or before the due date and time of offer submission (i.e. Part-I bid). The discount shall be applied on pro-rata basis to all items unless specified otherwise by the bidder.
2. Changes in offers or Revised offers given after Part-I bid opening shall not be considered as a part of the original offer unless such changes/revisions are requested by BHEL. In case of withdrawal of any Technical/Commercial deviation(s) by the bidder before opening of price bids/conducting the Reverse Auction, revision of price/impact bid will not be accepted.
3. In case there is no change in the technical scope and/ or specifications and/ or commercial terms & conditions, the supplier will not be allowed to change any of their bids after Technical bids are opened (after the due date and time of tender opening).
4. In case of changes in scope and/ or technical specifications and/ or commercial terms & conditions by BHEL and it accounts for price implications from bidders, all techno-commercially acceptable bidders shall be asked by BHEL (after freezing the scope, technical specifications and commercial terms & conditions) to submit the impact of such changes on their price bid. Impact price will be applicable only for changes in technical specification / commercial conditions by BHEL. The impact price must be submitted on or before the cut-off date specified by BHEL and the original price bid and the price impact bid will be opened together at the time of price bid opening.
5. Un-opened bids (including price bids) will be returned to the respective bidders after release of Purchase order. Regarding Offers for EPS tenders that get rejected on PQC/ techno-commercial grounds, the bids for the subsequent parts will not be opened i.e., both technical bid and price bid (Parts-II & III)will not be opened in case of rejection on PQC ground and price bid (Part-II/Part-III, as applicable) will not be opened in case of rejection on techno-commercial ground.
6. After receipt of Purchase Order, supplier should submit required documents viz.,specified drawings, bill of materials, datasheets, catalogues, quality plan, test procedure, type test report , O & M Manuals and/or any other relevant documents as per Specification/Purchase Order, as and when required by BHEL/Customer.

7. Any deviation to the terms and conditions not mentioned in the quotation by supplier in response to this enquiry will not be considered, if put forth subsequently or after issue of Purchase Order, unless clarification is sought for by BHEL and agreed upon in the Purchase Order.
8. Evaluation shall be on the basis of delivered cost (i.e. "Total Cost to BHEL").
   "Total Cost to BHEL" shall include total basic cost, packing & forwarding charges, taxes and/or duties(as applicable), freight charges, taxes on Services, customs clearance charges for imported items, any other cost indicated by bidder for execution of the contract and loading factors (for non-compliance to BHEL Standard Commercial Terms & Conditions). Benefits arising out of Nil Import Duty on DEEC, EPCG, DFIA Projects, Physical Exports or such 100% exemptions (statutory benefits), project imports, customer reimbursements of statutory duties (like Basic Customs Duty and cess on customs duty), Input tax credits as applicable will also be taken into account for arriving at the Total cost to BHEL (wherever applicable and as indicated in SCC document of tender).

   For EPS tenders, it shall be noted that the prices (including discounts) vis-a-vis currency quoted in EPS portal only will be considered as Final for the purpose of evaluation of the lowest bidder. Bidder shall ensure to indicate the applicable taxes against each line item in online portal, failing to which the same will be considered as inclusive/NIL.

   In the course of evaluation, if more than one bidder happens to occupy L-1 status, effective L-1 will be decided by soliciting discounts from the respective L-1 bidders.
   Incase more than one bidder happens to occupy the L-1 status even after soliciting discounts, the L-1 bidder shall be decided by a toss/draw of lots, in the presence of the respective L-1 bidder(s) or their representative(s).
   Ranking will be done accordingly. BHEL's decision in such situations shall be final and binding.

9. For evaluation of offers in foreign currency, the exchange rate (TT selling rate of SBI) shall be taken as under:

Single part bids:	Date of tender opening
Two/three part bids:	Date of Part-I bid opening
Reverse Auction:	Date of Part-I bid opening

   In case of Performance Bank Guarantee (PBG) also, exchange rate will be considered as mentioned above for converting foreign currency to Indian currency and vice versa.

   If the relevant day happens to be a bank holiday, then the exchange rate as on the previous working day of the bank (SBI) shall be taken.
10. Ranking (L-1, L-2 etc.) shall be done only for the techno-commercially acceptable offers.

E. <u>INFORMATION ON PAYMENT TERMS:</u>

1. All payments will be through Electronic Fund transfer (EFT). Vendor has to furnish necessary details as per BHEL standard format **(Refer Annexure IV)** for receiving all payments through NEFT.(Applicable for Indian vendors only).
2. In case of High Sea Sales transaction, customs clearance of the consignment landed on Indian Sea/Air ports will be done by BHEL based on the original HSS documents provided by vendors. All warehousing charges due to delay in submission of complete and or correct HSS documents to BHEL will be to supplier's account only. Such recovery will be made out of any of the available bills **(Refer Annexure V)**.
3. Statutory deductions, if any, will be made and the deduction certificate shall be issued.
   A. In case vendor does not provide PAN details, the TDS deduction shall be at the maximum percentage stipulated as per the provisions of Income Tax Act.

In addition to the above, Foreign vendors shall also submit relevant details of their bankers like Swift Code, Banker's Name &Address etc.

B. TDS deduction as per section 51 of CGST Act,2017 shall be applicable as per Gazette Notification No. 50/2018-Central Tax, Dated: 13th September 2018 and subsequent notification/s, as and when released by Govt. authorities.

4. Incomplete documentation will not be accepted. Delayed submission of invoice / documents may result in corresponding delay in payment. In this connection, request to also refer clause: G about invoicing & payment formalities under GST regime. Applicable documents shall be submitted to the purchaser at the time of execution of supplies/services for availing GST input credits.

F. STANDARD PAYMENT TERMS OF BHEL-EDN:

PURCHASE ORDERS FOR:	**SUPPLY WITH SERVICE(S)**	**SUPPLY ONLY**
INDIGENOUS PROCUREMENT	a. 100% of basic value with taxes and freight will be paid in 45 days from the date of dispatch or 15 days from the date of submission of complete set of documentation, whichever is later. Note: In case PBG is not furnished, only 90% payment will be released against 100% claim without the consent of Vendor. This 10% basic amount withheld towards PBG will be paid either against submission of supplementary invoice & Original PBG (or) against supplementary invoice without PBG after expiry of Warranty period.	b. 100% of PO value with taxes and freight will be paid in 45 days from the date of dispatch or 15 days from the date of submission of complete set of documentation, whichever is later.
IMPORT PROCUREMENT	c. 100% of basic value will be paid against usance draft of 45 days from the date of AWB/BOL on submission of complete set of documents. Note: In case PBG is not furnished, only 90% payment will be released against 100% claim without the consent of Vendor. This 10% basic amount withheld towards PBG will be paid either against submission of supplementary invoice & Original PBG (or) against supplementary invoice without PBG after expiry of Warranty period.	d. 100% of PO value will be paid against usance draft of 45 days from the date of AWB/BOL on submission of complete set of documents.
HIGH-SEA SALES PROCUREMENT	e. 100% of basic value will be paid in 45 days from the date of signing of High Sea Sale agreement or 15 days from the date of submission of complete set of documentation, whichever is later Note: In case PBG is not furnished, only 90% payment will be released against 100% claim without the consent of Vendor. This 10% basic amount withheld towards PBG will be paid either against submission of supplementary invoice & Original PBG (or) against supplementary invoice without PBG after expiry of Warranty period.	f. 100% of basic value will be paid in 45 days from the date of signing of High Sea Sale agreement or 15 days from the date of submission of complete set of documentation, whichever is later.

g. Erection and Commissioning:

Evaluation methodology: Unless and otherwise specified in SCC, E&C charges should not be less than 10% of the main supply value. In case the quoted total E&C value is less than 10% of the main supply value, BHEL shall evaluate Bidders Price deducting differential amount from main supply price proportionally from all items and apportioning towards E&C charges.

Payment term: 100% E&C charges along with tax as applicable, will be paid in 15 days from the date of submission of supplementary invoice/documents against proof of completion of E&C.

h. Erection Supervision and Commissioning:

Evaluation methodology: Unless and otherwise specified in SCC, E&C charges should not be less than 5% of the main supply value. In case the quoted total E&C value is less than 5% of the main supply value, BHEL shall evaluate Bidders Price deducting differential amount from main supply price proportionally from all items and apportioning towards E&C charges.

Payment term: 100% E&C charges along with tax as applicable, will be paid in 15 days from the date of submission of supplementary invoice/documents against proof of completion of E&C.

i. Comprehensive Annual Maintenance Contract:

Evaluation methodology: Unless and otherwise specified in SCC, CAMC will be applicable for a period of 04 years from the date of expiry of warranty period (or) from the date of completion of commissioning of equipment, whichever is later and the total CAMC value should not be less than 20% of the main supply value. In case the quoted total CAMC value is less than 20% of the main supply value, BHEL shall evaluate Bidders Price deducting differential amount from main supply price proportionally from all items and apportioning towards CAMC charges.

Payment terms: 100% CAMC charges along with tax as applicable, will be paid in 15 days from the date of submission of supplementary invoice/documents against proof of completion of CAMC on yearly basis.

j. Terms of Payment for Training: 100% payment will be made in 45 days from the date of completion of Training or 15 days from the date of submission of complete set of invoice along with documentary evidence, whichever is later.

LOADING FACTORS FOR DEVIATION IN PAYMENT TERMS (APPLICABLE FOR IMPORT PROCUREMENT ONLY):

1) For offers received with Sight draft payment term in place of Usance draft, loading applicable will be 1.0% of basic value.

2) For offers received with Letter of Credit payment term with Usance of 45 days, loading applicable will be 2.5% of basic value.
   Additional loading of 2% will be applicable for payment term as Letter of Credit at Sight.

k. Any payment term with credit period of less than 45 days for indigenous supply/HSS and any other variation of payment terms are liable for rejection.

l. Standard payment terms indicated in Clauses: F (a), (b), (c), (d), (e), (f), (g), (h), (i) & (j) will not attract any loading.

Note 1: Basic value of Purchase Order mentioned above will include all components of the purchase order and will exclude only taxes, duties, freight, training charges, E&C and AMC charges (wherever applicable). Wherever the Purchase Order is split into import portion and indigenous portion of supply, minimum % to be quoted for Services, wherever mentioned, will be of both purchase order values put together.

Note 2: In case of multiple packages/units in a power plant, payment of E&C charges will be processed on pro-rata basis.

Note 3: No deviation will be permitted from the duration of Guarantee/Warranty and/or Comprehensive Annual Maintenance Contract period specified in SCC.

G. Terms & Conditions to be complied under GST regime:

1. All invoices to contain BHEL-EDN (buyer) GSTIN number: 29AAACB4146P1ZB. However for CGST +SGST/UGST billing outside the state of Karnataka, invoice has to be generated with BHEL's Nodal Agency GSTIN number. Address of Nodal Agency along with GSTIN number will be provided by BHEL at the time of issuing dispatch clearance.

2. The Bidder shall mention Bidder's GSTIN number in all quotations and Invoices submitted.

3. The Bidder shall also mention HSN (Harmonized System of Nomenclature) / SAC (Services Accounting Code) mandatorily in all quotations and invoices submitted.

4. Invoice submitted should be in the format as specified under GST Laws viz., all details as mentioned in Invoice Rules like GST registration number(GSTIN), invoice number with date of issue, quantity, rate, value, taxes with nomenclature – CGST, SGST, UGST,IGST mentioned separately, HSN Code / SAC Code etc. Invoice should be submitted in original for buyer plus duplicate for credit availment.

5. Payment of GST to Vendor will be made only if it is matching with data uploaded by the Vendor in GST portal.

6. For invoices paid on Reverse charge basis – "Tax payable on reverse charge basis" to be mentioned on the invoice.

7. In case GST credit is delayed/denied to BHEL due to non/delayed receipt of goods and/or tax invoice or expiry of timeline prescribed in GST law for availing such ITC, or any other reasons not attributable to BHEL, GST amount will be recoverable from vendor along with interest levied/ leviable on BHEL.

8. In case vendor delays declaring such invoice in his return and GST credit availed by BHEL is denied or reversed subsequently as per GST law, GST amount paid by BHEL towards such ITC reversal as per GST law will be recoverable from vendor/contractor along with interest levied/ leviable on BHEL.

9. Vendor should intimate BHEL immediately on the same date of invoicing without any delay.

10. In case of discrepancy in the data uploaded by supplier in the GSTN portal or in case of any shortages or rejection in the supply, then BHEL will not be able to avail the tax credit and will notify the supplier of the same. Supplier has to rectify the data discrepancy in the GSTN portal or issue credit note (details to be uploaded in GSTN portal) for the shortages or rejections in the supplies, within the calendar month notified by BHEL.

11. Bidders to note that Rules & Regulations pertaining to E-way bill system are to be strictly adhered to, as and when notified by Govt. authorities.

H. Performance bank guarantee (PBG):

Performance bank guarantee (PBG) will be applicable as called in the tender documents. Unless otherwise specified in the SCC, the PBG against performance of the contract shall be valid for a period of 24 months from the date of dispatch of goods + claim period of 03 months, for a value equal to 10 % of the basic value of the purchase order which will include all components of the purchase order and will exclude only taxes, duties, freight, training charges, E&C and AMC charges (wherever applicable).

1. The BG issued in Indian Rupees by Banks in India is to be executed on Non-Judicial Stamp paper/e-stamp paper of appropriate value as per Stamp Act prevailing in the State(s) where the BG is submitted or is to be acted upon or the rate prevailing in the State where the BG was executed, whichever is higher. The Stamp Paper/e-stamp paper shall be purchased in the name of Vendor/Bank issuing the guarantee.
2. No deviation for the duration and value of PBG will be permitted.
3. PBG shall be from any of the BHEL consortium of bankers **(refer Annexure VI)**.
4. PBGs from nationalized banks are also acceptable.
5. PBG should be sent directly by the bank to the dealing executive mentioned in the purchase order located at the address mentioned in the purchase order.
6. PBG should be in the format specified **(refer Annexure VII)**. No deviation to this format will be allowed. However in case BHEL changes the PBG format, bidder shall honor the same.
7. Bank Guarantee should be enforceable in Bangalore.
8. In Case of Bank Guarantees submitted by Foreign Vendors-

   a. From Nationalized/Public Sector / Private Sector/ Foreign Banks (BG issued by Branches in India) can be accepted subject to the condition that the Bank Guarantee should be enforceable in Bangalore.

   b. From Foreign Banks (wherein Foreign Vendors intend to provide BG from local branch of the Vendor country's Bank)

   b.1 Please note that Bank Guarantee issued by any of the Consortium Banks only will be accepted by BHEL. As such, Foreign Vendor needs to make necessary arrangements for issuance of Counter-Guarantee by Foreign Bank in favour of the Indian Bank's (BHEL's Consortium Bank) branch in India. It shall be noted that all charges for issuance of Bank Guarantee/ counter- Guarantee should be borne by the Foreign Vendor.

   b.2 In case, Foreign Vendors intend to provide BG from Overseas Branch of our Consortium Bank (e.g. if a BG is to be issued by SBI Frankfurt), the same is acceptable. However, the procedure at sl.no. b.1 is required to be followed.

   b.3 The BG issued may preferably be subject to Uniform Rules for Demand Guarantees (URDG) 758 (as amended from time to time).
9. Expired PBGs will be returned only after expiry of the claim period.
10. PBG shall not be applicable for spares.

I. PROVISONS APPLICABLE FOR MSE VENDORS (MICRO AND SMALL ENTERPRISES) :

Benefits/facilities as applicable for Micro and Small Enterprises (MSEs) shall be available to MSEs registered with Government designated authorities as per the Purchase & Price Preference Policy of the Government subject to them becoming eligible otherwise.

Vendors who qualify as MSE vendors are requested to submit applicable certificates (as specified by the Ministry of Micro, Small and Medium Enterprises) at the time of vendor registration. Vendors have to submit the Udyog Aadhaar/Udyam Registration certificate along with attested copy of a CA certificate (Annexure VIII) applicable for the relevant financial year (latest audited) along with the tender documents in the Part-I bid to avail the applicable benefits.

Date to be reckoned for determining the deemed validity will be the date of bid opening (Part-I in case of two-part bid and three-part bid).

Documents have to be notarized/attested by a Gazetted officer and must be valid as on the date of part I bid opening for the vendors to be eligible for the benefits applicable for MSE vendors. Please note that no benefit shall be applicable if any deficiency in the above required documents are not submitted before the price bid opening/Reverse Auction. If the tender is to be submitted through e-procurement portal, then the above required documents are to be uploaded on the portal.

Bidders to however note the documents that shall be furnished in order to establish credentials as MSE vendor should be as per the extant statutory requirements specified by the Ministry of Micro, Small and Medium Enterprises.

PURCHASE PREFERENCE FOR MSE VENDORS:

MSE vendors quoting within a price band of L1 + 15% shall be allowed to supply up to 25% of the requirement against this tender provided

1. The MSE vendor matches the L1 price.
2. L1 price is from a non MSE vendor.
3. L1 price will be offered to the vendor nearest to L1 in terms of price ranking (L2 - nearest to L1). In case of non-acceptance by the MSE vendor (L2), next ranking MSE vendor will be offered who is within the L1 + 15% band (if L3 is also within 15% band).
4. 3% of the 25% will be earmarked for women owned MSEs.
5. 25% of the 25% (i.e., 6.25% of the total enquired quantity) will be earmarked for SC/ST owned MSE firms provided conditions as mentioned in (1) & (2) are fulfilled.
6. In case where no SC/ST category firms are meeting the conditions mentioned in (1) and (2) or have not participated in the tender, the 6.25% of earmarked quantity for SC/ST owned MSE firms will be distributed among the other eligible MSE vendors who have participated in the tender.
7. In case after the bid opening it is seen that no MSE has become L1, then depending on the nature of the item, if it is not possible to split the tendered items/quantities on account of reasons like customer contract requirements of supplying one make for a given project or technical reasons like the tendered item being a system etc., then BHEL would not counter offer the L1 prices even though there may be MSE bidders within the +15% band of L1. Such information that tendered quantity will not be split shall be indicated in the SCC.

J. INTEGRITY COMMITMENT IN THE TENDER PROCESS, AND EXECUTION OF CONTRACTS:

1. Commitment by BHEL: BHEL commits to take all measures necessary to prevent corruption in connection with the Tender process and execution of the Contract. BHEL will, during the tender process, treat all bidder / suppliers in a transparent and fair manner, and with equity.

2. Commitment by Bidder(s)/ Contractor(s):

   a. The Bidder(s)/ Contractor(s) commit(s) to take all measures to prevent corruption and will not directly or indirectly try to influence any decision or benefit which he is not legally entitled to.
   b. The Bidder(s)/ Contractor(s) will not enter with other Bidder(s) into any undisclosed agreement or understanding or any actions to restrict competition.

c. The Bidder(s)/ Contractor(s) will not commit any offence under the relevant Acts. The Bidder(s)/ Contractor(s) will not use improperly, for purposes of competition or personal gain or pass on to others, any information or document provided by BHEL as part of business relationship.
d. The Bidder(s)/ Contractor(s) will, when presenting his bid, disclose any and all payments he has made, and is committed to or intends to make to agents, brokers or any other intermediaries in connection with the award of the contract and shall adhere to the relevant guidelines issued from time to time by Government of India/ BHEL.

If the Bidder(s) / Contractor(s), before award or during execution of the Contract commit(s) a transgression of the above or in any other manner such as to put his reliability or credibility in question, BHEL is entitled to disqualify the Bidder(s) / Contractor (s) from the tender process or terminate the contract and/ or take suitable action as deemed fit.

K. <u>Integrity Pact (IP):</u>

a) IP is a tool to ensure that activities and transactions between the Company and its Bidders/ Contractors are handled in a fair, transparent and corruption free manner.
A panel of independent External Monitors (IEMs) have been appointed to oversee implementation of IP in BHEL.
The IP as enclosed with the tender is to be submitted (duly signed by authorized signatory who signs in the offer) along with techno-commercial bid. Only those Bidders who have entered into such an IP with BHEL would be competent to participate in the bidding. In other words, entering into this Pact would be a preliminary qualification.
b) Please refer Section-8 of the IP for Role and Responsibilities of IEMs (Annexure IX). In case of any complaint arising out of the tendering process, the matter may be referred to the IEM mentioned in the tender.

Note: No routine correspondence shall be addressed to the IEM (phone/ post/ email) regarding the clarifications, time extensions or any other administrative queries, etc. on the tender issued. All such clarification/ issues shall be addressed directly to the tender issuing (procurement) department."

Annexure

Annexure I

Guidelines for Indian Agents

- **Definition of Indian Agent**: An Indian Agent of foreign prinicipal is an individual, a partnership, an association of persons, a private or pubile company, that carries our specific obligation(s) towards processing of BHEL tender or finalization or execution of BHEL's contract on behalf of the foreign supplier.

In case of yes, vendor to note the following and reply accordingly:

i. BHEL shall deal directly with foreign vendors, wherever required, for procurement of goods. However, if the foreign principal desires to avail of the services of an Indian agent, then the foreign principal should ensure compliance to regulatory guidelines - which require mandatory submission of an Agency Agreement.

ii. It shall be incumbent on the Indian agent and the foreign principal to adhere to the relevant guidelines of Government of India, issued from time to time.

iii. The Agency Agreement should specify the precise relationship between the foreign OEM / foreign principal and their Indian agent and their mutual interest in the business. All services to be rendered by agent/ associate, whether of general nature or in relation to the particular contract, must be clearly stated by the foreign supplier/ Indian agent. Any payment, which the agent or associate receives in India or abroad from the OEM, whether as commission or as a general retainer fee should be brought on record in the Agreement and be made explicit in order to ensure compliance to laws of the country.

iv. Any agency commission to be paid by BHEL to the Indian agent shall be in Indian currency only.

v. Tax deduction at source is applicable to the agency commission paid to the Indian agent as per the prevailing rules.

vi. In the absence of any agency agreement, BHEL shall not deal with any Indian agent (authorized representatives / associate / consultant, or by whatever name called) and shall deal directly with the foreign principal only for all correspondence and business purposes.

vii. The "Guidelines for Indian Agents of Foreign Suppliers" enclosed at annexure –'A' shall apply in all such cases.

viii. The supply and execution of the Purchase Order (including indigenous supplies/ service) shall be in the scope of the OEM/ foreign principal. The OEM/ foreign principal should submit their offer inclusive of all indigenous supplies/ services and evaluation will be based on 'total cost to BHEL'. In case OEM/ foreign principal recommends placement of order(s) towards indigenous portion of supplies/ services on Indian supplier(s)/ agent on their behalf, the credentials/ capacity/ capability of the Indian supplier(s)/ agent to make the supplies/ services shall be checked by BHEL as per the extant guidelines of Supplier Evaluation, Approval & Review Procedure (SEARP), before opening of price bids. In this regard, details may be checked as per Annexure-B (copy enclosed). It will be the responsibility of the OEM/ foreign principal to get acquainted with the evaluation requirements of Indian supplier/ agent as per SEARP available on www.bhel.com.

The responsibility for successful execution of the contract (including indigenous supplies/ services) lies with the OEM/ foreign principal. All bank guarantees to this effect shall be in the scope of the OEM/ foreign principal.

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Vendor's Signature with Seal

Annexure-A

Guidelines for Indian Agents of Foreign Suppliers

1.0 There shall be compulsory registration of agents for all Global (Open) Tender and Limited Tender. An agent who is not registered with BHEL shall apply for registration in the registration form in line with SEARP.

1.1 Registered agents will file an authenticated Photostat copy duly attested by a Notary Public/Original certificate of the Principal confirming the agency agreement and giving the status being enjoyed by the agent and the commission/ remuneration/ salary/ retainership being paid by the principal to the agent before the placement of order by BHEL.

1.2 Wherever the Indian representatives have communicated on behalf of their principals and the foreign parties have stated that they are not paying any commission to the Indian agents, and the Indian representative is working on the basis of salary or as retainer, a written declaration to this effect should be submitted by the party (i.e. Principal) before finalizing the order.

2.0 Disclosure of particulars of agents/ representatives in India, if any.

2.1 Tenderers of Foreign nationality shall furnish the following details in their offers:

2.1.1 The Bidder(s)/ Contractor(s) of foreign origin shall disclose the name and address of the agents/ representatives in India if any and the extent of authorization and authority given to commit the Principals. In case the agent/ representative be a foreign Company, it shall be confirmed whether it is existing Company and details of the same shall be furnished.

2.1.2 The amount of commission/ remuneration included in the quoted price(s) for such agents/ representatives in India.

2.1.3 Confirmation of the Tenderer that the commission/ remuneration, if any, payable to his agents/ representatives in India, may be paid by BHEL in Indian Rupees only.

2.2 Tenderers of Indian Nationality shall furnish the following details in their offers:

2.2.1 The Bidder(s)/ Contractor(s) of Indian Nationality shall furnish the name and address of the foreign principals, if any, indicating their nationality as well as their status, i.e. whether manufacturer or agents of manufacturer holding the Letter of Authority of the Principal specifically authorizing the agent to make an offer in India in response to tender either directly or through the agents/ representatives.

2.2.2 The amount of commission/ remuneration included in the price (s) quoted by the Tenderer for himself.

2.2.3 Confirmation of the foreign principals of the Tenderer that the commission/ remuneration, if any, reserved for the Tenderer in the quoted price(s), may be paid by BHEL in India in equivalent Indian Rupees on satisfactory completion of the Project or supplies of Stores and Spares in case of operation items.

2.3 In either case, in the event of contract materializing, the terms of payment will provide for payment of the commission/ remuneration, if any payable to the agents/ representatives in India in Indian Rupees on expiry of 90 days after the discharge of the obligations under the contract.

2.4 Failure to furnish correct and detailed information as called for in paragraph 2.0 above will render the concerned tender liable to rejection or in the event of a contract materializing, the same liable to termination by BHEL. Besides this there would be a penalty of banning business dealings with BHEL or damage or payment of a named sum.

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ANNEXURE - II
LIST OF INTERNATIONAL GATEWAY AIRPORTS

For air based consignment, terms of delivery will be on FCA basis from following listed airports only. Vendors are requested to verify this list for use before submission of offer.

SCHEDULE NO	COUNTRY	CURRENCY CODE	AIRPORT
D01	UK	GBP	LONDON (HEATHROW)
D02	UK	GBP	NEW CASTLE
D03	UK	GBP	OXFORD. CHETLAM
D04	UK	GBP	BRISTOL. WELLINGBOROUGH
D05	UK	GBP	BIRMINGHAM
DO6	UK	GBP	EAST MIDLANDS
D07	UK	GBP	MANCHESTER
D08	UK	GBP	LEEDS
D09	UK	GBP	GLASGOW
D10	FRANCE	EURO	PARIS (ROISSY) & LYON
D11	SWEDEN	EURO	STOCKHOLM
D12	SWEDEN	EURO	GOTHENBERG & MALMO
D13	ITALY	EURO	ROMA, MILAN
D14	ITALY	EURO	TURIN, BOLOGNA, FLORENCE
D15	NETHERLANDS	EURO	AMSTERDAM, ROTTERDAM
D16	AUSTRIA	EURO	VIENNA, LINZ, GRAZ
D17	BELGIUM	EURO	ANTWERP, BRUSSELS
D18	DENMARK	DKK	COPENHAGEN
D19	JAPAN	JPY	TOKYO, OSAKA
D20	SINGAPORE	SGD	SINGAPORE
D21	CANADA	CAD	TORONTO
D22	CANADA	CAD	MONTREAL
D23	USA	USD	NEW YORK, BOSTON
D24	USA	USD	CHICAGO
D25	USA	USD	SAN FRANCISCO, LOS ANGELES
D26	USA	USD	ALANTA, HOUSTON
D27	GERMANY	EURO	MUNICH, KOLN, DUSSELDORF, HANNOVER, HAMBURG, STUTTGART, DAMSTADT, MANIHIEM, NURUMBERG
D28	GERMANY	EURO	FRANKFURT
D29	GERMANY	EURO	BERLIN
D30	SWITZERLAND	SFR	BASLE, ZURICH, GENEVA
D31	SPAIN	EURO	BARCELONA
D32	AUSTRALIA	AUD	SYDNEY
D33	AUSTRALIA	AUD	MELBOURNE
D34	AUSTRALIA	AUD	PERTH
D35	CZECH	EURO	PRAGUE
D36	HONG KONG	HKD	HONG KONG
D37	NEW ZELAND	NZD	AUCKLAND
D38	RUSSIA	USD	MOSCOW
D39	SOUTH KOREA	USD	KIMPO INTERNATIONAL, INCHEON
D40	FINLAND	EURO	HELSINKI
D41	ROMANIA	EURO	BUCHAREST
D42	NORWAY	EURO	OSLO
D43	IRELAND	EURO	DUBLIN
D44	ISRAEL	USD	TEL AVIV
D45	UAE	USD	DUBAI
D46	OMAN	USD	MUSCAT
D47	EGYPT	USD	CAIRO
D48	TAIWAN	USD	TAIPEI
D49	UKRAINE	USD	KIEV
D50	CHINA	USD	SHANGHAI, SHENZHEN
D51	PHILIPINES	USD	MANILA
D52	MALAYSIA	USD	KUALALUMPUR, PE NANG
D53	CYPRUS	USD	LARNACA
D54	SOUTH AFRICA	USD	JOHANNESBERG, DURBAN
D55	SLOVAKIA	EURO	BARTISLOVA
D56	SAUDI ARABIA	SAR	RIYADH
D57	TURKEY	EURO	ISTANBUL
D58	THAILAND	USD	BANGKOK
D59	BRAZIL	USD	SAO PAULO, RIO DE JANEIRO

ANNEXURE – III

DISCREPANCY IN WORDS & FIGURES – QUOTED IN PRICE BID

Following guidelines will be followed in case of discrepancy in words & figures-quoted in price bid:

(a) If, in the price structure quoted for the required goods/services/works, there is discrepancy between the unit price and the total price (which is obtained by multiplying the unit price by the quantity), the unit price shall prevail and the total price corrected accordingly, unless in the opinion of the purchaser there is an obvious misplacement of the decimal point in the unit price, in which case the total price as quoted shall govern and the unit price corrected accordingly.

(b) If there is an error in a total corresponding to the addition or subtraction of subtotals, the subtotals shall prevail and the total shall be corrected; and

(c) If there is a discrepancy between words and figures, the amount in words shall prevail, unless the amount expressed in words is related to an arithmetic error, in which case the amount in figures shall prevail subject to (a) and (b) above.

(d) If there is such discrepancy in an offer, the same shall be conveyed to the bidder with target date upto which the bidder has to send his acceptance on the above lines and if the bidder does not agree to the decision of the purchaser, the bid is liable to be ignored.

ANNEXURE - IV

Electronic Funds Transfer (EFT) OR Paylink Direct Credit Form

Please Fill up the form in **CAPITAL LETTERS** only.
TYPE OF REQUEST(Tick one): _____ CREATE _____ CHANGE

BHEL Vendor / Supplier Code:
Company Name :
Permanent Account Number(PAN):
Address

City: PINCODE STATE

Contact Person(s)
Telephone No:
Fax No:
e-mail id:

1 Bank Name:
2 Bank Address:

3 Bank Telephone No:
4 Bank Account No:
5 Account Type: Savings/Cash Credit
6 9 Digit Code Number of Bank and branch appearing on MICR cheque issued by Bank
7 Bank IFSC Code(applicable for NEFT)
8 Bank IFSC code(applicable for RTGS) (Indian Financial System Code)

A I hereby certify that the particulars given above are true, correct and complete and that I, as a representative for the above named Company, hereby authorise BHEL, EDN, Bangalore to electronically deposit payments to the designated bank account.
B If the transaction is delayed or not effected at all for reasons of incomplete or incorrect information, I would not hold BHEL / transfering Bank responsible.
C This authority remains in full force until BHEL, EDN,Bangalore receives written notification requesting a change or cancellation.
D I have read the contents of the covering letter and agree to discharge the responsibility expected of me as a participant under ECS / EFT.

Date:

Authorised Signatory:
Designation: Telephone No. with STD Code

Company Seal

Bank Certificate

We certify that_____has an Account No_____ with us and we confirm that the bank details given above are correct as per our records.

Date: (.....)
Place: Signature

Please return completed form **along with a blank cancelled cheque or photocopy** thereof to:
Bharath Heavy Electricals Ltd,
Attn:
Electronics Division, Mysore Road,
BANGALORE - 560 026
In case of any Querry, please call concerned purchase executive.

ANNEXURE - V

PRESENT PROCEDURE FOR SALE IN TRANSIT (HIGH SEA SALES)

In case of High Sea Sales, vendor should submit following documents:

1. **ORIGINAL HIGH SEA SALES AGREEMENT**
   - Sale agreement (on Rs. 200/- non-judicial stamp paper & notarised with 2 witnesses with identity) has to be signed between BHEL and the Party importing material. The date of the sale documents should be in between the date of House Air Way Bill / Bill of Lading and before landing of the goods in Indian origin.
   - Following shall be included in the High Sea Sales Agreement:
     "THE BUYER ALSO UNDERTAKE DISCHARGES, THE OBLIGATION AND FULFILLMENT OF CONDITIONS, IF ANY, ATTACHED TO THE IMPORTATION, ASSESSMENT AND CLEARANCE OF THE GOODS IN TERMS CUSTOMS TARIFF ACT 1975, THE CUSTOMS ACT 1962 & RULES & REGULATIONS MADE THERE UNDER AND OTHER RELEVANT ACTS, ORDERS, NOTIFICATIONS".

2. **ORIGINAL INVOICES: INDIGENOUS RUPEE INVOICE & FOREIGN CURRENCY INVOICE**
   - Prices should be C.I.F., designated airport/seaport basis.
   - I.E.C., C.S.T., K.S.T. Nos. to be mentioned.
   - Description of item (Nomenclature), Unit & Quantity in both the Foreign Currency & the Indigenous Invoice in Rupee shall be exactly as per Purchase Order Description of item, Quantity and Unit. The Indigenous Invoice value shall be exactly as per Purchase Order value.
   - Seller should give Foreign Currency Invoice from the original consignor. The Foreign Currency Invoice value should be at least 2% (two per cent) less than the Indigenous Rupee Invoice value in equivalent foreign currency.

4. **ORIGINAL HOUSE AIR WAY BILL/ BILL OF LADING**
   - The sale agents should duly endorse House Air Way Bill (HAWB) for air shipments or original Bill of Lading (O.B.L.) for sea shipments and Foreign Currency Invoice in favour of BHEL-EDN.

5. **ORIGINAL CARGO ARRIVAL NOTICE FROM FORWARDER.**

6. **ORIGINAL DELIVERY ORDER ISSUED IN NAME OF BHEL-EDN.**

7. **ORIGINAL PACKING LIST.**

8. **A LETTER TO THE COMMISSIONER OF CUSTOMS FOR EFFECTING ABOVE SALE.**

9. **A LETTER TO THE DEPUTY ASSESSOR (OCTROI) FOR EFFECTING ABOVE SALE IN FAVOUR OF BHEL.**

REMARKS: In case vendor needs any clarifications on the above, the same may be sought in writing.

ELECTRONICS DIVISION, BANGALORE

Annexure-VI

BHEL MEMBER BANKS (LIST OF CONSORTIUM BANKS)

Bank Guarantee (BG) shall be issued from the following banks only:

Sl. No.	Nationalised Banks	Sl. No.	Public Sector Banks
1	Allahabad Bank	18	IDBI
2	Andhra Bank		
3	Bank of Baroda	Sl. No.	**Foreign Banks**
4	Canara Bank	19	CITI Bank N.A
5	Corporation Bank	20	Deutsche Bank AG
6	Central Bank	21	The Hongkong and Shanghai Banking Corporation Ltd. (HSBC)
7	Indian Bank	22	Standard Chartered Bank
8	Indian Overseas Bank	23	J P Morgan
9	Oriental Bank of Commerce		
10	Punjab National Bank	**Sl. No.**	**Private Banks**
11	Punjab & Sindh Bank	24	Axis Bank
12	State Bank of India	25	The Federal Bank Limited
13	Syndicate Bank	26	HDFC Bank
14	UCO Bank	27	Kotak Mahindra Bank Ltd
15	Union Bank of India	28	ICICI Bank
16	United Bank of India	29	IndusInd Bank
17	Vijaya Bank	30	Yes Bank

Note:

- All BGs must be issued from BHEL consortium banks listed above.
- This list is subject to changes. Hence vendors are requested to check this list every time before issuing BGs.
- Bank Guarantees issued by Co-operative Banks/Financial Institutions cannot be accepted under any circumstance.

ANNEXURE VII

PROFORMA OF BANK GUARANTEE (in lieu of SECURITY DEPOSIT)

In consideration of Bharat Heavy Electricals Limited (hereinafter referred to as the 'Employer' which expression shall unless repugnant to the context or meaning thereof, include its successors and permitted assigns) incorporated under the Companies Act, 1956 and having its registered office at _____[1] through its Unit até é é é é é é ..(name of the Unit) having agreed to exempt (Name of the Vendor / Contractor / Vendors) with its registered office at_____ [2] (hereinafter called the said ñContractorò which term includes vendors), from demand under the terms and conditions of the Contract reference No._____ dated _____ [3] valued at Rsé é é é [4] (Rupees ----------)[4] (hereinafter called the said Contract), of Security Deposit for the due fulfilment by the said Contractor of the terms and conditions contained in the said Contract, on production of a Bank Guarantee for Rs._____ [5] (Rupees _____ only),

we ____(indicate the name and address of the Bank) having its Head Office at _____(address of the head Office) (hereinafter referred to as the Bank), , at the request of _____ [Contractor(s)], being the Guarantor under this Guarantee, do hereby irrevocably and unconditionally undertake to forthwith and immediately pay to the Employer, , an amount not exceeding Rs._____ without any demur, immediately on demand from the Employer and without any reservation, protest, and recourse and without the Employer needing to prove or demonstrate reasons for its such demand

Any such demand made on the bank, shall be conclusive as regards the amount due and payable by the Bank under this guarantee. However, our liability under this guarantee shall be restricted to an amount not exceeding Rs._____.

We undertake to pay to the Employer any money so demanded notwithstanding any dispute or disputes raised by the Contractor(s) in any suit or proceeding pending before any Court or Tribunal or Arbitrator or any other authority, our liability under this present being absolute and unequivocal.

The payment so made by us under this guarantee shall be a valid discharge of our liability for payment hereunder and the Contractor(s) shall have no claim against us for making such payment.

We, further agree that the guarantee herein contained shall remain in full force and effect during the period that would be taken for the performance of the said Contract and that it shall continue to be enforceable till all the dues of the Employer under or by virtue of the said Contract have been fully paid and its claims satisfied & the Employer certifies that the terms and conditions of the said Contract have been fully and properly carried out by the said contractor(s) or acceptance of the final bill or discharge of this guarantee by the Employer, whichever is earlier. This guarantee shall initially remain in force upto and including _____6 and shall be extended from time to time for such period as may be desired by the Employer. Unless a demand or claim under this guarantee

is made on us in writing on or before the _____[7], we shall be discharged from all the liability under this guarantee thereafter.

We, ____(indicate the name of the Bank)____further agree with the Employer that the Employer shall have the fullest liberty without our consent and without affecting in any manner our obligations hereunder to vary any of the terms and conditions of the said Contract or to extend time of performance by the said contractor(s) from time to time or to postpone for any time or from time to time any of the powers exercisable by the Employer against the said contractor(s) and to forbear or enforce any of the terms and conditions relating to the said Contract and we shall not be relieved from our liability by any reason of any such variation or extension being granted to the said contractor(s) or for any forbearance, act or omission on the part of the Employer or any indulgence by the Employer to the said contractor(s) or by any such matter or thing whatsoever which under the law relating to sureties would but for this provision have effect of so relieving us.

The Bank also agrees that the Employer at its option shall be entitled to enforce this Guarantee against the Bank as a principal debtor, in the first instance without proceeding against the Contractor and notwithstanding any security or other guarantee that the Employer may have in relation to the Contractor's liabilities.

This Guarantee shall not be determined or affected by liquidation or winding up, dissolution or change of constitution or insolvency of the Contractor but shall in all respects and for all purposes be binding and operative until payment of all money payable to the Employer in terms thereof. This guarantee will not be discharged due to the change in the constitution of the Bank or the Contractor(s).

We,é é é é é é . BANK lastly undertake not to revoke this guarantee during its currency except with the previous consent of the Employer in writing.
Notwithstanding anything to the contrary contained hereinabove:

a) The liability of the Bank under this Guarantee shall not exceedé é é é é é é é é [5]

b) This Guarantee shall be valid up to é é é é é é [6]

c) Unless the Bank is served a written claim or demand on or before _____[7] all rights under this guarantee shall be forfeited and the Bank shall be relieved and discharged from all liabilities under this guarantee irrespective of whether or not the original bank guarantee is returned to the Bank.

We, _____ Bank, have power to issue this Guarantee under law and the undersigned as a duly authorized person has full powers to sign this Guarantee on behalf of the Bank.

Date _____ Day of _____

for____(indicate the name of the Bank)__

(Signature of Authorised signatory)

[1] *ADDRESS OF THE EMPLOYER. I.e Bharat Heavy Electricals Limited*

[2] *ADDRESS OF THE VENDOR /CONTRACTOR / SUPPLIER .*

[3] *DETAILS ABOUT THE NOTICE OF AWARD/CONTRACT REFERENCE*

[4] *CONTRACT VALUE*

[5] *BG AMOUNT IN FIGURES AND WORDS*

[6] *VALIDITY DATE*

[7] *DATE OF EXPIRY OF CLAIM PERIOD*

Note:

1. Units are advised that expiry of claim period may be kept 3-6 months after validity date. It may be ensured that the same is in line with the agreement/ contract entered with the Vendor.

2. The BG should be on Non-Judicial Stamp paper/e-stamp paper of appropriate value as per Stamp Act prevailing in the State(s) where the BG is submitted or is to be acted upon or the rate prevailing in the State where the BG was executed, whichever is higher. The Stamp Paper/e-stamp paper shall be purchased in the name of Vendor/Contractor/Supplier /Bank issuing the guarantee.

3. In line with the GCC, SCC or contractual terms, Unit may carry out minor modifications in the Standard BG Formats. If required, such modifications may be carried out after taking up appropriately with the Unit/Regionôs Law Deptt.

4. **In Case of Bank Guarantees submitted by Foreign Vendors-**

   a. **From Nationalized/Public Sector / Private Sector/ Foreign Banks (BG issued by Branches in India)** can be accepted subject to the condition that the Bank Guarantee should be enforceable in the town/city or at nearest branch where the Unit is located i.e. Demand can be presented at the Branch located in the town/city or at nearest branch where the Unit is located.

   b. **From Foreign Banks (wherein Foreign Vendors intend to provide BG from local branch of the Vendor country's Bank)**

   b.1 In such cases, in the Tender Enquiry/ Contract itself, it may be clearly specified that Bank Guarantee issued by **any of the Consortium Banks only** will be accepted by BHEL. As such, Foreign Vendor needs to make necessary arrangements for issuance of Counter- Guarantee by Foreign Bank in favour of the Indian Bankôs (BHELôs Consortium Bank) branch in India. It is advisable that all charges for issuance of Bank Guarantee/ counter- Guarantee should be borne by the Foreign Vendor. The tender stipulation should clearly specify these requirements.

   b.2 **In case, Foreign Vendors intend to provide BG from** Overseas Branch of our Consortium Bank (e.g. if a BG is to be issued by SBI Frankfurt), the same is acceptable. However, the procedure at **sl.no. b.1** will required to be followed.

   b.3 The BG issued may preferably be subject to Uniform Rules for Demand Guarantees (URDG) 758 (as amended from time to time). The BG Format provided to them should clearly specify the same.

Annexure – VIII
(Applicable only for MSE suppliers)
Certificate by Chartered Accountant on Letter Head

This is to certify that M/s ....(hereinafter referred to as `Company') having its registered office at ..... is registered under MSMED Act 2006, (Entrepreneur Memorandum No (Part-11 ..... dtd ....., Category: ..... (Micro/Small) (Copy enclosed).

Further verified from the Books of Accounts that the investment of the company as per the latest audited financial year..... as per MSMED Act 2006 is as follows:

1. **For Manufacturing Enterprises:** Investment in plant and machinery (i.e. original cost excluding land and building and the items specified by the Ministry of Small Scale Industries vide its notification No.S.O.1722 (E) dated October 5, 2006:
   Rs.....Lacs.

2. **For Service Enterprises:** Investment in equipment (original cost excluding land and building and furniture, fittings and other items not directly related to the service rendered or as may be notified under the MSMED Act, 2006:
   Rs. .....Lacs.

The above investment of Rs. .....Lacs in within permissible limit of Rs.....Lacs for.....Micro / Small (Strike off which is not applicable) Category under MSMED Act 2006.

Or

The company has been graduated from its original category (Micro/ Small) (**Strike off which is not applicable**) and the date of graduation of such enterprise from its original category is ..... (dd/mm/yyyy) which is within the period of 3 years from the date of graduation of such enterprise from its original category as notified vide S.O. No. 3322(E) dated 01.11.2013 published in the gazette notification dated 04.11.2013 by Ministry of MSME.

Date:

(Signature)

Name:

Membership Number:

Seal of Chartered Accountant

Annexure-IX

INTEGRITY PACT

Between

Bharat Heavy Electricals Ltd. (BHEL), a company registered under the Companies Act 1956 and having its registered office at "BHEL House", Siri Fort, New Delhi - 110049 (India) hereinafter referred to as "The Principal", which expression unless repugnant to the context or meaning hereof shall include its successors or assigns of the ONE PART

and

_____, (description of the party along with address), hereinafter referred to as "The Bidder/ Contractor" which expression unless repugnant to the context or meaning hereof shall include its successors or assigns of the OTHER PART

Preamble

The Principal intends to award, under laid-down organizational procedures, contract/s for _____ _____ _____. The Principal values full compliance with all relevant laws of the land, rules and regulations, and the principles of economic use of resources, and of fairness and transparency in its relations with its Bidder(s)/ Contractor(s).

In order to achieve these goals, the Principal will appoint Independent External Monitor(s), who will monitor the tender process and the execution of the contract for compliance with the principles mentioned above.

Section 1- Commitments of the Principal

1.1 The Principal commits itself to take all measures necessary to prevent corruption and to observe the following principles:-

1.1.1 No employee of the Principal, personally or through family members, will in connection with the tender for, or the execution of a contract, demand, take a promise for or accept, for self or third person, any material or immaterial benefit which the person is not legally entitled to.

1.1.2 The Principal will, during the tender process treat all Bidder(s) with equity and reason. The Principal will in particular, before and during the tender process, provide to all Bidder(s) the same information and will not provide to any Bidder(s) confidential/ additional information through which the Bidder(s) could obtain an advantage in relation to the tender process or the contract execution.

1.1.3 The Principal will exclude from the process all known prejudiced persons.

1.2 If the Principal obtains information on the conduct of any of its employees which is a penal offence under the Indian Penal Code 1860 and Prevention of Corruption Act 1988 or any other statutory penal enactment, or if there be a substantive suspicion in this regard, the Principal will inform its Vigilance Office and in addition can initiate disciplinary actions:

Section 2 - Commitments of the Bidder(s)/ Contractor(s)

2.1 The Bidder(s)/ Contractor(s) commit himself to take all measures necessary to prevent corruption. He commits himself to observe the following principles during his participation in the tender process and during the contract execution.

2.1.1 The Bidder(s)/ Contractor(s) will not, directly or through any other person or firm, offer, promise or give to the Principal or to any of the Principal's employees involved in the tender process or the execution of the contract or to any third person any material, immaterial or any other benefit which he/ she is not legally entitled to, in order to obtain in exchange any advantage of any kind whatsoever during the tender process or during the execution of the contract.

2.1.2 The Bidder(s)/ Contractor(s) will not enter with other Bidder(s) into any illegal or undisclosed agreement or understanding, whether formal or informal. This applies in particular to prices, specifications, certifications, subsidiary contracts, submission or non-submission of bids or any other actions to restrict competitiveness or to introduce cartelization in the bidding process.

2.1.3 The Bidder(s)/ Contractor(s) will not commit any penal offence under the relevant Indian Penal Code (IPC) and Prevention of Corruption Act; further the Bidder(s)/ Contractor(s) will not use improperly, for purposes of competition or personal gain, or pass on to others, any information or document provided by the Principal as part of the business relationship, regarding plans, technical proposals and business details, including information contained or transmitted electronically.

2.1.4 Foreign Bidder(s)/ Contractor(s) shall disclose the name and address of agents and representatives in India and Indian Bidder(s)/ Contractor(s) to disclose their foreign principals or associates. The Bidder(s)/ Contractor(s) will, when presenting his bid, disclose any and all payments he has made, and is committed to or intends to make to agents, brokers or any other intermediaries in connection with the award of the contract.

2.2 The Bidder(s)/ Contractor(s) will not instigate third persons to commit offences outlined above or be an accessory to such offences.

2.3 The Bidder(s)/ Contractor(s) shall not approach the Courts while representing the matters to IEMs and will await their decision in the matter.

Section 3 - Disqualification from tender process and exclusion from future contracts

If the Bidder(s)/ Contractor(s), before award or during execution has committed a transgression through a violation of Section 2 above, or acts in any other manner such as to put his reliability or credibility in question, the Principal is entitled to disqualify the Bidder(s)/ Contractor(s) from the tender process or take action as per the separate "Guidelines on Banning of Business dealings with Suppliers/ Contractors", framed by the Principal.

Section 4 - Compensation for Damages

4.1 If the Principal has disqualified the Bidder from the tender process prior to the award according to Section 3, the Principal is entitled to demand and recover the damages equivalent Earnest Money Deposit/ Bid Security.

4.2 If the Principal has terminated the contract according to Section 3, or if the Principal is entitled to terminate the contract according to section 3, the Principal shall be entitled to

demand and recover from the Contractor liquidated damages equivalent to 5% of the contract value or the amount equivalent to Security Deposit/ Performance Bank Guarantee, whichever is higher.

Section 5 - Previous Transgression

5.1 The Bidder declares that no previous transgressions occurred in the last 3 years with any other company in any country conforming to the anti-corruption approach or with any other Public Sector Enterprise in India that could justify his exclusion from the tender process.

5.2 If the Bidder makes incorrect statement on this subject, he can be disqualified from the tender process or the contract, if already awarded, can be terminated for such reason.

Section 6 - Equal treatment of all Bidders/ Contractors / Sub-contractors

6.1 The Principal will enter into agreements with identical conditions as this one with all Bidders and Contractors. In case of sub-contracting, the Principal contractor shall be responsible for the adoption of IP by his sub-contractors and shall continue to remain responsible for any default by his sub-contractors.

6.2 The Principal will disqualify from the tender process all bidders who do not sign this pact or violate its provisions.

Section 7 - Criminal Charges against violating Bidders/ Contractors /Subcontractors

If the Principal obtains knowledge of conduct of a Bidder, Contractor or Subcontractor, or of an employee or a representative or an associate of a Bidder, Contractor or Subcontractor which constitutes corruption, or if the Principal has substantive suspicion in this regard, the Principal will inform the Vigilance Office.

Section 8 - Independent External Monitor(s)

8.1 The Principal appoints competent and credible Independent External Monitor for this Pact. The task of the Monitor is to review independently and objectively, whether and to what extent the parties comply with the obligations under this agreement.

8.2 The Monitor is not subject to instructions by the representatives of the parties and performs his functions neutrally and independently. He reports to the CMD, BHEL.

8.3 The Bidder(s)/ Contractor(s) accepts that the Monitor has the right to access without restriction to all contract documentation of the Principal including that provided by the Bidder(s)/ Contractor(s). The Bidder(s)/ Contractor(s) will grant the monitor, upon his request and demonstration of a valid interest, unrestricted and unconditional access to his contract documentation. The same is applicable to Sub-contractor(s). The Monitor is under contractual obligation to treat the information and documents of the Bidder(s)/ Contractor(s) / Sub-contractor(s) with confidentiality in line with Non- disclosure agreement.

8.4 The Principal will provide to the Monitor sufficient information about all meetings among the parties related to the contract provided such meetings could have an impact on the contractual relations between the Principal and the Contractor. The parties offer to the Monitor the option to participate in such meetings.

8.5 The role of IEMs is advisory, would not be legally binding and it is restricted to resolving issues raised by an intending bidder regarding any aspect of the tender which allegedly restricts competition or bias towards some bidders. At the same time, it must be understood that IEMs are not consultants to the Management. Their role is independent in nature and the advice once tendered would not be subject to review at the request of the organization.

8.6 For ensuring the desired transparency and objectivity in dealing with the complaints arising out of any tendering process, the matter should be examined by the full panel of IEMs jointly as far as possible, who would look into the records, conduct an investigation, and submit their joint recommendations to the Management.

8.7 The IEMs would examine all complaints received by them and give their recommendations/ views to CMD, BHEL, at the earliest. They may also send their report directly to the CVO and the Commission, in case of suspicion of serious irregularities requiring legal/ administrative action. IEMs will tender their advice on the complaints within 10 days as far as possible.

8.8 The CMD, BHEL shall decide the compensation to be paid to the Monitor and its terms and conditions.

8.9 IEM should examine the process integrity, they are not expected to concern themselves with fixing of responsibility of officers. Complaints alleging mala fide on the part of any officer of the organization should be looked into by the CVO of the concerned organisation.

8.10 If the Monitor has reported to the CMD, BHEL, a substantiated suspicion of an offence under relevant Indian Penal Code/ Prevention of Corruption Act, and the CMD, BHEL has not, within reasonable time, taken visible action to proceed against such offence or reported it to the Vigilance Office, the Monitor may also transmit this information directly to the Central Vigilance Commissioner, Government of India.

8.11 The number of Independent External Monitor(s) shall be decided by the CMD, BHEL.

8.12 The word `Monitor' would include both singular and plural.

Section 9 - Pact Duration

9.1 This Pact shall be operative from the date IP is signed by both the parties till the final completion of contract for successful bidder and for all other bidders 6 months after the contract has been awarded. Issues like warranty / guarantee etc. should be outside the purview of IEMs.

9.2 If any claim is made/ lodged during currency of IP, the same shall be binding and continue to be valid despite the lapse of this pact as specified above, unless it is discharged/ determined by the CMD, BHEL.

Section 10 - Other Provisions

10.1 This agreement is subject to Indian Laws and jurisdiction shall be registered office of the Principal, i.e. New Delhi.

10.2 Changes and supplements as well as termination notices need to be made in writing. Side agreements have not been made.

10.3 If the Contractor is a partnership or a consortium, this agreement must be signed by all partners or consortium members.

10.4 Should one or several provisions of this agreement turn out to be invalid, the remainder of this agreement remains valid. In this case, the parties will strive to come to an agreement to their original intentions.

10.5 Only those bidders / contractors who have entered into this agreement with the Principal would be competent to participate in the bidding. In other words, entering into this agreement would be a preliminary qualification.

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For & On behalf of the Principal	For & On behalf of the Bidder/ Contractor
(Office Seal)	(Office Seal)
Place----------	
Date----------	
Witness:_____	Witness:_____
(Name & Address) _____	(Name & Address) _____
_____	_____

Annexure-X

Restrictions under Rule 144(xi) of General Financial Rules, 2017 amendment dt: 23.07.2020

I. Any bidder from a country which shares a land border with India will be eligible to bid in this tender only if the bidder is registered with the Competent Authority.

II. "Bidder" (including the term 'tenderer', 'consultant' or 'service provider' in certain contexts) means any person or firm or company, including any member of a consortium or joint venture (that is an association of several persons, or firms or companies), every artificial juridical person not falling in any of the descriptions of bidders stated hereinbefore, including any agency branch or office controlled by such person, participating in a procurement process.

III. "Bidder from a country which shares a land border with India" for the purpose of this Order means :-

a. An entity incorporated, established or registered in such a country; or

b. A subsidiary of an entity incorporated, established or registered in such a country; or

c. An entity substantially controlled through entities incorporated, established or registered in such a country; or

d. An entity whose *beneficial owner* is situated in such a country; or

e. An Indian (or other) agent of such an entity; or

f. A natural person who is a citizen of such a country; or

g. A consortium or joint venture where any member of the consortium or joint venture falls under any of the above

IV. The *beneficial owner* for the purpose of (iii) above will be as under:

1. In case of a company or Limited Liability Partnership, the beneficial owner is the natural person(s), who, whether acting alone or together, or through one or more juridical person, has a controlling ownership interest or who exercises control through other means.

Explanation--

a. "Controlling ownership interest" means ownership of or entitlement to more than twenty-five per cent of shares or capital or profits of the company;

b. "Control" shall include the right to appoint majority of the directors or to control the management or policy decisions including by virtue of their shareholding or management rights or shareholders agreements or voting agreements;

2. In case of a partnership firm, the beneficial owner is the natural person(s) who, whether acting alone or together, or through one or more juridical person, has ownership of entitlement to more than fifteen percent of capital or profits of the partnership;

3. In case of an unincorporated association or body of individuals, the beneficial owner is the natural person(s), who, whether acting alone or together, or through one or more juridical person, has ownership of or entitlement to more than fifteen percent of the property or capital or profits of such association or body of individuals;

4. Where no natural person is identified under (1) or (2) or (3) above, the beneficial owner is the relevant natural person who holds the position of senior managing official;

5. In case of a trust, the identification of beneficial owner(s) shall include identification of the author of the trust, the trustee, the beneficiaries with fifteen percent or more interest in the trust and any other natural person exercising ultimate effective control over the trust through a chain of control or ownership.

V. An Agent is a person employed to do any act for another, or to represent another in dealings with third person.

ಭಾರತ್ ಹೆವಿ ಎಲೆಕ್ಟ್ರಿಕಲ್ಸ್ ಲಿಮಿಟೆಡ್
भारत हेवी इलेक्ट्रिकल्स लिमिटेड
Bharat Heavy Electricals Ltd.,
(A Government of India undertaking)
Electronics Division
PB 2606 , Mysore Road Bangalore , 560026 INDIA

CE: PR: 002- Rev 02

GENERAL COMMERCIAL CONDITIONS FOR CONTRACT

These 'General Commercial Conditions for Contract for Purchase' herein after referred to as GCC apply to all enquiries, tenders, requests for quotations, orders, contracts and agreements concerning the supply of goods and the rendering of related services (hereinafter referred to as "deliveries") to Bharat Heavy Electricals Limited and any of its units, regions or divisions (hereinafter referred to as "BHEL" or the Purchaser) or its projects/ customers.

Any deviations from or additions to these GCC require BHEL's express written consent. The general terms of business or sale of the vendor shall not apply to BHEL. Acceptance, receipt of shipments or services or effecting payment shall not mean that the general terms of business or sale of the vendor have been accepted.

Orders, agreements and amendments thereto shall be binding if made or confirmed by BHEL in writing. Only the Purchasing department of BHEL is authorized to issue the Purchase Order or any amendment thereof.

Definitions: Throughout these conditions and in the specifications, the following terms shall have the meanings assigned to them, unless the subject matter or the context requires otherwise.

a) 'The Purchaser' means Bharat Heavy Electricals Limited, Electronics division, Mysore road, Bangalore 560 026, a Unit of Bharat Heavy Electricals Limited (A Govt. of India Undertaking) incorporated under the Companies Act having its registered office at BHEL House, Siri Fort, New Delhi-110049, India and shall be deemed to include its successors and assigns. It may also be referred to as BHEL.
b) 'The vendor' means the person, firm, company or organization on whom the Purchase Order is placed and shall be deemed to include the vendor's successors, representative heirs, executors and administrator as the case may be. It may also be referred to as Seller, Contractor or Supplier.
c) 'Contract' shall mean and include the Purchase Order incorporating various agreements, viz. tender/ RFQ, offer, letter of intent/acceptance/ award, the General Conditions of Contract and Special Conditions of Contract for Purchase, Specifications, Inspection/ Quality Plan, Schedule of Prices and Quantities, Drawings, if any enclosed or to be provided by BHEL or his authorized nominee and the samples or patterns if any to be provided under the provisions of the contract.
d) 'Parties to the Contract' shall mean the 'The Vendor' and the Purchaser as named in the main body of the Purchase Order.

Order of Precedence:

In case of any inconsistency or contradiction between any of the documents, the order of precedence shall be Purchase Order, LOI / LOA, Special Conditions of Contract and General Conditions of Contract for commercial conditions; and specific agreement on technical conditions, RFQ/offer and specification for Technical Conditions.

Interpretation:

In the contract, except where the context requires otherwise:

a) words indicating one gender include all genders;
b) words indicating the singular also include the plural and words indicating the plural also include the singular;

c) provisions including the word "agree", "agreed" or "agreement" require the agreement to be recorded in writing, and
d) "Written" or "in writing" means hand-written, type-written, printed or electronically made, and resulting in a permanent record.

Applicable Conditions:

1. Price Basis: All prices shall be firm until the purchase order is executed / completed in all respects. No price variations / escalation shall be permitted.

2. Ordering and confirmation of Order:Vendor shall send the order acceptance on their company letter head/ through e-mail within a week from the date of receipt of Purchase Order or such other period as specified/ agreed by BHEL. BHEL reserves the right to revoke the order placed if the order confirmation differs from the original order placed. The acceptance of goods/services/supplies by BHEL as well as payments made in this regard shall not imply acceptance of any deviations.
   The purchase order will be deemed to have been accepted if no communication to the contrary is received within one week (or the time limit as specified/agreed by BHEL) from the date of receipt of the purchase order.

3. Documentation:After receipt of Purchase Order, vendor should submit necessary documents(if & as applicable) like drawings specified, bill of materials, datasheets, catalogues, quality plan, test procedure, type test report , O & M Manuals and/or any other relevant documents as per Specification/Purchase Order, as and when required by BHEL/Customer.
   At any stage within the contract period, the vendor shall notify of any error, fault or other defect found in BHEL's documents /specifications or any other items for reference. If and to the extent that (taking account of cost and time) any vendor exercising due care would have discovered the error, fault or other defect when examining the documents/specifications before submitting the tender, the time for completion shall not be extended. However if errors, omissions, ambiguities, inconsistencies, inadequacies or other defects are found in the vendor's documents, they shall be corrected at his cost, notwithstanding any consent or approval.

4. Penalty:
   a. For delay in documentation: In the event of delay in submission of complete set of specified documents ((like drawings, bill of materials, datasheets, catalogues, quality plan etc. as called in tender specifications including soft copies wherever applicable) in required sets beyond two(02) weeks (or as agreed/indicated in the SCC/Purchase Order) from the date of receipt of Purchase Order(by email), penalty at 0.5% (half percent) per week or part thereof, limited to a maximum of 5% (five percent) of the basic material value of the Purchase Order will be applicable.

      Penalty for delayed documentation if applicable, shall be deducted at the time of first supply payment. If penalty is applicable for duration of less than a week, penalty @ 0.5% (half percent) of the basic material value will be deducted. GST as applicable will be recovered along with penalty amount.

   b. For delay in delivery: In the event of delay in agreed contractual delivery as per Purchase Order, penalty @ 0.5 % (half percent) per week or part thereof but limited to a max of 10% (ten percent) value of undelivered portion (basic material cost) will be applicable. Delivery will commence from the date of issue of Manufacturing clearance along with approved document. The date for which Inspection call is issued by vendor along with test certificates / test reports /Certificate of Conformance / calibration reports, as proof of completion of manufacturing will be treated as date of deemed delivery for penalty calculation. In the absence of furnishing such document indicated above as proof of completion of manufacturing along with inspection call, actual date of inspection will be considered as date of deemed delivery and BHEL will not be responsible for delay in actual date of inspection.

Penalty for delayed delivery if applicable, shall be deducted at the time of first supply payment. If penalty is applicable for duration of less than a week, penalty @ 0.5% (half percent) of the basic material value will be deducted. GST as applicable will be recovered along with penalty amount.

5. Contract variations (Increase or decrease in the scope of supply): BHEL may vary the contracted scope as per requirements at site. If vendor is of the opinion that the variation has an effect on the agreed price or delivery period, BHEL shall be informed of this immediately in writing along with technical details. Where unit rates are available in the Contract, the same shall be the basis for such additional work. Vendor shall not perform additional work before BHEL has issued written instructions/ amendment to the Purchase Order to that effect. The work which the vendor should have or could have anticipated in terms of delivering the service(s) and functionality (i.e.) as described in this agreement, or which is considered to be the result of an attributable error on the vendor's part, shall not be considered additional work.

6. Inspection: Prior written notice of at least 10 days shall be given along with internal test certificates/COC and applicable test certificates. Materials will be inspected by BHEL-EDN-QS/CQS or BHEL nominated Third Party Inspection Agency (TPIA) or BHEL authorized Inspection Agency or Customer / Consultant or jointly by BHEL & Customer / consultant. All tests have to be conducted as applicable in line with approved Quality plan or QA Checklist or Purchase specification and original reports shall be furnished to BHEL-EDN, Bangalore for verification/acceptance for issue of dispatch clearance. BHEL reserves the right for conducting repeat test, if required.
   All costs related to inspections & re-inspections shall be borne by vendor. Whether the Contract provides for tests on the premises of the vendor or any of his Sub-contractor/s, vendor shall be responsible to provide such assistance, labour, materials, electricity, fuels, stores, apparatus, instruments as may be required and as may be reasonably demanded to carry out such tests efficiently. Cost of any type test or such other special tests shall be borne by BHEL only if specifically agreed to in the purchase order.

7. Transit Insurance: Transit insurance coverage between vendor's works and project site shall be to the account of BHEL, unless specifically agreed otherwise. However, vendor shall send intimation directly to insurance agency (as mentioned in dispatch instructions issued by BHEL) through fax/courier/e-mail, immediately on dispatch of goods for covering insurance. A copy of such intimation sent by vendor to insurance agency shall be given to BHEL along with dispatch documents. Dispatch documents will be treated as incomplete without such intimation copy. BHEL shall not be responsible for sending intimations to insurance agency on behalf of the vendor.

8. Mode of dispatch:
   Indigenous Scope: By road on Door Delivery Consignee Copy attached basis through your approved transporter (unless otherwise indicated in Dispatch Instructions), only on receipt of Despatch Clearance from BHEL.
   Imported Scope: By Air/Sea through BHEL approved Freight Forwarder/supplier approved Consolidator respectively as per agreed contractual terms, only on receipt of Dispatch Clearance from BHEL.

9. Changes in Statutory levies:
   If any rates of Tax are increased or decreased, a new Tax is introduced, an existing Tax is abolished, or any change in interpretation or application of any Tax occurs in the course of the execution of Contract, which was or will be assessed on the bidder in connection with performance of the Contract, an equitable adjustment of the Contract Price shall be made to fully take into account any such change by addition to the Contract Price or deduction there from, as the case may be. However, these adjustments would be restricted to direct transactions between BHEL and the bidder /agent of foreign bidder (if applicable). These adjustments shall not be applicable on procurement of raw materials, intermediary components etc. by the bidder /agent.

10. Availing duty/tax exemption benefits by bidder, wherever applicable: BHEL shall issue the required Certificate/s, as per relevant policies of the Govt. of India, to facilitate the bidders to avail any such benefits under the Contract. In case of failure of the bidders to receive the benefits partly or fully from the Govt. of India and/or in case of any delay in receipt of such benefits, BHEL shall neither be liable nor responsible in any manner whatsoever.

11. Taxes against sub-vendor dispatches: All taxes/levies, as applicable in respect of all components, equipments and material to be despatched directly from the sub-vendor's works to Site irrespective of the fact whether such taxes and levies are assessable and chargeable on Vendor or the BHEL, shall be to the vendor's account and no separate claim in this regard will be entertained by BHEL.

12. High Sea Sales (HSS): Customs clearance of the consignment landed on Indian Sea/Air ports will be done by BHEL based on the original HSS documents provided by vendors.
    Any delay in submission of complete/correct HSS documents to BHEL may incur demurrage charges. All demurrage charges on account of incomplete /incorrect HSS documents submission by vendor will be to vendor's account and all such charges will be recovered from any of the available vendor bills with BHEL.

13. Packaging and dispatch:The Seller shall package the goods safely and carefully and pack them suitably in all respects considering the peculiarity of the material for normal safe transport by Sea/ Air / Rail/ Road to its destination suitably protected against loss, damage, corrosion in transit and the effect of tropical salt laden atmosphere. The packages shall be provided with fixtures/ hooks and sling marks as may be required for easy and safe handling. If any consignment needs special handling instruction, the same shall be clearly marked with standard symbols / instructions. Hazardous material should be notified as such and their packing, transportation and other protection must conform to relevant regulations.
    The packing, shipping, storage and processing of the goods must comply with the prevailing legislation and regulations concerning safety, the environment and working conditions. Any Imported/Physical Exports items packed with raw/ solid wood packing material should be treated as per ISPM – 15 (fumigation) and accompanied by Phytosanitory/ Fumigation certificate. If safety information sheets (MSDS – Material Safety Data Sheet) exist for an item or the packaging, vendor must provide this information without fail along with the consignment.
    Each package must be marked with Consignee name, Purchase order number, Package number, Gross weight and net weight, dimensions (LxBxH) and Seller's name. Packing list of goods inside each package with PO item number and quantity must also be fixed securely outside the box to indicate the contents of each box. Total number of packages in the consignment must also be indicated in the packing list.
    Separate packing & identification of items should be as follows.
    1. Main Scope - All items must be tagged with part no. & item description.
    2. Commissioning accessories/spares - All items must be tagged with part no. & item description.
    3. Mandatory spares - All items must be tagged with part no. & item description.
    Nevertheless, vendor shall adhere to dispatch & packing instructions issued by BHEL at the time of dispatch.

14. Assignment of Rights & Obligations; Subcontracting: Vendor is not permitted to subcontract the delivery or any part thereof to third party or to assign the rights and obligations resulting from this agreement in whole or in part to third parties without prior written permission from BHEL. Any permission or approval given by the BHEL shall, however, not absolve the vendor of the responsibility of his obligations under the Contract.

15. Progress report: Vendor shall render such report as to the progress of work and in such form as may be called for by the concerned purchase officer from time to time. The submission and acceptance of such reports shall not prejudice the rights of BHEL in any manner.

16. Non-disclosure and Information Obligations: Vendor shall provide with all necessary information pertaining to the goods as it could be of importance to BHEL. Vendor shall not reveal any specified confidential information that may be divulged by BHEL to Vendor's employees not involved with the tender/ contract & its execution and delivery or to third parties, unless BHEL has agreed to this in writing beforehand. Vendor shall not be entitled to use the BHEL name in advertisements and other commercial publications without prior written permission from BHEL.

17. Cancellation /Termination of contract: BHEL shall have the right to completely or partially terminate the agreement by means of written notice to that effect. Termination of the Contract, for whatever reason, shall be without prejudice to the rights of the parties accrued under the Contract up to the time of termination.
    BHEL shall have the right to cancel/foreclose the Order/ Contract, wholly or in part, in case it is constrained to do so on account of any decline, diminution, curtailment or stoppage of the business.

18. Risk Purchase Clause: In case of failure of supplier, BHEL at its discretion may make purchase of the materials / services not supplied / rendered in time at the RISK & COST of the supplier. Under such situation, the supplier who fails to supply the goods in time shall be wholly liable to make good to BHEL any loss due to risk purchase.
    In case of items demanding services at site like erection and commissioning, vendor should send his servicemen/representatives within 7 days from the service call. In case a vendor fails to attend to the service call, BHEL at its discretion may also make arrangements to attend such service by other parties at the **RISK & COST** of the supplier. Under such situation the supplier who fails to attend the service shall be wholly liable to make good to BHEL any loss due to risk purchase/service including additional handling charges due to the change.

19. Shortages: In the event of shortage on receipt of goods and/or on opening of packages at site, all such shortages, caused by supplier's act or omission, shall be made good at free of cost within a reasonable time that BHEL may allow from such intimation.
    Transit Damages: In the event of receipt of goods in damaged condition or having found them so upon opening of packages at site, supplier shall make good of all such damages within a reasonable time from such intimation by BHEL. In case BHEL raises an insurance claim, the cost of material limited to insurance settled amount less handling charges will be reimbursed to supplier.

20. Remedial work: Notwithstanding any previous test or certification, BHEL may instruct the vendor to remove and replace materials/goods or remove and re-execute works/services which are not in accordance with the purchase order. Similarly BHEL may ask the vendor to supply materials or to execute any services which are urgently required for any safety reasons, whether arising out of or because of an accident, unforeseeable event or otherwise. In such an event, Vendor shall provide such services within a reasonable time as specified by BHEL.

21. Indemnity Clause: Vendor shall comply with all applicable safety regulations and take care for the safety of all persons involved. Vendor is fully responsible for the safety of its personnel or that of his subcontractor's men / property, during execution of the Purchase Order and related services. All statutory payments including PF, ESI or other related charges have to be borne by the vendor. Vendor is fully responsible for ensuring that all legal compliances are followed in course of such employment.

22. Product Information, Drawings and Documents: All specified drawings, technical documents or other technical information received by Vendor from BHEL or vice versa shall not, without the consent of the other party, be used for any other purpose than that for which they were provided. They may not, without the consent of the Disclosing party, otherwise be used or copied, reproduced, transmitted or communicated to third parties. All information and data contained in general product documentation, whether in electronic or any other form, are binding only to the extent that they are by reference expressly included in the contract.
    Vendor, as per agreed date/s but not later than the date of delivery, provide free of charge information and drawings which are necessary to permit and enable BHEL to erect, commission, operate and maintain the product. Such information and drawings shall be supplied in as many numbers of copies as may be agreed upon.
    All intellectual properties, including designs, drawings and product information etc. exchanged during the formation and execution of the Contract shall continue to be the property of the disclosing party.

23. Intellectual Property Rights, Licenses: If any Patent, design, Trade mark or any other intellectual property rights apply to the delivery (goods/related service) or accompanying documentation shall be the exclusive property of the Vendor and BHEL shall be entitled to the legal use thereof free of charge by means of a non-exclusive, worldwide, perpetual license. All intellectual property rights that arise during the execution of the Purchase Order/ contract for delivery by vendor and/or by its employees or third parties involved by the vendor for performance of the agreement shall belong to BHEL. Vendor shall perform everything necessary to obtain or establish the above mentioned rights. The Vendor guarantees that the delivery does not infringe on any of the intellectual property rights of third parties. The Vendor shall do everything necessary to obtain or establish the alternate acceptable arrangement pending resolution of any (alleged)

claims by third parties. The Vendor shall indemnify BHEL against any (alleged) claims by third parties in this regard and shall reimburse BHEL for any damages suffered as a result thereof.

24. Force Majeure: Notwithstanding anything contained in the purchase order or any other document relevant thereto, neither party shall be liable for any failure or delay in performance to the extent said failures or delays are caused by the "Act of God" and occurring without its fault or negligence, provided that, force majeure will apply only if the failure to perform could not be avoided by the exercise of due care and vendor doing everything reasonably possible to resume its performance.
A party affected by an event of force majeure which may include fire, tempest, floods, earthquake, riot, war, damage by aircraft etc., shall give the other party written notice, with full details as soon as possible and in any event not later than seven (7) calendar days of the occurrence of the cause relied upon. If force majeure applies, dates by which performance obligations are scheduled to be met will be extended for a period of time equal to the time lost due to any delay so caused.

    Notwithstanding above provisions, in an event of Force Majeure, BHEL reserves for itself the right to cancel the order/ contract, wholly or partly, in order to meet the overall project schedule and make alternative arrangements for completion of deliveries and other schedules.

25. Warranty:
Wherever required, and so provided in the specifications/ Purchaser Order, the Seller shall ensure that the goods supplied shall comply with the specifications laid down, for materials, workmanship and performance.
Unless otherwise specified in SCC, warranty period shall be applicable for a period of 24 months from the date of delivery of goods or 18 months from the date of commissioning of goods, whichever is earlier.
The warranty period as described above shall apply afresh to replaced, repaired or re-executed parts of a delivery. Unless otherwise specifically provided in the Purchase Order, Vendor's liability shall be co terminus with the expiration of the applicable warranty period.

26. Limitation of Liability: Vendor's liability towards this contract is limited to a maximum of 100% of the contract value and consequential damages are excluded. However the limits of liability will have no effect in cases of criminal negligence or wilful misconduct.
The total liability of Vendor for all claims arising out of or relating to the performance or breach of the Contract or use of any Products or Services or any order shall not exceed the total Contract price.

27. Liability during warranty: Vendor shall arrange replacement / repair of all the defective materials / services under its obligation during the warranty period. The rejected goods shall be taken away by vendor and replaced / repaired. In the event of the vendor's failure to comply, BHEL may take appropriate action including disposal of rejections and replenishment by any other sources at the cost and risk of the vendor.
In case, defects attributable to vendor are detected during Warranty period or where the commissioning call is issued within the warranty period, vendor shall be responsible for replacement/ repair of the goods as required by BHEL at vendor's cost even after expiry of warranty period.
Further if the equipment or any part thereof cannot be used by reason of such defect and/or making good of such defect, the warranty period of the equipment or such part, as the case may be, shall be extended by a period equal to the period during which the equipment or such part cannot be used by BHEL because of any of the aforesaid reasons. Upon correction of the defects in the facilities or any part thereof by repair/replacement, such repair/replacement shall have the warranty period for a period of twelve (12) months from the time such replacement/repair of the equipment or any part thereof has been completed.

28. Liability after warranty period: At the end of the warranty, the Vendor's liability ceases except for latent defects. For the purpose of this clause, latent defects shall be the defects inherently lying within the material or arising out of design deficiency which do not manifest themselves during the warranty Period, but later. The Contractor's liability for latent defects warranty for the equipment including spares shall be limited to a period of six months from the end of the warranty period of the respective equipment including spares or first time commissioning, whichever is later but not later than one (01) year from the date of expiry of warranty period.

29. Compliance with Laws: Vendor shall, in performing the contract, comply with all applicable laws. The vendor shall make all remittances, give all notices, pay all taxes, duties and fees, and obtain all permits, licences and approvals, as required by the laws in relation to the execution and completion of the contract and for remedying of any defects; and the Contractor shall indemnify and hold BHEL harmless against and from the consequences of any failure to do so.

30. Settlement of Disputes:Except as otherwise specifically provided in the Purchase Order, decision of BHEL shall be binding on the vendor with respect to all questions relating to the interpretation or meaning of the terms and conditions and instructions herein before mentioned and as to the completion of supplies/work/services, other questions, claim, right, matter or things whatsoever in any way arising out of or relating to the contract, instructions, orders or these conditions or otherwise concerning the supply or the execution or failure to execute the order, whether arising during the schedule of supply/work or after the completion or abandonment thereof. Any disputes or differences among the parties shall to the extent possible be settled amicably between the parties thereto, failing which the disputed issues shall be settled through arbitration. Vendor shall continue to perform the contract, pending settlement of dispute(s).

31. Arbitration Clause in case of Contract with vendors other than Public Sector Enterprise (PSE) or a Government Department:

    ARBITRATION & CONCILIATION

    The parties shall attempt to settle any disputes or difference arising out of the formation, breach, termination, validity or execution of the Contract; or, the respective rights and liabilities of the parties; or, in relation to interpretation of any provision of the Contract; or, in any manner touching upon the Contract, or in connection with this contract through friendly discussions. In case no amicable settlement can be reached between the parties through such discussions, in respect of any dispute; then, either Party may, by a notice in writing to the other Party refer such dispute or difference to the sole arbitration of an arbitrator appointed by Head of the BHEL–EDN. Such Sole Arbitrator appointed, shall conduct the arbitration in English language.
    The Arbitrator shall pass a reasoned award and the award of the Arbitration shall be final and binding upon the Parties.
    Subject as aforesaid, the provisions of Arbitration and Conciliation Act 1996 (India) or statutory modifications or re-enactments thereof and the rules made thereunder and for the time being in force shall apply to the arbitration proceedings under this clause. The seat of arbitration shall be Bangalore.
    The cost of arbitration shall be borne as decided by the Arbitrator upon him entering the reference.
    Subject to the Arbitration Clause as above, the Courts at Bangalore alone shall have exclusive jurisdiction over any matter arising out of or in connection with this Contract.
    Notwithstanding the existence or any dispute or differences and/or reference for the arbitration, the parties shall proceed with and continue without hindrance the performance of its obligations under this Contract with due diligence and efficiency in a professional manner except where the Contract has been terminated by either Party in terms of this Contract.

    Arbitration Clause in case of Contract with a Public Sector Enterprise (PSE) or a Government Department:

    In the event of any dispute or difference relating to the interpretation and application of the provisions of the Contract, such dispute or difference shall be referred by either party for Arbitration to the Sole Arbitrator in the Department of Public Enterprises to be nominated by the Secretary to the Government of India in-charge of the Department of Public Enterprises. The Arbitration and Conciliation Act, 1996 shall not be applicable to arbitration under this clause. The award of the Arbitrator shall be binding upon the parties to the dispute, provided, however, any Party aggrieved by such Award may make further reference for setting aside or revision of the Award to the Law Secretary, Department of Legal Affairs, Ministry of Law and Justice, Government of India. Upon such reference the dispute shall be decided by the Law Secretary or the Special Secretary or Additional Secretary when so authorized by the Law Secretary, whose decision shall bind the Parties hereto finally and conclusively. The Parties to the dispute will share equally the cost of arbitration as intimated by the Arbitrator.'

32. Applicable Laws and Jurisdiction of Courts: Prevailing Indian laws both substantive and procedural, including modifications thereto, shall govern the Contract. Subject to the conditions as aforesaid, the competent courts in Bangalore alone shall have jurisdiction to consider over any matters touching upon this contract.

33. General Terms: That any non-exercise, forbearance or omission of any of the powers conferred on BHEL and /or any of its authorities will not in any manner constitute waiver of the conditions hereto contained in these presents.
    That the headings used in this agreement are for convenience of reference only.
    That all notices etc., to be given under the Purchase order shall be in writing, type script or printed and if sent by registered post or by courier service to the address given in this document shall be deemed to have been served on the date when in the ordinary course, they would have been delivered to the addressee.