BID DOCUMENT

(NIB No. REIL/RE/2019-20/GRID CONNECTED /MWP/13 dated 07.03.2020)

FOR

DESIGN, ENGINEERING, SUPPLY, CONSTRUCTION, ERECTION, INSTALLATION, COMMISSIONING OPERATION & MAINTENANCE OF SOLAR PV POWER PLANTS

ISSUED BY

RAJASTHAN ELECTRONICS & INSTRUMENTS LTD.

(A "Mini Ratna"Central Public Sector Enterprise)

2, Kanakpura Industrial Area, Sirsi Road, JAIPUR – 302 034

T. No. 0141-2470531/2470908/2470363, Fax –0141-2470139

Website: www.reiljp.com

INDEX

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NOTICE INVITING BID
(NIB No. REIL/RE/2019-20/GRID CONNECTED /MWP/13 dated 07.03.2020)

Rajasthan Electronics & Instruments Limited (REIL), Jaipur invites sealed bids, from interested bidders for "Design, Engineering, Supply, Construction, Erection, Testing, Transportation, Unloading, Installation, Commissioning and 25 years Operation & Maintenance of Solar PV based Power Plant with capacities ranging from 500kWp to 2 MWp or more at various locations/ sub stations of MSEDCL in the state of Maharashtra".

The bid shall comprise of technical bid and commercial Bid. The detailed scope of work, terms and conditions etc. are available with the Bid Form.

The bids must also be accompanied with Earnest Money of Rs. 20.00 Lac only (Rupees Twenty Lac only) in form of crossed Demand Draft or Bank Guarantee in favour of "**Rajasthan Electronics & Instruments Limited , Payable at Jaipur".** The Bank Guarantee should be issued by any scheduled Bank and valid for 180 days. EMD will be refund after successful completion of the work.

The details for Bid are as follows.

S. No.	Item	Description
1	Last date for submission of Bid	27.03.2020 upto 11.00 AM
2	Earnest Money	Rs. Twenty Lac only (Valid for Six Month)
4.	Opening of technical Bid	28.03.2020 at 11.00 AM
5.	Opening of Commercial Bid	to be informed later to bidders successful in the technical bid
6	Address for Submission of Bid, and Opening of Bids	**Shri Deepak Gupta** **Dy. General Manager (MM)** **Rajasthan Electronics & Instruments Limited ,** **2, Kanakpura Industrial Area, Sirsi Road,** **JAIPUR – 302034** E-mail: Deepak.gupta@reil.co.in,

REIL reserves the right to reject the whole or part of any or all bids received, without assigning any reason**.**

Dy. General Manager (MM)

SECTION-I

INSTRUCTION TO BIDDERS

1. The Bid forms containing the Terms and Conditions , the Tender and the Schedule of contract, **should be returned in original along with the technical bid document, intact, after filling up the same and duly signing in full with stamp, on each page**, failing which the tender shall be liable for rejection. In the event of the space on the Schedule of contract / specifications of items/proforma being insufficient for the required purpose, additional pages may be added. Each \such additional page must be numbered consecutively, bearing the Tender Number and be duly signed and stamped by the bidder. In such cases, reference to the additional pages must be made in the Tender Form. If any modification of the schedule is considered necessary, you should communicate the same by means of separate letter sent along with the Tender.

2. **PROCEDURE FOR SUBMISSION OF TENDERS / BIDS:**

I. **The tender should be submitted in 'TWO BID' SYSTEM:-**

1) **PART -1 TECHNICAL BID:**
Technical Bid alongwith tender documents (duly signed on each page) to be uploaded in the e-tender portal. Technical Bid to be opened by the REIL committee.

a. The hard copy of technical bid duly completed and signed on each page, should be submitted along with the **"TECHNICAL BID"** and other supporting documents with in two days after due date. Hard copy from the Vendors who have participated in e-bid will only be accepted.

b. Board resolution/ Authorization letter for signing of the bid document from the Vendor be submitted.
c. Prices / Costs of the items ***should not be*** indicated anywhere in the Technical Bid. This should be followed meticulously failing which the bid is liable to be rejected.
d. EMD of Rs. Twenty Lac only be submitted with the bid in the form of Demand Draft / Bank Guarantee.

2) **PART -1I FINANCIAL BID:** Price Bid BOQ given with tender is to be uploaded strictly as per the format available with the tender failing which the offer is liable for rejection (renaming or changing format of BOQ sheet will not be accepted by the system).

The Technical Bid to be kept in a sealed envelope super-scribed with for "Design, Engineering, Supply, Construction, Erection, Testing, Transportation, Unloading, Installation, Commissioning and 25 years Operation & Maintenance of Solar PV based Power Plant with capacities ranging from 500 kw to 2 mw or more at various locations/ sub stations of MSEDCL in the state of Maharashtra"**.**

I. The cover should also be sealed and addressed to the

Dy. General Manager (MM),
Rajasthan Electronics & Instruments Ltd.,
2 Kanakpura Industrial Area, Sirsi Road, Jaipur- 302034.

II. Tenders submitted without the 'Two Bid' System procedure will be rejected.

Note: e-Procurement system does not allow submission of documents after due date of tender.Incomplete form or non-submission of required documents may results into rejection of your offer and no Communication shall be done for submission of documents.

3) LATEST HOUR FOR RECEIPT OF THE TENDER:

Your tender must reach this office not later than the date and time notified in the Tender Notice stated In the TENDER DOCUMENT. Any tender received after that shall be rejected. In the event of the stipulated date of opening of the tender being declared a closed holiday for Govt. offices, the date of opening of the tender(s) will be the next working day. Tender sent by hand delivery, should be delivered at this office not later than the due date and time stipulated in the schedule of tender.

4) OPENING OF TENDER:

The **Price/Financial bids** of the bidders whose technical bids are found technically suitable only will be opened later. **The decision of the evaluation committee on technical suitability shall be final.**

5) PRICES:

a. Prices/Financial bid are to be quoted in Indian Rupees and must be meaningful and measurable in the context.

b. Bidders should clearly specify whether prices quoted are inclusive of GST/duties/ statutory charges or such charges as extra. Where no specific mention GST or other duties quoted shall be **deemed to be inclusive of such taxes** / charges.

c. Price must be quoted in original sheet of BOQ failing which the same is liable to be rejected.

6) EARNEST MONEY

1. The tender must be accompanied by a sum of Rs. 20,00,000/- (Rupee Twenty Lac only) as Earnest Money in the form of pay orders, demand drafts or Bank Guarantee failing which the tender shall be summarily rejected. These forms of earnest money could be either of the Punjab National Bank or of any of the Nationalized Banks or by a scheduled bank.
2. Bank Guarantee should be valid for a period 06 month from the date of bid submission.

7) **Contract Performance Bank Guarantee (CPG):** Successful bidder shall submit PBG of 5% amount of total work order valid for 25 years after placement of LOI with in 15 days from the LOI.

Within fifteen (15) days of the receipt of notification of award from REIL, the successful bidder shall furnish the CPG in the form of Demand Draft/ Pay Order or Bank Guarantee for 5% of the total contract value. The Bank Guarantee must be valid to cover Delivery Period + Warrantee Period + Three Months Claim Period. Any delay in submission of SD/CPG shall be deemed as accruing of financial benefit to the supplier and REIL may take necessary interest penalty recovery action (interest @ SBI's MCLR + 2 %) from the payments due to the supplier for the period of delay. However, this provision does not bind REIL in any way from proceeding against the supplier (including forfeiture of **EMD,** cancellation of the empanelment/LOA, etc.) for non-compliance towards non-submission of the SD/CPG.

In case Bidder provides CPG for shorter duration, it shall be for a minimum period of 3.5 years and REIL reserves right to invoke CPG in case extended CPG/fresh CPG is not furnished at least 90 days prior to expiry of original CPG.

SECTION-II

A. ELIGIBILITY CONDITIONS:

Bidder must fulfill following criteria:-

Bidder should have experience for electrical 11KV/33KV switchyard /transmission line/ grid connected systems.

AND

Bidder should have experience successfully completing Solar Power Plants during last Five years in any of the following categories:-

The bidders should have experience of one work of Solar Power Plant capacity > 80% of capacity of 3.5 MWp Plant capacity in NIT i.e. 2.8 MW.

OR

The bidders should have experience of two works of Solar Power Plant capacity > 50% of capacity of 3.5 MWp Plant capacity in NIT i.e. 1.75 MW.

OR

The bidders should have experience of three work of Solar Power Plant capacity > 40% of capacity of 3.5 MWp plant capacity in NIT t i.e. 1.4 MW.

B. FINANCIAL CAPABILITY, EXPERINCE:-

1. Firm should have average turnover of Rs. 10 Crore in last three financial years.

Bidder should submit following documents along with Technical bid :-

1. Bankers Report.
2. Balance sheet for last two years.
3. Turnover and networth value duly certified by CA.
4. Photocopy of the last Three years Income Tax Return.
5. Experience in Installation, Commissioning and maintenance of SPV Power Plant Systems. (attached verified documents such as I&C and maintenance certificate.
6. Photocopy of GST/service tax registration No., TIN no., PAN no.
7. EMD.
8. Declaration that firm is not blacklisted by any government department/ PSU.
9. Any other relevant documents

C) OTHER CONDITIONS:

a) **Responsibility for executing Contract**: The contractor is to be entirely responsible for the execution of the contract in all respects in accordance with the terms and conditions as specified in the acceptance of tender.

b) The contractor shall not sublet transfer or assign the contract to any part thereof without the written permission of the Dy. General Manager (MM). In the event of the contractor contravening this condition, Dy. General Manager (MM) be entitled to place the contract elsewhere on the contractors account at his risk and the contractor shall be liable for any loss or damage, which the Dy. General Manager(MM), may sustain in consequence or arising out of such replacing of the contract.

c) **Document**: The bidder should have a valid **PAN / TAN /GST NO & other statutory document as applicable** and produce attested copies of such certificates along with the tender papers in Technical Bid, failing which the tender is liable to be rejected. Check list be attached.

d) **Right to accept / reject**: REIL reserves the right to reject any or all tender without assigning any reason whatsoever. Also, the REIL authority reserve the right to **award** any or part or full contract to any successful agency at its discretion and this will be binding on the bidder.

e) The quantity of the SPV Systems shown in the tender can be increased or decreased to any extent depending upon the actual requirement.

f) **Assistance to contractor**: The contractor shall not be entitled for assistance either, in the procurement of raw materials required for the fulfillment of the contract or in the securing of transport facilities.

D. Electrical Contractor License

- The work shall be carried out by the contractor, having valid Electrical Contractor License for carrying out installation work under the direct supervision of the persons holding valid certificates of competency issued by the State Government.

- The successful BIDDER shall furnish the names and particulars of the certificate of competency of supervisor and workmen to be engaged for carrying out this work.

SECTION-III

SCOPE OF WORK

Project Scope and Technology Selection:

Under this programme, REIL will establish small Solar PV based small power plants with capacities approx.500 kW to 2 MW (Total Capacity 3.5 MW) on the open, unused lands at various locations / substations of MSEDCL in the state of Maharashtra.

Site descriptions:

1. The requisite land for implementation of proposed small solar PV power plants at different sub-stations, in the state of Maharashtra will be provided to the contractor(s) for development.
2. The lands are located within the premises/around the substations, in various locations of Maharashtra.
3. The lands are located within the premises of substations, in various locations of Maharashtra.
4. Interconnection point for evacuation of power from the plant will be the designated substation at 11 Kv level.

The Scope of Work under this package, includes site survey, all design & engineering, procurement & supply of equipment and materials , testing at manufacturers works, inspection, 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 Grid Interactive Solar PV Power Plant and performance demonstration with associated equipment and materials along with associated transmission system up to 11 kV at designation substation at various substations, on turnkey basis in the state of Maharashtra, India and 25 (Twenty Five) years comprehensive operation and maintenance.

1. The equipment and materials for approx. 3.5 MW cumulative or more capacities Grid Interactive Solar PV Power Plants with associated system (typical) shall include but not be limited to the receipt, unloading, storage, erection, testing and commissioning of all supplied material for the following:

i. Solar PV modules, Module mounting structures, fasteners, array foundation and module interconnection.
ii. Array Junction boxes, distribution boxes and fuse boxes: MCBs, Surge Arrestors with string monitoring capabilities and with proper lugs, glands, ferrules, terminations and mounting structures.
iii. DC and AC cables of appropriate sizes with adequate safety and insulation.
iv. Power Conditioning Units (PCU)/Inverter (String or Central grid-tie) 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.
v. Step up transformers (Inverter Duty with suitable intermediate voltage but not less than 11 kV) in relevance with state grid code and inverter manufacturer requirements.
vi. Suitable protection system.
vii. LT Power and Control Cables including end terminations and other required accessories for both AC & DC power.
viii. Internal 415V interconnection & indoor feeder panels to cater auxiliary needs of Plant.
ix. 11 kV indoor/ outdoor panels having incoming and outgoing feeders with VCBs, CTs, PTs, Bus bars, cables terminals kits and Main Bus. Each bay shall consist of VCB, CT, Isolators with earth

switch, LAs and PT's etc.

x. Data acquisition system with remote monitoring facilities. Provision for specific data transfer to the State Load Dispatch Centre (SLDC) may be provided as per the DISCOMs requirement.

xi. Lightning arrestors for entire plant area.

xii. PVC pipes, cable conduits, cable trays and accessories/trenches.

xiii. Earthing of the entire plant as per relevant standards.

xiv. Control room equipment related to Solar Power Generating Systems (SPGS).

xv. Testing, maintenance and monitoring of equipment(s). Spares & consumables, as required, for 25 years O&M period.

xvi. Necessary CCTV cameras at suitable locations in the plant area in order to capture any trespassing, theft & pilferage etc.

xvii. Fire detection & protection system in the plant area. Adequate number & types of fire extinguishers. All safety gadgets during Construction and O&M period including but not limited to, anti-static rubber mats of appropriate grade, PPE, rubber gloves and shoes etc.

xviii. Design of approx. 0.5 MWp – 2 MWp Grid Interactive Solar Power Generating System (s) and its 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. design memorandum, GTP and GA drawings for the major equipment & facilities, design basis & calculation sheets, and other relevant drawings and documents required for engineering of all facilities within the fencing to be provided under this contract, are covered under contractor's scope of work. The contractor has to provide the project design document with all the necessary technical details including simulation reports.

xix. Estimation and determination of the plant generation on daily basis in form of look ahead scheduling of power output.

xx. Any other equipment / material, not mentioned but essentially required to complete the small solar power plants in all respects.

xxi. Contractor has to carry out the site survey of the open land allocated to the contractor and install the solar PV power plant of suitable capacity based on the shadow free area. However the contractor has to install a minimum of approx. 500 kWp of SPGS in any of the allocated lands/substations. However a variation of (-20%) of the capacity may be allowed to be installed at any project site depending on the open/vacant / shadow free area available at the designated substation(s).

xxii. Requisite testing facilities at site, safety requirements and provision for other things that may require for successful operation and maintenance of plant and equipment.

xxiii. In case, the contractor wishes to use higher quantity of solar PV modules on the DC side of any power plant, the contractor has to provide the complete design document justifying the necessary AC/DC ratio. However the maximum acceptable AC to DC ratio is 1:1.20.

xxiv. Submission of work progress report by the contractor.

xxv. In case of absence of the standards for any of the equipment, the contractor may comply to the latest CEA/CERC/State Grid code.

b) During the O&M period, the contractor shall,

i. Keep the measured daily generation, import, auxiliary, fault log data at regular intervals and provide the same to REIL ad REIL employer EESL/DISCOM in electronic form compatible in excel format. The right to use the data shall remain with REIL and its employer EESL/DISCOM. Generation data shall be provided in the form of continuous day around generation curve. The plant outage data (due to solar plant or DISCOM grid) shall be maintained and submitted to REIL and its employer EESL/DISCOM on monthly basis.

ii. Maintain materials, spares, tools & tackles, logistics and accessories, which are necessary or usual for satisfactory and trouble-free operation and maintenance of the Solar Power Generating System(s).

c) The items of civil design and construction work shall include all works required for solar power generating system and should be performed specifically with respect to following but not limited to:

i. Conducting Soil testing of the allocated plot area.
ii. Conduction of contour survey and mapping of the whole plot area.
iii. Construction of foundation for mounting structures for SPV panels, considering life of Plant & existing soil/ natural conditions.
iv. Construction of foundation for transformers, switchgears, buildings (if any), equipment etc.
v. Necessary arrangement for module cleaning shall be made available in SPV array yard.
vi. Suitable Communication System.
vii. Perimeter lighting: Fabrication, supply & erection along with required GI Poles, junction boxes, support, brackets, accessories & LED lights as required.
viii. Supply of ferrules, lugs, glands, terminal blocks, galvanized sheet steel junction boxes with powder coating paint for internal fixtures, cable fixing clamps, nuts and bolts etc. of appropriate sizes as required in the Plant.
ix. Power Cables laying underground / over ground with proper cable tray arrangements
x. Entire GI cable tray with proper support and accessories inside equipment room and control room and other locations as required.

d) The contractor shall carry out the site surveys and submit the report approval to REIL and liason with EESL and DISCOM for the allotted substation (s) as per the time lines and formats. The report shall contain the details of the solar power generating system, proposed capacity of the solar power generating system etc. in site survey report format.

e) All approvals as necessary for setting up of a Solar Power Plant including CEIG/CEA/DISCOM, connectivity, power evacuation etc. as per the latest regulations / guidelines for which DISCOM will facilitate the bidder.

f) The Contractor shall arrange deployment of qualified and suitable manpower and required necessary tools, logistics, spares & consumables during construction, commissioning and O&M.

g) Complete responsibility of total Operation & Maintenance of Solar Power Generating Systems including all the infrastructure developed as a part of EPC Contract for 25 years from Operational Acceptance of the Plant, including deployment of necessary staff after the commissioning till final acceptance shall be with the Contractor. Any cost(s) associated with the project for successful commissioning and O&M during the project period shall be borne by the contractor.

h) All approvals, equipment, item and works which are not specifically mentioned in this document but are required for successful completion of work including construction, commissioning, O&M of Solar PV Power Plant (s) in every respect and for safe and efficient construction & erection, operation and guaranteed performance are included in the scope of the Contractor.

i) Submission of following documents, drawings, data design, and engineering information to REIL and its employer EESL and DISCOM or its authorized representative for review and approval in hard copy and soft copy from time to time as per project schedule.

i. Contour map of the complete land area.
ii. General arrangement, array layout diagrams and assembly drawings of all major equipment.
iii. Design basis criteria along with relevant standards (list of standards and respective clause description only).
iv. Design calculations and sheets with expected power loss at each stage and backup sheets, if any.

Lightening arrestor with area coverage also to be provided.

v. Detailed technical specifications of all the equipment.
vi. Schematic diagram for entire electrical system including single line diagrams (SLD)
vii. GTP & G.A. drawings for all types of structures/ components, 11 kV switchgears & other interfacing panels.
viii. Relay setting charts.
ix. Quality assurance plans for manufacturing and field activities.
x. Detailed site EHS plan, fire safety & evacuation plan and disaster management plan.
xi. Detailed risk assessment and mitigation plan.
xii. Test reports (for type, acceptance, and routine tests).
xiii. O&M Instruction's manuals and its drawings.
xiv. As-built drawings / documents and deviation list from good for construction (GFC).
xv. O&M plans, schedules and operational manuals for all equipment etc.
xvi. Daily progress update.
xvii. Weekly site work progress report with catch-up plan(s), as necessary to monitor actual timelines of the project during construction period along with the real time snap shots during the time of construction.
xviii. Monthly O&M reports after commissioning of the project.

j) All drawings shall be fully corrected to agree with the actual "as built" site conditions and submitted to REIL and EESL/DISCOM after commissioning of the project for record purpose. All as-built drawings must include the Good for Construction deviation list.
k) The Contractor shall provide a detailed training plan for all operation, maintenance procedures, which shall after approval by REIL and EESL/DISCOM form the basis of the training program. The contractor shall also provide training to DISCOM's nominated staff.
l) The Contractor shall 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.
m) Establishing a system to maintain an inventory of spare parts, tools, equipment, consumables and other supplies required for the facility's hassle free operation.
n) Adequate and seamless insurance coverage during construction period and O&M period to cater all risks related to construction and O&M of Plant to indemnify the REIL and EESL/DISCOM.
o) Maintain at the facility accurate and up-to-date operating logs, records and monthly reports regarding the generation, Operation & Maintenance of facility. Contractor shall also submit monthly energy bills (export, import etc.) to REIL and EESL/DISCOM before 3rd of every month.
p) Perform or contract for and oversee the performance of periodic overhauls or maintenance required for the facility in accordance with the recommendations of the original equipment manufacturer (OEM).
q) Procurement for spares parts, overhaul parts, tools, equipment, consumables, etc. required to operate and maintain the project in accordance with the prudent utility practices and having regarded to warranty recommendations during entire O&M period.
r) The contractor shall transfer (if any) and handover all the SPGS assets in good condition on completion of the 25 year period to EESL.
s) The Contractor shall, if advised by the Employer, clear all the debris / scrap / equipment in line with Govt. of India's guidelines and rules for waste management and disposal of waste, at the end of the 25 years of O&M period at no extra cost to REIL and its employer EESL.
t) Maintain and keep all administrative offices, roads, tool room, stores room, equipment, clean, green and in workable conditions.

All the type test reports along with Material Dispatch Clearance Certificate (MDCC) and MSDS for all applicable product & equipment and cables are to be submitted by the Contractor prior to the dispatch of the same. Contractor has to provide the type test report for all the equipment used under this contract. If the equipment is not type tested, the Contractor has to ensure conduction of such test and supply the type test Report to the REIL and EESL/DISCOM without any additional cost.

2. **Required Documentation**

Complete documentation shall be provided for the design, manufacturing/assembling, testing, installation, commissioning, start-up, operation, maintenance, repair and disposal of the solar power generating system components.

The bidder shall provide the following minimum documentation:

1. Project design document containing detailed engineering calculations, losses, drawings, simulation reports, performance guarantee etc.
2. Technical data sheets
3. Test reports and commissioning protocols
4. Installation, operation and maintenance manual

3. Operation & Maintenance (O&M):

i) The contractor shall be entrusted to carry out the total O&M activities of the Solar Power Generating System(s) upto the interconnection point as per the scope of work for the 25 (Twenty Five) years with immediate effect from the date of operational acceptance.

ii) The Turnkey contractor shall be responsible for all the required activities for the successful construction, running, guaranteed energy generation & maintenance of the Solar Power Generating Systems covering:

iii) Deputation of qualified and experienced engineers Supervisors & Technicians.

iv) Successful running of Solar Power Plant for guaranteed energy generation.

v) Co-ordination with DISCOM/other statutory organizations as per the requirement on behalf of EESL for Joint Metering Report (JMR), furnishing generations schedules as per requirement, revising schedules as necessary and complying with grid requirements updated time to time.

vi) Monitoring, controlling, troubleshooting maintaining of logs & records, registers.

vii) Supply of all spares, consumables and fixing / application as required.

viii) Supply & use of spares, consumables, tools, logistics and skilled manpower throughout the maintenance period as per recommendations of the equipment manufacturers and requirement of the Plant & other associated infrastructure developed under the scope of EPC works.

ix) Conducting periodical checking, testing, overhauling, preventive and corrective action.

x) Up keeping of all equipment, building, roads, Solar PV modules, inverters etc.

xi) Arranging & updating any licenses/permits required for successful operation of plant (s).

xii) Submission of periodical reports to EESL/DISCOM on the energy generation & operating conditions of the power plant.

xiii) Furnishing monthly JMR statements to EESL/DISCOM by 3rd of every month.

xiv) Contractor shall be responsible for making all the payments towards renewal of all the permits / clearances etc. (if required) to the Government bodies /DISCOM /STU for smooth operation of the project.

xv) Periodic cleaning of solar modules as per the recommendations of OEM & existing site conditions.

xvi) Repair & replacement of components of SPGS including all other associated infrastructure developed as a part of EPC Works which has gone faulty or worn-out components including those which has become inefficient.

b) Continuous monitoring the performance of the Solar Power Generating Systems and regular maintenance of the whole system including Modules, PCU's, transformers, outdoor/indoor panels/ kiosks and other infrastructure developed as a part of EPC works in order to extract & maintain maximum energy output from the SPGS & serviceability from the associated infrastructure

(i) Preventive and corrective maintenance of the complete Solar Power Plant and associated infrastructure developed as a Part of EPC work, including supply of spares, consumables, repair & replacement of wear and tear, overhauling, replacement of damaged modules, invertors, PCU's and insurance covering all risks (Fire & allied perils, earth quake, terrorists, burglary, power output warranty of solar PV modules and others) as required, for a period of 25 (Twenty Five) years from the date of start of O&M of the project.

(ii) The period of Operation and Maintenance will be deemed to commence from the date of Operational acceptance. EESL may extend the O&M period beyond the project duration at mutually agreed terms and conditions.

(iii) All the equipment required for Testing, Commissioning and O&M for the healthy operation of the SPGS must be calibrated, time to time, from the NABL accredited labs and the certificate of calibration must be provided prior to its deployment.

c) Operation and Performance Monitoring

(i) Operation part consists of deputing necessary manpower required to operate the Solar Power Generating System (s) at the full capacity. Standard Operation procedures (SOPs) such as preparation to starting, running, routine operations with safety precautions, monitoring etc., shall be carried out as per the manufacturer's instructions & best engineering practices to have trouble free & optimum operation of the complete system with maximum possible energy generation.

(ii) Daily work of the operation and maintenance in the Solar Power Generating System (s) involves periodic cleaning of Modules, logging the voltage, current, power factor, power and energy output of the Plant at different levels along with fault/breakdown log. 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 operator shall record monthly energy output, down time (due to solar power plant and grid), fault logs & their Root Cause Analysis reports etc.

d) Maintenance

(i) The contractor shall carry out the periodical plant maintenance as given in the manufacturer's service manual and perform operations to achieve committed generation.

(ii) Regular periodic checks of the m odules, PCU's and other switchgears shall be carried out as a part of routine corrective & preventive maintenance. In order to meet the maintenance requirements stock of consumables are to be maintained as well as various spare as recommended by the manufacturer.

(iii) Maintenance of other major equipment involved in Solar Photovoltaic Power Generating System are transformers, underground/ over head cables, indoor/ outdoor VCB/ SF6 kiosk, associated switchgears, other fixtures & components metering panel, fire protection system & other infrastructure developed as a part of scope of Work during development of Plant. Particular care shall be taken for outdoor equipment to prevent corrosion. Earth resistivity of plant as well as individual earth pit is to be measured and recorded every month. If the earth resistance is high, suitable action is to be taken to bring down the same to required level.

(iv) A maintenance record is to be submitted to operation/engineer-in-charge to record the regular maintenance work carried out as well as any breakdown maintenance along with the date of maintenance reasons for the breakdowns steps have taken to attend the breakdown duration of the breakdown including action taken to avoid the same in future.

(v) The 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/night. An information shall be provided to Engineer-in-charge for such operation prior to start.

(vi) The Contractor will attend to any breakdown jobs immediately for repair/replacement /adjustments and complete it at the earliest working round the clock. During breakdowns (not attributable to normal wear and tear) at O&M period, the Contractor shall immediately report the accidents, if any, to the Engineer In-charge showing the circumstances under which it happened and the extent of damage and or injury caused.

(vii) The Contractor shall comply with the provision of all relevant acts of Central or State Governments including but not limited to Payment of Wages Act 1936, Minimum Wages Act 1948, 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.

(viii) The contractor shall at his own expense provide all amenities to his workmen as per applicable laws and rules.

(ix) The Contractor shall ensure that all safety measures are taken at the site to avoid accidents to his or his sub-contractor or EESL/DISCOM's Workmen.

(x) If negligence / mal-operation of the contractor's operator results in failure of equipment such equipment should be repaired replaced by contractor at free of cost.

e) Quality Spares & Consumables

In order to ensure longevity and safety of the core equipment and optimum performance of the system the contractor should use only genuine spares of high quality standards.

f) Testing Equipment, Tools and Tackles

The Contractor shall arrange for all the necessary testing equipment, tools and tackles for carrying out all the construction, operation and maintenance work covered under this contract. All the instruments are required to be calibrated from NABL accredited lab before put in use. The certificate of the same shall be submitted to EESL/DISCOM for verification.

g) DISCOM's Scope of Work

i. Existing security staff of DISCOM at the substation (s) may be utilized for the security of the power plant at substations, however the Contractor has to take necessary measures for security of the equipment/plants for smooth operation & maintenance including guaranteed minimum energy output.

ii. With prior approval from the DISCOM, the contractor may use the DISCOM's control room in the existing substation. However, contractor may construct a separate control room(s) for power plant.

iii. DISCOM may assist to contractor for availing the following during construction and O&M period:

- Water supply
- Electricity supply

iv. DISCOM will provide the developed land plot for establishing the small solar PV power plant(s)
v. DISCOM will construct and maintain the approach road to the site.
vi. DISCOM will construct fencing to the land plot.
vii. DISCOM will construct & erect complete evacuation line along with ABT meters (including metering panel) from the switchyard of solar power project at DISCOM substation. .O&M of this evacuation system will be carried out by DISCOM.
viii. Construction of bays and installation of all necessary associated equipment's and protection & metering system at interconnection point at DISCOM substations.
ix. DISCOM will provide the support to contractor for grid connectivity & SLDC clearance.
x. Evacuation voltage for the solar PV plants would be at 11kV for all plants.

h) Construction Power & Water Supply

(i) Cost of electricity and water required during construction and O&M shall be payable by the contractor. For construction, temporary connection for construction power from DISCOM/suitable supply source shall be arranged by the contractor as per applicable tariff.
(ii) The EESL/DISCOM shall not provide facility for storage of material, and accommodation for labours at site. The Contractor shall make his own arrangement for the above.

i) Warranty

a. PV modules used in grid connected small solar power plants by considering a linear degradation must be warranted for peak output wattage, which should not be less than 90% at the end of 10 years and 80% at the end of 25 years. Bidder to submit and take the approval on the quality plan (including Visual, Dimensional, HV, IV, EL etc.) for solar PV modules from EESL. EESL/DISCOM officials reserves the right to carry out the Pre Dispatch Inspection of solar PV modules and other components at manufacturer facility (ies) before dispatch to site/s. At least 15 days' notice to be given by bidder to EESL for carrying out the PDI.
b. The Inverters/PCUs installed in the solar power plant must have a warranty for the project period.
c. The mechanical structures, electrical works and overall workmanship of the grid connected Solar Power Plant must be warranted for a period of 25 years from the date of Commercial Operation Date.
d. The Contractor must ensure that the goods supplied under the contract are new, unused and of most recent or current models and incorporate all recent improvements in design and materials unless provided otherwise in the Contract.
e. During the period of Warranty/Guarantee the Contractor shall remain liable to replace any defective parts, that becomes defective in the Plant, of its own manufacture or that of its sub-Contractors, under the conditions provided for by the Contract under and arising solely from faulty design, materials, workmanship or any reason attributable to works carried out by the contractor, provided such defective parts are not repairable at Site. After any replacement, the defective parts shall be returned to the Contractors works at the expense of the Contractor unless otherwise arranged.
f. During the Operation & Maintenance, the Contractor shall be responsible for any defects in the work due to faulty workmanship or due to use of sub-standard materials in the work. Any defects in the work during the O&M period shall therefore, be rectified by the Contractor without any extra cost to the EESL/DISCOM within a reasonable time as may be considered from the date of receipt of such intimation from the EESL/DISCOM failing which the EESL/DISCOM reserves the right to take up rectification work at the risk and cost of the Contractor.
g. Warranty certificate issued by the manufactures shall be submitted and individual factory test report of manufactures shall also to be submitted along with invoice of the supply order after

delivery. Every item should bear serial number provided during the manufacturing process. These serial numbers should be mentioned by manufacturer in all the following documents, while submission of bills after delivery of the order items:-

- Invoice
- Factory test report (In house test report generated during manufacturing)
- Warranty certificate

h. If contractor does not rectify/supply the said problem after written notices than the defected equipment as per BOM noticed shall be rectified/purchased through CPG amount of contractor deposited in EESL.

j) Rejection of Materials

The REIL/EESL/DISCOM's decision in regard to the quality of the material and workmanship will be final. The Contractor at its own cost and risk without any compensation shall immediately remove any material rejected by the REIL/EESL/DISCOM from the Site of work.

k) Labour Engagement

The Contractor shall be responsible to provide all wages and allied benefits to its labours engaged for execution of the project work and also to carry out Operation & Maintenance service.

The Contractor shall remain liable to the authorities concerned for compliance of the respective existing rules and regulations of the government for this purpose and shall remain liable for any contravention thereof. The contractor is encouraged to use local manpower as per the local statutory (labour) requirement, if any.

l) Training of DISCOM's Personnel

On successful commissioning of the Plant, the Bidder shall provide training on Plant operations and maintenance to a team (Engineers and Technician/ Operators) as nominated by REIL/EESL/DISCOM, within first three months of Operation of Plant.

m) Authorized Test Centers for test certificates

The transformers/ inverters/ cables and other Balance of system equipment deployed in the solar PV power Plant shall have valid test certificates for their qualification as per above specified IEC/ IS Standards by one of the NABL Accredited Test Centers in **India.** In case of module types/ equipment for which such Test facilities may not exist in **India,** test certificates from reputed ILAC Member body accredited Labs abroad (with proof of accreditation) will be acceptable.

n) Solar Power Generating System (s) Performance Guarantee

a) The Plant performance will be evaluated through number of generated Energy generation in any year from each project at substation as per Clause 12 'Guaranteed Energy Generation' of 'Specifications'.

b) During O&M contract, the Plant performance will be evaluated based on guaranteed energy generation. For guaranteed energy generation, please refer to Annexure 4 of this section.

c) Bidders are expected to make their own study of solar radiation profile and other related parameters of the area & make sound commercial judgment about the guaranteed energy generation. It shall be the responsibility of the Bidder to assess the corresponding solar insolation values and related factors of solar Plant along with expected grid availability.

d) The performance of Plant may also be verified by the contractor based on minimum CUF demonstrated at the end of every year from the date of Operational Acceptance till the culmination of the O&M period. During this period, the contractor shall operate and maintain the Plant with full reliability and up keep.

o) Operation & Maintenance (O&M)

The Operation and Maintenance shall be comprehensive. The maintenance service provided shall ensure project functioning of the Solar PV system as a whole and Power Evacuation System to the extent covered in the Contract. All preventive / routine maintenance and breakdown / corrective maintenance required for ensuring maximum uptime shall have to be provided. Accordingly, the Comprehensive Operation & Maintenance shall have two distinct components as described below:

i) Preventive / Routine Maintenance:

This shall be done by the Contractor regularly and shall include activities such as cleaning and checking the health of the Solar PV system, cleaning of module surface, tightening of all electrical connections, and any other activity including the associated civil works, wear and tear that may be required for proper functioning of the Solar PV system as a whole. Necessary maintenance activities, Preventive and Routine for transformers and associated switch gears and transmission line also shall be included.

ii) Breakdown / Corrective maintenance:

Whenever a fault/failure/breakdown/malfunctioning occurs, the Contractor has to attend to rectify the fault & the fault must be rectified within the 48 hours from the time of occurrence of fault, failing which LD will be applicable in line with Clause a.16 'Liquidated Damages' depending upon nature of fault/failure/defect/ breakdown/malfunctioning. The contractor must maintain all the records pertaining to such faults/failure/breakdown/malfunctioning and necessary measures taken. The date of Comprehensive Operation & Maintenance Contract period shall begin on the date of Successful demonstration of guaranteed energy generation i.e. operational acceptance. However, operation of the Power Plant means operation of system as per bid and workmanship in order to keep the project trouble free covering the guarantee period. The contractor must demonstrate the committed CUF at the end of every year in accordance with commitment made in the Techno- Commercial Enclosures of the Bid.

iii) Serviceability Level Agreement (SLA)

a) Contractor shall make efforts to maintain 100 % serviceability of complete Plant including all other associated infrastructure developed by the Contractor during execution of project as its scope of work.
b) Contractor shall produce monthly serviceability report for individual components of the plant & associated infrastructure to the EESL/DISCOM by 5th of next month.
c) Contractor shall maintain a Complaint log book, which shall include the timing of logging of complaint including unique Complaint number, time of closure of complaint & its Root Cause Analysis.
d) Such rectification work carried out by EESL/DISCOM doesn't exempts/relieves Contractor from its responsibility towards subsequent operation, maintenance, repair & replacement of such component/ infrastructure of the Plant or meeting the performance parameters of the Plant.
e) O&M Routine & Manpower: Contractor shall provide Preventive / Routine Maintenance schedule based on Original Equipment manufacturer and good engineering practices.

p) Project Timelines

The project would be developed in two parts.

Part I: Site Surveys, submission of drawings for approval, Minutes of Meet, project design document.
Part II: Implementation of small solar power plants including O&M for 25 years
Part I:

The Contractor shall submit the plan for carrying out site surveys within one week from the date of issuance of LoA. The contractor shall complete the site surveys of all the allotted substations within ten (10) days from the date of issuance of LoA. The contractor shall submit the final array layout,

Electrical Single Line Diagram (SLD), site survey reports and project design document as per the timelines shown below:

Part II:

The date of handover of substation site (s) to the contractor for implementation of Solar Power Generating System (SPGS) shall be treated as Zero date. The contractor shall submit the detailed execution plan (MS Projects/PERT/GANTT chart etc.) within one week (07 days) from the date of issuance of NTP.

The time lines for Completion of the EPC Works is 90 days from the Zero date.

Note: However, extended timeline due to delay in handing over of land to the Contractor shall not have financial liability on EESL.

q. Timelines for Scope of work in Days

S. No.	Stage	Reference from D
1.	Issue of LOA / NTP	Zero Date (D)
2.	The contractor shall submit the detailed execution plan (MS Projects/PERT/GANTT chart etc.)	D+7
3.	Commencement of civil and allied works	D+ 15
4.	Supply of major equipment like Solar PV modules, Modules Mounting Structures, Power Conditioning Units (PCU)/Inverter, Transformers, BoS etc.	D+30
5.	Installation of all major equipment including MMS, Solar PV modules, Inverters / PCU, Transformers etc..	D+ 45
6.	Complete installation, testing and Pre-commissioning of small Solar PV Power Plant/Solar Power Generating System	D+ 60
7.	Commissioning of Plant (SPGS) along with Completion of Facilities in line with Technical/Functional/Performance Requirement stated under this Tender Document.	D+90

Guaranteed energy generation demonstration Test as Per Technical Specification for Operational Acceptance shall be done only after commissioning of Plant & Completion of all associated infrastructure as mentioned under Technical Specification.

r. Part Commissioning

Contractor is allowed to commission any of the allocated site(s) with a minimum capacity of 500 kWp and above only. However, the contractor shall submit the final testing and commissioning reports for claiming the same.

s. LIQUIDATED DAMAGES

In case of shortfall in guaranteed energy generation or any delay in the execution of the order beyond the stipulated time schedule decided including any extension permitted in writing, REIL reserves the right to recover from the Contractor for the loss incurred due to delay in commissioning or shortfall in guaranteed energy generation as indicated in the table below.

Alternatively, REIL reserves the right to purchase the material and completion of the works from elsewhere at the sole risk and cost of the successful bidder/ contractor and recover all such extra cost incurred by REIL in procuring the material from resources available including EMD/Bid security/ encashment of the bank guarantee or any other sources etc. and in case of shortfall of some resources bidder shall deposit the same with REIL forthwith. Further, if any extra cost is incurred by REIL due to delay in work completion by the party beyond the completion time as per PO/LOA, the same shall be recovered from the party's Invoice/EMD/BG etc. If recovery is made from CPG, in such cases, contractor is required to recoup the BG on immediate basis. REIL may adjust all amount recoverable from successful bidder from any amount payable to him.

Alternatively REIL may cancel the order completely or partly without prejudice to his right under the alternatives mentioned above.

i. Liquidated Damages (LD) for delay in commissioning

In case the commissioning of project is delayed or the contractor is not able to meet the timelines as mentioned in tender then the contractor shall pay the Liquidated Damages (LD) at the rate mentioned below for the un-commissioned capacity:

Delay Period	**Penalty**
Upto 30 days	1.15 x loss of generation in no. of unit for days of delay (calculated on pro rate basis as per Clause 12 of 'Specification') X Rs. / kWh (Per kWh rate in Rs. As per PPA between EESL & respective DISCOM)
From 31-60 days	1.2 x loss of generation in no. of unit for period of delay (calculated on pro rate basis as per Clause 12 of 'Specification') X Rs. / kWh (Per kWh rate in Rs. as per PPA between EESL & respective DISCOM)
From 61 & above days	1.25 x loss of generation in no. of unit for period of delay (calculated on pro rate basis as per Clause 12 of 'Specification') X Rs. / kWh (Per kWh rate in Rs. as per PPA between EESL & respective DISCOM)

If contractor failed to commission the project beyond 90 days of COD as mentioned in project timeline REIL reserves the right to terminate the contractor and contractor shall reimburse to REIL, the loss incurred.

Note: Contractor shall inform in writing to MSEDCL and REIL/EESL by atleast 30 days in advance regarding the date of Commercial Operations Day of the respective site(s). However the delay in synchronization and commissioning due to DISCOM may be excluded from LD

ii. Liquidated Damages (LD) for deviation in Guaranteed Energy Generation.

The Contractor shall guarantee the energy generation from the project as per the table in the given tender.

In case the contractor is not able to meet the guaranteed energy generation per the table given in tender, then the contractor shall be liable to pay the Liquidated Damages (LD) as per below mentioned formula:

Description	Calculation
Liquidated Damages	1.15 x No. of kWh shortfall in a year (calculated on pro rata basis given in tender) X Rs./kWh (As per PPA signed between EESL and DISCOM)

The Liquidated damages amount calculated may be adjusted from any amount payable by REIL to the contractor or CPG.

In case the Project fails to generate any power continuously for 30 days 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 CPG will be encashed. In case the amount discovered in an event of default is more than the encashed CPG amount, then REIL reserves the right to recover the differential amount from other ongoing projects (if any) or by other means, as applicable from the bidder. The contractor has to rectify the solar power plant(s) without any extra cost to REIL AND EESL/DISCOM. The contractor shall take necessary corrective measures to guarantee the minimum energy generation as per TENDER.

In case of partial or full encashment of CPG by REIL , the bidder shall recoup the CPG with in 28 days.

t. INCENTIVE FOR EXCESS ENERGY GENERATION

Contractor has to guarantee the minimum energy generation in any year as per given in tender. In case, the gross energy generated by the project is more than the minimum guaranteed energy generation, the contractor will be paid an incentive as per the below calculation:

Description	Calculation
Incentive	No. of excess kWh generated in a year (over an above the energy as per given in tender) X Rs. One /kWh (inclusive of all taxes, duties, cesses, etc.)

The incentive amount shall be calculated at the end of the every O&M Year and paid to the Contractor in the next bill amount.

u. Third Party Inspection Agency

A third party inspection agency ("Third Party Inspectors" or "TPI") may be appointed by REIL/ EESL/DISCOM, at its sole discretion, to conduct any kind of inspection regarding but not limited to procurement, fabrication, installation, hook-up and commissioning during the execution of the Project. The Contractor shall provide necessary access and coordination to conduct such inspections. The extent of third party inspectors' involvement shall be finalized after mutual discussions between the Contractor and REIL/ EESL/DISCOM.

REIL and EESL/DISCOM or its authorised representatives, reserve the right to inspect the project components, as per project schedule to ensure compliance of the quality of Components/ material as per the specification and data sheet, before dispatch to site. REIL/ EESL/DISCOM at its own discretion will visit the premises for inspection with prior intimation to the Contractor. It is the responsibility of the contractor to inform REIL/ EESL/DISCOM at least 14 days prior to the despatch of the project equipment. All administrative expenses for REIL/EESL/DISCOM or its authorised representatives, will be borne by REIL/EESL/DISCOM for above inspections. However, all the expenses related to testing and inspection at manufacturer/ supplier premises or at project site shall be borne by the contractor only.

In case contractor fails to show the compliance for the component under inspection as per Technical Specification & approved drawing /design & same is not approved for mass production or dispatch, in such cases Contractor shall bear the expenses towards visit of REIL/EESL/DISCOM's team for subsequent visit/s for inspection of same component.

v. INSURANCE

A.: Obtain the insurance policies: Successful bidder/contractor shall obtain the policies**.**

B: Insurance policy expenses: Successful bidder/contractor shall bear all expenses irelation to obtaining policies, as described in this clause.

C: Insurance Policy: Successful bidder shall obtain the insurance policy as under:

i. During the Contract period, i.e., during Construction, all insurance related expenses shall be borne by the Contractor. The goods supplied (including the Solar PV modules) under the Contract shall be fully insured against the loss or damage incidental to manufacture or acquisition, transportation, storage and delivery in such a manner that REIL/ EESL/DISCOM shall not incur any financial loss, as long as the plant continues to remain under the custody of the Contractor.

ii. Adequate and seamless insurance coverage during construction period and O&M period to cater all risks related to construction and 0&M of Plant to indemnify the REIL/ EESL/DISCOM. The insurance during the construction and O&M period shall also cover the Solar PV modules. Insurance certificate of warehouse and / storage facility shall be submitted to REIL/ EESL before the start of the erection and commissioning work.

iii. In case of any loss or damage or pilferage or theft or fire accident or combination of the said incidents etc. under the coverage of insurance, the Contractor shall lodge the claim as per rules of insurance. Any FIR required to be lodged to local Police Station shall be the responsibility of the Contractor.

iv. The Contractor shall arrange to supply/ rectify/ recover the materials even if the claim is unsettled for timely completion of the project. The final financial settlement with the insurance company shall rest upon the Contractor.

v. In case of any delay of the project attributable to the Contractor, the Contractor himself in consultation with EESL/DISCOM should take the extension of insurance. Any financial implications shall, however, be borne by the Contractor.

vi. The Contractor should arrange for providing insurance coverage to its workmen under Workmen's Compensation Act or similar Rules,and Acts as applicable during execution of work for covering risk against any mishap to its workmen. The Contractor shall also undertake a Third Party Insurance. The REIL/ EESL/DISCOM will not be responsible for any such loss or mishap.

vii. All other insurance like In - transit insurance (Marine/ Cargo/ others as applicable), Contractor All Risk, Erection All Risk, workmen compensation , third party liability, insurance against theft and acts of GOD and others as required for the Construction and O&M of the Plant and to indemnify the REIL/ EESL/DISCOM/ equipment/ material and resources shall be borne by the Contractor. Fire insurance is to be arranged by the Contractor up to the years of O&M of the Contract.

viii. EESL/DISCOM shall be named as co - insured under all-insurance policies taken out by the contractor pursuant to Clause Arbitration in teder, except for the workmen compensation, third party liability and EESL/DISCOM's liability insurances. Also, Contractors' sub - contractor shall be named as co - insured under all insurances taken out by the contractor pursuant to Arbitration given in tender except for Cargo insurance, workmen compensation insurance and REIL/ EESL/DISCOM's liability insurance. All insurers' rights of subrogation against such co - insured for losses or claims arising out of the performance of the contract shall be waived under such policies.

ix. All the insurance cover taken for the construction and O&M period shall be seamless in nature.

x. The insurance are to be suitably taken for the activity/ act which is required to cover all the risks associated to the activity / act. The contractor shall be responsible to take suitable insurance till the

completion of the O&M contract and indemnify the REIL/EESL/DISCOM from all associated risks whatsoever

w. **TRANSPORTATION, DEMURRAGE, WHARF AGE, ETC. -**

Contractor 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 Contractor, and the related cost shall be included in the Contract Price.

Successful bidder, on whom letter of award is placed, is to ensure all safety guidelines, rules and regulations, labour laws etc. Successful bidder indemnifies REIL/ EESL for any accident, injury met by its labour, employee or any other person working for him. Any compensation sought by its labour, employee or any other person working for him shall be paid by successful bidder as per settlement solely. REIL/ EESL has no role to play in this matter.

GENERAL TERMS & CONDITIONS OF THE CONTRACT

1) AMENDMENT

Except as otherwise provided herein, no addition, amendment to or modification of the Contract shall be effective unless it is in writing and signed by and on behalf of both parties.

2) SEVERABREILITY

In the event that any or any part of the terms conditions or provisions contained in the Contract shall be determined invalid, unlawful or unenforceable to any extent such term, condition or provision shall be served from the remaining terms, conditions and provisions that shall continue to be valid and enforceable to the fullest extent permitted by law.

3) CONFIDENTIAL TREATMENT

It is understood and agreed that data, know-how and other such proprietary information that was provided or will be provided by either party, will remain confidential.

4) RELATIONSHIP OF THE PARTIES

REIL relationship with Vendor will be that of a Business Associate, and nothing in this Contract shall be construed to create a relationship, joint venture, partnership.

5) INDEMNITY

REIL and the Vendor will indemnify, defend, and hold harmless each other and its divisions, successors, subsidiaries and affiliates, the assigned of each and their directors, officers, agents and employees from and against all liabilities, claims, losses, and damages of any nature, including, without limitation, all expenses (including attorney's fees), cost, and judgments incident there to REIL and REIL's obligations under this indemnity will survive the expiration, termination, completion or cancellation of this Contract or an order hereunder.

6) RESTRICTIN ON EMPLOYMENT

Both the parties have agreed that they will not recruit any members of staff of other party directly or indirectly.

7) ARBITRATION

All disputes arising out of this contract and questions relating to its interpretation etc. shall be referred to the contract committee headed by ED/GM and if not resolved shall be referred to the sole arbitration of Managing Director, Rajasthan Electronics & Instruments Ltd., for his decision, which shall be final and binding on both parties. The Venue of Arbitration proceedings shall be at Jaipur.

8) RISK AND COST

In the event of failure on the part of the contractor in the supply, installation and commissioning of goods and services, which is required in view of the pending orders, REIL shall be entitled to cancel the remaining order and procure the outstanding quantity through other sources at risk and costs of the contractor.

9) TERMINATION OF CONTRACT:

REIL shall be entitled to terminate this Contract, in the event of any or all or any of the following events, with a written notice of 15 days with due consent of the Vendor:-

i. has abandoned the Contract
ii. has without valid reason failed to complete the projects in respect of the contract.
iii. persistently fails to execute the Contract in accordance with the Contract or persistently neglects to carry out its obligations under the Contract without just and proper cause.

10) DURATION OF CONTRACT

This contract shall take effect on the day of execution of this contract and shall endure for the period of 5 year from date of commissioning and hand over the Power Plant(s) to beneficiary and renewable as per mutual agreement.

11) GOVERNING LAW

This contract and its validity, interpretation and performance will take effect and be governed under the laws of India. Venue in any action in law or equity arising from the terms and conditions of this contract shall be the court of appropriate jurisdiction in Jaipur, Rajasthan (India)

12) PREFERENCE TO MSE

Preference to MSE will be given and procurement from SC/ST and Women Entrepreneurs shall be done as per the government guidelines. Start Ups are exempted from condition of prior turnover and prior experience subject to meeting of quality and technical specifications.

13) CONTRACT:

Before execution of the work, security deposit be submitted and a contract agreement for execution of the work shall be signed by the Vendor with REIL within 7 days of LOI from REIL. In case agreement is not executed within the stipulated time, earnest money will be forfeited.

Annexure-II

SECTION-IV

TECHNICAL REQUIREMENT OF SOLAR POWER PLANT

Minimum Technical Specifications of Solar Power Generating System(s) are as follow:

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.

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. 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. 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.

Shadow free plant layout to ensure minimum losses in generation during the day time. Higher system voltage and lower current options to be followed to minimise ohmic losses. Selection of PCUs with proven reliability and minimum downtime. Ready availability of requisite spares. 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. Each component offered by the bidder shall be of established reliability. The bidder may be allowed to install a higher solar PV array as per tender Specifications. In case the bidder wishes to install a higher DC side capacity other than the one mentioned as per teder Specifications, prior approval must be required from EIC for any additional higher DC side capacity. However, REIL reserves the right to accept or reject any additional DC side capacity. 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.

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

Bidders must mandatorily follow the latest codes/standards for all the material being used in the projects and other requirements as per notifications being published by Ministry of New and Renewable Energy (MNRE), Govt. of India from time to time.

1. Bill of Material:

The equipment and material for 0.5MW to 2 MW (AC) or More capacities Grid Interactive Solar Photovoltaic Power Plant with associate system (typical) shall include, but not limited to the following:

S. No	Items	Unit
1	Solar SPV Modules **(To be supplied by REIL)**	Nos.
2	Module Mounting Structures including-fasteners and damps	Set
3	Main Junction Boxes with monitoring capabilities	Lot
4	Solar module array to Junction box Interconnection cable (Cu), MC4Connectors	RM
5	Junction box to Inverter Interconnection Cable (Cu/ Al)	RM
6	Connection accessories - lugs, ferrules, glands, terminations etc.	Lot
7	AC Cable (LT/ HT) of appropriate sizes	RM
8	Power Conditioning Units/ Inverters	NOS.
9	String level monitoring system (SCADA) and ancillaries	Set
10	Transformers (Power, Inverter and Auxiliary)	Set
11	Circuit breakers, CT and PT set (at all voltage levels used)	Set
12	11 kV Indoor/ outdoor interfacing panels with CT, VCB, PT, Relays etc.	Set
13	11 kV XLPE Outgoing feeder cable and associated infrastructure	Set
14	AC & DC distribution panels/ boards, PDB, LDB etc.	Lot
15	Control and Relay Panel	Lot
16	Lightning Arresters of suitable ratings	NOS.
17	Earth mat for switch yard, DC field array and equipment	Lot
18	Control and power cables	Lot
19	Surge Protection devices and Fuses	Set
20	Earth cables, flats and earthing pits	Lot
21	Equipment and Control room with associated equipment	Lot
22	Rubber Mats for specific kV ratings and safety gadgets, PPE etc.	Lot
23	Fire extinguisher e- Foam type, CO2 type, ABC type etc., as applicable	Lot
24	Sand Buckets	Lot
25	Discharge Rods	Lot
26	Cable for power evacuation with suitable support system.	Lot
27	Power efficient peripheral lighting arrangement for the Plant safety	NOS.
28	Fire - Alarm system and signboards in buildings	Lot
29	Metering Equipment (Meters, and associated CT and PT's)	Set
30	CCTV cameras including monitoring system	Set
31	Danger sign plates, anti-climbing, bird protection etc.	Lot

All the information shown here is indicative only and may vary as per design and planning by the Contractor. The Contractor must provide the BOM of the Plant as per the design during the time of bidding.

The technical features of major equipment are described hereunder.

2. Photovoltaic Modules (REIL will supply the SPV Module at site)

Technical Specs of Solar PV Modules

- All the components shall be in accordance with technical specifications given in relevant latest IS/IEC standards. Use of PV modules with higher power output is preferred.
- PV module (s) containing crystalline silicon should be used.
- Each of the Solar PV module shall be rated for a minimum of 300 Watts peak with 72 cells & above. The Solar PV modules shall have a positive power tolerance
- The efficiency of the PV modules should be minimum 16% and fill factor should be more than 75%.
- Power Output Warranty: PV modules must be warranted for output wattage, which should not be less than 90% at the end of 10 years and 80 % at the end of 25 years.
- Any damage/rejection should be made good or replaced immediately without any extra cost or loss to EESL.
- The PV modules shall be supplied with the suitable Aluminium frame. The terminal box on the module should have a provision for "Opening" for replacing the cable, if required.
- The Contractor shall obtain the approval of the Quality plan prior to manufacturing/ inspection call. 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 cells shall be used. The modules shall be uniformly laminated without any lamination defects. Modules have to grouped and rated as per the below table:

Power Output of the solar PV modules	**Rated power output of the Modules (Rating sticker)**
300 – 304.99 Wp	300 Wp
305 – 309.99 Wp	305 Wp
310 – 314.99 Wp	310 Wp
315 – 319.99 Wp	315 Wp
320 – 324.99 Wp	320 Wp
325 – 329.99 Wp	325 Wp
330 – 334.99 Wp	330 Wp

Note: Grouping of any of the modules (as per above table or higher wattage) have to be done as per the above order. The band of any of the modules supplied by the contractor shall have to be arranged in a similar manner as per the range mentioned in the above table.

The PV modules used in the grid connected solar power projects must qualify to the latest edition of the following IEC or IS qualification test or standards.

Sl No.	**Code/Standard**	**Description**
1	IEC 61215	Crystalline silicon terrestrial photovoltaic (PV) modules

		– Design qualification and type approval
2	IEC 61701	Salt mist corrosion testing of photovoltaic (PV) modules
3	IEC 61853- Part 1/ IS 16170	Part 1 for Photovoltaic (PV) module performance testing and energy rating. Irradiance and temperature performance measurements and power rating
4	IEC 62716	Photovoltaic (PV) Modules – Ammonia (NH3) Corrosion Testing
5	IEC 61730 Photovoltaic (PV) Module Safety Qualification –	Modules must qualify to Part 1: Requirements for Construction, Part 2: Requirements for Testing
6	IEC 62804	test methods for detection of PID (potential-induced degradation)
7	IEC 60068	Environmental testing

* Supplier to submit all the above requisite latest test certificates of solar PV modules at the time of submission of the bid.
* Four bus bar or better technology solar PV modules to be used.
* Bidder must submit valid Construction Data Form (CDF) in support of Bill of Material (BoM).

The Solar PV module shall be free of potential induced degradation (PID). The PID test of module, the system voltage will be subject to a conditioning of three cycles at 85 deg.C and 85% RH for a period of 96 hours.

In case of expiration of standards or inapplicability, local standards and regulations may apply.

Note- Equivalent standards may be used. In case of clarification following person/agencies may be contacted.

i. Ministry of New and Renewable Energy (MNRE, Govt. of India)
ii. National Institute of Solar Energy (NISE)
iii. The Energy & Resources Institute (TERI)
iv. UL
v. MNRE / NABL accredited labs

Identification and Traceability

Each PV module used in any solar power Project must use a RF identification tag. The following information must be mentioned in the RFID used on each module (This can be inside or outside the laminate, but must be able to withstand harsh environmental conditions)

i. Name of the manufacturer of PV Module
ii. Name of the Manufacturer of Solar cells
iii. Month and year of the manufacture (separately for solar cells and module)
iv. Country of origin (separately for solar cells and module)

v. I-V curve for the module at Standard Test Condition (1000 W/m2, AM 1.5, 250C)
vi. Wattage, Im, Vm and FF for the module
vii. Unique Serial No. and Model No. of the module
viii. Date and year of obtaining IEC PV module qualification certificate
ix. Name of the test lab issuing IEC certificate
x. Other relevant information on traceability of solar cells and module as per ISO-9000
xi. EESL Logo including a disclaimer note of "Government Supply, Not for sale in retail market" Color coding of the modules, Anti-theft mechanism etc. The instructions to successful bidder(s) shall be provided by the EESL at the later stage.

Required Testing

Factory Acceptance Tests (FAT)

The Quality Plan/ test program for the Factory Acceptance Tests (FAT) shall be submitted to EESL for approval at least 4 weeks prior commencing of tests. The test report shall be submitted prior to shipment of material.

EESL reserves the right to visit the PV module factory at any time during manufacturing process to assess quality and production scheduling status.

Additional Independent Test

Additional independent certified Third Party testing of the PV modules is required. The bidder shall propose a list of Third Party testing laboratories for EESL approval. The bidder shall organize and facilitate the EESL visit and/or testing in the factory or laboratory, if required.

EESL reserves the right to select PV modules randomly for the following tests:

- Module performance tests
- Module behavior test (irradiation and temperature)
- Module electroluminescence tests
- All testing must be included in the proposal and be supported by the bidder.

Site Tests

- The PV modules shall be subject to witness testing onsite to ensure their performance.
- The testing should be performed during the following phases of the project:
  - Pre-commissioning
  - Commissioning and test on completion
  - Performance tests

The site tests shall be witnessed by the EESL. The commissioning test program shall be submitted at least 2 weeks prior in advance of any testing.

Safe Disposal of Solar PV Modules

The bidder will ensure that all Solar PV modules from their plant after their end of life' (when they become defective/ non-operational/ non-repairable) are disposed in accordance with the "e-waste (Management and Handling) Rules, 2011" notified by the Government and as revised and amended from time to time.

Authorized Test Centres

The PV modules deployed shall have valid test certificates for their qualification as per above specified IEC/ BIS Standards by one of the NABL Accredited Test Centres in India. In case of module types/ equipment for which such Test facilities may not exist in India, test certificates from reputed ILAC Member Labs abroad will be acceptable.

Inspection

EESL reserves the right to test the Solar PV Modules before the dispatch to confirm their standards to the contract specifications. If required, the pre dispatch testing of the Solar PV Modules shall be done at the manufacture's place. These tested parameters should match the IEC/ISI/MNRE/BEE standards of tender. If components of the system are not as per the standards, entire lot has to be replaced with new components which shall confirm to the standards mentioned in the tender at Supplier's cost. EESL, reserves the right to verify flash test reports of Solar PV modules.

1. *PV Array Configurations*

The Solar array shall be configured in multiple numbers of sub-arrays, providing optimum DC power to auditable number of sub arrays. The Contractor shall submit their own design indicating configuration of PCU and respective sub arrays and associated bill of material.

i. UV resistant Cable-ties (suitable for outdoor application shall be used to hold and guide the cables/wires from the modules to junction boxes or inverters. All the cables were aesthetically tied to module mounting structure.

ii. In case the string monitoring unit (SMU) is mounted on the module mounting structure, Contractor to take into consideration of the load thus added on the MMS. Accordingly, suitable supporting members for mounting the SMU must be designed and supplied. Separate structure for mounting of SMU can also be proposed.

iii. Every major Component of the Plant should be suitably named/ numbered & marked for ease of traceability, identification and maintenance.

2. String Monitoring Unit (SMU):

All SMUs should be equipped with appropriate functionality, safety (including fuses, grounding, contacts etc.) and protection.

The terminals will be connected to copper bus-bar arrangement of proper sizes to be provided. The junction boxes will have suitable cable entry points fitted with cable glands of appropriate sizes for both incoming and outgoing cables. Suitable markings shall be provided on the bus-bars for easy identification and weather resistant cable ferrules will be fitted at the cable termination points for identification.

The standards and codes:

Standard/Code	**Description**
IEC 60529	Enclosure Ingress Protection
IEC 62262	Enclosure Impact Protection

IEC 60296	Fuse
IEC 61643-12	Surge Protection Device
IEC 62852 or EN 50521	Solar cable connector

The Junction Boxes shall have suitable arrangement for the followings

a) Provide arrangement for disconnection for each of the groups/incomers.
   - Provide a test point for each sub-group for quick fault location and to provide group array isolation.
   - Suitable space for workability and natural cooling.

b) The junction boxes shall be dust, vermin, and waterproof and made of thermoplastic/ metallic in compliance with IEC 62208, which should be sunlight/ UV resistive as well as fire retardant & must have minimum protection to IP65 (Outdoor) and Protection Class II.

c) Array Junction Box will also have suitable surge protection. In addition, over voltage protection shall be provided between positive and negative conductor and earth ground such as Surge Protection Device (SPD). The maintenance free earthing shall be done as per the relevant standards.

d) Array Junction Box should have adequate ratings of solar DC fuses & isolating miniature circuit breakers at both the terminals (+ve as well as –ve), provided in recommendation with the inverter manufacturer. The fuses should be so designed that it should protect the modules from the reverse current overload.

e) At outgoing side DC Disconnector switches Switch of suitable capacity shall be provided.

f) Contractor shall submit all the test reports/ test certificates and compliance certificates during Detailed Design Engineering & before installation at site.

3. Power Conditioning Unit (PCU)

i. Power Conditioning Unit (PCU)/ Inverter shall consist of an electronic inverter along with associated control, protection and data logging devices.

ii. Central inverter/ String Inverter of appropriate capacity may be used.

- The rated power/name plate capacity of the inverters shall be the AC output of the inverter at 50^{o}C.
- All PCUs should consist of associated control, protection and data logging devices and remote monitoring hardware and compatible with software used for string level monitoring.
- Dimension, weight, cooling arrangement etc. of the PCU shall be indicated by the Bidder in the offer. Type (in- door & out-door) of installation also to be indicated.
- Contractor has to provide sufficient information about the inverter to be installed at the project site to the satisfaction of the EESL/DISCOM before placing the final order for PCUs/Inverters. Service center of the PCU manufacturer must be in India.
- The minimum European efficiency of the inverter shall be 98% load as per IEC 61683 standard for measuring efficiency. The Bidder/ Contractor shall specify the conversion efficiency of different loads i.e. 25%, 50%, 75% and 100% in its offer. The Bidder/ Contractor should specify the overload capacity in the bid.
- The inverters shall have minimum protection to IP 65(Outdoor)/IP 21(indoor)and Protection Class II.
- Nuts & bolts and the PCU enclosure shall have to be adequately protected taking into consideration

the atmosphere and weather prevailing in the area.

- Grid Connectivity: Relevant CERC regulations and grid code as amended and revised from time to time shall be complied. The system shall incorporate a unidirectional inverter and should be designed to supply the AC power to the grid at load end. The power conditioning unit shall adjust the voltage & frequency levels to suit the Grid.
- All three phases shall be supervised with respect to rise/fall in programmable threshold values of frequency.
- The inverter output shall always follow the grid in terms of voltage and frequency. This shall be achieved by sensing the grid voltage and phase and feeding this information to the feedback loop of the inverter. Thus control variable then controls the output voltage and frequency of the inverter, so that inverter is always synchronized with the grid.

4. Operational Requirements for Inverter/ PCU

i. The PCU must have the feature to work in tandem with other similar PCU's and be able to be successively switched "ON" and "OFF" automatically based on solar radiation variations during the day. Inverters must operate in synergy and intelligently to optimize the generation at all times with minimum losses.
ii. The PCU shall be capable of controlling power factor dynamically.
iii. Maximum power point tracker (MPPT) shall be integrated in the power conditioner unit to maximize energy drawn from the Solar PV array. The MPPT should be microprocessor based to minimize power losses. The details of working mechanism of MPPT shall be mentioned by the Bidder in its offer. The MPPT unit shall confirm to IEC 62093 for design qualification.
iv. The system shall automatically "wake up" in the morning and begin to export power provided there is sufficient solar energy and the grid voltage and frequency is in range.
v. Basic System Operation (Full Auto Mode): The control system shall continuously monitor the output of the solar power Plant until pre-set value is exceeded & that value to be indicated.
vi. PCU shall have provisions/features to allow interfacing with monitoring software and hardware devices.

5. Protection against faults for PCU

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. In addition, it shall have following minimum protection against various possible faults.

a. Grounding Leakage Faults: The PCU shall have the required protection arrangements against grounding leakage faults.
b. Over Voltage & Current: In addition, over voltage protection shall be provided between positive and negative conductor and earth ground such as Surge Protection Devices (SPD).
c. Galvanic Isolation: The PCU inverter shall have provision for galvanic isolation with external transformer, if required.
d. Anti-islanding (Protection against Islanding of grid): The PCU shall have anti- islanding protection. (IEEE 1547/UL 1741/ equivalent BIS standard)

e. Unequal Phases: The system shall tend to balance unequal phase voltage (with 3- phase systems).
f. Reactive Power: The output power factor of the PCU should be of suitable range to supply or sink reactive power. The PCU shall have internal protection arrangement against any sustained fault in the feeder line and against lightning in the feeder line.
g. Isolation: The PCU shall have provision for input & output isolation. Each solid- state electronic device shall have to be protected to ensure long life as well as smooth functioning of the PCU.
h. PCU shall have arrangement for adjusting DC input current and should trip against sustainable fault downstream and shall not start till the fault is rectified.
i. Each solid state electronic device shall have to be protected to ensure long life of the inverter as well as smooth functioning of the inverter.
j. All inverters/ PCUs shall be three phase using static solid state components. DC lines shall have suitably rated isolators to allow safe start up and shut down of the system. Fuses & Circuit breakers used in the DC lines must be rated suitably.

6. Standards & Compliances (PCU)

i. PCU shall confirm to the following standards and appropriately certified by the labs:

IEC 61683	Photovoltaic systems - Power conditioners - Procedure for measuring efficiency
EN 50530:2010 with 2013 Amendment 1	Overall efficiency of grid connected photovoltaic inverters
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, Harmonics etc.
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
IEEE 1547:2003 with 2014 Amendment 1	IEEE Standard for Interconnecting Distributed Resources with Electric Power Systems
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 or as amended from time to time.	

i. The Bidder/Contractor should select the inverter as per its own system design so as to optimize the power output, however selected inverter must comply with the Technical/functional requirement of Plant as per this Tender Document.

ii. Desired Technical requirements of PCU.

Parameter	Specification
Rated AC power	As per design
Maximum input voltage	1000 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)

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

Construction:

- Power Conditioning Unit (PCU) shall consist of an electronic three phase inverter along with associated control, protection, filtering, measurement and data logging devices.
- Every DC input terminal of PCU shall be provided with fuse of appropriate rating. The combined DC feeder shall have suitably rated isolators for safe start up and shut down of the system.
- Type-II surge protective device (SPD) conforming to IEC 61643-12 shall be connected between positive/ negative bus and earth.
- In case external power supply is required, standalone UPS shall be used to meet auxiliary power requirement of PCU. It shall have a backup storage capacity of 2 hours.
- Circuit Breaker of appropriate voltage and current rating shall be provided at the output to isolate the PCU from grid in case of faults.
- 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.
- 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.

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

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.

Standby Mode

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

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.

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.

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
(x) Cooling fan failure
(xi) Auxiliary supply failure

Grid Support Functions

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.

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.

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.
All the test certificates as per the standards mentioned above shall be submitted for approval. The tests should have been conducted at a test laboratory compliant with ISO 17025 for testing and calibration and accredited by an ILAC member signatory. 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.

Inverter Transformer
Standards and Codes

Inverter 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:2099, IEC:60137	Bushings for alternate voltage above 1000 V
IS: 335, IEC 60296	Insulating oil
IS: 3639	Fittings and Accessories for Power Transformers

- Technical Requirements

Parameters	Inverter Transformer
VA Rating	As per system requirement and SLD
Voltage Ratio	11 kV/ Inverter output voltage
Duty, Service & Application	Continuous Solar Inverter application and converter Duty (Outdoor)

Winding	As per system design requirement
Frequency	50 HZ
Nos. of Phase	3
Vector Group & Neutral Earthing	As per system/inverter manufacturer requirement and SLD
Cooling	ONAN
Tap Changer	OCTC, No. of steps shall be as per the SLD and system requirement
Impedance at 75°C	As per Inverter Manufacturer requirement and SLD
Permissible Temperature rise over an ambient of 50°C (irrespective of tap)	
Top Oil	50°C
Winding	55°C
SC withstand time (thermal)	2 second
Termination	As per system requirement and SLD
Bushing rating, Insulation class (Winding & bushing)	HV side - 12 kV porcelain bushings LV side – 1.1 kV porcelain bushings
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. Bidder shall furnish over fluxing characteristic up to 150%
Air Clearance	As per CBIP
* Single Line Diagram (SLD) will be finalized during detailed engineering.	

- Construction

i. 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 low oil level alarm contact.

ii. 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.

iii. 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.

iv. 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.

v. 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.

vi. 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.

vii. 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 class of +/-2 deg. For inverter transformers, WTI shall be provided for all the windings.

viii. 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.

ix. 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.

x. Suitable relay, double float type with alarm and trip contacts, along with suitable gas collecting arrangement shall be provided. RTCC panel, as per design, to be provided.

xi. Inverter transformer shall be provided with spring operated Pressure Relief Device (with trip contacts) with suitable discharge arrangement for oil.

xii. Filter valve at top the tank and drain cum sampling valve at bottom of the tank shall beprovided.

xiii. 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.

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

xv. 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.

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

xvii. 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.

General Standards

i. All equipment shall be designed for operation in coastal climate at the required capacity. The reference parameters for which the transformers are to be designed are as under:-

Particular	Condition
Maximum ambient temperature	50^{O}C
Maximum daily average ambient temp	40^{O}C
Maximum yearly weighted average ambient temp	35^{O}C
Minimum ambient air temperature (Cooling)	-5^{O}C
Max. Relative Humidity	95%
Yearly Avg. number of thunder storms	30-50
Average Number of rainy days	60 days
Fog	In winter
Number of months during which topical monsoon	5 months
Dust storms	May occur
Cyclone	Area is cyclone prone
Average Annual rain fall	100 cms.
Maximum wind speed	180 kmph

i. Efficiency:
The percentage loading for the maximum efficiency shall be clearly stated at unity power factor as well at 0.9 and 0.9 power factor (lead and lag).

ii. Insulation:
The dielectric strength of the winding, given insulation and the bushings shall conform to the values given in IS: 2026 (Part III)/1981 (or its latest amendment) for highest system voltage and shall be suitable for the impulse test\power frequency test voltages.

iii. Factory Assembly and Tests:
The transformer shall be completely assembled and tested at the Factory. Routine and Acceptance tests as per specification/ standards are to be conducted and no deviation in respect of conducting these tests will be acceptable. No extra charges for these tests will be paid. Test charges shall be part of cost of the equipment. If EESL/DISCOM selects to send a representative, all tests shall be carried out in his presence. Type test certificate shall be furnished before start of supply.

iv. Routine Tests:
Each completed transformer shall be subjected to following routine tests as per IS: 2026

Part. I & III (latest amendment). No extra charges for any of the tests shall be paid. No deviation shall be acceptable. If the supplier desires, he may not fix radiators on transformers (other than the one which is to be type tested) during routine testing. However in that case, radiator manufacturer's test certificate shall be furnished for reference of inspecting officer with undertaking that supplier shall be responsible for proper alignment/fixing of radiator on transformer at site.

- Measurement of resistance of each winding.
- Measurement of turn's ratio between HV-LV windings at each tap.
- Checking of polarity and phase relation-ships for each winding.
- Measurement of no load loss and no load current.
- Positive phase sequence impedance/short circuit impedance between HV-LV windings on minimum, maximum and normal taps.
- Separate source voltage withstand test.
- BDV test on transformer oil.
- Induced over voltage withstand test.
- Measurement of neutral unbalance current.
- Regulation at rated load at unity, 0.90 and 0.80 lagging power factor.
- Load losses measured at rated frequency by applying voltage sufficient to produce the rated relevant current in one winding with the other winding short circuited.
- Measurement of insulation resistance.
- The total losses shall comprise of the No Load Losses, load losses at rated output duly converted at 75 deg. C average winding temperature and shall also be indicated in the test report. Load losses shall be that corresponding to rated load on HV & LV winding.
- Routine dielectric tests as per IS: 2026(Part. I & III), 1981 and any amendments thereto.
- Check complete transformer against approved outline drawing, provision for all fittings, finish oil level etc.

ii. Tests at Site

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

i. Insulation resistance test.
ii. Ratio and polarity test.
iii. Dielectric test on oil.
iv. Physical check

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

Further Tests:

The EESL/DISCOM reserves the right of having other reasonable tests carried out at his own expenses either before dispatch or during performance guarantee period from Govt. approved/ Govt. recognized lab to ensure that the transformer complies with the requirements of this specification after due intimation to the supplier. In case the equipment is not found meeting the requirement of Technical Specification of Tender Document, all expenses incurred for such testing will be on supplier's account and the material shall be replaced by the supplier at site free of cost.

Frequency and System Voltage:

The transformer shall be suitable for continuous operation with a frequency variation of ± 2.5% from normal of 50Hz without exceeding the specified temperature rise. The system shall be designed for a suitable voltage range as per the Grid code of the state or as per MSEDCL standard. However the flux density requirements shall be as per this specification.

Installation & Commissioning

Mainly following activities are required to be carried out before commissioning of Power Transformers:-

- Assembling of Power Transformer accessories as per GA drawing.
- Testing activities in presence of EESL/DISCOM such as
  - Ratio Test
  - Megger Value
  - Magnetic balance
  - Oil BDV
  - Earth Resistance
  - Buchhloz Relay checking.
  - WTI/OTI/MOLG (oil level) checking.
  - Checking of points of leakage of oil from Transformer body/ Radiator/Valve
  - Setting of Relays in Panel

Circuit Breakers

i. The circuit breakers shall be capable of rapid and smooth interruption of currents under all conditions completely suppressing all undesirable phenomena even under the most severe and persistent short circuit conditions or when interrupting small currents or leading or lagging reactive currents. The circuit breakers shall be 'Restrike-Free' under all operating conditions. The details of any device incorporated to limit or control the rate of rise of re-striking voltage across, the circuit breaker contacts shall be stated. The over voltage across, the circuit breaker contacts shall be stated. The over voltage caused by circuit breaker while switching inductive or capacitive loads shall not exceed 2.5 times the highest phase to neutral voltage. The actual make and break times for the circuit breakers throughout the ranges of their operating duties shall be stated in the offer and guaranteed

ii. **Applicable Standards:** The materials shall conform in all respects to the relevant Indian Standard Specifications/ IEC Standards, with latest amendments indicated (reference only) below:

IS-13118/1991	General requirements for Circuit breakers for voltage above 1000 V IEC 62271-100-1/2001
IS-2705/1992	Current Transformers
IS-2099/1986	Bushings for alternating voltages above 1000 V
ISS-2633/1964	Methods of testing uniformity of coating of zinc coated articles
IS-3231/1986	Electrical relays for power system protection
IS-1248/1983	Specification for Ammeters & Voltmeters
IS-335/1983	New insulating oils Electrical IEC 71 (For oils in CTs) Clearances
IS-2147/1962	Degree of protection provided by enclosures for low voltage switchgear & control gear

iii. The arc quenching chambers shall have devices to ensure almost uniform distribution of voltage across the interrupters.

iv. Appropriate & adequate Capacity 415V AC indoor air Circuit Breaker as per the IEC 60898 / IEC 62271 – 100 or equivalent Indian Standards along with control circuit and protection relay circuit, fuses, annunciations and remote operating and controlling facility from the Main Control Room.

v. Circuit breaker shall be C2/Ml class under all duty conditions and shall be capable of performing their duties without opening resistor. The circuit breaker shall meet the duty requirement of any type of fault or fault location and shall be suitable for line charging and dropping when used on 6kV effectively grounded or ungrounded systems and perform make and break operations as per the stipulated duty cycles satisfactorily.

vi. The circuit breaker shall be capable for breaking the steady & transient magnetizing current corresponding to transformers. It shall also be capable of breaking line charging currents as per

IEC- 62271-100 with a voltage factor of 1.4

vii. The rated transient recovery voltage for terminal fault and short line faults shall be as per IEC: 62271-100.

viii. The Contractor may note that total break time of the breaker shall not be exceeded under any duty conditions specified such as with the combined variation of the trip coil voltage, pneumatic pressure etc. While furnishing the proof of the total break time of complete circuit breaker, the Contractor may specifically bring out the effect of non-simultaneity between same pole and poles and show how it is covered in the guaranteed total break time.

ix. Contractor shall indicate the noise level of breaker at distance of 50 to 150 m from base of the breaker.

x. While furnishing particulars regarding the D.C. component of the circuit breaker, the Contractor shall note that IEC-62271-100 requires that this value should correspond to the guaranteed minimum opening time under any condition of operation.

xi. The critical current which gives the longest arc duration at lock out pressure of extinguishing medium and arc duration shall be indicated.

xii. Contractor has to provide the type test reports for the CB before the dispatch.

xiii. All the duty requirements specified above shall be provided with the support of adequate test reports.

Operating Mechanism of Circuit Breakers

i. Circuit shall be vacuum type with electrically spring charged mechanism.

ii. The operating mechanism shall be anti-pumping and trip free (as per IEC definition) electrically under every method of closing. The mechanism of the breaker shall be such that the position of the breaker is maintained even after the leakage of operating media and / or gas. The circuit breaker shall be able to perform the duty cycle without any interruption.

iii. Electrical tripping shall be performed by shunt trip coil. Provision shall also be made for local electrical control. 'Local / remote' selector switch and close & trip push buttons shall be provided in the breaker central control cabinet. Remote located push buttons and indicating lamps shall also be provided. The VCB coil DC supply through appropriately rated battery bank and charger to be supplied by the Contractor.

iv. Operating mechanism and all accessories shall be in local control cabinet. A central control cabinet for the three poles of the breaker shall be provided along with supply of necessary tubing, cables, etc.

v. Mounting and supporting structure for Circuit Breaker: The circuit breakers should be self-supporting type. However, if necessary for the purpose of minimum ground clearance the circuit breakers should be mounted on raised steel structures which should be included in the scope of supply of circuit breaker. Bidder/Contractor to obtain the necessary information and data required for design of foundations of the circuit breaker be obtained from the CB supplier.

vi. Max. Impact loading in terms of equivalent static load both compression and upward due to opening/closing of the breakers. It shall be clearly stated whether these forces shall act simultaneously or at different timing.

vii. Necessary connecting materials such as clamps, bolts, nuts, washers etc. and fixing bolts for mounting the equipment on the supporting structures wherever required should be obtained from the circuit breaker supplier.

viii. General parameters: Vacuum type Circuit Breaker:

Particulars	**Details**
Type of circuit breaker	Vacuum type
Highest System Voltage	As per system design

Rated operating voltage	As per system design
Rated frequency	50 Hz (+3% to -5%)
Number of poles	Three (3)
Rated/ minimum power frequency Withstand voltage	As per system design
Rated lightning impulse Withstand	As per system design
Rated operating duty cycle	0 - 0.3 sec. - CO – 3 min. – CO
Rated line charging breaking	As per IEC
Reclosing	Single and three phase high speed
Maximum fault level	As per system design
Auxiliary contacts	As required plus 6NO and 6NC
Noise level	Maximum 140dB at 50m distance
Seismic acceleration	0.4 g horizontal

ix. Co-ordination of rated voltages, short circuit breaking current and rated normal current for guidance as per IS 13118 for rated voltage 33 kV and above

x. Circuit Breaker Protection against

- Over Current
- Earth fault
- Under voltage & over voltage protection
- Under frequency & over frequency
- SF6 gas pressure low (where applicable)
- DC supply failure

Isolators

i. The isolators and accessories shall conform in general to IEC 62271-102 (or equivalent Indian standard) except to the extent explicitly modified in specification.

ii. Each isolating switch should have the following particulars under the site conditions for the system under design (typical values for 36 kV system are given).

iii. General Parameters: Isolators

Particular	Details
Operating mechanism of Isolator and Earth Switch	Motor operated
Nominal system voltage	As per system design
Highest system voltage	As per system design
Type	Outdoor (IP 65)
Rated short time current of isolator and earth switch	As per system design
Rated dynamic short time with stand current of isolator and earth	As per system design
Impulse withstand voltage with 1.2/50 micro sec. wave	As per system design
One minute power frequency withstand Voltage	As per system design
Temperature rise	As per Table-IV of IS: 9921
Rated mechanical terminal load	As per 62271-102

Indicating and Integrating Meters/Instruments:

i. All indicating instruments shall be of switchboard type, back connected, suitable for flush mounting and provided with dust and vermin proof cases for tropical use and finished in suitable color. All instruments shall have practical laboratory means for adjustment of accuracy. The limits of errors for ammeters/voltmeters shall be those permissible for class 1.5 instruments as per IS: 1248.

ii. A.C. Static HT Tri Vector Meter:
A.C. Static HT Tri Vector Meter shall be installed as per STATE DISCOM's/STU's norms and shall be intimated while placement of order. The meters shall be located at eye level to facilitate observations of readings correctly.

iii. The ammeters and voltmeters shall be suitably scaled to indicate the current/voltage for all the rating of current/voltage transformers. A phase selector switch with four/six position shall be used to measure the current/voltage of each phase/line. The Contractor shall provide test certificate and calibration certificate along with the supply of the instrument.

iv. The meters shall be located at normal eye level to facilitate observation of readings correctly.

Surge Arrestors

i. The surge arrestors (SAs) shall conform in general to IEC 60099-4 or IS: 3070 except t o the extent modified in the specification. Arresters s h a l l b e of hermetically sealed units, self-supporting construction, suitable for mounting on lattice type support structures. Contractor shall furnish the technical particulars of Surge arrester.

ii. The SA's shall be of heavy duty station class and gapless Metal Oxide type without any series or shunt gaps. The SAs shall be capable of discharging over- voltages occurring during switching of unloaded transformers, and long lines.

iii. Arrestors shall be complete with insulating base for mounting on structure. Suitably enclosed for outdoor use and requiring no auxiliary or battery supply for operation shall be provided for each single pole unit with necessary connection.

iv. The surge arrestors shall conform to type tests and shall be subjected to routine and acceptance tests in accordance with IEC-60099-4.

v. Each lightning arrestors should have the following particulars under the site conditions for the system under design:

Codes and Standard

IS: 2309: Code of Practice for the protection of building and allied structures against lightning.

NF C 17-102: Lightning Protection with Early Streamer Air Termination rod

- Complete Solar Array with associated structure shall be protected from Direct Lightning Stroke. Lightning Protection for solar array shall be achieved with any or both of the following two systems as per specification provided in the following section;

(1) Single Rod Air Terminal (Faraday Rods),

(2) Early Streamer Emission (ESE) Air Terminal.

Suitable earthling and equipotential bonding shall be ensured for the air termination rods as per applicable standard/Equipment manufacturer guidelines. Current carrying parts and accessories such as clamps, fasteners, down conductor, Test links and earth termination etc. shall be preferably procured from OEM of Air Terminals if it is supplied by them as part of lighting protection system.

- Lightning Protection System for solar array with single rod air terminal
  Solar array of Plant shall be protected from direct lightning strike with straight or angled air termination rods of suitable class as per IS:2309 to be fixed with the module mounting structure (MMS). Air termination rods shall have minimum two clamps to be fixed with MMS and must be capable of carrying full lightning current. Contractor to ensure proper fixing of the clamps with MMS to allow lightning current to pass through the clamp without damage and to sustain the rods during high velocity wind. Contractor shall submit the calculation to determine the no. and location of air termination rods to be fixed on structure to provide the lightning protection to each solar module and structure. Earth riser shall be connected to that part/pole of MMS which is nearest to air termination rod.
- Lightning Protection System for solar array with E.S.E air terminal
  Solar array shall be protected from direct lightning stroke with Early Streamer Emission air terminal in accordance to NF C 17-102 (Latest revision). Number and location of ESE air terminal shall be decided during detail engineering. For this purpose, design calculation and AutoCAD drawing of the layout of ESE terminal shall be submitted to EESL/DISCOM for approval. ESE air terminal shall be type tested in any national/international approved lab for advance triggering time (ΔT) and lighting Impulse current test and type test report shall be submitted to EESL/DISCOM for approval.

1. Each ESE air terminal shall be provided with separate earthling termination and test link for equipotential bonding of Lighting Protection System as per OEM guidelines/NFC 17 -102. Each ESE air terminal shall be equipped with lightning stroke counter to be fixed at suitable height in serial on the down conductor.
2. ESE air terminal shall be erected on isolated foundation to be approved by EESL/DISCOM. If required, Suitable guy wire shall be used to support the mast of ESE terminal against the wind.

- Location and layout of ESE terminal shall be in such a manner that it cast no shadow on the PV Modules during 08:30 AM to 04:30 PM.
- Lightning Protection System for Inverter Room (LCR) and MCR Contractor needs to provide the Lightning Protection for each inverter, Switchyard building and Main Control Room building in accordance to IS:2309.

Protective Relays

i. The Solar PV system and the associated power evacuation system interconnections should be protected as per IEC 61727 Ed.2, norms. Over current relays, differential protection relays (for grid tie power Transformer only) and earth fault relays have to be essentially provided. All relay should be numerical type & should also be remote operation and control enabled from the control room.
ii. All the relays must be solid state type and based on open access communication protocol. The numerical relays shall have RS 485 port for communication.
iii. The operating voltage of the relays shall be 110 V DC/220 V DC as per battery bank rating.
iv. Necessary battery bank shall also be provided in order to supply uninterrupted power to relays and control & protection circuit of the Plant.
v. Detailed Design calculations shall be provided on fault power computations and the philosophy of protective relaying with respect to short circuit kA calculations. Design, drawing and model of protection relay shall be approved by EESL/DISCOM/ state DISCOM.
vi. The Contractor must submit the relay setting chart as a part of design documents in coordination with the connecting substation.

Contacts:

i. The moving & fixed contacts shall be made of hard drawn electrolytic grade copper strips and shall be heavy duty self- aligning & high pressure type preferably which applies pressure to the

contact surfaces after the blades are fully closed and release the pressure before they start to open. High pressure type contacts shall wipe the contact surfaces, while opening and closing. The contacts shall be so designed that wiping, action shall not cause securing or abrasion on the contact surfaces. The wiping action shall be sufficient to remove oxide film, formed during the operation of the switches. The pressure shall be developed by rotation of the entire blade.

ii. The temperature rise of contacts due to the flow of rated short circuit current for a period of 3 seconds shall not cause any annealing or welding of contacts.

iii. The moving contacts, if provided, shall close first and open last so that no damage is caused due to arcing whatever to the main contacts. The Contractor shall give full details of such contacts with necessary drawings.

iv. The arcing contacts, if provided shall close first and open last so that no damage is caused due to arcing whatever to the main contacts. The tender shall give full details of such contacts with necessary drawings.

v. The female contact and its tensioning by spring shall be such that there will, always, be a positive contact with adequate pressure to give enough contact surface for the passing of current. The springs provided should not go out of alignment or get entangled with the male contact during operation. The details of springs shall be furnished on the G.A. drawing.

Earthing Blades

i. The Isolators controlling the transmission line (underground transmission cables) shall be equipped with earthing blades. The Earthing blades shall be counter balanced to ensure easy operation.

ii. Line earth switch shall consist of three Earthing links per Isolator which will normally rest against the frames, when the connected Isolator is in closed position. The Earthing links of all three phases shall be suitable for fitting on either side of the Isolator.

iii. Short time current withstand capacity of earthing blades of Isolator Earthing Switch shall be same as that of the main blades of Isolator. The material of the earthing Isolator, Each earthing blade shall be provide with flexible copper connections of adequate length of not less than 60mm2 are for connection between the operating shall and the base frame.

iv. The rated making capacity of earthing switches shall be as specified in the applicable standard of isolators

Insulators

i. Bushings shall be manufactured and tested in accordance with IS: 2099 & IEC: 137. Hollow column insulators shall be manufactured and tested in accordance with IEC: 60233/IS: 5261. The support insulators shall be manufactured and tested as per IS: 2544 / IEC: 600168/IEC: 600273. The insulators shall also conform to IEC 815 as applicable. Contractor shall furnish the technical particulars of all type of insulators used.

ii. Porcelain insulator shall comply IS: 731-1976 or equivalent international standard and shall be homogenous, free from laminations, cavities and other flaws or imperfections that might affect the mechanical or dielectric quality and shall be thoroughly vitrified, tough and impervious to moisture. Hollow porcelain should be in one integral piece in green & fired stage.

iii. Contractor may offer silicone rubber housed composite type insulator as an alternative to the above porcelain insulator with equivalent creep age distance.

iv. Data sheets for the insulators with cantilever strength and compression strength, etc. shall be submitted.

v. Insulators shall be rated for not less than 6kN for bus bar supports and 4kN for isolators.

Bus Bar

i. The outdoor bus-bars and equipment connections shall be of suitable size as per norms of MSEDCL.

ii. The bus-bars and the connection jumpers shall be supported on post insulators wherever required.

iii. The ACSR bus bars are an over ground system of wires strung between two supporting structures and supported by strain type insulators. The stringing tension may be limited to 500-900 kg depending upon the size of the conductor used. These types of bus bars are suitable for earthquake prone areas. All the bus bars are to be provided with insulating sleeves with appropriate color code.

iv. Bus bar Material – The materials in common use for bus bars and connections of the strain type are ACSR conductor or as per DISCOMs requirement.

v. Since aluminium oxides rapidly, great care is necessary in making connections. In the case of long spans expansion joints should be provided to avoid strain on the supporting insulators due to thermal expansion or contraction of pipe.

vi. The bus bar sizes should meet the electrical and mechanical requirements of the specific application for which they are chosen.

Note: Unless otherwise specified, all equipment and materials shall confirm to the latest applicable Indian Standards. Equipment complying with any other International Standards will also be considered if it ensures performance of equipment equal to a superior to Indian Standard.

Control & Relay Panel

General Requirement:

- The control & relay panel shall be free standing, simplex type, floor mounting type, fabricated from 2 mm thick MS sheet for main enclosure and 1.6 mm thick MS sheet for internals and partitions. The main enclosure shall be mounted on a base frame fabricated out of 100x50 ISMC mild steel section.
- The enclosure external finish color shade shall be decided by the EESL/DISCOM, The internal surface shall have a glossy white finish all over.
- The control & relay panel shall contain the following metering and protection devices:

1. Metering, Indications & Controls
2. Ammeter:
3. Ammeter selector switch
4. Voltmeter:
5. Voltmeter selector switch
6. Load manager to display the following parameters: MW, MVA, MVArh, MVAr Cos , Hz,
7. Indication lamps for R, Y, B phases, Breaker 'ON' (R), Breaker 'OFF' (G), Breaker 'TRIP' (A), Spring charged (W), Trip Circuit Healthy (B)
8. TNC switch, spring return to neutral position shall be provided for circuit breaker operation.
9. Local / Remote selection switch for circuit breaker operation
10. Semaphore indicators (LED type) for CB and Isolator 'Open' & 'Close' positions
11. Mimic diagram for the systems with aluminium strips and 'ON' 'OFF' indications for isolators

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

Control Circuit

i. Control supply for breaker closing / tripping - 110V DC
ii. Air Circuit Breaker spring charge motor – 240 V AC, 1 phase
iii. Moulded Case Circuit Breakers – 240 V AC, 1 phase
iv. Indications, annunciation – 110V DC
v. Space heater, sockets, etc. – 240 V AC, 1 phase

Bus Bar & Cable Cavity

i. The material for main bus bars and tap off bus bars shall be electrolytic grade aluminum with properly color coded HR PVC sleeved insulation
ii. Bus bar shall be suitable for short circuit rating and current suitable for all connected load.
iii. Cable entry for incoming and outgoing cables shall be from Bottom.
iv. A suitable gland plate shall be supplied for termination of power, control and instrumentation cables.
v. Whenever feeders are housed in multi-tier configuration these tiers shall be segregated by sheet metal barriers.
vi. Earthing: Earthing bus bar shall be terminated at both ends of the switchgear to suit the connections to outside earthing conductor. All components inside the module are required to be earthed individually and are to be looped and connected to the horizontal earth bus. All the non-current carrying parts of the panels, e.g., enclosure, must be connected to earth as per the regulations.

Terminals*:*

i. CT circuit - Isolating link type terminals with shorting facility
ii. PT circuit – clip on type terminals
iii. Spare contacts shall be wired up to terminal block. 10% spare terminals shall be provided for each module

Specific Requirement

i. All ACBs/ VCBs, as applicable, shall be 4 pole, electrically operated, draw-out type, with closing coil, spring charge motor, trip coil, TNC switch for close and trip, manual closing and tripping push buttons, door I/L, test and service position micro switches, emergency P.B., safety shutters, etc. The circuit breaker shall be provided with anti-pumping feature.
ii. ACBs/ VCBs, as applicable, shall be complete with microprocessor release and shall be provided with over current, short circuit and earth fault protections.
iii. Minimum10% spare feeders of each rating shall be provided in the switchgear.
iv. All current transformers shall have 5/1A secondary and all meters shall be suitable for 5/1A operation.
v. All indicating lamps shall be of LED cluster type. ACB feeders shall be provided with ON, OFF, AUTOTRIP, SPRING CHARGED, TEST, SERVICE, TRIP CIRCUIT HEALTHY indications
vi. All indicating instruments, including MFM, shall be flush mounting, Digital type and of standard size.

vii. Window annunciator with hooter and accept, test, reset button shall be provided. Necessary auxiliary relays for contact multiplication shall be provided in the panel.

viii. The maximum temperature of the bus bars, droppers and contacts at continuous current rating under site reference ambient temperature of 50º C shall not exceed 105º C.

ix. Instrumentation: Switchgear instrumentation shall be provided as follows:

- Mains Incomer – Voltmeter with selector switch
- Ammeter with selector switch
- Power Factor meter
- Frequency meter
- TVM + MD meter
- Potential indicating lamps
- Outgoing Feeders
- Ammeter with selector switch on all feeders

LT/HT Switchgear

Standards and Codes for HT switchgear

- 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.

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	IS 14697 AC Static Transformer Operated Watthour and Var-hour Meters, Class 0.2S and 0.5S

Low/ High Voltage Switchgear Panels

i. The LT/ HT switchgear panels shall be designed as per the relevant IS codes and as per the approved design for the panel. All the parts of the panel must be rated as per the relevant rated voltage level. All the panels must have multifunction meters (MFM) flushed with the surface of the panels. However, the outgoing feeder can have Tri vector meter (TVM) for the energy accounting.

ii. The Power Control Centre (PCC)/ Switchgear shall be rated for the maximum output of the supply transformer feeding the system. The short circuit withstand rating (1 sec) at rated voltage of the switchgear shall be relevant to the existing electrical system short circuit ratings.

iii. The configuration of the PCCs shall be as per the Single Line Diagram of the system.

iv. Power Control Centers (Construction)

- Single front / compartmentalized, m odular design, degree of protection IP52 with provision of extension on both sides.
- Incomer feeders: mains incomer - Electrically operated draw out type Air Circuit
- Breakers (ACBs)/ Vacuum Circuit breakers (VCBs), as applicable.
- Outgoing feeders: Moulded Case Circuit Breakers (MCCBs)/ electrically operated draw out type Air Circuit Breakers (ACBs) / Vacuum Circuit Breakers (VCBs), as applicable.
- The color finish shade of switchgear enclosure for interior shall be glossy white & for exterior it shall be light grey, semi glossy shade 631 of IS: 5. if a different exterior shade is desired by the EESL/DISCOM, the same shall be intimated to the supplier.
- The PCC shall be fabricated out of CRGO sheet steel; 2 mm thick for the outer shall all-round. The internal walls and separators shall be of 1.6 mm thick CRGO sheet steel.
- The gland plates shall be 3 mm thick.

The detailed requirements are however discussed in the previous sections.

Type Test for HT switchgear:

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	
Communication requirements	IEC 61850	
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
Electromagnetic Compatibility tests	IEC 61869-3	7.2.5
Test for accuracy	IEC 61869-3	7.2.6
Short-circuit withstand capability test	IEC 61869-3	7.2.301
Communication requirements	IEC 61850	
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
Electromagnetic Compatibility tests	IEC 61869-3	7.2.5

Test for accuracy	IEC 61869-3	7.2.6
Short-circuit withstand capability test	IEC 61869-3	7.2.301

DC Cable and Wires

i. All cables and connectors for use for installation of solar field must be of solar grade which can withstand harsh environment conditions including High temperatures, UV radiation, rain, humidity, dirt, salt, burial and attack by moss and microbes for 25 years and voltages as per latest IEC standards. (Note: DC cables for outdoor installations should comply with the TUV 2PfG 1169/09.07 for service life expectancy of 25 years)

ii. **Insulation**: Outer sheath of cables shall be electron beam cross-linked XLPO type and black in colour. In addition, Cable drum no. / Batch no. to be embossed/ printed at every one meter. Cable Jacket should also be electron beam cross- linked XLPO, flame retardant, UV resistant and black in colour. DC positive current carrying cables should have marking of red line on black outer sheath.

iii. All the DC cables from SMU to Inverter must be Single Core cable.

iv. DC cables used from solar modules to array junction box shall be solar grade copper (Cu) with XLPO insulation and rated for 1.1kV only. However, the cables used from array junction box to inverter can be XLPE Aluminium with 1.1kV rating as per relevant standards.

v. In addition to manufacturer's identification on DC 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

vi. Wires with sufficient ampacity and parameters shall be designed and used so that maximum voltage-drop at full power from the PV modules to inverter should be less than 1.5%. Successful Bidder/Contractor shall provide voltage drop calculations in unlocked excel sheet.

vii. Only terminal cable joints shall be accepted. No cable joint to join two cable ends shall be accepted. Necessary bimetallic connectors have to be used for connecting Cu bus bar and Al cables or vice-versa. All wires used on the LT side shall conform to IS and should be of appropriate voltage grade. Only copper conductor wires (up to Array Junction Box) compliant with IEC 60228, Class 5 of reputed make shall be used.

viii. All high voltage cables connecting the main junction box/string inverters to the transformers should be PVC insulated grade conforming to IS 1554 and cables shall also conform to IEC 60189 for test and measuring the methods.

ix. Cable terminations shall be made with suitable cable lugs & sockets etc., crimped properly and passed through brass compression type cable glands at the entry & exit point of the cubicles.

x. All cable/wires shall be provided with UV resistant printed ferrules for DC side however, for HT cables, punched/ embossed aluminium tags are required. The marking on tags shall be done with good quality letter and number ferrules of proper sizes so that the cables can be identified easily.

xi. The wiring for modules interconnection should be weather resistant. However, for crossing with road, drain and trenches etc., the cable must pass through GI / Hume pipe of appropriate size with proper protection at ends to prevent any damage inflected by the edge of the pipe.

xii. Type test reports and Data sheets of individual cable sizes (HT & LT) shall be submitted for approval by EESL/DISCOM.

Standards and codes:

Cable	From	To	Conductor/ Insulation	Volage Rating	Applicable Standard
Solar Cable*	Module	SMU	Copper/ XLPO	1.1 kV DC	TUV 2 PfG 1169/08.2007
DC Cable	SMU	Power Conditioning Unit	Copper or Aluminium/ XLPE	1.1 kV DC	IS 7098 Part I
* Cable used for module interconnection shall also be referred as solar cable.					

Switchboard box / DC Distribution Box (DCDB) / AC Distribution Box (ACDB) panels

i. Successful Bidder/Contractor shall provide sufficient no. of switchboards /DCDB/ ACDB wherever required.
ii. All boxes/ panels should be equipped with appropriate functionality, safety (including fuses, grounding, etc.) and protection.
iii. The terminals will be connected to bus-bar arrangement of proper sizes to be provided. The panels/ boxes will have suitable cable entry points fitted with cable glands of appropriate sizes for both incoming and outgoing cables.
iv. Adequate rating fuses & isolating MCB/ MCCB should be provided.
v. The panels/ boxes shall have suitable arrangement for the followings:
- Provide arrangement for disconnection
- Provide a test point for quick fault location
- To provide isolation
- The current carrying rating of the boxes/ panels shall be suitable with adequate safety factor
- The rating of the boxes/ panels shall be suitable with adequate safety factor to inter connect to the local/ internal grid
- Thermal/ heat dissipation arrangement/ Vent for safe operation.
- Adequate number of spare terminals to receive suitable runs and size of cables required for the Inverter/Transformer rating

vi. The boxes/ panels must be grounded properly to ensure all safety related measures for safe operation. The parts of panel, wherever applicable, must be insulated properly.
vii. All the Panels to be manufactured with sufficient space for working and must have temperature suitability up to 85^0 C with separate cable and bus bar alley.
viii. The boxes/ panels shall be dust, vermin, and waterproof and made of thermoplastic/ metallic in compliance with IEC 62208, which should be sunlight/ UV resistive as well as fire retardant & must have minimum protection to IP 65(Outdoor)/ IP 20(indoor) and Protection Class II.

All panels/ boxes shall be provided with adequately rated bus-bar, incoming control, outgoing control etc. as a separate compartment inside the panel to meet the requirements of the Chief Electrical Inspector General (CEIG)/CEA. All live terminals and bus bars shall be shrouded.

8. AC Cables:

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

- 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.
- 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 Owner's approval.
- In addition to manufacturer's identification on cables as per relevant standard, following marking shall also be provided over outer sheath.
  - Cable size and voltage grade
  - Word 'FRLS' at every meter
  - Sequential marking of length of the cable in meters at every meter
- Cables shall be sized based on the following considerations:
  - Rated current the equipment
  - 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. Successful Bidder shall provide voltage drop calculations in excel sheet.
  - Short circuit withstand capability as per design for 1s.
  - De-rating factors according to laying pattern

9. Earthing

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
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	

- 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.
- 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.

- Earth conductors shall be made of copper bonded steel or galvanized steel of sufficient cross section to carry the fault current and withstand corrosion.
- 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 the driven depth of the electrode.
- Every alternate post of the 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.
- 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.

10. Lightning Protection System

- Lightning Protection System for entire plant against direct lighting strokes shall be provided with Early Streamer Emission (ESE) Air Terminal as per NFC 17-102:2011.
- Protection Level for the entire plant shall be level – I.
- Each ESE air terminal shall be provided with following accessories.

I. Highly insulated poly-plastic adaptor to fix the ESE air terminal with the FRP mast
II. Fiberglass Reinforced Plastic (FRP) mast
III. Coupler to connect FRP mast with GI mast
IV. Galvanized Iron mast with base plate and guy wire kit
V. 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. .
VI. Test joint with each down conductor
VII. Lightning event counter complying with EN 50164-6 or equivalent standard. It shall be fixed at suitable height in series with the down conductor.
VIII. 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.

- 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.
- 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.

SCADA and Remote Monitoring System

i. The Plant shall be automatically operated and shall be controlled by microprocessor based control system SCADA and should be Open Platform Communications (OPC) compliant. There shall be simultaneous data logging, recording and display system for continuous monitoring of data for different parameters of different sub systems, power supply of the power Plant at DC side and AC side.
ii. An integrated SCADA shall be supplied which should be capable of communicating with all inverters and provide information of the entire Solar PV Grid interactive power Plant.
iii. The SCADA shall be string level monitoring compatible and shall have features of remote access to the real time data. SCADA shall have features for generating the day ahead schedule of generation based on historical data/ suitable logic. Also, system must be capable of sending the telemetry data to the local SLDC via GPRS/ GSM/ suitable mode.
iv. Computer-aided data acquisition unit shall be a separate & individual system comprising of different transducers to read the different variable parameters, A/D converter, multiplexer, de-multiplexer, interfacing hardware and software which will be robust & rugged suitable to operate

in the control room Environment.

v. Reliable sensors for solar insolation, temperature, and other weather and electrical parameters are to be supplied with the data logger unit.

vi. The Data Acquisition System should be housed in a desk made of steel sheet.

vii. All data shall be recorded chronologically date wise. The data file should be MS Excel/ CSV compatible. The data, if needed, can be accessible remotely through authorized access. The data logger shall have internal reliable battery backup and data storage capacity to record all sorts of data simultaneously round the clock. All data shall be stored in a common work sheet chronologically and representation of monitored data shall be in graphics mode or in tabulation form. All instantaneous data can be shown in the Computer Screen. Provision should be available for Remote Monitoring.

viii. SCADA shall measure and continuously record electrical parameters and provide following data (but not limited to) at a 5-15 minute interval.

ix. SCADA shall have feature to be integrated with the local system as well remotely via the web using either a standard modem or a GSM/WIFI modem. The Contractor shall provide compatible software and hardware so that data can be transmitted via. Standard modem.

x. This will be the Contractor's responsibility to apply and get the suitable connection for SCADA, office & control room on behalf of the EESL/DISCOM & all the expenditures including payment of periodic bills of Internet provider shall be met by the Contractor.

xi. SCADA shall be provided with reliable power supply along with backup supply for at least one hour to cater to outage of grid.

xii. The SCADA shall be compatible to the requirements for measuring and reporting the performance-ratio (PR) of the Plant.

The Contractor shall provide all administrative rights/ privileges/passwords of the SCADA system to the EESL/DISCOM. The EESL/DISCOM have rights over the data generated in the Plant

Power and Control Cables specifications on AC side

i. The size of each type of cable selected shall be based on minimum voltage drop; however the maximum drop shall be limited to 2%. Due consideration shall be made for the de-rating of the cables with respect to the laying pattern in buried trenches / on cable trays, while sizing the cables.

ii. All cables shall be supplied in the single largest length to restrict the straight- through joints to the minimum number.

iii. Only terminal cable joints shall be accepted. No cable joint to join two cable ends shall be accepted. All cable/wires shall be marked with good quality letter and number ferrules of proper sizes so that the cables can be identified easily. The ferrules used must be UV resistant. However, for HT cables, embossed ferrules can be used.

iv. Cable terminations shall be made with suitable cable lugs & sockets etc., crimped properly and passed through brass compression type cable glands at the entry & exit point of the cubicles.

v. The cables shall be adequately insulated for the voltage required and shall be suitably colour coded for the required service. Bending radii for cables shall be as per manufacturer's recommendations and IS: 1255.

vi. Cables inside the equipment room, control room and in the switchyard shall be laid in Galvanized Cable Trays mounted on mild steel supports duly painted, in constructed trenches with RCC raft and sidewalls or bricks sidewalls and provided with removable RCC covers.

vii. All the communication cables (RS 485, fibre optics etc.) must be supplied with type test reports and shall laid in accordance with the relevant IS codes. It must be laid so that there is no interference

with the power cables.

viii. Type test reports and Data sheets of individual cable sizes (HT & LT) shall be submitted for approval by EESL/DISCOM. Drum numbers and drum length details shall be submitted with each consignment

Codes and Standards

i. IS: 1255 Code of practice for installation and maintenance of power cables Up to and including 33kV rating.
ii. IS: 9537 Conduits for electrical installation.
iii. IS: 13573 Joints and termination for polymer cables for working voltages from 6.6kV up to and including 33kV performance requirements and type tests.
iv. VDE 0278 Tests on cable terminations and straight through joints.
v. BS 6121 Specification for mechanical cable glands for elastomers and Plastic insulated cables.
vi. Indian Electricity Act
vii. Indian Electricity Rules

Design and Constructional Features

Inter Plant Cabling

Interplant cabling for main routes shall be laid in Cable trenches/cable trays/buried/duct banks. In case of Duct banks, pull-pits shall be filled with sand and provided with a PCC covering. All buried cables shall be armoured.

Cable glands

Cable shall be terminated using double compression type cable glands. Cable glands shall conform to BS: 6121 and be of robust construction capable of clamping cable and cable armour (for armoured cables) firmly without injury to insulation. Cable glands shall be made of heavy duty brass machine finished and nickel chrome plated. Thickness of plating shall not be less than 10 micron. All washers and hardware shall also be made of brass with nickel chrome plating Rubber components shall be of neoprene or better synthetic material and of tested quality. Cable glands shall be suitable for the sizes of cable supplied/erected.

Cable lugs/ferrules

Cable lugs/ferrules for power cables shall be tinned copper solder less crimping type suitable for aluminum compacted conductor cables. Cable lugs and ferrules for control cables shall be tinned copper type. The cable lugs for control cables shall be provided with insulating sleeve and shall suit the type of terminals provided on the equipments. Cable lugs and ferrule shall conform to relevant standard.

Trefoil clamps

Trefoil clamps for single core cables shall be pressure die cast aluminum or fibre glass or nylon and shall include necessary fixing accessories like G.I. nuts, bolts, washers, etc. Trefoil clamps shall have adequate mechanical strength to withstand the forces generated by the peak value of maximum system short circuit current.

Cable Clamps & Straps

The cable clamps required to clamp multicore cables on vertical run shall be made up of suitable size. For clamping the multicore cables, self- locking, de- interlocking type nylon clamps/straps shall be used. The clamps/straps shall have sufficient strength and shall not get affected by direct exposure to sun rays and outdoor environment.

Installation

Cable tray and Support System Installation

i. Cables shall run in cable trays mounted horizontally or vertically on cable tray support system which in turn shall be supported from floor, ceiling, overhead structures, trestles, pipe racks, trenches or other building structures.
ii. Horizontally running cable trays shall be clamped by bolting to cantilever arms and vertically running cable trays shall be bolted to main support channel by suitable bracket/clamps on both top and bottom side rails at an interval of 2000 mm in general.
iii. For vertical cable risers/shafts cable trays shall be supported at an interval of 1000mm in general. Fixing of cable trays to cantilever arms or main support channel by welding shall not be accepted. Cable tray installation shall generally be carried out as per the approved guidelines/ drawings.
iv. The cantilever arms shall be positioned on the main support channel with a minimum vertical spacing of 300 mm unless otherwise indicated.
v. All cable way sections shall have identification, designations as per cable way layout drawings and painted/stenciled at each end of cable way and where there is a branch connection to another cable way.

Conduits/Pipes/Ducts Installation

i. The Contractor shall ensure for properly embedding conduit pipe sleeves wherever necessary for cabling work. All openings in the floor/roof/wall /cable tunnel/cable trenches made for conduit installation shall be sealed and made water proof by the Contractor.
ii. GI pull wire of adequate size shall be laid in all conduits before installation. Metallic conduit runs at termination shall have two lock nuts wherever required for junction boxes etc.
iii. Conduit runs/sleeves shall be provided with PVC bushings having round edge at each end. All conduits/pipes shall have their ends closed by caps until cables are pulled. After cables are pulled, the ends of conduits/pipes shall be sealed with Glass wool/Cement Mortar/Putty to prevent entrance of moisture and foreign material.
iv. Exposed conduit/pipe shall be adequately supported by racks, clamps, straps or by other approved means. Conduits /pipe support shall be installed square and true to line and grade with an average spacing between the supports as given below, unless specified otherwise.

Cable Installation

Cable installation shall be carried out as per IS: 1255 and other applicable standards. For Cable unloading, pulling etc. Following guidelines shall be followed in general:

i. Cable drums shall be unloaded, handled and stored in an approved manner on hard and well drained surface so that they may not sink. In no case shall be drum be stored flat i.e. with flange horizontal. Rolling of drums shall be avoided as far as possible. For short distances, the drums may be rolled provided they are rolled slowly and in proper direction as marked on the drum. In absence of any indication, the drums may be rolled in the same direction as it was rolled during taking up the cables. For unreeling the cable, the drum shall be mounted on suitable jacks or on cable wheels and shall be rolled slowly so that cable comes out over the drum and not from below. All possible care shall be taken during unreeling and laying to avoid damage due to twist, kink or sharp bends. Cable ends shall be provided with sealed plastic caps to prevent damage and ingress of moisture.
ii. While laying cable, ground rollers shall be used at every 2 meter interval to avoid cable touching ground. The cables shall be pushed over the rollers by a gang of people positioned in between the rollers. Cables shall not be pulled from the end without having intermediate pushing arrangements. Pulling tension shall not exceed the values recommended by cable manufacturer. Selection of cable drums for each run shall be so planned so as to avoid using straight through joints. Care should be taken while laying the cables so as to avoid damage to cables. If any particular cable is damaged,

the same shall be repaired or changed to the satisfaction of Project Manager.

iii. Bending radii for cables shall be as per manufacturer's recommendations and IS: 1255.

iv. Where cables cross roads/rail tracks, the cables shall be laid in Hume pipe/HDPE pipe.

v. No joints shall be allowed in trip circuits, protection circuits and CT/PT circuits. Also joints in critical equipment in main plant area shall not be permitted. Vendor shall identify and accordingly procure the cable drum length.

vi. In each cable run some extra length shall be kept at suitable point to enable one LT/two HT straight through joints to made, should the cable develop fault at a later stage. Control cable termination inside equipment enclosure shall have sufficient lengths so that shifting of termination in terminal blocks can be done without requiring any splicing.

Separation

At least 300mm clearance shall be provided between:

- HT power & LT power cables,
- LT power & LT control/instrumentation cables

Directly Buried Cables

i. Cable trenches shall be constructed for directly buried cables. Construction of cable trench for cables shall include excavation, preparation of sieved sand bedding, riddled soil cover, supply and installation of brick or concrete protective covers, back filling and compacting, supply and installation of route markers and joint markers. Laying of cables and providing protective covering shall be as per IS: 1255.

ii. RCC cable route and RCC joint markers shall be provided wherever required. The voltage grade of the higher voltage cables in route shall be engraved on the marker. Location of underground cable joints shall be indicated with cable marker with an additional inscription "Cable Joint".

Cable Terminations & Connections

i. Work shall include all clamps, fittings etc. and clamping, fitting, fixing, plumbing, soldering, drilling, cutting, taping, preparation of cable end, crimping of lug, insulated sleeving over control cable lugs, heat shrinking (where applicable), connecting to cable terminal, shorting and grounding as required to complete the job.

ii. The equipment will be generally provided with undrilled gland plates for cables/conduit entry. The Contractor shall be responsible for punching of gland plates, painting and touching up. Holes shall not be made by gas cutting. The holes shall be true in shape. All cable entry points shall be sealed and made vermin and dust proof. Unused openings shall be effectively sealed by 2mm thick aluminium sheets.

iii. Control cable cores entering control panel/switchgear/MCC/miscellaneous panels shall be neatly bunched, clamped and tied with self-locking type nylon cable ties with de interlocking facility to keep them in position.

iv. All the cores of the control cable to be terminated shall have identification by providing ferrules at either end of the core, each ferrule shall be indelible, printed single tube ferrule and shall include the complete wire number and TB number as per the drawings. The ferrule shall fit tightly on the core. Spare cores shall have similar ferrules with suffix sp1, sp2, ---etc. along with cable numbers and coiled up after end sealing.

v. All cable terminations shall be appropriately tightened to ensure secure and reliable connections.
Note: Contractor must comply with the relevant grid regulations, DISCOM'S, State Transco's and CEA's guidelines with respect to all the works corresponding to power evacuation, transmission, termination along with metering at designated substation.

Danger Plates

Size of each Danger Notice plates shall be 200 mm x 150 mm made of mild steel sheet and at least 2 mm thick, and vitreous enamelled white on both sides and with inscription in signal red colours on front side as required. The inscriptions shall be in Hindi, Local Language and English.

Fire alarm System

i. Any rooms shall have fire detection and alarm system installed as per relevant standards and regulations. The installation shall meet all applicable statutory requirements, safety regulations in terms of fire protection.

ii. Liquefied CO2/ Foam/ ABC type fire extinguisher shall be upright type of capacity 5/10 kg having IS: 2171. 7 IS: 10658 marked. 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. Contractor shall provide portable fire extinguisher as per the recommendation by relevant fire safety authority.

iii. The minimum 2 no. of fire extinguishers (CO2 and Foam type each) shall be provided at every buildings/enclose, however Contractor must comply with existing building code for fire Protection by NFPA, IS & State Fire Protection Department.

iv. Sand bucket should be wall mounted made from at least 24 SWG sheet with bracket fixing on wall conforming to IS 2546 at strategic locations.

v. The plan for fire extinguishing must be provided by the Contractor to EESL/DISCOM for the approval.

Testing Instruments for Electrical & Electronic

Contractor shall also provide required set of onsite testing instruments/equipment viz

(i) Earth resistance tester:

Sl. No	Parameters	Specification
1	Display	LCD Digital Display with backlight
2	Range	Earth Resistance: up to 2000 Ω Earth Voltage : 200 V
3	Safety Ratings	IP 56
4	Programmable Limits setting	Enabled
Accessories		
1	Earth Ground Stakes (4 Nos)	
2	Three cable reels with cable length up to 20 m	
3	Carry Case-1 (capable of handling tester along with accessories)	
4	1 set of spare battery	

(i) Array Tester:

Sl. No	Parameters	Specification
1	Display	LCD Digital Display with backlight
2	Functionality	All electrical tests required by IEC 62446- 1:2016

3	Memory	Up to 200 records & USB downloadable to Computer
Accessories		
1	A set of two, 4mm fused leads for extra protection during installation tests.	
2	Leads which enable the Solar PV100 to connect directly to PV arrays which use MC3 connectors	
3	1 set of spare battery	

(ii) Insulation tester:

Sl. No	Parameters	Specification
1	Display	LCD Digital Display with backlight
2	Insulation Test Range	0.1 MΩ to 10 GΩ
3	Test Voltage	50 V, 100 V, 250 V, 500 V, 1000 V
4	Test Voltage accuracy	+20% on positive side only no negative variation is allowed
5	Insulation Test Current	1 mA nominal
6	Auto Discharge	Discharge time< 0.5 Second for C=1
7	Open Circuit test Voltage	>4 V, <8 V
8	AC/DC Voltage measurement	600 V (0.1 V Resolution)
8	Short Circuit Current	> 200 mA
Accessories		
1	Heavy duty Test Lead Set – 4 Nos.	

2	Carry Case with sufficient space for accommodating accessories.

(i) Multi-meters:

Sl. No	Parameters	Specification
1	Display	LCD Digital Display with backlight
2	AC/DC Current	500 μ A to 10 A (Accuracy 0.15 %)
	AC/DC Voltage	50 mV to 1000 V (Accuracy 0.025 %)
3	Resistance	50 Ω to 5000 Ω (Accuracy 0.05 %)
4	Capacitance	1 nF to 100 mF (Accuracy 1.0 %)

5	Frequency	99.999 Hz, 999.99 Hz, 9.9999 Hz, 99.999 kHz, 999.99 kHz (Accuracy 0.005 %)
Accessories		
1	Temperature Probe	
2	Silicon Test Lead	
3	Alligator Clip	
4	Carry Case with sufficient space for accommodating accessories.	

(i) Clamp meters:

Sl. No	Parameters	Specification
1	Display	LCD Digital Display with backlight
2	Jaw Opening	30 mm
3	Maximum Wire Size	600 MCM
3	Current Range	0 to 400 A
4	Accuracy Current	2.0 %
5	Voltage range	0 to 600 V
6	Voltage Accuracy	1.5 %
7	Resistance Range	0 to 4000 Ω
Accessories		
1	Test leads	
2	Electrical test leads	
3	Probe light & extender	
4	Carry Case with sufficient space for accommodating accessories.	

(i) Transformer oil BDV kit:

Sl. No	Parameters	Specification
1	Display	LCD Digital Display with backlight
2	Input:	230 Volts, 50 Hz, Accuracy /- 10%
3	Output	0 - 100 KV
3	Capacity	1 kVA
4	Duty Cycle	Continuous
5	Compliance	IS-6792

(ii) Infra-red thermal imaging hand held Camera:

Sl. No	Parameters	Specification

1	Temperature measurement Range	Up to 650°C° Accuracy ±2°°C°
2	On-screen emissivity Correction	Possible
3	On-screen reflective background temperature Correction	Enabled
3	On screen transmission Correction	Enabled
4	Detector Type	Focal Plane Array, uncooled micro-bolometer, 320 x 240 pixels or better
5	Total Pixels	> 75000
6	Infrared spectral Band	7.5 μm to 14μm (long wave)
7	Field of view	46° x 34°
8	Spatial Resolution (IFOV)	2.62 mRad
9	Wi-Fi Connectivity	Enabled
10	Data Storage	USB & memory card enabled

Note:

a) All testing equipment shall possess valid calibration certificate issued from approved NABL / accredited labs.

b) Instruments of superior rating is allowed after seeking consent of the DISCOM

c) Maintenance, calibration, up keeping, repair & replacement of these tools will be in the scope of Contractor during 25 years of O&M.

d) It is Contractor's responsibility to arrange for tools, tackles, logistics, test kits, manpower, experts etc. required for trouble free operation of Plant

General Guidelines

i. Any civil, electrical, mechanical & plumbing work which is not mentioned or included in this tender document but necessary for the Plant shall be borne by the Contractor.

ii. Successful Bidder/ Contractor shall prepare all designs / drawings have based on the specifications given in the tender and in light of relevant BIS/IS/ equivalent standard.

iii. The Contractor shall provide type test reports and datasheet/ GTP for all equipment used for the

project.

iv. The EESL/DISCOM reserves right to modify the design at any stage, to meet local site conditions / project requirements.

v. All work shall be carried out in accordance with the latest edition of the Indian Electricity Act and rules formed there under and as amended from time to time.

Guaranteed Energy Generation

Number of units generated per Annum

For every 'KILO WATT PEAK (kWp)' of solar PV modules installed by the contractor, the contractor shall guarantee the minimum energy generation (net energy exported to grid i.e. after deducting auxiliary consumption/import) as tabulated below. The guaranteed energy generation per annum at a particular site will be calculated based on on pro rata basis based on the total installed plant capacity (kWp). The guaranteed energy generation shall be calculated based on the energy reading recorded at the DISCOM's main billing meter.

Minimum Guaranteed Energy generated by each of the solar PV power plant at the end of the first year for the state of Maharashtra is tabulated:

Plant Capacity (kWp)	250	500	1000	1500	2000	2500
kWh per annum (First year)	3,83,250	7,66,500	15,33,000	22,99,500	30,66,000	38,32,500

- The annual guaranteed energy generation is calculated for 12 months from the date of Commercial Operations Date (COD). The annual guaranteed energy generation from SPGS shall be calculated after deducting the auxiliary power consumption (including imports).
- The minimum annual guaranteed energy generation may be adjusted against the period for which the DISCOM's grid is not available (shall be counted from 8:00 AM to 6:00 PM shall be counted). The contractor shall make the necessary arrangements to keep the record of Energy Generation, Plant Outages and Grid unavailability period. The loss of energy due to faults from the plant side shall not be considered for the estimating the annual energy generation. The grid unavailability period shall be duly certified by the DISCOM and EESL officials. The grid unavailability report shall be submitted by contractor to DISCOM and EESL on monthly basis.
- The degradation in energy generated shall be considered by the bidder as per sl no. 'b' of clause a.11 'Solar Power Generating System (s) Performance Guarantee' of this document. For guaranteed energy generation from the Solar Power Generating System(s), please refer to Annexure 4 of this section.
- The gross energy generation readings on monthly basis recorded from the billing meter (Main / Check). The energy bills submitted by the contractor to the EESL shall also clearly indicate the Gross Energy generated, imported by the plant.
- Contractor may deploy String or Central grid-tie string inverters
- Contractor may carry out the survey of the open land available at the substation and install the solar PV plant of suitable capacity based on the land availability.

Civil, Mechanical & Plumbing Works

This section of Technical Specifications describes detailed technical and functional requirements of all civil, Mechanical & Plumbing works included in the scope. All the Civil, Mechanical & Plumbing works must be done considering coastal environmental/climatic condition existing at site.

All design and construction of civil works shall conform to relevant Indian standards such as BIS, IRC, MORST, NBC etc. Design of steel structures shall conform to IS: 800, 802 or 802 as applicable with working stress method (WSD) of design. Design of concrete structure shall conform to IS: 456. For design of liquid retaining structure IS: 3374 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 EESL/DISCOM and the contractor shall submit proper justification along with his request to the EESL/DISCOM for his review. All the design/ drawings shall be prepared/ approved by the chartered structural engineer. The design calculations for MMS, RCC structure, steel structure, foundation system, road work, drainage work, etc. shall be submitted for prior approval of EESL/DISCOM before commencement of construction.

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 with design properties considered, type of sections used 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 load combinations considered and conclusions on design results with supporting sketches for easy reference and clarity. Where a computer program (other than STAAD Pro) is used for analysis and design, the contractor shall also include a write-up on the computer program used along with validation check. Input and output file shall also be given in the design report to facilitate its review and approval by the EESL/DISCOM.

The construction methodology for MMS and its foundations, road works, drains and pile load test procedure shall also be submitted for prior approval of EESL/DISCOM before start of works. The construction shall be done only as per approved drawings

11. Other Investigations

- The contractor shall also obtain and study other input data at proposed project site for design of the project. This shall include data related to earthquake and wind, rainfall, maximum & minimum ambient temperature, humidity, high food level (HFL) etc.
- Topographical survey, area grading, as applicable.
- 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 and steep variations in topography the study shall also include the effect of topographical variations on array layout. The contractor shall submit all the details/design to the EESL/DISCOM for approval.
- 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 different grades of concrete to be used in the work. The concrete mix shall be designed for each source of cement and quarry as per provisions of relevant Indian Standard.

12. Foundations

- Contractor shall design all foundations for buildings, equipment, Switch yard structures, Transformer, MMS & other structures as per relevant BIS standards and recommendations of Geotechnical investigation report.
- In case the contractor proposes to provide pile foundation for support of module mounting structure (MMS); the type, dia. and length of pile shall be as per recommendations of Geotechnical Investigation Report corresponding to prevalent soil characteristics at site,.

- In case collapse of foundation strata during drilling of the pile bore, removal steel liner shall be used to maintain design depth and diameter of the pile for proper concreting.
- The design pile capacity under direct compression, lateral load and pull out shall be verified through field trials by conducting initial load tests on test piles to be specially cast for this purpose. The tests shall conform to IS 2911 – Part 4. The no. and location of such tests shall be as discussed and finalized with Engineer- in-charge. However, min. 3 no. of Tests shall be conducted under each category.
- Contractor shall also carry out routine tests on 0.5 % of the total no. of working piles as per provisions of IS: 2911 – Part 4.
- Contractor must take into account that the site is prepared by filling of sand from coastal area.

Module Mounting Structure (MMS)

- The ground mounting structure design must follow the existing land profile.
- The structure shall be designed to allow easy replacement of any module and shall be in line with the site requirements.
- The MMS stub/ column, rafter, purlin, ties and bracing members shall conform to Indian standards as mentioned in the list of codes and 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.
- The minimum thickness (BMT) of various elements of MMS structure shall be as following: Stub/ column & Bracing/Purlin & other members. Final thickness of the members shall be arrived by structural analysis considering combination of all possible loads.
- The contractor can also propose new light gauge structural steel or structural aluminium sections other than specified above subject to approval of the EESL/DISCOM. In this case the contractor shall submit his proposal stating the technical advantages of the proposed sections for EESL/DISCOMs review along with supporting literature.
- MMS column post shall be supported with base plate secured to foundation using anchor bolts for easy maintenance/ repair/ replacement.
- The primary loads and load combinations for design of MMS structure shall be as specified under "Design Load".
- The support structure design shall be as per relevant Indian standard(s) and shall be with working stress method considering appropriate factor of safety. No increase in permissible stress under wind/ Seismic load combination shall be permitted.
- The maximum permissible deflection/side sway limits for various elements of MMS under serviceability conditions shall be as following: Lateral deflection for Column/ stub– Span/ 240 & Vertical deflection for Rafter and Purlin – Span.
- In case of fundamental time period of MSS table structure more than 1 Sec, the structure design shall be checked against dynamic effects of wind as per provisions of IS – 875 (Part-3).
- MMS shall support SPV modules at a given orientation & tilt, absorb and transfer the mechanical loads to the ground properly.
- Welding of structure at site shall not be allowed and only bolted connections shall be used.
- The MMS structure shall be hot dip galvanized with minimum thickness of coating not less than 80 microns on each side. Galvanization shall conform to IS-2629, 4759 & 4736 as applicable, considering coastal environmental condition. 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 such foreign material as are likely to interfere with the coating process. The Contractor should ensure that inner side should also be coated. The galvanization shall be done after fabrication of members to ensure galvanization of all cut surfaces. In case the proposed section is made up of Aluminium,

anodized coating shall be Gr AC25 and shall conform to IS: 1868. 10.13 The array structure shall be so designed that it will occupy minimum space without sacrificing the output from SPV panels at the same time.

- Two numbers of anti-theft fasteners of stainless steel on two diagonally opposite corners for each module shall be provided. All the fasteners and washers (packing & spring) for Module Mounting Structure and Module shall be adequately protected from atmosphere and weather prevailing in the area. 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 316 equivalent and must sustain the adverse climatic conditions to ensure the life of the structure for atleast 25 years.
- Modules shall be clamped & bolted with the structure properly. The material of clamps shall be Anodized Al / Stainless Steel. Clamp/bolt shall use EPDM rubber and must be designed in such a way so as not to cast any shadow on the active part of a module. In case bolts are used, Spring Washers shall be used bolt head end and EPDM rubber shall be used in between Module & purlin.
- The MMS foundation shall be designed as per the loads specified under clause "Design Loads".The anti-theft bolts, nuts etc shall be provided by the Contractor.
- The array structure shall be grounded properly using maintenance free earthing kit
- The Contractor shall specify installation details of the PV modules and the support structures with appropriate diagram and drawings.
- The Contractor should design the structure height considering highest flood level at the site and the finished grade level.
- For multiple module mounting structures located in a single row, the alignment of all modules shall be within an error limit of maximum 10mm.
- The Successful Bidder/ Contractor shall submit the detailed foundation &structural design basis and the list of reference standards, in this Bid, duly certified by a Chartered Structural Engineer having adequate successful experience in similar works.
- The contractor shall submit the detailed design calculations and drawings for MMS structure, bill of materials and their specifications/ standards to the EESL/DISCOM for approval within 30 days from issue of LOA/ NTP before start for fabrication work.
- Contractor must submit the complete quality documents i.e. test certificates for all tests conducted starting from raw material stage, in process, final testing w.r.t structure.

Concrete Works

- All RCC works shall be with design mix as per IS 456 and the materials used viz. Cement, coarse & fine aggregate, Reinforcement steel etc. shall conform to relevant BIS standards.
- The minimum grade of RCC shall be M25 except for underground (UG) water tank where the grade of concrete shall be min. M30. PCC shall be of min. grade M10 (equivalent nominal Mix – 1:3:6) unless otherwise specified.
- Reinforcement steel shall be of high strength TMT bars of grade Fe500 Dconforming to IS: 1786. Ductile detailing in accordance with IS: 13920 shall be adopted for superstructure and sub-structure of all RCC buildings and structures.
- For grouting works anti shrink ready mix grout of approved make or cement mortar (CM) grout with non-shrink additive shall be used. The grout shall be high strength grout having min. characteristic strength of 30 N/ mm2 at 28 days.

Miscellaneous Steel Works

- Unless otherwise specified all structural steel work shall be designed as per provisions of IS: 800 with working stress method of design (WSD).
- 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.

Pipe and Cable Trenches

- All cable trenches shall be of RCC. The min. wall and base slab thickness shall be 100mm for depth ≤ 750mm and 150mm for depths > 750mm. The trench shall be designed for lateral load due to external soil fill, ground water table at FGL and 50 KN/ Sqm surcharge. External trenches shall be kept min. 100mm above FGL to avoid entry of rain water.

  Internal cable trench shall be provided with chequered plate (min. 8mm thick) covers, the trench cover shall be provided with suitable lifting hooks. Both top edges of the cable trench shall be provided with min. 50x50x6 mm edge protection angle.

Transformer Yard Civil Works

- Transformer and equipment foundations shall be founded on piles/isolated spread footings depending on the final geotechnical investigation report.
- Transformer foundations shall have its own pit which would cover the area of the transformer and cooler banks, so as to collect any spillage of oil or oil drainage in case of emergency.
- The oil pit shall be filled with granite stone gravel of 40 mm size uniformly graded. The retention capacity of the transformer pit shall be min. 1/3 volume of the transformer oil which is filled with gravel with 300mm free space above gravel fill.
- The individual transformer oil pit shall be connected to an oil collection pit which shall be sized to accommodate full oil volume of the transformer connected to it, without backflow. The oil collection pit shall be connected to oily water drainage system. Dimensions of the discharge pipe shall consider rainfall intensity also. The water shall be discharged into the nearest drain by gravity flow or pumping.
- Both, the transformer pit and the oil collection pit shall be of RCC. The oil collection pit shall be provided with RCC cover.
- The area around the transformer and equipment shall be covered with gravel. The transformer yard fencing work shall conform to CEIG requirements.
- Transformer track rails shall conform to IS: 3443. 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.

Water Supply & Cleaning of Modules

- Contractor has to plan and install the effective module cleaning system as per the prevailing conditions at Site. The system may include the storage water tanks, pumps, laying of GI/HDPE/UPVC pipes, flexible pipes, taps/ valves, pressure gauges etc. as per the planning by the Contractor. Contractor has to submit the drawing/ plan for the proposed module cleaning system.
- All the pipes thus laid must be buried in ground at least 150mm below FGL. Road crossings and drain crossings, the pipes must be passed through GI/ Hume pipes as applicable.

Inspection & Testing Inspection*:*

- EESL/DISCOM shall have free access to Contractor's manufacturer's works to inspect, expedite and witness shop floor tests. Any materials or work found to be defective or which does not meet the requirements of the specification will be rejected and shall be replaced at Contractor's cost. EESL/DISCOM reserves the right to carry out stage wise inspection of fabrication and components. The Contractor shall furnish a detailed quality assurance plan (QAP) for review by the

EESL/DISCOM.

- The test & inspection shall be carried out at manufacturer's work and at the site with the Contractor's obligation. The test and Inspection shall be done in accordance with the relevant standards and the Manufacturer's standard before the delivery to site as well as after the erection and commission at site. The Contractor shall give the list of tests that they will carry out at site to show the performance of Plant.
- A detailed 'QAP' for Manufacturing and Inspection shall be submitted by the Contractor for EESL/DISCOM's approval. The data of each test and inspection shall be recorded and submitted as soon as the test/ trials are conducted and will also be a part of final documentation.
- The shop test shall be carried out to prove the performance parameters of the offered model. The testing shall be done in the presence of the representatives of the department.
- The EESL/DISCOM will nominate its representatives for inspection of stage manufacturing and testing at works & 7 days training at premises of SPV module and PCU manufacturer.
- Manufacturer has to submit procedure for Test carried out at their Factory:

i. Start Up Trials
ii. Load Test
iii. Records & Measurements
iv. Safety Device List
v. Setting values for all sensors for Pressure and Temperature
vi. Dimensional Check-up, Overall Inspection, Completeness of Scope of Supply
vii. Shop Test/Load Test for Solar Power Plant

Load Trials & Reliability test at Site

- Performance Guarantee Test at Site for Grid Connect Solar Power Plant, HT Panel etc.
- These tests will be conducted at site as per site conditions at available load and after performing all pre-commissioning check and trials and after readiness of the entire Solar Power Plant system which are required to carry out the load trials
- All the tests which are mentioned in the load test of Solar Power Plant will be carried out in presence of EESL/DISCOMs' Representative at Site under site conditions and the parameters checked in accordance with the data sheet and guaranteed parameters given by the Contractor.
- All the equipment supplied by the vendor will be tested as per relevant standard/ Quality assurance plan at site conditions and the performance monitored.

Quality Considerations

- Contractor will submit and get finalized detailed comprehensive Standard Field Quality Plan (SFQP) within 30 days from date of issue of the LOA/NTP/PO for bought out items and items manufactured by them. The Standard Field Quality Plan shall equipment till final inspection and testing to be followed for bought out items and items manufactured by Contractor. Accordingly, the Manufacturing Quality Plan shall be submitted broadly under following sub-heads:-

viii. Raw material/Bought Out items and Components.
ix. In process inspection and test/checks to establish successful completion/ accomplishment of the process.
x. Final tests/checks in accordance with relevant national/ international standards/specification.

- The quantum of check for each and every inspection/test items shall be based on an established sampling method and the quantum of check indicated in the SFQP should be designed adequate quality protection.
- In case reference documents/acceptance norms are indicated as per Plant standards then the same

shall be duly substantiated/properly explained by well- established and proven engineering practices. All submissions will be in English language only.

- Contractor will to allow EESL/DISCOM to carry out Quality/Audit/Quality surveillance on Contractor's and our sub-vendor's work with reference to contractual obligations to ensure that the quality management practices/norms as detailed out in the Quality Manual are adhered to. To facilitate this activity, you shall keep EESL/DISCOM informed all progress of work in this contract on monthly basis.
- Contractor will associate/fully witness in each inspection being carried out at their/their sub-vendor's works by our authorized inspection engineer(s).
- EESL/DISCOM shall also carry out quality audit and quality surveillance of your systems, procedures and quality control activities. However, this shall not relive you of any of your contractual responsibilities under the contract.

13. Performance and Functional Warranty / Guarantees

- During the period of Warranty / Guarantee the Contractor shall remain liable to replace any defective parts, that becomes defective in the Plant, of its own manufacture or that of its sub-Contractors, under the conditions provided for by the Contract under and arising solely from faulty design, materials or workmanship, provided such defective parts are not repairable at Site to the extent that it operates at its full efficiency, reliability capacity.
- At the end of guarantee period, the Contractor's liability shall cease. In respect of goods not covered by the first paragraph of this clause, the EESL/DISCOM shall be entitled to the benefit of such guarantee given to the Contractor by the original Contractor or manufacturer of such goods.
- During the first year of assured performance demonstration and Operation & Maintenance thereafter, the Contractor shall be responsible for any defects in the work due to faulty workmanship or due to use of sub-standard materials in the work. Any defects in the work during the guarantee period shall therefore, be rectified by the Contractor without any extra cost to the EESL/DISCOM within a reasonable time as may be considered from the date of receipt of such intimation from the EESL/DISCOM failing which the EESL/DISCOM shall take up rectification work at the risk and cost of the Contractor.

Site Details: Site will be in the state of Maharashtra ranging from 500kWp to 2MWp. Exact Sites shall be provided later.

Format for MoM during Site Survey

Minutes of Meeting held between DISCOM, M/s EESL and Contractor at _____
district for Small Solar Plant at_____substation

Date: DD.MM.YYYY

A joint survey was conducted by EESL and/or DISCOM and Contractor for finalization of available area for small solar power plant. Drawings of solar array layout & structural drawings and following are the observations as tabulated below:

Sl No.	Description	Scope	Remarks
1	Tree cutting within the proposed/ marked area for solar installation	DISCOM	
2	Relocation of /Removal of existing HT lines from proposed/marked area for solar installation	DISCOM	
3	Provision of spare feeder/ bay extension for the solar power evacuation	DISCOM	
4	Provision for HT cable (with trenching) from solar plant HT panel to power evacuation point	DISCOM	
5	Fencing and approach road to solar plant	DISCOM	
6	Provision of solar material storage area		
7	Ground levelling and clearance	DISCOM	
8	DISCOM to confirm site handover date after completion of all above work	DISCOM	
9	Removal of all unused items in existing old control room and Availability of same for use of solar plant	DISCOM	
10	Submission of structure layout, SLD, etc. for approval to EESL/DISCOM	Contractor / LoA +17 days	

**Contractor may add additional rows with time lines as per the scope of work by respective agencies*

Name	Designation	Signature

Proforma for Site Survey

Name of the Substation	
Rating of the Substation	
Date of Survey	

Table of Contents

1. General Data

Customer Name	
Survey Conducted By	
Contact/Nodal Official	
Designation	
E-Mail	
Telephone/Mobile	

2. Site Data

City	
Address	
Latitude and Longitude	

Nearest Railway Station				
Nearest Airport				
Location Type	Residential	Commercial	Industrial	Defence
Type of Area available	Roof	Ground	Roof & Ground	
Power Plant Type	Off-grid	Grid-tied	Grid-interactive (Hybrid)	
Type of Power Available	Grid (Utility)	Diesel Generator	Wind	
Inverter Room Availability	Available	Not available		

3. Climate Data

Parameters	Summer		Winter	
	Max	Min	Max	Min
Temperature				
Wind velocity				
Average rain fall per annum				

4. Land Data (for Ground installations)

Land area (sq. m) for setting up the solar plant	
Land Type	☐ Flat ☐ Slope
Slope of Land	East / West / North / South facing
Approach road to site	☐ Yes ☐ No
Type of Soil	
Is available area shadow free?	☐ Yes ☐ Partial Any obstructions nearby_____

Water availability	
Bore wells	Nos
Water supply	
Security at the plant	
Clearance of Land	
Is fencing available for complete project land	
Type of fencing	
Availability of periphery road	

5. Electrical data

Grid (Utility)	Voltage (kV) :			
Frequency [Hz]:				
Availability of bay (Bay extension)				
Energy Details	Daily	Monthly	Yearly	
Energy Consumed (kWh)				
Min. Load	_____kW	_____Amps		
Max. Load	_____kW	_____Amps		
Average Load (kW)	_____kW	_____Amps		
Minimum load During holidays or Weekends (kW)				
Tariff Paid (Rs.) (If any)				
Sanctioned Load (kW)				
Duration of Power cuts at 11 kV (Avg) (interruptions only)	_____Hours/month; _____Hours/Year			
Incomer duration of Power cuts	_____Hours/Year			

(interruptions only)			
Peak hour Duration		Peak hour time range	
No of Transformers			
Rating and **Capacity** of each Transformer			
Total Capacity of Transformers	MVA		

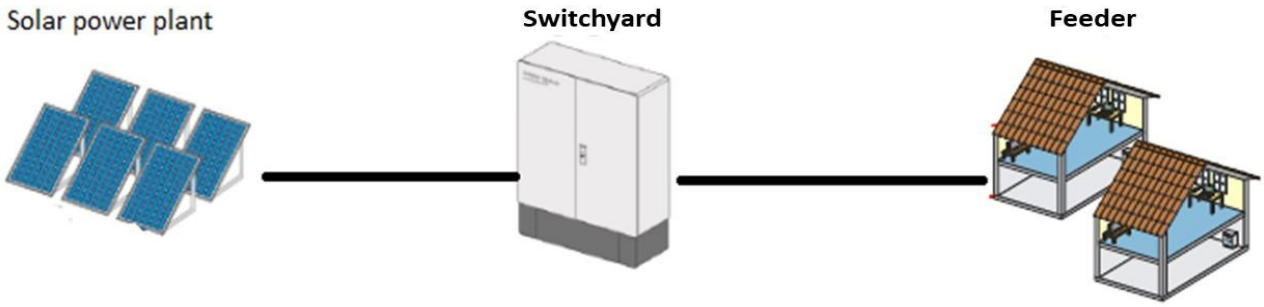
6. *Control room*

Size of the Control room	
Space availability for installation of new systems	
RMS / SLDC	

7. Power House data

LT panel location	
Space availability in existing LT room	☐ Yes ☐ No

8. Distances



Meters meters

9. Observations

SI. No.	Particulars	Remarks
1	No of trees (and type, if any)in the proposed solar plant area	

2	No of LT and HT lines in the in the proposed solar plant area	
3	Availability of water (municipal, bore well etc)	
4	Any other land developmental activity required	

10. Drawings

Sl. No.	Drawing	**Attached**
1	Master plant layout	
2	Single Line Diagram (SLD)	
3	Ground drawing	
4	Substation layout	

Dated: *Place:*

Signature of EESL Representative Signature of DISCOM Representative

Additional Points

1. Attach photographs of land or installation area facing east side
2. Give the details of obstruction for solar power plant
3. Provide photographs of Distribution board, in which power evacuation need to be done.

Annexure-4

Guaranteed Energy Generation from Small solar power plants

Year	Annual Guaranteed Energy Generation, kWh					
	250 kWp	500 kWp	1000 kWp	1500 kWp	2000 kWp	2500 kWp
1	383250	766500	1533000	2299500	3066000	3832500
2	380376	760752	1521503	2282254	3043005	3803757
3	377524	755047	1510092	2265138	3020183	3775229
4	374693	749385	1498767	2248150	2997532	3746915
5	371883	743765	1487527	2231289	2975051	3718814
6	369094	738187	1476371	2214555	2952739	3690923
7	366326	732651	1465299	2197946	2930594	3663242
8	363579	727157	1454310	2181462	2908615	3635768
9	360853	721704	1443403	2165102	2886801	3608500
10	358147	716292	1432578	2148864	2865150	3581437
11	355461	710920	1421834	2132748	2843662	3554577
12	352796	705589	1411171	2116753	2822335	3527918
13	350151	700298	1400588	2100878	2801168	3501459
14	347525	695046	1390084	2085122	2780160	3475199
15	344919	689834	1379659	2069484	2759309	3449136
16	344919	689834	1379659	2069484	2759309	3449136
17	342333	684661	1369312	2053963	2738615	3423268
18	339766	679527	1359043	2038559	2718076	3397594
19	337218	674431	1348851	2023270	2697691	3372113
20	334689	669373	1338735	2008096	2677459	3346823
21	332179	664353	1328695	1993036	2657379	3321722
22	329688	659371	1318730	1978089	2637449	3296810
23	327216	654426	1308840	1963254	2617669	3272084
24	324762	649518	1299024	1948530	2598037	3247544
25	322327	644647	1289282	1933917	2578552	3223188

PAYMENT TERMS

Terms of payment: The terms of payment would be as follows:

1. Submission of Contract Performance Guarantee is a prerequisite for the release of payment.
2. Acceptance of LOA and signing of Contract Agreement.

During Supply Installation, Testing and Commissioning:

Description	% of Payment	Criteria
Part A Supply of Balance of System (BoS) including Grid Tie Inverter, MMS, Transformers, AJB, Cables, Connectors etc. required for successful commissioning including Inland transportation such as including loading, unloading and transfer to Site, insurance and other costs incidental to delivery	60% of (Part A) as per price bid table i.e. Supply Part + and 100% GST)	Within 30 days of successful installation/erection of project(s) upon submission of project(s) wise installation/erection report by contractor, duly verified by REIL / EESL-authorized representative / EIC at designated site (s).
Part B Erection, Installation & Commissioning of SPGS project	30% of (Part A) as per price bid table i.e. Supply Part & 90% of (Part B) as per price bid table i.e. Erection, Installation & Commissioning (and 100% GST)	Within 30 days of successful testing, synchronization and commissioning of project(s) and successful operation of the project(s) along with requisite documentation, training program(s) and Issuance of Completion / Commissioning certificate by respective DISCOM and stamped by REIL / EESL- authorized representative/EIC at designated site (s).
	10% of (Part A + Part B) as per price bid table	After one year of reliable and trouble free operation and demonstration of the energy generation by the project as per LoA/RfP from the date of commissioning of the project (s).

IV. Part -D: Payment during O&M Period:

- Selected bidder(s) shall be paid O&M value (Part D) as per Price bid table for the 25 years on quarterly basis, as per the awarded Contract Value of the awarded Package.
- **This amount will be released in equal installments during the O&M period (% of total O&M value as per the below table) at the end of each quarter (for 25 years) of satisfactory service. If the prices quoted at O&M for 25 years is less than 30% of total project cost (i.e. Part A + Part B + Part C + Part D) of the price bid, then the differential amount will be subtracted from total cost quoted in Part A and Part C (i.e. Part A + Part C) of the price bid and accordingly, LoA/LoI will be issued to the successful bidder.**

Years	% of O&M value released quarterly during the period in equated manner
1 – 5	10%
6 – 10	15%

11 – 15	35%
16 – 20	10%
21 – 25	30%

Notes:

1. The capacity of each the project installed at each project site will be based on the vacant land available at each substation.
2. Progressive payment for items for Part A, Part B and Part C of price bid table will be made against the bills based on certification by the Project Manager/ Engineer In – Charge for the work completed.
3. The release of first progressive payment for Part A, Part B and Part C of price bid table shall also be subject to submission of documentary evidence by the System Integrator towards having taken the insurance policy (ies) in terms of relevant provisions of Insurance clause in the tender documents and acceptance of same by the Project Manager/ Engineer-In-Charge.
4. Price will remain firm till the execution of the contract.
5. The payment will be made to the bidder within 30 days after submission of Invoices complete in all respect i.e. with all the required documents and compliance of relevant terms and conditions of the LoA duly accepted and certified by EIC.

PERFORMA (EMD)

BANK GUARANTEE TOWARDS EARNEST MONEY DEPOSIT

Bank Guarantee No.

Date

To,

Rajasthan Electronics & Instruments Limited, (REIL)
2, Kanakpura Industrial Area Sirsi Road,
Jaipur-302034 (Rajasthan)

Dear Sir,

In accordance with Invitation for Bids under your Bid Document No. **……..**M/s. **……(Bidder Name)** having its registered office at …….....' (hereinafter called the bidder) wish to participate in the said Bid for ……(WORK NAME)

As an irrevocable bank guarantee against Bid Security for an amount of Rs. ……. only (Rs. ……. only) valid up to ……**,** required to be submitted by the Bidder as a condition precedent for participation in the said Bid which amount is liable to be forfeited on the happening of any contingencies mentioned in the Bidding Documents.

We, the **……..(Bank Name & address)** guarantee and undertake to pay immediately on demand by Rajasthan Electronics & Instruments Limited the amount of Rs. …… only) without any reservation, protest, demand and recourse. Any such demand made by the 'REIL' shall be conclusive and binding on us irrespective of any dispute or difference raised by the Bidder.

This Guarantee shall be irrevocable and shall remain valid up to ……..(date of expiry of Guarantee)**..** If any further extension of this guarantee is required, the same shall be extended to such required period (not exceeding one year) on receiving instructions from **M/s. ……..(Bidder Name)** on whose behalf this guarantee is issued.

This guarantee will remain in force up to and including ……..(date of expiry of Guarantee). , and any demand in respect thereof must reach the Bank not later than the above date.

Notwithstanding anything contained herein above:

i) Our liability under this guarantee shall not exceed Rs. ……/- only)
ii) This bank guarantee shall be valid up to …….(date of expiry of Guarantee).
iii) We are liable to pay the guaranteed amount or any part thereof under this Bank Guarantee only and only if we receive from you a written claim or demand on or before ……. (date of expiry of Guarantee).

The said letter of guarantee has been transmitted through SFMS gateway to your bank. It is advised that in your own interest, you may verify the genuineness of above letter of guarantee from your bank / branch.

Dated the date of 2020.

Bank Name

(sealed & signed)

PRICE (FINANCIAL) BID

(NIB No. REIL/RE/2019-20/MAHARASHTRA/MWP/13 dated 07.03.2020)

(To be submitted online)

Sub: Complete Scope of work including Design, Engineering, Supply, Construction, Erection, Testing, Transportation, Unloading, Installation, Commissioning and 25 years Operation & Maintenance of Solar PV based Power Plant with capacities ranging from 500 KW to 2 MW or more at various locations/ sub stations of MSEDCL in the state of Maharashtra. **(REIL will supply the SPV modules at site)**

(AS PER SCOPE OF WORK)

NAME OF BIDDER _____

SN.	Description	Unit Price, Rs./ Wp (GST extra as applicable)
A.	Supply of Balance of systems (BoS) including Grid Tie Inverter, MMS, Transformers, AJB, Cables, Connectors, LT, HT Panels etc. required for successful commissioning.	
B.	**I & C Part:** Erection, Installation & Commissioning of Solar Power Grid connected Systems Project	
C.	**AMC Part**: Operation & Maintenance of Solar Power Grid connected Systems Project for 25 years.	
	Total (A+B+C)	

Date:- (SIGNATURE OF BIDDER)