

# **Thrissur Corporation Electricity Department (TCED)**

## **Request for Proposal**

**For**

***Design Supply Installation Testing  
Commissioning and O and M of 100  
KWp Grid Connected Solar Power Plant  
at Skywalk***

# SUMMARY

## **PART I – BIDDING PROCEDURES AND REQUIREMENTS**

### **Section 1: Request for Proposals (RFP) Notice**

This Section includes Request for Proposals.

### **Section 2: Eligibility and Qualification Requirements**

This Section contains information regarding specific eligibility and qualification requirements applicable for prospective bidders to be considered for further evaluation of their proposal.

### **Section 3: Project Requirements and Specifications**

This Section describes the System Requirement, Specifications, Quality Requirements, Standards, Activities and Tasks, Plans, Deliverables, Documentation, and other requirements/ details related to and/or connected with the Project.

### **Section 4: Project Scope of Work**

This Section describes the background information of the Project, Scope, of Work, Operation and Maintenance of equipment, Bill of Materials and other requirements/ details related to and/or connected with the Project.

## **PART II – CONDITIONS OF CONTRACT AND FORMS**

### **Section 5: Conditions of Contract and Forms**

This Section includes standard contract form. It includes General Conditions of Contract (“GCC”), payment method and Special Conditions of Contract (“SCC”). The SCC include clauses specific to this contract to supplement the General Conditions.

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## PART I – BIDDING PROCEDURES AND REQUIREMENTS

### Section-1: Request for Proposal Notice

#### **“Design, Supply, Installation, Testing, Commissioning and O&M of 100 KWp Grid Connected Solar Power Plant at Skywalk”**

#### PROCUREMENT NOTICE

#### (Single Stage Two-Envelope Bidding Process with e-Procurement)

#### NATIONAL OPEN COMPETITIVE PROCUREMENT

**Contract Title: “Design, Supply, Installation, Testing , Commissioning and O&M of 100 KWp Grid Connected Solar Power Plant at Skywalk”**

**Request for Proposal (RFP)/ Tender Number: PDS/5441/24**

**Issued on: 14/08/2024**

**Thrissur Corporation Electricity Department (hereinafter also referred to as ‘Utility’ or TCED) invites online Proposals for “Design, Supply, Installation, Testing, Commissioning and O&M of 100KWp Grid Connected Solar Power Plant at Skywalk”. Bidders are advised to note the clauses on Eligibility and Qualification Requirements in Section-2 and Evaluation Criteria in Section-3 of the RFP Document for evaluation of Proposals.**

1. Bidding for selection of supplier will be conducted through National open competitive procurement.
2. The RFP Document is available online on <https://etenders.kerala.gov.in> from [14/08/24] to [05/09/24] on payment of cost of document (Tender Fee) as indicated in the TABLE below. The prospective Bidders would be responsible for downloading the RFP Document and ensuring that any addenda/ corrigendum/ amendment/ clarification thereto available on the website is also downloaded and incorporated.
3. The bidding shall be conducted **under Single Stage Two-Envelope Bidding process with e-Procurement.**
4. Under the Single Stage Two-Envelope Bidding process, the Bidder shall not quote, disclose, or submit its price in the Technical Proposal (First Envelope) or in any other manner, whatsoever, except as part of the Financial Proposal (Second Envelope). In case of any non- compliance in this regard, the Proposal shall be out-rightly / summarily rejected.

5. Technical proposal shall contain the scanned copies of the following documents which every bidder has to upload.
  - i. Part I & II of the tender documents downloaded from the website.
  - ii. Agreement in the prescribed format (Annexure I-D) on Govt. of Kerala stamp paper worth Rs.200/--
  - iii. Copy of Registration Certificate of the bidder firm.
  - iv. Copy of the work orders and certification from the Purchase regarding execution of the order, to prove the experience in executing similar orders, as specified.
  - v. Documents to prove the Turnover of the bidder.
  - vi. Details of the technical offer, including test certificates issued in the name of the bidder.
  - vii. List of Service centres within Kerala with full address and phone nos. (or the required undertaking)
  - viii. Summary of Bid Qualification Requirements (Format as in Annexure I-C)
  - ix. Declaration by the Bidder (format as in Annexure-II-E)
  - x. Statement of Deviations (format as in Annexure-II-F)
  - xi. Declaration for Deviations (format as in Annexure-II-G)
  - xii. Declaration of Subsidy Claim (format as in Annexure-II-H)
6. Envelop-2: shall contain the Price Schedule as per BOQ in Excel format for this tender to be downloaded from e-tender website, duly digitally signed by the tenderer/authorised signatory of the tenderer.
7. The department doesn't take any responsibility for any technical snag or failure that has taken place during document upload.
8. An incomplete and/or ambiguous and/or conditional Proposal and/or Proposal submitted late is liable to be ignored/ summarily rejected.
9. Proposal must be submitted online through the e-Procurement/ e-Tendering process specified in Section 3. Any Proposal or modifications to Proposal received outside the e-Procurement system will not be considered, unless otherwise specified in Section 3. Utility shall not be held liable for any delays due to e-Procurement/ e-Tendering system failure beyond its control. Even though the system will attempt to notify the bidders of any bid updates, Utility shall not be liable for any information not received by the bidder. It is the bidders' responsibility to verify the website for the latest information related to this RFP.
10. Important dates, amounts and other details pertaining to this RFP Notice including submission and opening of proposal, cost of documents/ Tender Fee, address for communication, etc., are given in the TABLE below.
11. If TCED office happens to be closed on the specified date of opening of the Proposals, the Proposals / bids will be opened on the next working day at the same time and venue or as may be notified by TCED.
12. The quotes for the Design, Supply, Installation, Testing & Commissioning including 5 years of warranty (EPC Part), and the quote for the 5-year Operation and Maintenance (O&M part) to be provided by the bidders. The L1 bidder will be selected based on their quotes on the EPC part with 5-year warranty and the O & M quote will be part of evaluation.
13. Other details can be seen in the RFP document.

# TABLE

## Other Details

A.	<p>Address for Communication including Contact details:  Assistant Secretary, Electricity Department, Thrissur Corporation  Thrissur – 680 001  e-mail: <a href="mailto:astced.lsgd@kerala.gov.in">astced.lsgd@kerala.gov.in</a>, <a href="mailto:electricitydepartment@yahoo.co.in">electricitydepartment@yahoo.co.in</a></p>
B.	<p>Payment of cost of document/ Tender Fee:</p> <ol style="list-style-type: none"> <li>1. Tender Fee shall be made in the form of A/C payee demand draft in favour of TCED or RTGS payable at Thrissur drawn on any Scheduled Commercial Bank.</li> <li>2. Tender Fee (or its receipt in case of RTGS payment) and Bid Security must be submitted in physical form in a sealed envelope at address given above, before the Bid Submission Deadline. The sealed envelope shall be clearly marked on the top as “Tender Fee for <b>Design, Supply, Installation, Testing, Commissioning and O&amp;M of 100KWp Grid Connected Solar Power Plant at Skywalk</b>”</li> <li>3. Any Bid not accompanied by a Tender Fee as above shall be rejected by TCED as non-responsive.</li> <li>4. Tender Fee is non-refundable</li> </ol>
C.	<p>Other Payments or Bank Guarantees for the RFP/ Contract shall be as per the terms and conditions defined in this RFP Document</p>

## Section-2: Eligibility and Qualification Requirements

### BID QUALIFICATION REQUIREMENTS

1. Every tenderer should submit along with his e-tender an Earnest Money Deposit (EMD) unless exempted. This may be done electronically from any of the Nationalized/Scheduled Banks. The EMD of the disqualified tenderers will be returned automatically through e-procurement system. The EMD of the successful tenderers may be adjusted towards the security deposit. No interest shall be paid for the earnest money deposit.
2. An agreement in Rs.200/-worth Kerala stamp paper as per the format given in Annexure I-D must be submitted as a hardcopy to Electricity Department, Thrissur Corporation, Thrissur before the deadline for submission of e-tender.
3. Bidder must submit valid test certificates of the components (solar PV module and solar inverter) proposed to be supplied/used. Bids without valid IEC test certificates will be rejected. Undertaking from the manufacturers instead of valid IEC Test Certificates shall not be accepted
4. The bidder should have successfully installed solar photovoltaic power plants (Off-Grid and On-Grid) of at least 1MWp aggregate capacity in the last 3 years, out of which at least 500kWp plant should be a Grid connected SPV Power Plant

(without Battery).The bidder should complete at least one project out of on grid of capacity 100 KWp or more in as a single project.Copy of work order & bills/certification from the purchaser regarding execution of the order should be submitted as a proof of executing the supply.

5. Annual turnover of the bidder should be at least Rs:500 lakh, in any of the three years in last 5 years. Documentary evidence has to be submitted in the form of certified copies of Audited Statement of Accounts/Profit and Loss Accounts or Sales Tax returns statement or certification from the Statutory Auditor.
6. Vendor should have at least one service centre/authorized service provider in Kerala.Detailed list with address,contact details and proof has to be submitted. If the bidder does not have such facility at the time of tendering, an undertaking agreeing to set up and intimate the same within 15 days of letter of intent should be enclosed.
7. The bidder should submit a valid PV Simulation Report for energy yield Data along with Technical Offer.The PV Power plant should be designed with quality components (PV Modules,Inverters etc.) So as to obtain a minimum Performance Ratio (PR)of 90% or above during commissioning. TCED will verify the PV Simulation Reports for its authenticity.

## Section 3: Project Requirements and Specifications

### 3.1: System Components- Technical Compliance for System Components

S/ N	System Component	Capacity/ rating	Minimum Technical Compliance
1.	Solar panel (MONO PERC Half cut of capacity 640 Wp or above)	As per the required capacity	IS 14286 - Design Qualification and Type Approval for Crystalline Silicon Terrestrial Photovoltaic (PV) Modules IEC/IS 61730: Part I & II;
2.	Grid Tied Inverter	As per the required capacity	IS 16221: Part 1 & 2- Safety of Power Converters for use in Photovoltaic Power Systems IS 16169 - Test Procedure of Islanding Prevention Measures for Utility- Interconnected Photovoltaic Inverters
3.	Module Mounting Structure	As per the required capacity	IS 2062 - Hot Rolled Medium and High Tensile structural Steel IS 4759 - Hot-dip Zinc Coatings on structural steel and other products
4.	Cables	As required	IEC 60227 / IS 694 IEC 60502 / IS 1554 (Pt. I & II)

5.	Switches/ Circuit Breakers	As required	IEC 60947 partI, II, III /IS 60947 PartI, II, III
6.	Connectors		EN 50521
7.	Surge Protection Device		IEC 60364-5-53 / IS 15086-5
8.	Junction Boxes/Enclosures for Inverters/ Charge Controllers	As required	IP 54 (for indoor) or IP 65 / IP 21(for outdoor) as per IEC 529
9.	Energy Meter for Recording Solar Electricity Generated & Two-way meter for Distribution Licensee grid connection		As per CEA Regulations; IEC 60687/ IEC 62052-11 / IEC62053-22 / IS 14697
10.	Lightning Protection	As required	As per IEC 62305 / IEC 62561
11.	Electrical Grounding (Earthing)	As required	As per IS 3043

### 3.2 : STANDARDS AND REGULATIONS TO BE COMPLIED

The connectivity should be as per

- a. Technical Standards for connectivity of the Distributed generation resources, Regulation, 2013.
- b. KSERC (Grid interactive Distributed Solar Energy Systems) Regulations, 2014.
- c. Central Electricity Authority (Measures relating to Safety and Electric Supply) Regulations, 2023 has to be followed safely and Electricity Supply.
- d. Metering should be as per CEA regulation 2006.
- e. MNRE guidelines
- f. Any amendments thereof will also be applicable.

### 3.3: SPV MODULES

Only the PV modules with MONO PERC Half cut cells of module capacity 600 Wp or above, listed in the ALMM list issued by MNRE from time to time are to be used. However, the specifications for the PV Module are detailed below:

3.3.1 The PV modules must be PID compliant, salt, mist & ammonia resistant and should withstand weather conditions for the project lifecycle.

3.3.2 The back sheet of PV modules shall be with minimum of three layers with outer layer (exposure to ambience) and shall be made of PVDF or PVF. The Back sheets for PV Module with 2 layered or 3 layered Polyester types or the back sheets with Polyester (PET type) at Air side material are not permitted for the empanelment; The minimum thickness of the core layers (without adhesive and inner EVA coated) must be 300 microns. The maximum allowed water vapour transmission rate shall be less than 2 g / m<sup>2</sup>/day and shall have a Partial Discharge > / = 1500V DC

3.3.3 The front glass shall meet the following specifications:



- a. The facing glass must be Tempered, PV grade with Low iron and high transmission.
  - b. The transmission shall be > 93 %
  - c. Thickness shall be min 3.2 mm
  - d. Textured to trap more light
  - e. The glass shall have an Anti-reflective coating for the better transmission and light absorption.
  - f. Tempered glass to meet the external load conditions
- 3.3.4 The encapsulant used for the PV modules should be UV resistant in nature. No yellowing of the encapsulant with prolonged exposure shall occur. The sealant used for edge sealing of PV modules shall have excellent moisture ingress Protection with good electrical insulation and with good adhesion strength. Edge tapes for sealing are not allowed.
- 3.3.5 Anodized Aluminium module frames of sufficient thickness shall be used which are electrically & chemically compatible with the structural used for mounting the modules having provision for earthing.
- 3.3.6 UV resistant junction boxes with minimum three numbers of bypass diodes and two numbers of MC4 connectors or equivalent with appropriate length of 4 sq.mm Cu cable shall be provided. IP67 degree of protection shall be used to avoid degradation during Life.
- 3.3.7 Shading correction/ bypass diode for optimizing PV out to be incorporated in each solar module or panel level.
- 3.3.8 Each PV module used in any solar power project must use a RF identification tag (RFID), which must contain the following information. The RFID can be inside or outside the module laminate but must be able to withstand harsh environmental conditions.
- a. Name of the manufacturer of PV Module
  - b. Name of the manufacturer of Solar cells
  - c. Month and year of the manufacture (separately for solar cells and module)
  - d. Country of origin (separately for solar cell and module)
  - e. I-V curve for the module.
  - f. Peak Wattage, IM, VM and FF for the module
  - g. Unique Serial No. and Model No. of the module
  - h. Date and year of obtaining IEC PV module qualification certificate
  - i. Name of the test lab issuing IEC certificate
  - j. Other relevant information on traceability of solar cells and module as per ISO 9000 series
- 3.3.9 The following details should be provided on the module
- a. Name of the manufacture
  - b. Month and year of manufacture
  - c. Rated Power at STC
  - d. VMP, IMP, VOC, Isc

- 3.3.10 The successful bidder shall arrange an RFID reader to show the RFID details of the modules transported to sites, to the site Engineer in charge up to their satisfaction, which is mandatory for the site acceptance test.
- 3.3.11 The PV modules must qualify (enclose Test Reports/Certificates from IEC/NABL accredited laboratory) as per relevant IEC standard. The Performance of PV Modules at STC conditions must be tested and approved by one of the IEC/NABL Accredited Testing Laboratories.
- 3.3.12 PV modules used in solar powerplant/ systems must be warranted for 10 years for their material, manufacturing defects, workmanship. The output peak watt capacity which should not be less than 90% at the end of 10 years and 80% at the end of 25 years
- 3.3.13 Original Equipment Manufacturers (OEM) Warrantee of the PV Modules shall be submitted by the successful bidder when the material delivered at site.
- 3.3.14 The PV modules shall conform to the following standards:
- a. IS 14286: Crystalline silicon terrestrial photovoltaic (PV) modules — design qualification and type approval.
  - b. IEC 61215 / IEC 61646: c-Si (IEC 61215): Crystalline silicon terrestrial photovoltaic (PV) modules - Design qualification and type approval Thin Film (IEC 61646): Design, Qualification & Type Approval.
  - c. IEC 61730-1: Photovoltaic Module safety qualification- Part 1: Requirements for construction.
  - d. IEC 61730-2: Photovoltaic Module safety qualification- Part 2: Requirements for testing.
  - e. IEC 61701: Salt mist corrosion testing of photovoltaic modules
  - f. IEC 62716: Test Sequences useful to determine the resistance of PV Modules to Ammonia (NH<sub>3</sub>).
- 3.3.15 The PV module should have IS14286 qualification certification for solar PV modules (Crystalline silicon terrestrial photovoltaic (PV) modules — design qualification and type approval). The exemption of this certification and other details are described, as per MNRE's Gazette Notification No. S.O. 3449 (E). Dated 13th July, 2018.

### **3.4: POWER CONDITIONING UNIT (PCU)**

The Power Conditioning Unit shall be String Inverter with power exporting facility to the Grid.

#### **General Specifications:**

- 3.4.1 All the Inverters should contain the following clear and indelible Marking Label & Warning Label as per IS 16221 Part II, clause 5. The equipment shall as a minimum, be permanently marked with:
- a. The name or trademark of the manufacturer or supplier.
  - b. A model number, name or other means to identify the equipment.

- c. A serial number, code or other markings allowing identification of manufacturing location and the manufacturing batch or date within a three- month time period.
  - d. Input voltage, type of voltage (A.C. or D.C.), frequency, and maximum continuous current for each input.
  - e. Output voltage, type of voltage (A.C. or D.C.), frequency, maximum continuous current, and for A.C. outputs, either the power or power factor for each output.
  - f. The Ingress Protection (IP) rating.
- 3.4.2 The inverter output shall be 415 VAC, 50 Hz, 3 phase.
- 3.4.3 The inverter shall include appropriate self-protective and self-diagnostic Feature to protect itself and the PV array from damage in the event of inverter component failure or from parameters beyond the inverter's safe operating range due to internal or external causes.
- 3.4.4 PCU shall have the dynamic and efficient MPPT algorithm behaviour which finds maximum power point even in low light conditions. The PCU Company should be able to display this feature.
- 3.4.5 The PCU shall be supplied within-built advanced grid feed-in feature Along with dynamic feed-in control considering self-consumption. The PCU shall also include control functions for optimum feed-in of reactive power and effective power. The amount of reactive power injection and absorption can be controlled depending upon under/over excited systems.
- 3.4.6 The PCU shall have a provision of external shutdown via remote Signal separately with an in-built floating-point contact or similar option using any minimum interface which is to ensure the emergency stop function in the inverter
- 3.4.7 The PCU shall have a higher degree of ingress protection of IP 65 to handle robust environment conditions from dust and water ingress under complete outdoor installations.
- 3.4.8 The data logger should possess the feature of extracting the data externally with open protocols like Modbus TCP/RTU. The manufacturer should provide the Modbus register mapping file to utilize this feature.
- 3.4.9 The inverter shall have an efficient cooling concept with better power derating feature to handle higher temperatures and ensure the best efficiency. The inverter shall be able to provide full rated output power even at ambient temperatures of 50<sup>0</sup>C. The manufacturer to provide the power derating curves to demonstrate the same.
- 3.4.10 The inverter shall be flexible in terms of the installation and should be capable for installation in a horizontal position facilitating easy installation for site specific requirements.
- 3.4.11 The inverter shall have an integrated feature of emergency stop to halt the inverter from operation considering safety scenarios.
- 3.4.12 The PCU manufacturer should have an authorised service centre in Kerala. The details of the service centre along with the spare list must be submitted along with the bid.
- 3.4.13 PCU should be able to respond smoothly to the voltage fluctuations on the

low-tension grid via active & reactive power control/ support. The PCU should be able to respond separately to fulfil below mentioned:

3.4.13.1 Finding out optimisation of the system

3.4.13.2 Optimal power distribution on each phase

3.4.13.3 Prevent PCU from unnecessary disconnections

3.4.14 The PCU Company should have grid connected solar plants running in the country with inverters atleast 7 years from the time of bidding to showcase the service reliability and long-term presence. Also, the PCU should have local presence in the county for atleast last 5 years. The PCU manufacturer may need to provide authentic details to customer if asked to prove the same.

3.4.15 The Technical Specification of On-Grid Inverters are summarized below:

<b>Specifications of Inverters</b>	
<b>Parameters</b>	<b>Detailed specification</b>
Nominal voltage	230V/415V
Voltage Band	Between 80% and 110% of V nominal
Nominal Frequency	50 Hz
Operating Frequency Range	47.5 to 50.5 Hz
Waveform	Sine wave
Harmonics	AC side total harmonic current distortion < 3%
Ripple	DC Voltage ripple content shall be not more than 1%
Efficiency	Efficiency shall be >98%
Casing protection levels	Degree of protection: Min IP-65
Operating ambient Temp range	-10 to + 60 degree Celsius
Operation	Completely automatic including wakeup, synchronization (phase locking) and shutdown
MPPT	MPPT range must be suitable to individual array voltages
Protection Class	1
Protections	Over voltage: both input and output Over current: both input and output Over / Under grid frequency Over temperature Short circuit Lightning Surge voltage induced at output due to external source Islanding
Ingress Protection	IP 65

Recommended LED indications	ON Grid ON Under/ Over voltage Overload Over temperature
Recommended LCD Display on front Panel	DC input voltage DC current AC Voltage (all 3 phases) AC current (all 3 phases) Frequency Ambient Temperature Instantaneous power Cumulative output energy Cumulative hours of operation Daily DC energy produced
Communication Interface	RS485/ RS232/Wi-Fi (with or without USB)

3.4.16 The Technical Specification for Interconnection are summarized below:

Sl No	Parameters	Requirements	Reference
1	Overall conditions of service	Reference to regulations	Conditions for Supply of Electricity
2	Overall Grid Standards	Reference to regulations	Central Electricity Authority (Grid standards) Regulations 2010
3	Equipment	Applicable industry standards	IEC/EN standards

4	Safety and Supply	Reference to regulations,	Central Electricity
		(General safety requirements	Authority (Measures of safety and electricity supply) Regulations, 2010 and subsequent amendments
5	Meters	Reference to regulations and additional conditions issued by the commission.	Central Electricity Authority (Installation & operation of meters) regulations 2006 and subsequent amendments
6	Harmonic current	Harmonic current injections from a generating station shall not exceed the limits specified in IEEE 519	IEEE 519 relevant CEA (Technical Standards for connectivity of the distributed generation resource) Regulations 2013 and subsequent amendments
7	Synchronization	Photovoltaic system must be equipped with a grid frequency synchronization device, if the system is using synchronizer inherently built into the inverter, then no separate synchronizer is required	Relevant CEA (Technical Standards for Connectivity of the distributed generation resources) regulations 2013 and subsequent amendments.
8	Voltage	The voltage-operating window should minimize nuisance tripping and should be under operating range of 80% to 110% of the nominal connected voltage. beyond the clearing time of 2 seconds, the Photovoltaic system must isolate itself from the grid	

9	Flicker	Operation of Photovoltaic system should not cause voltage flicker in excess of the limits stated in IEC	Relevant CEA regulations 2013 and subsequent if any, (Technical standards for connectivity of the
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Sl No	Parameters	Requirements	Reference
		61000 or other equivalent Indian standards if any	distributed generation resource)
10	Frequency	When the distribution system frequency deviates outside the specified limits (50.5 Hz on upper side and 47.5 Hz on lower side) up to 0.2 sec, the Photovoltaic systems shall automatically disconnect from grid and be in island mode.	
11	DC injection	Photovoltaic systems shall not inject DC current greater than 0.5% of full rated output at the interconnection point or 1% rated inverter output current into distribution system under any operating conditions.	
12	Power Factor	While the output of the inverter is greater than 50%, a lagging power factor greater than 0.9 shall be maintained.	
13	Islanding and Disconnection	The photovoltaic system in the event of voltage or frequency variations must island/disconnect itself with the time stipulated as per IEC standards	
14	Overload and overheat	The inverter should have the facility to automatically switch off in case of overload or overheat and should restart when normal conditions are restored	



### 3.4.17 The Certifications of On-Grid Inverters are summarized below:

Standard	Description
IS/IEC 61683: 1999	Photovoltaic systems - Power conditioners - Procedure for measuring efficiency
IS/IEC 61727: 2004 IEC 61727: 2004	Photovoltaic (PV) systems- Characteristics of the utility interface
IS 16221: Part 1: 2016	Safety of power converters for use in photovoltaic power systems - Part 1: General requirements
IS 16221: Part 2: 2015	Safety of power converters for use in photovoltaic power systems - Part 2: Particular requirements for inverters
IS 16169: 2019	Utility-interconnected photovoltaic inverters - Test procedure of islanding prevention measures
IS 16782: 2018 IEC 62910: 2015	Utility - Interconnected Photovoltaic Inverters Test Procedure for Low Voltage Ride - Through Measurements
IEC/EN 61000-3-3/ 3-11/ 3-5	Electromagnetic compatibility (EMC) - Part 3-11; Limits; Limitation of Voltage Change, Voltage Fluctuations and Flicker in Public Low- Voltage Supply Systems; Rated Current <16A / >16A and <75A / >75A per Phase respectively
IEC/EN 61000-3-2/ -3-12/ -3-4	Electromagnetic compatibility (EMC) - Part 3-12; Limits; Limits for Harmonic Currents produced by equipment connected to the public low voltage systems with Rated Current <16A / >16A and <75A / >75A per Phase respectively
*IEC/EN 61000-6-1 / 6-2	Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity standard for residential and commercial / industrial environments
*IEC/EN 61000-6-3 / 6-4	Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Emission standard for residential and commercial / industrial environments
IEC 60068-2-1	Environmental testing - Part 2-1: Tests - Test A: Cold
IEC 60068-2-2	Environmental testing - Part 2-2: Tests - Test B: Dry heat
IEC 60068-2-14	Environmental testing - Part 2-14: Tests - Test N: Change of temperature
IEC 60068-2-30	Environmental testing - Part 2-30: Tests - Test Db; Damp heat, cyclic (12 h + 12 h cycle)

**\*Recommended but not mandatory**

### 3.5: REMOTE MONITORING SYSTEM

A dedicated Remote Monitoring System (Hardware and software) for monitoring the plant shall be provided. It is recommended that the following important parameters shall be accessible through the Data Logging Facility.

- a) AC Voltage
- b) AC Output current
- c) Output Power
- d) Energy in kWh
- e) DC Input Voltage
- f) DC Input Current
- g) Temperatures (C)
- h) Inverter Status

Provision for Internet monitoring and download of historical data shall be incorporated. GSM Modem/Wi Fi modem in case GSM connectivity is used or Wireless Router + modem in case Ethernet connection is being used for remote access must be provided. The data is to be transmitted to TCED server and the successful bidder must undertake all the works required for such deployment including software and arrange for APIs etc.

### **3.6: ELECTRICAL SAFETY, EARTHING AND PROTECTION**

- a. All SPV system should comply with Central Electricity Authority (Measures relating to Safety and Electric Supply) Regulations, 2023.
- b. Internal Faults: In built protection for internal faults including excess temperature, commutation failure, overload, and cooling fan failure (if fitted) is obligatory.
- c. Over Voltage Protection: Over Voltage Protection against atmospheric lightning discharge to the PV array is required. Protection is to be provided against voltage fluctuations in the grid itself and internal faults in the power conditioner, operational errors and switching transients.
- d. Earth fault supervision: An integrated earth fault device shall have to be provided to detect eventual earth fault on DC side and shall send message to the supervisory system.
- e. Adequate firefighting equipment per site must be provided by the successful bidder at the sites of installation. The fire extinguishers shall be provided in the control room housing inverters as well as on the Roof or site where the PV arrays have been installed. One liquefied CO2 fire extinguisher upright type of capacity min 8 kg having IS: 2171 -7, IS: 10658. A minimum of Two Fire extinguishers to be provided for installation capacity upto 50 kW, and additional fire extinguisher per 25 KW or part of thereof to be provided by the successful bidder.

### **3.7 : CABLING PRACTICE**

Cabling is required for wiring from AC output of inverter/PCU to the Grid Interconnection point. It includes the DC cabling from Solar Array to AJB and from AJB to inverter input.

- 3.7.1 All cables of appropriate size to be used in the system shall have the following characteristic:
  - a. Shall conform to IEC 60227 / IS 694 & IEC 60502 / IS 1554 standards.
  - b. Temperature Range: -10 degree Celsius to +80 degree Celsius
  - c. Voltage rating: 660/1000V
  - d. Excellent resistance to heat, cold, water, oil, abrasion, UV radiation
  - e. Flexible

- 3.7.2 Sizes of cables between any array interconnections, array to junction boxes, junction box to inverter etc. shall be so selected to keep the voltage drop (power loss) of the entire solar system to the minimum (2%).
- 3.7.3 For the DC cabling, XLPE or XLPO insulated and sheathed, UV stabilized single core flexible copper cables shall be used; multi-core cables shall not be used. The Connectors being used must comply - IS 16781: 2018 | IEC 62852 : 2014 - Connectors for DC Application in Photovoltaic Systems Safety Requirements and Tests
- 3.7.4 XLPE insulated Aluminium cable of suitable area of cross section can be used in the AC side subject to a minimum area of cross section of 10 sq.mm. Outdoor AC cables shall have a UV -stabilized outer sheath IS/IEC 69947.
- 3.7.5 All LT XLPE cables shall conform to IS: 7098 part I&II.
- 3.7.6 The total voltage drop on the cable segments from the solar PV modules to the solar grid inverter shall not exceed 2.0%.
- 3.7.7 The total voltage drop on the cable segments from the solar grid inverter to the building distribution board shall not exceed 2.0%
- 3.7.8 The electric cables for DC systems for rated voltage of 1500 V shall conform to BIS 17293:2020
- 3.7.9 The DC cables from the SPV module array shall run through a UV-Stabilized PVC conduit pipe / HDPE Double Wall Corrugated (DWC) conduits of adequate diameter with a minimum wall thickness of 1.5mm and suitably tagged and marked with proper manner by good quality ferule or by other means so that the cable is easily identified.
- 3.7.10 Cables and wires used for the interconnection of solar PV modules shall be provide with solar PV connectors (MC4) and couples.
- 3.7.11 All cables and conduit pipes shall be clamped to the rooftop, walls and ceilings with thermo-plastic clamps at intervals not exceeding 50cm; the minimum DC cables size shall be 4.0mm<sup>2</sup> copper; the minimum AC cable size shall be 4.0mm<sup>2</sup> copper. In three phase systems, the size of the neutral wire size shall be equal to the size of the phase wires. Conduits for taking outdoor cables shall be UV treated.
- 3.7.12 Cable Marking: All cable/wires are to be marked in proper manner by good quality ferule or by other means so that the cable can be easily identified. The following colour code shall be used for cable wires
- a. DC positive: red (the outer PVC sheath can be black with a red line marking
  - b. DC negative: black
  - c. AC single phase: Phase: red; Neutral: black
  - d. AC three phase: phases: red, yellow, blue; neutral: black
  - e. Earth wires: green.

- 3.7.13 Cables and conduits that have to pass through walls or ceilings shall be taken through PVC pipe sleeve.
- 3.7.14 Cable conductors shall be terminated with tinned copper end ferrules to prevent fraying and breaking of individual wire strands. The termination of the DC and AC cables at the Solar Grid Inverter shall be done as per instructions of the manufacturer, which in most cases will include the use of special connectors.
- 3.7.15 All cables and connectors used 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. DC cables used from solar modules to array junction box shall solar grade copper (Cu) with XLPO insulation and rated for 1.1 kV as per relevant standards only.
- 3.7.16 Bending radii for cables shall be as per manufactures recommendations and IS: 1255.
- 3.7.17 For laying/termination of cables latest BIS/IEC Codes/ standards shall be followed,

### **3.8 : FACTORY TESTING**

- a. PCU shall be tested prior to shipment and factory test certificate for relevant parameters should be provided with the PCU supplied. TCED officials may be allowed to witness the tests if required.
- b. Factory testing shall not only be limited to measurement of phase currents, efficiencies, harmonic content and power factor, but shall also include all other necessary tests/simulation required and requested by TCED Engineers. Tests may be performed at 25, 50, 75 and 100 percent of the rated nominal power.

### **3.9 : ARRAY SUPPORT STRUCTURE**

- a. Photovoltaic arrays must be mounted on a stable, durable structure that can support the array and withstand wind, rain, and other adverse conditions. The modules will be fixed on structures with fixed arrangement.
- b. The module mounting structures shall have adequate strength and appropriate design suitable to the locations, which can withstand the load and high wind velocities. Stationary structures shall support PV modules at a given orientation, absorb and transfer the mechanical loads to the surface properly.
- c. Wherever required, suitable number of PV panel structures shall be provided. Structures shall be of flat-plate design using minimum size of C (75 x 40 x 5 mm) or L (55 x 55 x 5mm) or I (60x 40x 4mm) sections or higher dimensions for respective sections.

- d. Each structure with fixed tilt should have a tilt angle as per the site conditions to take maximum insolation which will be approximately equal to the latitude of the location facing true South with a North - South orientation. The tilt angle can vary from 9 degree to 12 degree based on the location's latitude in Kerala
- e. The PV module mounting structure shall have a capacity to withstand a wind velocity of 150 km/hr unless specified for dedicated requirements
- f. Suitable fastening arrangement such as grouting and calming should be provided to secure the installation against the specific wind speed. The PV array structure design shall be appropriate with a factor of safety of min 1.5.
- g. The materials used for structures shall be Hot dip Galvanized Mild Steel conformed to IS 2062:1992 or aluminium of suitable grade minimum alloy 6063 or better.
- h. The minimum thickness of galvanization for hot dip Galvanized Mild Steel should be atleast 80 microns as per IS 4759. The galvanisation thickness will be checked during inspection and the vendor is to arrange the equipment needed for the same at the site.
- i. The Bolts, Nuts, fasteners, and clamps used for panel mounting shall be of Stainless Steel SS 304.
- j. Structures shall be supplied complete with all members to be compatible for allowing easy installation at the site. Additional Structures/Frames for required vfor the installation of modules if any need to be provided by the bidder.
- k. The structures shall be designed to allow easy replacement of any module, repairing and cleaning of any module. No Welding is allowed on the mounting structure. Adequate spacing shall be provided between two panel frames and rows of panels to facilitate personnel protection, ease of installation, replacement, cleaning of panels and electrical maintenance
- l. Aluminium structures used shall be protected against rusting either by coating or anodization. Aluminium frames should be avoided for installations in coastal areas.
- m. The structure shall be designed to withstand operating environmental conditions for a period of minimum 25 years. And shall be free from corrosion while installation.
- n. Screw fasteners shall use existing mounting holes provided by module manufacturer. No additional holes shall be drilled on module frames
- o. The total load of the structure (when installed with PV modules) on the roof should be less than 60 kg/m<sup>2</sup>
- p. Minimum distance between the lower level of PV Module and the ground shall be 0.6m from the ground level.
- q. The PV Panel area shall be accessible for cleaning and for any repair

work.

- r. Sufficient gap needs to be provided between the rows to avoid falling of shadow of one row on the next row. Seismic factors for the site will be considered while making the design of the foundation.
- s. Adequate spacing shall be provided between any two modules secured on PV panel for improved wind resistance.
- t. Installation of structure for solar PV mounting should not tamper with the water proofing of the roofs.

3.9.1 The Rooftop Structures maybe classified in three broad categories as follows (drawings in Format-II-J). The bidders are required to quote the rates for each separately in the financial bid:

**i. Ballast structure**

- a. The mounting structure must be Non-invasive ballast type and any sort of penetration of roof to be avoided.
- b. The minimum clearance of the structure from the roof level should be in between 70-150 mm to allow ventilation for cooling, also ease of cleaning and maintenance of panels as well as cleaning of terrace.
- c. The structures should be suitably loaded with reinforced concrete blocks of appropriate weight made out of M25 concrete mixture.

**ii. Tin shed**

- a. The structure design should be as per the slope of the tin shed.
- b. The inclination angle of structure can be done in two ways
  - b.1. Parallel to the tin shed (flat keeping zero-degree tiling angle), if the slope of shed in Proper South Direction.
  - b.2. With same tilt angle based on the slope of tin shed to get the maximum output.
- c. The minimum clearance of the lowest point from the tin shade should be more than 100 mm.
- d. The base of structure should be connected on the Purlin of tin shed with the proper riveting. All structure member should be of minimum 2mm thickness.

**iii. RCC Elevated structure: It can be divided into further three**

**categories**

**A. Minimum Ground clearance (300mm - 1000 mm)**

- a. The structure shall be designed to allow easy replacement of any module and shall be in line with site requirement. The gap between modules should be minimum 30mm.
- b. Base Plate - Base plate thickness of the Structure should be

5mm for this segment.

- c. Column - Structure Column should be minimum 2mm in Lip section / 3mm in C- Channel section. The minimum section should be 70mm in Web side and 40mm in flange side in Lip section.
- d. Rafter - Structure rafter should be minimum 2mm in Lip section / 3mm in C- Channel section. The minimum section should be 70mm in Web site (y-axis) and 40mm in flange side (x-axis).
- e. Purlin - Structure purlin should be minimum 2mm in Lip section. The minimum section should be 60mm in Web side 40mm in flange Lip section.
- f. Front/back bracing - The section for bracing part should be minimum 2mm thickness.
- g. Connection - The structure connection should be bolted completely. Leg to rafter should be connected with minimum 12 diameter bolt. Rafter and purlin should be connected with minimum 10 diameter bolt. Module mounting fasteners should be SS-304 only and remaining fasteners either SS-304 or HDG 8.8 Grade.
- h. For single portrait structure the minimum ground clearance should be 500mm.

#### **B. Medium Ground clearance (1000mm - 2000 mm)**

- a. Base Plate - Base plate thickness of the Structure should be Minimum 6MM for this segment.
- b. Column - Structure Column should be minimum 2mm in Lip section / 3mm in C- Channel section. The minimum section should be 80mm in Web side and 50mm in flange side in Lip section.
- c. Rafter - Structure rafter should be minimum 2mm in Lip section / 3mm in C- Channel section. The minimum section should be 70mm in Web side and 40mm in flange side in Lip section.
- d. Purlin - Structure purlin should be minimum 2mm in Lip section. The minimum section should be 70mm in Web side and 40mm in flange side in Lip section.
- e. Front/back bracing - The section for bracing part should be minimum 2mm thickness.
- f. Connection - The structure connection should be bolted completely. Leg torafter should be connected with minimum 12 diameter bolt. Rafter and purlin should be connected with minimum 10 diameter bolt. Module mounting fasteners should be SS-304 only and remaining fasteners either SS-304 or HDG 8.8 Grade.

#### **C. Maximum Ground clearance (2000mm - 3000 mm)**

- a. Base Plate - Base plate thickness of the Structure should be minimum 8mm for the segment.
- b. Column - Structure Column thickness should be minimum 2.6MM in square hollow section (minimum 50x50) or rectangular hollow section (minimum 60x40) or 3MM in C-Channel section.
- c. Rafter - Structure rafter should be minimum 2MM in Lip section / 3MM in Channel section. The minimum section should be 80MM in Web side and 50MM in flange side in Lip section.
- d. Purlin - Structure purlin should be minimum 2MM in Lip section. The minimum section should be 80mm in Web side and 50mm in flange side in Lip section.
- e. Front/back bracing - The section for bracing part should be minimum 3mm thickness.
- f. Connection - The structure connection should be bolted completely. Leg to rafter should be connected with minimum 12 diameter bolt. Rafter and purlin should be connected with minimum 10 diameter bolt. Module mounting fasteners should be SS-304 only and remaining fasteners either SS-304 or HDG 8.8 Grade.

#### **D. Super elevated structure (More than 3000 mm)**

##### ***i. Base structure***

- b. Base Plate - Base plate thickness of the Structure should be 10mm for this segment.
- c. Column - Structure Column minimum thickness should be minimum 2.9mm in square hollow section (minimum 60x60) or rectangular hollow section (minimum 80x40).
- d. Rafter - Structure Rafter minimum thickness should be minimum 2.9mm in square hollow section (minimum 60x60) or rectangular hollow section (minimum 80x40)
- e. Cross bracing - Bracing for the connection of rafter and column should be of minimum thickness of 4mm L-angle with the help of minimum bolt diameter of 10mm.

##### ***ii. Upper structure of super elevated structure***

- a. Base Plate - Base plate thickness of the Structure should be minimum 5mm for this segment.
- b. Column - Structure Column should be minimum 2mm in Lip section / 3mm in Channel section. The minimum section should be 70mm in Web side and 40mm in flange side in Lip section.
- c. Rafter - Structure rafter should be minimum 2mm in Lip section / 3mm in Channel section. The minimum section should be 70mm in Web side and 40mm in flange side in Lip section.



- d. Purlin - Structure purlin should be minimum 2mm in Lip section. The minimum section should be 60MM in Web side and 40MM in flange side in Lip section.
  - e. Front/back bracing – The section for bracing part should be minimum 2mm thickness.
  - f. Connection – The structure connection should be bolted completely. Leg to rafter should be connected with minimum 12 diameter bolt. Rafter and purlin should be connected with minimum 10 diameter bolt. Module mounting fasteners should be SS-304 only and remaining fasteners either SS-304 or HDG 8.8 Grade.
- iii. If distance between two legs in X-Direction is more than 3M than sag angle/Bar should be provide for purlin to avoid deflection failure. The sag angle should be minimum 2mm thick, and bar should be minimum 12Dia.
  - iv. Degree - The Module alignment and tilt angle shell be calculated to provide the maximum annual energy output. This shall be decided on the location of array installation.
  - v. Foundation – Foundation should be as per the roof condition; two types of the foundation can be done- either penetrating the roof or without penetrating the roof.
    - a) If penetration on the roof is allowed (based on the client requirement) then minimum 12MM diameter anchor fasteners with minimum length 100MM can be used with proper chipping. The minimum RCC size should be 400x400x300 cubic mm. Material grade of foundation should be minimum M20.
    - b) If penetration on roof is not allowed, then foundation can be done with the help of 'J Bolt' (refer IS 5624 for foundation hardware). Proper Neto bond solution should be used to adhere the Foundation block with the RCC roof. Foundation J - bolt length should be minimum 12MM diameter and length should be minimum 300MM.

### **3.10 : SURGE PROTECTION**

The system should have installed with Surge Protection Device (SPD) for higher withstand of the continuous PV-DC voltage during earth fault condition. SPD shall have safe disconnection and short circuit interruption arrangements through integrated DC in-built bypass fuse (parallel) which should get tripped driving failure mode of MOV, extinguishing DC arc safely to protect the installation against fire hazards. The SPD should be provided in the AC Distribution Box as well. Type 2 SPD having maximum Discharge Current (8/20  $\mu$ s) of value 40 kA with a minimum response time less than 25ns.

### **3.11 : EARTHING**

The Solar PV Plant should have a dedicated earthing system. The Earthing for array and LT power shall be made as per the provisions

of **IS:3043-2018** “Code of practice for earthing (Second Revision),” that governs the earthing practices of a PV system and **IS732:2019** “Code of practice for electrical wiring installations (Fourth Revision)

- 3.11.2 Earthing System shall connect all non-current carrying metal receptacles, electrical boxes, appliance frames, chassis and PV module mounting structures in one long run. The earth strips should not be bolted. Earthing GI strips shall be interconnected by proper welding. Exothermic / Aluminothermic welding are only allowed for jointing earth electrode.
- 3.11.3 The earthing conductor should be rated for 1.56 times the maximum short circuit current of the PV array. The factor 1.56 considers 25 percent as a safety factor and 25 percent as albedo factor to protect from any unaccounted external reflection onto the PV modules increasing its current
- 3.11.4 In any case, the cross-section area or the earthing conductor for PV equipment should not be less than 6 mm<sup>2</sup> if copper, 10 mm<sup>2</sup> if aluminium or 70 mm<sup>2</sup> if hot-dipped galvanized iron. For the earthing of lightning arrestor, cross-section of the earthing conductor should not be less than 16 mm<sup>2</sup> of copper or 70 mm<sup>2</sup> if hot-dipped galvanized iron. Copper bonded Earth electrodes of minimum thickness of 250 microns and diameter of 14.2mm and length of 3m must be used in compliance with the National Building Code of India 2016. The complete Earthing system shall be mechanically & electrically connected to provide independent return to earth.
- 3.11.5 Masonry enclosure with the earth pit of size not less than 400mm X 400 mm(depth) complete with cemented brick work (1:6) of minimum 150mm width duly plastered with cement mortar (inside) shall be provided. In case FRP based Earth chambers are used, the same must be certified by NABL accredited laboratory for Compression Test/Weight Holding Capacity. Hinged inspection covers of size not less than 300mm X 300mm with locking arrangement shall be provided. Suitable handle shall be provided on the cover by means of welding a rod on top of the cover for future maintenance.
- 3.11.6 Minimum required gap shall be provided in between earth pits as per relevant standard. Body earthing shall be provided in inverter each panel frame, module mounting structures, kiosk and in any other item as required.
- 3.11.7 Earth pit shall be constructed as per IS: 3043-2018. Electrodes shall be embedded below permanent moisture level. Earth pits shall be treated with salt and charcoal if average resistance of soil is more than 20-ohm meter. The use of Earth enhancing compounds of adequate quantity is to be used in case the earth value is high in compliance with IEC 62561-7:2011
- 3.11.8 There shall be adequate number of interconnected earth pits provided in each location and minimum required gap shall be provided in between earth pits as per relevant standard. The interconnection is to be done using Copper conductors of minimum 25 mm x 3 mm or HDGI conductor of minimum 25mm x

6mm.

- 3.11.9 Earth resistance shall not be more than 5 ohms. Earthing system must be interconnected through GI strip to arrive equipotential bonding. The size of the HDGI earth strip must be minimum 25mm X 6mm and the coating thickness of minimum 80 microns is to be maintained.
- 3.11.10 In compliance to Rule 11& 61 Of Indian Electricity Rules,1956(as amended up to date), all non-current carrying metal parts shall be Earthing with two separate and distinct earth continuity conductors to an efficient earth electrode.
- 3.11.11 The equipment grounding wire shall be connected to earth strip by proper fixing arrangement. Each strip shall be continued up to at least 500mm from the equipment.
- 3.11.12 Necessary provisions shall be made for bolted isolating joints of each earthing pit for periodic checking of earth resistance.
- 3.11.13 The frame of inverter cabinet shall be connected with the earthing bus bar through the earthing terminals using flexible braided copper wire; all metal casing and shielding of the plant, each array structure of the photovoltaic yard, equipment, inverters and control systems shall be earthed through proper earthing.
- 3.11.14 Earthing system shall connect all non-current carrying metal receptacles, electrical boxes, appliance frames, chassis and photovoltaic module mounting structures in one long run and the earth strips shall be interconnected by proper welding and shall not be bolted;
- 3.11.15 For each earth pit, a necessary test point shall be provided.
- 3.11.16 Total no of Earth pits required for solar plants shall be as per the Electrical Inspectorate norms.

### **3.12 : LIGHTNING PROTECTION FOR PV ARRAY**

The SPV power plant should be provided with lightning and over voltage protection. The source of over voltage can be lightning or other atmospheric disturbance. The lightning conductors shall be made as per applicable Indian Standards in order to protect the entire array yard from lightning stroke.

The design and specification shall conform to IS/IEC 62305, "Protection against lightning" govern all lightning protection-related practices of a PV system.

- The entire space occupying SPV array shall be suitably protected against lightning by deploying required number of lightning arresters. Lightning protection should be provided as per IS/ IEC 62305.
- Lightning system shall comprise of air terminations, down conductors, test links, earth electrode etc. as per approved drawings.
- The protection against induced high voltages shall be provided by the use of surge protection devices (SPDs) and the earthing terminal

of the SPD shall be connected to the earth through the earthing system.

- Separate pipe for running earth wires of Lightning Arrestor shall be used.
- The Vendor / Company shall submit the drawings and detailed specifications of the PV array lightning protection equipment to Employer for approval before installation of system.

### **3.13 : AC DISTRIBUTION PANEL BOARD**

- a. AC Distribution Board (ACDB) shall control the AC power from inverter and should have necessary surge arrestors.
- b. An ACDB panel shall be provided in between PCU and Utility grid. It shall have MCB/MCCB/ACB or circuit breaker of suitable rating for connection and disconnection of PCU from grid.
- c. The connection between ACDB and Utility grid shall be of standard cable/ Conductor with suitable termination. It shall have provision to measure grid voltage, current and power.
- d. The incomer shall be selected at required rating. The ACDB enclosure shall be of good protection and suitable for mounting on the trenches / on wall.
- e. All the 415 V AC or 230 V AC devices/equipment like bus support insulators, circuit breakers, SFU isolators (if applicable), SPD, etc. mounted inside the switch gear shall be suitable for continuous operation.
- f. Switches/ circuit breakers/ connectors meeting general requirements and safety s as per IS 60947 measurements a per IS 60947 PartI, II, III and IEC 60947 part I, II and III.
- g. Junction boxes, enclosures, panels for inverters/ Controllers shall meet IP 65 (for indoor) as per IEC 529. The use of PVC enclosures is not permitted.
- h. All combiner boxes shall be provided with suitable surge protective device with arc extinguishing capability as per the relevant standards to avoid any risk of fire.

### **3.14 : DC DISTRIBUTION BOARD**

- a. DC bus/ cable which can handle the current and the voltage of inverter output safely with necessary surge arresters per the relevant IS standards.
- b. Polyamide glands and MC4 Connectors may also be provided. The rating of the junction box shall be suitable with adequate safety factor to interconnect the Solar PV array.
- c. DC panel should be equipped with an adequate capacity indoor DC circuit breaker along with control circuit, protection relays, fuses, annunciations and remote operating and controlling facility from the main control facility.

- d. DCDB shall have sheet from enclosure of dust and vermin proof, the busbar/ cables are to be made of copper of desired size. DCDB shall be fabricated to comply with IP 65 protection. The PVC enclosures is not permitted.
- e. All combiner box shall be provided with suitable surge protective device with arc extinguishing capability as per the relevant standards to avoid any risk of fire

### **3.15 : CABLES, SWITCHES AND GENERAL REQUIREMENTS**

- a. PVC insulated copper cables with current rating suitable for AC and DC as per the National Electric Code, and meeting:
  - i. General Test and Measuring Method as per IEC 60189/ IS 694
  - ii. PVC insulated cables for working voltages up to 1100 V and UV resistant for outdoor installation as per IEC 60502/ IS 1554 (Pt. I & II).
- b. Cable Marking: All cable/wires are to be marked in proper manner by good quality ferule or by other means so that the cable can be easily identified.
- c. Switches/ circuit breakers/ connectors meeting general requirements and safety measurements as per IS 60947 PartI, II, III and EN 50521 for AC/DC.
- d. All indoor panels will have protection of IP 54 or better, as per site conditions. All outdoor panels will have protection of IP 65 or better, as per site condition.

### **3.16 : AC/DC WIRING**

Before submitting the tender, actual measurement of cables required for wiring from AC output of inverter/PCU to load point should be calculated and this work is also included in the tender. The actual cable required from module to DC distribution board and DC distribution board to inverter input should be calculated and this work should be done as part of Solar Power Plant installation. Separate drawings for exclusively for the AC/DC Wiring should be provided.

### **3.17 : CIVIL WORKS**

While installing solar power plants on rooftops, the physical condition of the rooftop, chances of shading, chances water level rise in the rooftop during raining due improper drainage in the roof-top should be taken into consideration.

- a. PV array shall be installed in the terrace space free from any obstruction and/or shadow and to minimize effects of shadows due to adjacent PV panel rows.
- b. PV array shall be oriented in the south direction in order to maximize annual energy yield of the plant.

- c. The solar PV array must be installed on the rooftop in such a way that there is sufficient space on the rooftop for maintenance etc.
- d. There should not be any damage what so ever to the rooftop due to setting up of the solar power plant so that on a later day there is leakage of rainwater, etc. from the rooftop.
- e. Some civil works are inevitable for erecting the footings for the module mounting structure as discussed in Module Mounting Structure section. The rooftop may be given a suitable grading plaster with suitable leak proof compound so as to render the roof entirely leak proof.
- f. Ample clearance shall be provided in the layout of the inverter and DC/AC distribution boxes for adequate cooling and ease of maintenance.
- g. While cabling the array, care must be taken such that no loose cables lie on the rooftop.
- h. The rooftop should look clean and tidy after installation of the array.
- i. Neatness, tidiness and aesthetics must be observed while installing the systems.
- j. RCC Works - All RCC works shall be as per IS 456 and the materials used viz. Cement reinforcement, steel etc. shall be as per relevant IS standards. Reinforcement shall be high strength TMT Fe 415 or Fe 500 conforming to IS: 1786-1985.
- k. Brick Works (If any) - All brick works shall be using 1st class bricks of approved quality as per IS 3102.
- l. Plastering - Plastering in cement mortar 1:5, 1:6 and 1:3 shall be applied to all.
- m. Display of mandatory items- Single Line Diagram and layout diagram of modules and interconnection at installation site shall be provided near the inverter.
- n. For painting on concrete, masonry and plastered surface IS: 2395 shall be followed. For distempering IS 427 shall be followed referred. For synthetic enamel painting IS 428 shall be followed. For cement painting IS 5410 shall be followed.
- o. All Civil works required for the installation of the PV Plant and other civil and electrical work in evacuation infrastructure, wherever necessary, shall be within the scope of the bidder
- p. The layout of Inverter accommodation shall be designed to enable adequate heat dissipation and availability. Mount within the existing infrastructure available in consultation with the Site in charge. String Inverters may be installed with Canopy type structure over it to protect it from frequent monsoon and weather changes.
- q. Installation of walkways with foldable hand rails as per IS.

## Section 4: Project Scope of Work

### 4.1. Definition

Solar PV power plant system comprises of C-Si (Crystalline Silicon)/ Thin Film Solar PV modules with intelligent Inverter having MPPT technology and Anti-Islanding feature and associated power electronics, which feeds generated AC power to the Grid. Other than PV Modules and Inverter/Inverters, the system consists of Module Mounting Structures, appropriate DC and AC Cables, Array Junction Boxes (AJB) / String Combiner Boxes (SCB), AC and DC Distribution Box, Lightning Arrester, Earthing Systems, etc. The system should be capable for exporting the generated AC power to the Grid, whenever the Grid is available with all System Protection facilities.

### 4.2. Scope of Work

- 4.2.1 The scope includes the Design, Supply, Installation, Testing and Commissioning of Rooftop On-Grid SPV power plants. All the necessary approvals from Electrical Inspectorate, feasibility study, necessary civil work, Mounting of Module Structures, PV Module Installation, walkway with foldable handrails, Inverter Installation, DC/AC Cabling and interconnections, Installation of Lightning Arresters, Energy meters for production with suitable isolator and Earthing System as per the standards, arranging all the necessary inspections from Electrical Inspectorate as part of Pre-Commissioning, if any, Commissioning of the PV Power Plant, are coming under the scope of the bidder.
- 4.2.2 The additional costs for site specific cabling works, earthing, mounting structure modifications etc are under the scope of the bidder.
- 4.2.3 It is mandatory that the bidders are to visit the sites and quote the rates considering all the requirements as mentioned in this tender document. No requests for revision of rates will be entertained. In case, the successful bidder is not undertaking the specific work, the work will be cancelled and disciplinary proceedings will be initiated against the bidder and all payments due will be withheld. Hence, Bidders are requested to visit the site before quoting and the rate for successful commissioning in all aspects is to be quoted.
- 4.2.4 The rate quoted should be all inclusive including delivery of materials, the cost of materials and labour for the civil works, Installation and Commissioning, 5-year Warranty, fee for approval from the Electrical Inspectorate if any, Solar Meter, Remote monitoring facility, Insurance, GST and all other expenses deemed necessary for the proper implementation of the conditions and specification incorporate in the tender.
- 4.2.5 The Operation and Maintenance of the Powerplant for the whole period of warranty will be duty of the vendor. The rates for O&M per year need to be quoted in the BoQ file provided
- 4.2.6 The Component wise split up of the costs in percentage for each capacity

is to be included as part of the technical bid (included as format A).

- 4.2.7 Any other work required for the successful commissioning of the power plant which are not mentioned in this document and are required as per prevailing laws & regulations in the country.

### 4.3. SCHEDULE OF SUPPLY

- 4.3.1 The items should be delivered and installed at the sites of constructions for which work order shall be given and specified by TCED, under prior intimation to TCED. The list of sites is listed below:
- 4.3.2 The successful bidder should complete the Supply, Installation, Testing and Commissioning of Solar Power Plant.
- 4.3.3 If the successful bidder fails to deliver the materials within the days mentioned below (from the date of award of contract), the order stands cancelled and TCED will award the work to the next bidder and penalty as decided by TCED will be levied.

#	Capacity of Solar Plant in kW	Material Delivery (Days)	Completion Period (Days)
1	<= 100	30	60
2	>100	45	75

- 4.3.4 For any delay in Installation and Commissioning beyond the period mentioned above (from the date of award of contract), the TCED will charge penalty of 0.5% of the order value/week or part thereof, subject to the cost not exceeding 10% of the total cost.
- 4.3.5 Order will be cancelled if the delay of service is more than this time period and work will be issued to the second lowest bidder
- 4.3.6 Bidders are to submit their quotes only after visiting the site and the details of additional works required for the successful commissioning of the power plant is to be mentioned in the technical bid. No additional amount for any works will be provided under any circumstance, even if the site requires additional work other than quoted by the bidder. Hence, special care must be taken while submitting the bids.
- 4.3.7 Supply of the SPV module must be from the ALMM list issued by MNRE from time to time. The test certificates and reports of the inverters being used for the project must be submitted along with the bid. TCED reserves the right to reject the bid based on the non-conformity of the inverter being supplied.
- 4.3.8 The successful bidder shall submit the detailed BoM and the timeline for completion along with the agreement and security deposit. This timeline must be followed and no extension of time for completing the installation will be granted. Although, time extension may be granted for things beyond the control of the bidder.
- 4.3.9 In case of no valid reason, extension of time of completion that can be granted at a time shall be 25% of the original time. The



maximum extension that can be granted for a work shall be limited to half the original time of completion.

- 4.3.10 When the contract period has to be extended wholly or partly due to default on the part of the bidder, the Agreement Authority may sanction extension of time after imposing fine as mentioned below;

Period	Rate of Fine
First Extension	1% of the PAC subject to a minimum of Rs. 1000/- and maximum of Rs. 50,000/-.
Second Extension	2% of the PAC subject to a minimum of Rs. 2000/- and maximum of Rs. 1,00,000/-

#### 4.4 : WARRANTY

- a. 5 years' warranty should be provided by the supplier for the system and components, or part of the system has to be provided as per the special conditions of the contract.
- b. PV modules used in solar power plants/ systems must be warranted for their output peak watt capacity, which should not be less than 90 % at the end of 10years and 80% at the end of 25 years
- c. The Warranty Card to be supplied with the system must contain the details of the all the components supplied including serial numbers accompanied with the OEM warranty card

#### 4.5 : OPERATION AND MAINTENANCE

- 4.5.1 For the optimal operation of a PV plant, maintenance must be carried out on a regular basis. All the components should be kept clean. It should be ensured that all the components are fastened well at their due place. The O&M Charges for 5-year period is to be quoted by the bidders
- 4.5.2 The service personnel should visit the installations at least once a month for preventive maintenance even if no faults are reported. Reports of these preventive maintenance visits and generation data should be submitted to the TCED office on a monthly basis.
- 4.5.3 Maintenance guidelines for various components viz. solar panels, inverter, wiring etc. are discussed below:

##### 4.5.3.1 SOLAR PV PANELS

Although the cleaning frequency for the panels will vary from site to site depending on soil, it is recommended that

- a) The panels are cleaned at least once every thirty days.

- b) Use water and a soft sponge or cloth for cleaning.
- c) Do not use detergent or any abrasive material for panel cleaning.
- d) Iso-propyl alcohol maybe used to remove oil or grease stains.
- e) Do not spray water on the panel if the panel glass is cracked or the back side is perforated.
- f) Wipe water from module as soon as possible.
- g) Use proper safety belts while cleaning modules at inclined roofs etc.
- h) The modules should not be cleaned when they are excessively hot. Early morning is particularly goodtime for module cleaning.
- i) Check if there are any shade problems due to vegetation or new building and report the same to TCED.
- j) Ensure that the module terminal connections are not exposed while cleaning; this poses a risk of electric shock..
- k) Never use panels for any unintended use, e. g. drying clothes, chips etc. Ensure that monkeys or other animals do not damage the panels.

#### **4.5.3.2 CABLES AND CONNECTION BOXES**

- a) Check the connections for corrosion and tightness.
- b) Check the connection box to make sure that the wires are tight, and the water seals are not damaged.
- c) There should be no vermin inside the box.
- d) Check the cable insulating sheath for cracks, breaks or burns. If the insulation is damaged, replace the wire.
- e) If the wire is outside the building, use wire with weather-resistant insulation.
- f) Make sure that the wire is clamped properly and that it should not rub against any sharp edges or corners.
- g) If some wire needs to be changed, make sure it is of proper rating and type.

#### **4.5.3.3 INVERTER**

- a) The inverter should be installed in a clean, dry, and ventilated area.
- b) Remove any excess dust in heat sinks and ventilations. This should only be done with a dry cloth or brush.
- c) Check that vermin have not infested the inverter. Typical signs of this include spider webs on ventilation grills or wasps' nests in heat sinks.
- d) Check functionality, e.g., automatic disconnection upon loss of grid power supply, at least once a month.
- e) Verify the state of DC/AC surge arrestors, cable connections, and circuit breakers.

#### 4.5.3.4 Inspection and Maintenance Schedule

Component	Activity	Description	Interval
PV Module	Cleaning	<ul style="list-style-type: none"> <li>Clean PV modules with plain water or mild dishwashing detergent.</li> <li>Do not use brushes, any types of solvents, abrasives, or harsh detergents.</li> </ul>	Monthly or as per site conditions
PV Array	Inspection	<ul style="list-style-type: none"> <li>Check the PV modules and rack for any damage.</li> <li>Note down location and serial number of damaged modules.</li> </ul>	Annual
	Inspection	<ul style="list-style-type: none"> <li>Determine if any new objects, such as vegetation growth, are causing shading of the array and move them if possible.</li> </ul>	Half Yearly
	Vermin Removal	<ul style="list-style-type: none"> <li>Remove bird nests or vermin from array and rack area.</li> </ul>	Half Yearly
Junction Boxes	Inspection	<ul style="list-style-type: none"> <li>Inspect electrical boxes for corrosion or intrusion of water or insects. Seal boxes if required.</li> <li>Check position of switches and breakers.</li> <li>Check operation of all protection devices.</li> </ul>	Annual
Wiring	Inspection	<ul style="list-style-type: none"> <li>Inspect cabling for signs of cracks, defects; loose connections, overheating, arcing, short or open circuits, and ground faults.</li> </ul>	Annual
Inverter	Inspection Service	<ul style="list-style-type: none"> <li>Observe instantaneous operational indicators on the faceplate of the inverter to ensure that the amount of power being generated is typical of the conditions.</li> <li>Inspect Inverter housing or shelter for physical maintenance, if required.</li> </ul>	Monthly
Plant	Monitoring	<ul style="list-style-type: none"> <li>Operation and Performance Monitoring</li> </ul>	Monthly
Spare Parts	Management	<ul style="list-style-type: none"> <li>Manage inventory of spare parts.</li> </ul>	As needed

4.5.3.5 The faulty system or components should be replaced/ repaired within 7 days of fault reporting. The servicing should be carried out at the site of installation. If any of the components are to be taken out from the site for repair, a standby must be provided to ensure un-interrupted power generation and the systems functions smoothly.

4.5.3.6 Any Delay in servicing beyond 7 days of fault reporting would attract penalty at the rate fixed by TCED and further actions

will be initiated against the agency.

4.5.3.7 A designated contact Telephone Number and address should be submitted for reporting faults during the O&M period of 5 years.

#### **4.6 : PERFORMANCE RATIO TEST (PR TEST)**

The Plant should run minimum two weeks without any major equipment failure to start the PR test. The Contractor shall submit two copies of O&M manual with soft copy before the start of PR Test.

- i. The PR test shall be conducted at site by the Contractor in presence of the TCED officials as per IEC61724. The PR test procedure shall be submitted by the Contractor for review and approval. Any special equipment, instrumentation tools and tackles required for the successful completion of the performance test shall be arranged by the Contractor at his own cost.
- ii. The procedure for PR demonstration tests shall be as follows:
  - Depending on the requirement, Irradiance meter / Pyranometer shall be used at site locations. The PR test shall be conducted at site as per IEC 61724.
  - The factors excluded for calculation are Generation loss due to grid outage, irradiance below 250 W/m<sup>2</sup>, the measured global solar radiation of the period of the outage of the power evacuation system.
  - Individual measurements shall be taken for multiple MPPTs, in case of connecting strings having modules with different orientations or different tilt angle or any other module mismatch. The time synchronized GHI is measured through irradiance meter and energy output would be measured through the Power Quality Analyser. The measurements are taken continuously over the cumulative period and the relevant valid readings are extracted for calculations.

Plant PR shall then be estimated using the formula:

**Performance Ratio of the solar plant for a period of time =**  
*Energy measured (kWh) / (Irradiance (kWh/m<sup>2</sup>) on the panel x Active area of PV module (m<sup>2</sup>) x PVmodule efficiency (%)*

The EPC Contractor shall demonstrate minimum PR of 90% (measured at output of the inverter/solar meter level) in the initial PR test within 7 consecutive days. If the contractor fails to prove the desired performance ratio at the time of completion and during any of the consecutive years of defect liability period, he will be given a second chance to demonstrate the PR within another 7 consecutive days. Still if it is not achieved, the same shall be demonstrated within another 7 consecutive days and still if it is not achieved, EPC contractor shall improve the quality of the plant by replacement of module/other components with all suitable modification requirements on balance of systems at his own cost to achieve the performance ratio. After obtaining Energisation Approval from Electrical Inspectorate and demonstration of minimum specified PR, the solar plant shall be commissioned which shall be the date of completion of the project.

#### 4.7 : DATE OF COMMISSIONING

After the Inspection and approval of the Electrical Inspectorate, date of Energisation to the Grid will be considered as the official Date of Commissioning (DoC) of the project. To ensure PR, the bidder will be allowed EPC contractor shall improve the quality of the plant by replacement of any components with all suitable modification requirements on balance of systems at this own cost to achieve the performance ratio.

#### 4.8 : OPERATION MANUAL

An Operation, Instruction and Maintenance Manual, should be provided with the system. The following minimum details must be provided in the manual.

- i. About solar powerplant – its components and expected performance.
- ii. DO's and DON'T's
- iii. Cleaning of Solar PV Modules in regular intervals
- iv. Clear instructions on regular maintenance and troubleshooting of solar power plant
- v. AS built Drawings for the Installation
- vi. OEM Warrantee Certificates of Inverters, PV Modules, Batteries etc.
- vii. Specification of PV Plant
- viii. Data Sheets of major equipment like PV Module, Inverter etc.
- ix. Name and address of the E.P.C Contractor and the contract person in case of non-functionality of the solar powerplant.

#### 4.9 : BILL OF MATERIAL

The bidder should provide the bill of material mentioning the quantity of each of the item consisting in the system, along with the offer in the format as show below for each capacity:

SN	Item	Make (If any)	Model & Individual Capacity (If any)	Qty (Nos)	Rating/Cap a city
1.	PV Module				
2.	PCU/Inverter				
3.	DC Cables				
4.	AC Cables				
5.	AJB/SCB				
6.	Module Mounting Structure (MMS)				
7.	ACDB				
8.	Lightning Arrester				
9.	Earthing System Details and No. of Earth pits				
10.	Data Acquisition System				

#### 4.10 : SITE INSPECTON

It is recommended that the bidders visit all the sites listed here for the physical verification and for correctly estimating the quantity, especially related to structure and cabling, before submitting the bids. Bidder must include all the AC/DC wiring cost, replacement of instrument transformers, panel boards etc only after visiting the proposed site. The quoted amount will be for all the site-specific works and no additional amount will be allotted for any sort of works.

The contractor shall submit the detailed design along with capacity of the solar plant in each building before the commencement of work and get approved by the authorised TCED Engineer.

The site-specific requirement of ladders for accessing PV modules, pathway facility (with minimum 75cm in width) along with handrails and guard rails in case of sheet roofs are under the scope of the bidder. The Fabrication of Permanent Ladder should be of GI (min14 SWG), coated with Epoxy steel primer with rung spacing not be more than 10 inches and rung width of min 50 inches. Side Handrails / Grab Bars welded on both sides for safety purpose with an extension of Min 50 inches above the landing or access level. The pathway can be either of GI or FRP material and shall include handrails of minimum seventy-five centimeter in width for safety without causing shade on the PV module and Guardrails to prevent accidental falls from the sheet roofs.

#### 4.11 : CLEANING

The bidder shall provide permanent arrangement for module washing in the SPV Plant. Waterlines maybe drawn to feed water from the available resources. Contractor has to provide additional facility including pipeline, motor for pumping to the additional overhead tank, if required.

#### 4.12 : DISPLAY BOARD

The vendor has to display a board of size at the project site of size minimum 60 cm x 30 cm including the following details.

- Plant Name, Capacity, Location, Type of Renewable Energy plant (solar), Date of commissioning etc. The details of the scheme as specified in the work order.

#### 4.13 : INSURANCE

- a. The power plant must be insured at every stage of operation - from Material dispatch, storage, completion of installation and till 5 years after commissioning. The insurance coverage on handing over of the system must include all conditions of **Standard Fire and Special Perils Policy (Material Damage)**.

- b. The insurance premium for the 5 years of warranty is to be paid by the bidder. Only the system components are to be insured. On handing over of the system, the original insurance policy is to be handed over to the authorised person at the site of installation and a copy to TCED Office. The annual premium payment receipt must be handed to the authorised person at the site of installation.

#### **4.14 : POWER QUALITY TEST**

- a. Harmonic distortion at the point of coupling to utility grid shall be as per IEEE 519-2022. Test report for THD and individual harmonics (3Rd, 5th and 7th) for current and voltage shall be submitted for energisation approval of the plant. DC component shall also be tested and maintained as per standard or other applicable standards

## **PART II – CONDITIONS OF CONTRACT AND FORMS**

### **Section 5: Conditions of Contract and Forms**

#### **5.1 General Conditions**

The tenders should be submitted online at [www.etenders.kerala.gov.in](http://www.etenders.kerala.gov.in)

The tenders should be as per the prescribed form which should be downloaded from the e-tender website. The cost of tender forms should be paid online, and once paid will not be refunded. Tender forms are not transferable. Tenders that are not in the prescribed form are liable to be rejected.

Intending tenderers should submit their tenders on or before the due date and time mentioned in the tender abstract. Late tender will not be accepted.

The rates quoted should be only in Indian Currency. Tenders in any other currency are liable to rejection. The rates quoted should be for the unit specified in the schedule attached.

The tenderer shall submit a copy of PAN card of the authorised signatory along with tender.

Tenders subject to conditions will not be considered. They are liable to be rejected on that sole ground.

The tenders will be opened on the specified day and time in the Office of the Assistant Secretary, Electricity Department, Thrissur Corporation. The bidders or the bidder's representatives with proper authorization issued by the bidder may be present at the time of opening of tenders.

Every tenderer should send along with his tender an Earnest Money Deposit. This may be paid online at the e-tenders website.

If any tenderer withdraws from his tender before the expiry of the period fixed for keeping the rates firm for acceptance, the Earnest Money if any, deposited by him, will be forfeited.

- (a) The tenderer shall clearly specify whether the articles offered bear Bureau of Indian Standards mark/IEC Certification or not. In such cases, they shall produce copies of certification mark along with their tender in support of it.
- (b) Tenders shall clearly specify whether the goods are offered from indigenous sources or from imported stocks in India or from foreign sources to be imported under a license.



The final acceptance/rejection of the tenders rests entirely with the Assistant Secretary, Electricity Department, Thrissur Corporation who does not bind themselves to accept the lowest or any tender.

In the case of materials of technical nature, the successful tenderer should be prepared to guarantee satisfactory performance for a period of guarantee under a definite penalty.

Communication of acceptance of the e-tender normally constitutes a concluded contract. Nevertheless the successful tenderer shall also execute an agreement for the due fulfillment of the contract within the period to be specified in the letter of acceptance. The contractor shall have to pay all stamp duty, Lawyer's charges and other expenses incidental to the execution of the agreement. Failure to execute the agreement within the period specified will entail the penalties set out below:

- (a) The successful tenderer shall before signing the agreement and within the period specified in the letter of acceptance of his tender, deposit a sum equivalent to 5% of the value of the contract as security for the satisfactory fulfillment of the contract less the amount of earnest money deposited by him along with his tender. The amount of security may be deposited in the manner of Demand Draft or Bank Guarantee in favour of the Assistant Secretary, Electricity Department, Thrissur Corporation payable at Thrissur, Kerala from any of the nationalized/Scheduled Banks. If the successful tenderer fails to deposit the security and execute the agreement as stated above, the earnest money deposited by him will be forfeited to Electricity Department, Thrissur Corporation and contract arranged elsewhere at the defaulter's risk and any loss incurred by Electricity Department, Thrissur Corporation on account of the purchase will be recovered from the defaulter who will however not be entitled to any gain accruing thereby.
- (b) Incases where a successful tenderer, after having made partial supply and installation fails to fulfill the contracts in full, all or any of the materials not supplied/installed may at the discretion of Electricity Department, Thrissur Corporation be installed by means of another tender/quotation or by negotiation or from the next higher tenderer who had offered to supply already, and the loss if any caused to Electricity Department, Thrissur Corporation shall thereby together with such sums as may be fixed by Electricity Department, Thrissur Corporation towards damages be recovered from the defaulting tenderer.
- (c) If the contractor fails to install within the time/period(s) specified in the contract, Electricity department, Thrissur Corporation shall without prejudice to its other remedies under the contract, deduct from the contract prices, as liquidated damages, a sum equivalent to 2% of the delivered price of the delayed stores or unperformed services for each month of delay until actual delivery or performance, up to a maximum deduction of 10% of the contract price. Once the maximum is reached, the purchaser may consider termination of the contract at the risk and cost of the contractor.

The security deposit shall, subject to the conditions specified herein be returned to the contractor within three months after the expiration of the contract but in the event of any dispute arising between Electricity Department, Thrissur Corporation and the contractor, Electricity Department, Thrissur Corporation shall be entitled to deduct out of the deposits or the balance thereof, until such dispute is determined the amount of such damages, costs, charges and expenses as may be claimed. The same may also be deducted from any other sum which may be due at any time from Electricity Department, Thrissur Corporation to the contractor. In all cases where there are guarantee for the goods supplied, the security deposit will be released only after the expiry of the guarantee period.

All payments to the contractors will be made by the Assistant Secretary, Electricity Department, Thrissur Corporation in due course

- i. by the cheques on District Treasury or State Bank of India.
- ii. in the case of supplied from abroad, by drafts as maybe arranged between the contracting parties.

All incidental expenses incurred by Electricity Department, Thrissur Corporation for making payments outside the State in which the claim arises shall be borne by the contractor.

Payments will be made only after the required technical verification and based on the inspection Report by TCED officials.

The contractor shall not assign or make over the contract on the benefits or burdens thereof to any other person or body corporate. The contractor shall not underlet or sublet to any person or persons or body corporate the execution of the contract or any part thereof without the consent in writing of the purchasing officer who shall have absolute power to refuse such consent or to rescind such consent (if given) at any time if he is not satisfied with the manner in which the contract is being executed and no allowance or compensation shall be made to the contractor or the subcontractor upon such rescission. Provided always that if such consent be given at any time, the contractor shall not be relieved from any obligation, duty or responsibility under this contract.

In case the contractor becomes insolvent or goes in to liquidation, or makes or proposes to make any assignment for the benefit of his creditors or proposes any composition with his creditors for the settlement of his debts, carries on his business or the contract under inspection on behalf of or his

creditors or in case any receiving order(s) for the administration of his estate

are made against him or in case the contractor shall commit any act of insolvency or in case in which under any clause or clauses any act of insolvency or in case in which under any clause(s) of this contract the contractor shall have rendered himself liable to damages amounting to the whole of his security deposits, the contract shall, thereupon, after notice given by the Purchasing Officer to the contractor, be determined and Electricity Department, Thrissur Corporation may complete the contract in such time and manner and by such persons as Electricity Department, Thrissur Corporation shall think fit. But such determination of the contract shall be without any prejudice to any right or remedy of Electricity Department, Thrissur Corporation against the contractor or his sureties in respect of any breach of contract committed by the contractor. All expenses and damages caused to Electricity Department, Thrissur Corporation by any breach of contract by the contractor shall be paid by the contractor or to Electricity Department, Thrissur Corporation and may be recovered from him under the provision of the Revenue Recovery Act in force in the State.

In case the contractor fails to supply and installation of the SPV Power Plant within the time provided for the same, or in case the contractor commits any breach of any of the covenants, stipulations and agreements herein contained, and on his part to be observed and performed, then and in any such case, it shall be lawful for Electricity Department, Thrissur Corporation (if they shall think fit to do so) to arrange for the purchase of the said articles and things from elsewhere or on behalf of Electricity Department, Thrissur Corporation by an order in writing under the hand of the Assistant Secretary put an end to this contract and in case Electricity Department, Thrissur Corporation shall have incurred sustained or been put to any costs, damages or expenses by reason of such purchase or by reason of this contract having been so put an end to or in case any difference in price, compensation, loss, costs, damages, expenses or other moneys shall then or any time during the continuance of this contract be payable by the contractor to Electricity Department, Thrissur Corporation under and by virtue of this contract, it shall be lawful for Electricity Department, Thrissur Corporation from and out of any moneys for the time being payable or owing to the contract or from Electricity Department, Thrissur Corporation under or by virtue of this contract otherwise to pay and reimburse to Electricity Department, Thrissur

Corporation all such costs, damages and expenses they may have sustained, incurred or been put to by reason of the purchase made elsewhere or by reason of this contract having been so put an end to as aforesaid and also all such difference in price, compensation, loss, costs, damages, expenses and other moneys as shall for the time being payable by the contractor aforesaid.

Any some of money due and payable to the contractor (including security deposit returnable to him) under this contract may be appropriated by The Assistant Secretary or any other person authorised by Electricity Department, Thrissur Corporation and set off against any claim of Electricity Department, Thrissur Corporation for the payment of a sum of money arising out of or under any other contract made by the contractor or with Electricity Department, Thrissur Corporation or any other person authorised by Electricity Department, Thrissur Corporation. Any sum of money due and payable to the successful tenderer or contract or from Electricity Department, Thrissur Corporation shall be adjusted against any sum of money due to Electricity Department, Thrissur Corporation from his under any other contracts.

Every notice hereby required or authorised to be given may be given to the contractor personally or left at his residence or last known place of abode or business, or may be handed over to his agent personally, or may be addressed to the contractor or by post at his usual or least known place of abode or business. If so addressed and posted, shall be deemed to have been served on the contractor on the date on which in the ordinary course of post, a letter so addressed and posted would reach his place of abode or business.

The tenderer shall undertake the installation of the PV Power Plant according to the specified engineering standards and specifications.

No representation for enhancement of rate once accepted will be considered.

The prices quoted should be inclusive all taxes, duties, cesses etc. which are or may become payable by the contractor under existing or future law or rules of the country of origin/supply or delivery during the course of execution of the contract.

The tenderer will invariably furnish the required certificates with their bills for payment —

\*Certified that the goods which GST has been charged have not been exempted under the GST Rules made there under and the charges on account of sales tax on these goods are correct under the provisions of the relevant Act or the rules made there under certified further that we ... (or our Branch or Agent).....(Address) are registered as dealers in the State of under Registration No.....for purposes of sales tax.'

Special conditions, if any, of the tenderers attached with the tenders will not be applicable to the contract unless they are expressly accepted in writing by the purchaser,

The tenderer should send along with his tender an agreement executed and signed in Kerala Stamp Paper of value Rs.200/-. A specimen form of agreement is given Annexure I-D to this tender. Tenders without the agreement in stamped paper will be rejected outright.

Conditions in the technical document, technical specifications and special conditions of this tender document would override these general conditions, wherever applicable.

Electricity Department, Thrissur Corporation, by notice sent to the contractor, may terminate the contract, in whole or in part, at any time for its convenience. The notice of termination shall specify that termination is for Electricity Department, Thrissur Corporation's convenience, the extent

to which performance of the contractor under the contract is terminated, and the date upon which such termination becomes effective.

Envelope-1 shall be opened at the time and date announced in the tender notice.

Envelope-2 containing price Bid will not be opened at the time of opening Envelope -1. Envelope -2 will be opened later, the date of which will be intimated to the qualified tenderers, and this information would also be available on the e-tenders website.

In case any difference or dispute arises in connection with the contract, all legal proceedings relating to the matter shall be instituted in the Court within whose jurisdiction the Assistant Secretary, Electricity Department, Thrissur Corporation voluntarily resides.

The courts situated at the place where the Head Quarters of Electricity Department, Thrissur Corporation is situated viz, Thrissur alone will have jurisdiction to entertain civil suits and all other legal pertaining to this contract.

## **5.2 PAYMENT METHOD**

**5.2.1** No Advance payment will be given. All the documents submitted should be certified by the TCED officer.

**5.2.2** The terms of payment shall be:

### ***5.2.2.1 EPC Payment***

- i. Upon delivery of major components (PV Modules, Inverter etc) at the respective sites, 60 % of the contract value excluding O&M cost will be released as first part payment. The supplier shall submit the invoice for the materials (including serial numbers and delivery challan) duly certified by the TCED Officer along with report regarding the supply of materials
- ii. On completion of the installation of power plant and filing application for testing, 20% of the contract value excluding O&M cost shall be released as second part payment. The supplier shall submit the invoice for the materials supplied and all documents related including the Project Completion Report to the completion of the work certified by the TCED officer shall be submitted for the release of the amount. The PCR submitted will be used for conducting the pre-commissioning tests.
- iii. On commissioning of the grid connected system, 10% of the contract value excluding O&M cost will be released. All documents related to the completion of the work including commissioning report shall be submitted for the release of the amount.
- iv. The balance 10% shall be retained as performance security and will be released in equal parts of 2% after each year of operation with the acceptable PR value considering maximum 1% yearly degradation. This period will be considered only from the date of commissioning. This can be released against a bank guarantee of equivalent amount valid for 5 years.

- v. The security deposit of 3% furnished along with the contract agreements shall be released on successful completion of supply, installation and commissioning.

#### **5.2.2.2 O&M Payment**

- i. The O&M charges shall be released after completion of every 6 months of the O&M period. The start of O&M period will be considered from the scheduled date of operation.
- ii. The preventive maintenance reports along with receipt of premium of insurance and generation reports are to be submitted for the release of O&M payments.
- iii. The payment shall be released after the inspection by the authorized personnel of TCED on annual basis.

**5.2.3** Income tax, contribution to workers' welfare fund and other statutory deductions shall be made from the payment as per prevailing norms.

### **5.3. Special Conditions**

Each Bidder should submit only one (1) bid. Any bidder who submits/participates in more than one bid for the work shall be disqualified.

The tenders will be opened in the presence of bidders present at the date and time advised in the Bidding Document. If the due date for receiving and opening the tender happens to be declared holiday, then the tender will be received and opened on the very next day, for which no prior intimation will be given.

If the bidder has NOT submitted the requisite EMD OR Agreement, OR if the price bids are included in Envelope -A or Envelope -B, OR if Envelope-C is not submitted along with the tender, such tenders will be summarily rejected.

During the technical evaluation period, Thrissur Corporation may seek more clarifications/details from any or all of the tenderers, if found necessary.

The price bids of technically qualified tenderers only will be opened and the L1 bidder will be awarded the work of supply and installation of items after fulfilling all the requirements.

### **5.4. Service and maintenance**

The faulty system or components should be replaced/repared within 10 days of fault reporting. The servicing should be carried out at the site of installation. The service personnel should visit the installations at least once in a month for preventive maintenance even if no faults are reported. Delay in servicing beyond 10 days of fault reporting would attract penalty at the rate of Rs.10,000/-per fortnight or part thereof.

Designated contact Telephone Number, Email and Address for communication should be submitted for reporting faults during the warranty period.

## ANNEXURE I-C : SUMMARY OF BID QUALIFICATION REQUIREMENTS

1	Name of the bidder	
2	Address in full	
3	Contact Details Mobile Land Phone Fax E mail	
4	Name and Designation of the authorised signatory	
5	Details of EMD submitted along with the bid in favour of Assistant Secretary Electricity Department, Thrissur Corporation.	
6	Total Number and capacity of solar power plants installed so far	Number of systems:
		Total capacity:
		(Proof to be enclosed and flagged as Annexure.....page no.....)
7	Annual turnover of the firm during last three years (Rs.)	
		(Proof to be enclosed and flagged as Annexure.....page no.....)
8	No.of service centres/Authorised service providers in Kerala	
9	Agreement submitted in stamp paper(YES/NO);	

## ANNEXURE I-D : AGREEMENT

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ARTICLES OF AGREEMENT executed on this the ..... day of .....Two thousand and .....between the Electricity Department,Thrissur Corporation of the one part and Sri .....Name and address of the tenderer)hereinafter referred to as"the Bounden")of the other part.WHEREAS in response to the Notification No.....dated.....the bounden has submitted to Electricity Department,Thrissur Corporation an e-tender for the Supply,Installation &Commissioning of a total of 160kWp Grid Connected SPV power plant at Thrissur Municipal Corporation Buildings,Thrissur,in Thrissur Corporation,Thrissur District specified therein subject to the terms and conditions contained in the said e-tender.

AND WHEREAS the bounden has furnished to Electricity Department,Thrissur Corporation a sum of Rs.....as Earnest Money Deposit for execution of an agreement undertaking the due fulfilment of the contract in case his e-tender is accepted by Electricity Department,Thrissur Corporation.NOW THESE PRESENTS WITNESS and it is hereby mutually agreed as follows:-

In case the etender submitted by the bounden is accepted by Electricity Department,Thrissur Corporation and the contract for .....is awarded to the bounden, the bounden shall within fifteen days of acceptance of his e-tender,execute an agreement with Electricity Department,Thrissur Corporation incorporating all the terms and conditions under which Electricity Department,Thrissur Corporation accepts his e-tender.

In case the bounden fails to execute the agreement as aforesaid incorporating the terms and conditions governing the contract,Electricity Department,Thrissur Corporation shall have power and authority to recover ffrom the bounden any loss or damage caused to Electricity Department,Thrissur Corporation by such breach as may be determined by Electricity Department,Thrissur Corporation by appropriating the moneys inclusive of Earnest Money Deposited by the bounden and if the Earnest Money is found to be inadequate the deficit amount may be recovered from the bounden and his properties movable and immovable in the manner hereinafter contained.

All sums found due to Electricity Department,Thrissur Corporation under or by virtue of this agreement shall be recoverable from the bounden and his properties movable and immovable under the provisions of the Revenue Recovery Act for the time being in force as though such sums are arrears of land revenue and in such other manner as Electricity Department,Thrissur Corporation may deem fit.

In witness whereof Sri .....Name and Designation) for and on behalf of the Electricity Department,Thrissur Corporation and Sri. .... the bounden have hereunto set their hands the day and year shown against theirrespective signature.

Signed by Sri.....

(Date).....

in the presence of witnesses

Signed by Sri.....

(Date).....

in the presence of witnesses

## ANNEXURE II-C : BIDDER'S TECHNICAL INFORMATION SUMMARY

(To be filled in by bidder, Use copies, for each model offered )

1.	Name of the bidder as in registration certificate	
2.	Address in full	
3.	Contact Details Mobile Land Phone Fax No. Email Address	
4.	Name of the authorised signatory	
5.	Designation of the authorised signatory	
6.	Whether the bidder is a bonafide manufacturer/integrator of the item tendered ?	

### 7.Details of main components in the systems offered and the test certificates

S/N	Criteria	PV Module	Inverter
1.	Make offered		
2	Model offered		
3	Lab from which Test certificate obtained		
4	Test Certificate No.		
5	Date of Test Certificate		
6	Standards to which it complies, as per test certificate		
7.	Copy of test certificate enclosed at page No...(of this tender submission)		

I have read the General Tender Terms & Conditions for e-Procurement, General Conditions Special Conditions and Bidder's Technical Information summary of this e-tender and hereby agree to participate in the e-tender strictly adhering to the conditions and the details furnished along with bid are true and correct.

Signature of authorised signatory with

Date:

Name:

Designation:



**ANNEXURE II-D : FORMAT FOR WARRANTY CARD TO BE  
SUPPLIED WITH EACH SOLAR SYSTEM**

1.Name &Address of the Bidder/Bidder of the System

2.Name &Address of Purchasing Agency

3.Data of supply of the system

4.Details of PV Module(s)supplied in the system

Make

Model

Serial No.(s).

**Wattage of the PV Module(s)under STC**

Warranty valid up to

5.Details of BOS items(Inverter etc)

**System Make**

**Model**

Serial No.(s)

**Warranty valied up to**

6.Designation&Address of the person to be contractor  
for claiming Warranty obligations

## ANNEXURE II-E : DECLARATION BY THE BIDDER

**Tender Notification No.PDS- for Design, Supply,Installation Testing & Commissioning of a .....kW Grid Connected SPV power plant at..... Thrissur Corporation,Thrissur District.**

Tender notification Date

To

The Assistant Secretary  
Electricity Department,Thrissur Corporation.

We,the undersigned,declare that:

- 1.We have examined and have no reservations to the Bidding Document, including Addenda No.....
- 2.We offer to supply in conformity with the Bidding Document and in accordance with the delivery schedule.
- 3.Our Bid shall be valid for a period of 6 months from the date fixed as deadline for the submission of tenders in accordance with the Bidding Document,and it shall remain binding upon us and may be accepted at any time before the expiration of that period;
- 4.If our Bid is accepted,we commit to submit a Security Deposit in the amount of 5 percent of the Contract Price for the due performance of the Contract,;
- 5.We are not participating,as Bidders,in more than one Bid in this bidding process;
- 6.Our firm,its affiliates or subsidiaries,including any subcontractors or contractors for any part of the Contract,has not been declared ineligible by the TCED or Government of Kerala;
- 7.We understand that this Bid,together with your written acceptance thereof included in your notification of award,shall constitute a binding contract between us,until a formal Contract is prepared and executed.
- 8.Our firm has obtained the certifications from MNRE or NABL approved Test laboratories that the goods and services are satisfying the technical criteria specified in the bid.

Signature:

Name:

Date :

## ANNEXURE II-F : STATEMENT OF DEVIATIONS

**Name of Work: Design, Supply, Installation, Testing & Commissioning of a .....KW Grid Connected**

**SPV power plant at ..... in Thrissur Corporation, Thrissur District**

c-Tender No.:PDS-

Name and Address:

To,

The Assistant Secretary,  
Electricity Department,  
Thrissur Corporation, Thrissur

Dear Sir

**Sub:-Deviations from bid conditions relating to bit No.....for  
the Design, Supply, Installation, Testing & Commissioning of a  
.....kW Grid Connected SPV power plant at ..... in Thrissur  
Corporation, Thrissur District**

In respect of whatever has been stated to the contrary anywhere else in our offer, only the following are the deviations and variations from the exception to the specifications and documents for the subject e-Tender No.PDS- ..... These deviations and variations are exhaustive, except these deviations. The entire supply and installation will be effected as per your bid specifications and documents. Further I/We agree that additional conditions, if any found in the offer other than those stated below, except those pertaining to any rebates offered /reductions in cost to the Electricity Department, Thrissur Corporation shall not be given effect to. I/We also certify that the financial implication of these deviations if to be withdrawn has been furnished.

Signature of the Tenderer

## ANNEXURE II-G : DECLARATION FOR DEVIATION

**From.**

To,

The Assistant Secretary  
Electricity Department,  
Thrissur Corporation, Thrissur.

Dear Sir.

**Sub:-Bid for Design, Supply, Installation, Testing & Commissioning  
of a .... kW Grid Connected SPV power plant at ..... in  
Thrissur Corporation, Thrissur District**

Ref:-Bid No.....

This has reference to your above referrer bid. As required therein we are pleased to submit our price bid for the above bid in a separate sealed cover, We have also submitted the pre-qualification bid in a separate sealed cover.

We declare that we are qualified to participate in the above-referred bid inline with your qualification requirements stipulated in the "Bid documents". We further declare that we have brought out all our deviations to the conditions of contract stipulated in your bid documents indicating therein the cost for withdrawing the conditions in case you for such withdrawal will be limited to the amount mentioned against each deviation separately.

It is understood that the deviations to the conditions of the bid documents as have been brought out are exhaustive.

We agree and declare that irrespective of whatever has been stated elsewhere in the bid documents only those deviations that have been specifically brought out in Annexure-II to Part II hold good.

I/We have enclosed ... amount of Rs ..... towards Earnest Money Deposit, in a separate sealed cover. ... proof of having deposited an

Thanking You

Yours faithfully,  
(Signature of Bidder):

Date:

## **ANNEXURE II-H : DECLARATION ON SUBSIDY CLAIM**

Tender Notification No.:PDS-

**Design, Supply,Installation, Testing &Commissioning of a ..... kW Grid  
Connected SPV power plant at .....in Thrissur Corporation, Thrissur District.**

To

The Assistant Secretary  
Electricity Department,  
Thrissur Corporation,Thrissur.

I hereby declare that we will not apply directly to MNRE for claiming the subsidy for this SPV project with 150 kW capacity and proposed to be installed at Thrissur Corporation,Thrissur District.

**Signature of Bidder:**

**Name :**

**Date :**

**Office Seal**

## **ANNEXURE II-J : ENGINEERING DRAWING OF STRUCTURE**

The bidder should submit and get the necessary approval of the following detailed Engineering Drawings before the execution of the project:

- i. Single Line Diagram of the PV Power Plant
- ii. Detailed Plot Plan for the Deployment of PV Array.
- iii. Schematic Diagram.
- iv. Module Mounting Structure (Plan & Elevation).

The successful bidder should submit the soft copy of the Solar Radiation Data that

They have used for PV System Simulation of the Solar PV Power Plant.