



**Basic Details**

|                                      |                           |                                       |              |
|--------------------------------------|---------------------------|---------------------------------------|--------------|
| Organisation Chain                   | ANERT                     |                                       |              |
| Tender Reference Number              | ANERT-TSR/42/2023-DE(TSR) |                                       |              |
| Tender ID                            | 2024_ANERT_658105_1       | Withdrawal Allowed                    | Yes          |
| Tender Type                          | Open Tender               | Form of contract                      | EPC Contract |
| Tender Category                      | Works                     | No. of Covers                         | 1            |
| General Technical Evaluation Allowed | No                        | ItemWise Technical Evaluation Allowed | No           |
| Payment Mode                         | Not Applicable            | Is Multi Currency Allowed For BOQ     | No           |
| Is Multi Currency Allowed For Fee    | No                        | Allow Two Stage Bidding               | No           |

**Cover Details, No. Of Covers - 1**

| Cover No | Cover                         | Document Type | Description   |
|----------|-------------------------------|---------------|---------------|
| 1        | Fee/PreQual/Technical/Finance | .pdf          | Technical Bid |
|          |                               | .xls          | Financial Bid |

**Tender Fee Details, [Total Fee in ₹ \* - 0.00]**

|                              |      |                |     |                |     |
|------------------------------|------|----------------|-----|----------------|-----|
| Tender Fee in ₹              | 0.00 | Fee Payable To | Nil | Fee Payable At | Nil |
| Tender Fee Exemption Allowed | No   |                |     |                |     |

**EMD Fee Details**

|                 |       |                       |     |
|-----------------|-------|-----------------------|-----|
| EMD Amount in ₹ | 0.00  | EMD Exemption Allowed | No  |
| EMD Fee Type    | fixed | EMD Percentage        | NA  |
| EMD Payable To  | Nil   | EMD Payable At        | Nil |

**Work / Item(s)**

|                                      |   |                           |                    |                       |        |
|--------------------------------------|---|---------------------------|--------------------|-----------------------|--------|
| Title                                | Design, Supply, Installation and Commissioning of 10 kW Grid connected SPV Power Plant with battery backup at Pazhayannur Grama Panchayat, Thrissur |                           |                    |                       |        |
| Work Description                     | Design, Supply, Installation and Commissioning of 10 kW Grid connected SPV Power Plant with battery backup at Pazhayannur Grama Panchayat, Thrissur |                           |                    |                       |        |
| Pre Qualification Details            | Please refer Tender documents.  |                           |                    |                       |        |
| Independent External Monitor/Remarks | NA  |                           |                    |                       |        |
| Tender Value in ₹                    | NA  | Product Category          | Solar Power Plants | Sub category          | NA     |
| Contract Type                        | Tender  | Bid Validity(Days)        | 60                 | Period Of Work(Days)  | 30     |
| Location                             | Pazhayannur Grama Panchayat, Thrissur   | Pincode                   | 680670             | Pre Bid Meeting Place | NA     |
| Pre Bid Meeting Address              | NA  | Pre Bid Meeting Date      | NA                 | Bid Opening Place     | Online |
| Should Allow NDA Tender              | No  | Allow Preferential Bidder | No                 |                       |        |

**Critical Dates**

|                                     |                      |                                   |                      |
|-------------------------------------|----------------------|-----------------------------------|----------------------|
| Publish Date                        | 13-Feb-2024 02:00 PM | Bid Opening Date                  | 22-Feb-2024 04:00 PM |
| Document Download / Sale Start Date | 13-Feb-2024 02:00 PM | Document Download / Sale End Date | 22-Feb-2024 03:00 PM |
| Clarification Start Date            | NA                   | Clarification End Date            | NA                   |
| Bid Submission Start Date           | 13-Feb-2024 02:00 PM | Bid Submission End Date           | 22-Feb-2024 03:00 PM |

**Tender Documents**

| NIT Document | S.No | Document Name | Description | Document Size |
|--------------|------|---------------|-------------|---------------|
|--------------|------|---------------|-------------|---------------|

|                            |             |                      |                      |                    |                              |
|----------------------------|-------------|----------------------|----------------------|--------------------|------------------------------|
|                            | 1           | Tendernotice_1.pdf   | NIT and Abstract     | (in KB)            | 253.99                       |
| <b>Work Item Documents</b> | <b>S.No</b> | <b>Document Type</b> | <b>Document Name</b> | <b>Description</b> | <b>Document Size (in KB)</b> |
|                            | 1           | Tender Documents     | TDHybrid.pdf         | Tender Document    | 858.07                       |
|                            | 2           | BOQ                  | BOQ_1017382.xls      | Financial Bid      | 375.50                       |

### **Tender Inviting Authority**

|                |   |
|----------------|---|
| <b>Name</b>    | CEO ANERT   |
| <b>Address</b> | Office of CEO, ANERT Law College Road, Vikas Bhavan. PO, Thiruvananthapuram - 695 033 |



**AGENCY FOR NEW & RENEWABLE ENERGY  
RESEARCH AND TECHNOLOGY (ANERT)**

Department of Power, Government of Kerala  
Thiruvananthapuram, Kerala – 695 033;  
[www.anert.gov.in](http://www.anert.gov.in) , [projects@anert.in](mailto:projects@anert.in)

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## **E-TENDER DOCUMENT**

***Design, Supply, Installation and Commissioning  
of 10 kW Grid connected SPV Power Plant with  
battery backup at Pazhayannur Grama  
Panchayat, Thrissur***

**Ref. No.: ANERT-TSR/42/2023-DE(TSR)**

### **PART 1 – GENERAL CONDITIONS**

**Date of Publishing of Bids** : - 13/02/2024

**Last Date of Submission of Bids** : - 22/02/2024

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## E-TENDER NOTICE

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Competitive e-tenders in one cover system with Price Bid in accordance with the ANERT approved technical specifications are invited from ANERT registered vendors for SPV Power plants for the ***Design, Supply, Installation and Commissioning of 10 kW Grid connected SPV Power Plant with battery backup at Pazhayannur Grama Panchayat, Thrissur.*** The e-tender documents can be downloaded from the e-tendering website of Govt. of Kerala. Tender form will not be available in any other form.

Thiruvananthapuram

CEO

13/02/2024

## TENDER ABSTRACT

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|                                     |  |
|-------------------------------------|--|
| Ref. No.                            | <b>ANERT-TSR/42/2023-DE(TSR)</b>   |
| Name of Work                        | <b>Design, Supply, Installation and Commissioning of 10 kW Grid connected SPV Power Plant with battery backup at Pazhayannur Grama Panchayat, Thrissur</b> |
| Building Site and Requirements      | <b>Pazhayannur Grama Panchayat,<br/>Thrissur -680670</b>   |
| Download of Tender Form             | <a href="http://www.etenders.kerala.gov.in">http://www.etenders.kerala.gov.in</a>  |
| Last date of submission of Tender   | <b>22/02/2024, 03.00 PM</b>  |
| Date and Time of opening the Tender | <b>22/02/2024, 03.30 PM</b>  |
| Warranty period                     | 5 years from the date of Commissioning   |
| Availability of Tender Forms        | Website <a href="http://www.etenders.kerala.gov.in">http://www.etenders.kerala.gov.in</a>  |
| Place of opening of tender          | Office of CEO, ANERT<br>Law College Road, Vikas Bhavan. PO,<br>Thiruvananthapuram - 695 033, Kerala  |

Thiruvananthapuram  
13/02/2024

Sd/-

## **GENERAL TERMS AND CONDITIONS FOR E-PROCUREMENT**

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This e-Tender is being published for the Design, Supply, Installation and Commissioning of 10 kW Grid connected SPV Power Plant with battery backup at Pazhayannur Grama Panchayat, Thrissur. The tender is invited in one cover system through e-procurement portal of Government of Kerala ([www.etenders.kerala.gov.in](http://www.etenders.kerala.gov.in)). Prospective bidders willing to participate in this tender shall necessarily register themselves with above mentioned e-procurement portal.

The tender timeline is available in the critical date section of this tender published in [www.etenders.kerala.gov.in](http://www.etenders.kerala.gov.in)

### **1. ONLINE BIDDER REGISTRATION PROCESS:**

- 1.1 Bidders should have a Class III or above Digital Signature Certificate (DSC) to be procured from any Registration Authorities (RA) under the Certifying Agency of India. Details of RAs will be available on [www.cca.gov.in](http://www.cca.gov.in). Once, the DSC is obtained, bidders have to register on [www.etenders.kerala.gov.in](http://www.etenders.kerala.gov.in) website for participating in this tender. Website registration is a one-time process without any registration fees. However, bidders have to procure DSC at their own cost.
- 1.2 Bidders may contact e-Procurement support desk of Kerala State IT Mission over telephone at 0471- 2577088, 2577188, 2577388 or 0484 – 2336006, 2332262 - through email: [helpetender@gmail.com](mailto:helpetender@gmail.com)/[etendershelp@kerala.gov.in](mailto:etendershelp@kerala.gov.in) for assistance in this regard

### **2. ONLINE TENDER PROCESS:**

The tender process shall consist of the following stages:

- i. Downloading of tender document: Tender document will be available for free download on [www.etenders.kerala.gov.in](http://www.etenders.kerala.gov.in). However, tender document fees shall be payable at the time of bid submission as stipulated in this tender document.
- ii. Pre-bid meeting: (not applicable)
- iii. Publishing of Corrigendum: All corrigenda shall be published on [www.etenders.kerala.gov.in](http://www.etenders.kerala.gov.in) and shall not be available elsewhere.



- iv. Bid submission: Bidders have to submit their bids along with supporting documents to support their eligibility, as required in this tender document on [www.etenders.kerala.gov.in](http://www.etenders.kerala.gov.in). No manual submission of bid is allowed and manual bids shall not be accepted under any circumstances.
- v. In case bidder encounters any technical issues pertaining to e-Procurement system while acting on the tender, computer screen shot of the error message with date & time stamp on the web-browser along with the query shall be e-mailed by the bidder to the help desk (**helpetender@gmail.com/etendershelp@kerala.gov.in**), for resolution of the problem. At the same time, problem must be intimated to the concerned Tender Inviting Authority via email.
- vi. The time taken to ascertain, evaluate and suggest a solution for the problem reported by bidder may vary from case to case. Hence bidders are advised to submit the bid **at least 2 working days before the due date** and time of bid submission to avoid any last-minute issues that may come up.
- vii. Opening of Bid and Bidder short-listing: The single cover bids will be opened, evaluated and shortlisted as per the eligibility. Failure to submit the required documents online will attract disqualification. Price bids of the eligible bidder's will open the same day of opening and the work will be awarded.

### **3. DOCUMENTS COMPRISING BID:**

3.1 (a) The First Stage - Part-I Pre- Qualification cum Technical Bid with Commercial terms without Price Bid

Technical proposal shall contain the scanned copies of the following documents which every bidder has to upload:

**Envelop -1** shall contain, Part-I (this document in PDF form)/scanned copies of:

- i. Tender documents downloaded (signed with office seal)
- ii. Summary of Bid qualification requirement (Annexure A)
- iii. Agreement in the prescribed format (Annexure C) on Govt. of Kerala stamp paper worth Rs.200/-
- iv. Copy of Registration Certificate of the bidder firm
- v. Details of credit rating done, to prove the experience in executing similar orders

- vi. Bill of Material
- vii. Details of the technical offer, including test certificates issued in the name of the bidder
- viii. Declaration by the bidder (format as in Annexure – D)
- ix. Declaration of relationship with ANERT employee (format as in Annexure - E)

3.1 (b) The Second Stage (Financial Cover as per two cover system):

**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/authorized signatory of the tender.

- 3.2 The department doesn't take any responsibility for any technical snag or failure that has taken place during document upload.
- 3.3 The Bidder shall complete the Price bid as per format given for download along with this tender.

Note: The blank price bid should be downloaded and saved on bidder's computer without changing file-name otherwise price bid will not get uploaded. The bidder should fill in the details in the same file and upload the same back to the website.

- 3.4 Fixed price: Prices quoted by the Bidder shall be fixed during the bidder's performance of the contract and not subject to variation on any account. A bid submitted with an adjustable/ variable price quotation will be treated as non-responsive and rejected.

#### 4. SUBMISSION PROCESS:

- 4.1 For submission of bids, all interested bidders have to register online as explained above in this document. After registration, bidders shall submit their Technical bid and Financial bid online on [www.etenders.kerala.gov.in](http://www.etenders.kerala.gov.in) along with online payment of tender document fees and EMD.
- 4.2 For page-by-page instructions on bid submission process, please visit [www.etenders.kerala.gov.in](http://www.etenders.kerala.gov.in) and click "Bidders Manual Kit" link on the home page.

- 4.3 It is necessary to click on “Freeze bid” link/ icon to complete the process of bid submission otherwise the bid will not get submitted online and the same shall not be available for viewing/ opening during bid opening process.

## **5. VALIDITY**

- 5.1 The tender offer shall be kept valid for acceptance for a period of 6 months from the date of opening of offers. The offers with lower validity period are liable for rejection. Further, the tenderer may extend the validity of the Bids without altering the substance and prices of their Bid for further periods, if so required

## **6. DEVIATIONS**

- 6.1 The offers of the Tenderers with Deviations in Commercial terms and Technical Terms of the Tender Document are liable for rejection.

## **7. BLACK LIST**

- 7.1 All the intending tenderers shall agree that in the event of the documents furnished with the offer being found to be bogus or the documents contain false particulars, they shall be blacklisted for future tenders/ association with ANERT and EMD shall be forfeited against any losses incurred by ANERT.

## **8. BIDDER'S LOCATION**

- 8.1 The tenderers are requested to furnish the exact location of their factories/godown with detailed postal address and pin code, telephone and fax nos. etc. in their tenders to arrange inspection by ANERT, if considered necessary.
- 8.2 All communication shall be made to the registered email of the bidder in the e-tendering systems and ANERT shall not be responsible for non-receipt or delay of any such communication.

## **9. CORRUPT AND FRAUDULENT PRACTICES**

ANERT requires compliance with its policy in regard to corrupt and fraudulent/prohibited practices as set forth in this proposal. In further pursuance of this

policy, the selected service Provider(s) shall permit ANERT or its representatives to inspect the accounts, records and other documents relating to the submission of the Proposal and execution of the contract, in case of award, and to have the records inspected by ANERT.

## **10. CONFLICT OF INTEREST**

- i. The service Provider(s) is required to provide professional, objective, and impartial services, at all times holding ANERT's interests paramount, strictly avoiding conflicts with other assignments or its own corporate interests, and acting without any consideration for future work. The supplier has an obligation to disclose to ANERT any situation of actual or potential conflict that impacts its capacity to serve the best interest of ANERT. Failure to disclose such situations may lead to the disqualification of the supplier or the termination of its Contract and/or sanctions by the Government.
- ii. Relationship with the ANERT staff: a service Provider (including its subsidiaries /partners) that has a close business or family relationship with a professional staff of the ANERT who are directly or indirectly involved in any part of the preparation of this document, the selection process for the Contract, or the supervision of the Contract, may not be awarded a Contract, unless the conflict stemming from this relationship has been resolved in a manner acceptable to ANERT throughout the selection process and the execution of the Contract. Any other types of conflicting relationships as indicated in the Tender

## **11. CONFIDENTIALITY**

- i. From the time the Proposals are opened to the time the Contract is awarded, the agency (ies) should not contact any of the officials of ANERT on any matter related to its Technical and/or Financial Proposal. Information relating to the evaluation of Proposals and award recommendations shall not be disclosed to the agency (ies) who submitted the Proposals or to any other party not officially concerned with the process, until the publication of the Contract award information.
- ii. Any attempt by the agency (ies) or anyone on behalf of the Suppliers to influence improperly ANERT in the evaluation of the Proposals or Contract award decisions

may result in the rejection of its Proposal and may be subject to the application of prevailing Government sanctions procedures.

- iii. Notwithstanding the above provisions, from the time of the Proposals" opening to the time of Contract award publication, if a agency (ies) intends to contact ANERT on any matter related to the selection process, it should do so only in writing.
- iv. The Bids should be submitted only through the e-tender portal [www.etenders.kerala.gov.in](http://www.etenders.kerala.gov.in). Agency (ies) shall upload all the necessary documents in the e tender portal before the last date & time for online submission. Proposal received after the submission deadline will be treated as non-responsive and will be excluded from further evaluation process.
- v. Proposals must be direct, concise, and complete. ANERT will evaluate bidder's proposal based on its clarity and the directness of its response to the requirements of the project as outlined in this tender document. Bidders shall furnish the required information on their technical and financial proposals in the enclosed formats only. Any deviations in format or if the proper information is not provided properly, the tender will be liable for rejection. Tender Evaluation committee may seek clarification, if required, while evaluating the proposal.
- vi. The technical bid opening date, time and the address are as stated in the tender document. The Financial Proposal shall remain securely stored online till the technical evaluation is completed and the results intimated to all successful bidders

## **12. APPLICABLE LAW**

The work order shall be governed by the laws and procedures established by Government of Kerala, within the frame work of applicable legislation and enactment made from time to time concerning such commercial dealings. Any default in the terms and conditions of the document by the service provider will lead to rejection of work order.

## **13. AMENDMENT OF TENDER DOCUMENT**

At any time prior to the deadline for submission of the tender, ANERT may for any reason, modify the tender document. The amendment document/ corrigendum shall be

notified through the website [www.etenders.kerala.gov.in](http://www.etenders.kerala.gov.in) and such amendments shall be binding on all the bidders.

#### **14. COMMENCEMENT OF SERVICE**

The successful bidder should sign the contract agreement within 7 days of issue of work order. The successful bidder should start the services as defined in the scope of work within 10 days of Issue of work order.

#### **15. GOVERNMENT OF KERALA – CORRUPT AND FRAUDULENT PRACTICES**

ANERT follows the policy of the Government of Kerala for anti-corruption and fraudulent practices to maintain sound procurement principles of open competition, economy and efficiency, transparency, and fairness. ANERT requires the agency (ies) to observe the following Government manuals (amended from time-to-time) during the selection process and in execution of such contracts The Kerala Financial Code (KFC), 2008 (7th Edition, 1st Edition was in 1963), The Stores Purchase Manual (SPM), 2013.

## **BID QUALIFICATION REQUIREMENTS**

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### **16. BID QUALIFICATION REQUIREMENTS**

- 16.1.1 Every tenderer should submit along with his e-tender an Earnest Money Deposit (EMD). This may be done electronically from any of the Nationalized/Schedule 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 deposited.
- 16.1.2 An agreement in Rs.200/- Kerala stamp paper as per the format given in Annexure IC must be submitted along with e-tender document.
- 16.1.3 The bidder must use PV modules listed in the ALMM list issued by MNRE from time to time. A detailed BoM in the letter head of the bidder is to be provided along with the bid.
- 16.1.4 Price Bid in excel format, for this tender to be downloaded from e-tender website, duly digitally signed by the tenderer/authorized signatory of the tender.

### **17. Eligibility Requirement**

Only the empanelled vendors for SPV Power plants issued by ANERT from time to time are eligible for participation in the tender. The maximum Power plant capacity and total volume of the works are limited to their grade allotted by M/s ICRA Ltd and as mentioned in the Registration order.

## CONDITIONS OF CONTRACT

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### 18. GENERAL CONDITIONS

- 18.1 The tenders should be submitted online at [www.etenders.kerala.gov.in](http://www.etenders.kerala.gov.in)
- 18.2 The tenders should be as per the prescribed form which should be downloaded from the e-tender website.
- 18.3 Intending tenderers should submit their tenders on or before the due date and time mentioned in the tender abstract.
- 18.4 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.
- 18.5 Tenders subject to conditions will not be considered. They are liable to be rejected on that sole ground.
- 18.6 The final acceptance/rejection of the tenders rests entirely with CEO, ANERT who do not bind themselves to accept the lowest or any tender.
- 18.7 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 fulfilment 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) A non-refundable licensing fee of 2.5% has to be remitted by tenderer. This will be deducted from the payment of tenderer while releasing payment.
  - b) The successful tenderer shall sign an agreement with ANERT within the period specified in the letter of acceptance of this tender. The amount of stamp duty for the agreement must be in compliance with G.O.(P) No.113/2019/TD. dtd 24.07.2019 with respect to public works. They are to deposit a sum equivalent to 3% of the value of the contract as security for the satisfactory fulfilment of the contract less the amount of money deposited by him along with his tender.



The amount of security may be deposited in the manner prescribed to be specified in the work order issued by ANERT.

- c) There will be no exemption for MSE's in depositing this security amount. 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 ANERT and contract arranged elsewhere at the defaulter's risk and any loss incurred by ANERT on account of the purchase will be recovered from the defaulter who will however not be entitled to any gain accruing thereby.
- d) In cases where a successful tenderer, after having made partial works, fails to fulfil the contracts in full, all or any of the materials not supplied may at the discretion of the Purchasing Officer be purchased 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 ANERT shall thereby together with such sums as may be fixed by ANERT towards damages be recovered from the defaulting tenderer.
- e) If the contractor fails to deliver all or any of the stores or perform the service within the time/period(s) specified in the contract, the purchaser shall without prejudice to its other remedies under the contract, deduct from the contract prices, as liquidated damages, a sum equivalent to 0.5 % of the delivered price of the delayed stores or unperformed services for each week of delay until actual delivery or performance, up to a maximum deduction of 10% of the contract price of the delayed stores and services. Once the maximum is reached, the purchaser may consider termination of the contract at the risk and cost of the contractor.

18.8 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 ANERT and the contractor, ANERT 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 ANERT 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.

- 18.9 (a) All payments to the contractors will be made in due course by ANERT  
(b) All incidental expenses incurred by ANERT for making payments outside the State in which the claim arises shall be borne by the contractor.
- 18.10 Payments will be made only after the supply, Installation and Commissioning of the items and certification by the competent Technical personnel of ANERT.
- 18.11 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.
- 18.12 In case the contractor becomes insolvent or goes into 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 or 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 ANERT may complete the contract in such time and manner and by such persons as ANERT shall think fit. But such determination of the contract shall be without any prejudice to any right or remedy of ANERT against the contractor or his sureties in respect of any breach of contract committed by the contractor. All expenses and damages caused to ANERT by any breach of contract by the contractor shall be paid

by the contractor to ANERT and may be recovered from him under the provisions of the Revenue Recovery Act in force in the State.

18.13 In case the contractor fails to supply and deliver any of the said articles and things or the works within the time provided for delivery of 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 ANERT (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 ANERT by an order in writing under *the* hand of the CEO put an end to this contract and in case ANERT 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 ANERT under and by virtue of this contract, it shall be lawful for ANERT from and out of any moneys for the time being payable or owing to the contractor from ANERT under or by virtue of this contract or otherwise to pay and reimburse to ANERT 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.

18.14 Any sum of money due and payable to the contractor (including security deposit returnable to him) under this contract may be appropriated by the CEO or any other person authorised by ANERT and set off against any claim of ANERT for the payment of a sum of money arising out of or under any other contract made by the contractor with ANERT or any other person authorised by ANERT. Any sum of money due and payable to the successful tenderer or contractor from ANERT shall be adjusted against any sum of money due to ANERT from him under any other contracts.

18.15 Every notice hereby required or authorised to be given may be either 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 by post at his usual or last known place of abode or business and 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.

- 18.16 The tenderer shall undertake the installation and commissioning of the system according to the standards and specification.
- 18.17 No representation for enhancement of rate once accepted will be considered.
- 18.18 The prices quoted should be inclusive of GST and all other expenses which are or may become payable by the contractor under existing or future laws or rules of the country of origin/supply or delivery during the course of execution of the contract.
- 18.19 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.
- 18.20 The tenderer should send along with this tender an agreement executed and signed in Kerala Stamp Paper of value Rs.200/-. A specimen form of agreement is given as Annexure IC to this tender. Tenders without the agreement in stamped paper will be rejected outright.
- 18.21 **Conditions in the technical document, technical specifications and special conditions of this tender document would override these general conditions, wherever applicable.**
- 18.22 ANERT, by notice sent to the Supplier, 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 ANERT's convenience, the extent to which performance of the Supplier under the contract is terminated, and the date upon which such termination becomes effective.
- 18.23 E-tender shall be opened at the time and date announced in the tender notice, and the price bid will be evaluated on the same day.
- 18.24 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 CEO, ANERT voluntarily resides.

18.25 The Courts situated at the place where the headquarters of ANERT is situated viz, Thiruvananthapuram alone will have jurisdiction to entertain civil suits and all other legal pertaining to this contract.

## **19. SPECIAL CONDITIONS**

- 19.1 Each bidder should submit only one (1) bid. Any bidder who submits/participates in more than one bid for the work shall be disqualified.
- 19.2 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.
- 19.3 If the price bid is not submitted along with the tender, such tenders will be summarily rejected.
- 19.4 **During the tender evaluation, ANERT may seek more clarifications/details from any or all of the tenderers, if felt necessary.**
- 19.5 **ANERT reserves the right, in the interest of completion of work within the time limit, to award portion/portions of the Work order to next higher bidders, called for negotiation in the increasing order of their price offers, if they agree to supply at the L1 price.**
- 19.6 **The rate quoted should be all inclusive including delivery of materials at the locations to be specified, and the cost of materials and labour for the civil works, installation and commissioning, warranties, fee for approval from the Electrical Inspectorate if any, Fee for KSEBL Feasibility application and registration fee along with GST and all other expenses.**
- 19.7 **The price quotes should be inclusive of initial cost of supply, installation and commissioning, support during the warranty period of 5-years.**
- 19.8 The tender offer shall be kept valid for acceptance for a period of 1 month from the date of opening of bid. The offers with lower validity period are liable for rejection.
- 19.9 The evaluation of the price bid will be based on the grand total of all-inclusive amount quoted excluding GST.



**AGENCY FOR NEW & RENEWABLE ENERGY  
RESEARCH AND TECHNOLOGY (ANERT)**

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## **E-TENDER DOCUMENT**

***Design, Supply, Installation and Commissioning  
of 10 kW Grid connected SPV Power Plant with  
battery backup at Pazhayannur Grama  
Panchayat, Thrissur***

**Ref. No.: ANERT-TSR/42/2023-DE(TSR)**

### **PART – 2: SCOPE OF WORKS**

|  |            |                   |
|--|------------|-------------------|
| <b>Date of Publishing of Bids</b>      | <b>: -</b> | <b>13/02/2024</b> |
| <b>Last Date of Submission of Bids</b> | <b>: -</b> | <b>22/02/2024</b> |

## SCOPE

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### 20. INVITATION TO BID

- 20.1 **ANERT is the State Agency for Renewable Energy in Kerala** having its Headquarters at Thiruvananthapuram, Kerala, and various district level offices **This tender has been issued by the ANERT for the selection of agency for the Design, Supply, Installation and Commissioning of grid connected Solar Power Plant with battery backup with 5-year warranty in the State of Kerala.**
- 20.2 To meet the requirements, ANERT proposes to invite bids from ANERT registered vendors for Solar Power Plant to provide services as per details/**scope of work** mentioned in this tender document.
- 20.3 Bidder shall mean any entity (i.e. juristic person) who meets the **eligibility criteria** of this tender and willing to provide the Services as required in this bidding document. The interested Bidders who agree to all the terms and conditions contained in this document may submit their Bids with the information desired in this bidding document.
- 20.4 Address for submission of Bids, contact details including email address for sending communications are given in this tender document.
- 20.5 This document shall not be transferred, reproduced or otherwise used for purpose other than for which it is specifically issued.
- 20.6 Interested Bidders are advised to go through the entire document before submission of Bids to avoid any chance of elimination. The eligible Bidders desirous of providing services to ANERT are invited to submit their technical proposal in response to this tender. The criteria and the actual process of evaluation of the responses to this tender and the selection of Bidder will be entirely at ANERT's discretion. This tender seeks proposal from Bidders who have the necessary experience, capability & expertise to provide ANERT the proposed Services adhering to its requirements outlined in this tender.

## 21. DEFINITION

Solar PV power plant system comprises of 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 along with battery bank. Other than PV Modules, Battery 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.

## 22. SCOPE OF WORK

22.1 The scope includes the Supply, Installation, Testing and Commissioning of Hybrid SPV power plants with battery backup. All the necessary approvals from KSEBL/Electrical Inspectorate, feasibility study, necessary civil work, Mounting of Module Structures, PV Module Installation, Inverter Installation, DC/AC Cabling and interconnections, Installation of Lightning Arresters and Earthing System as per the standards, Arranging all the necessary inspections from KSEBL/Electrical Inspectorate/ ANERT District Office as part of Pre-Commissioning, if any, Commissioning of the PV Power Plant, are coming under the scope of the bidder. The site details are as below:

| SN | Name of Site                            | Proposed Capacity (kWp) | Battery Backup (Hrs   kWh) |
|----|---|-------------------------|----------------------------|
| 1  | Krishi Bhavan, Pazhayannur GP, Thrissur | 10                      | 2   24                     |

22.2 The required load segregation for interconnecting to the load side of hybrid inverter is to be done by the successful bidder.

22.3 The successful bidder is to undertake the fee for KSEBL feasibility, Registration and all other expenses. The additional costs for site specific cabling works, earthing, mounting structure modifications etc are under the scope of the bidder.

22.4 The scope of enhancing load with the utility wherever necessary is under the scope of the bidder. Further, the replacement of CTs, PT and RPR wherever necessary is under the scope of the bidder. The rates for the same are to be considered in the bid on EPC basis.



- 22.5 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.
- 22.6 **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, Net Meter, Remote monitoring facility, Operation and Maintenance of the Power plant for the whole period of warranty, Insurance, GST and all other expenses deemed necessary for the proper implementation of the conditions and specification in-corporated in the tender.**
- 22.7 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).
- 22.8 Any site-specific cost for access ladders, pathway etc if required are under the scope of the bidder.
- 22.9 If required, the successful bidder shall replace the existing CTs, PT, RPRs and other electrical works required for the successful commissioning of the power plant.
- 22.10 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.

### **23. SCHEDULE OF SUPPLY**

- 24.1 The items should be delivered and installed at the institution for which work order shall be given and specified by ANERT, under prior intimation and supervision of ANERT.

| SN | Name of Site                            | Proposed Capacity (kWp) | Battery Backup (Hrs   kWh) |
|----|---|-------------------------|----------------------------|
| 1  | Krishi Bhavan, Pazhayannur GP, Thrissur | 10                      | 2   24                     |

24.2 If the successful bidder fails to deliver the materials within the days mentioned below, the order stands cancelled and ANERT will award the work to the next bidder and penalty as decided by ANERT will be levied.

| # | Capacity of Solar Plant | Material Delivery (Days) | Completion Period (Days) |
|---|-------------------------|--------------------------|--------------------------|
| 1 | < 10                    | 30                       | 45                       |

24.3 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. ANERT reserves the right to reject the bid based on the non-conformity of the inverter being supplied.

24.4 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.

24.5 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.

24.6 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/- |

24.7 Penalty for delay in supply and installation and commissioning will be imposed at 0.5 % per week up to a maximum 10%. In case of delay in supply

and installation, CEO, ANERT may cancel the contract and take recourse to other action as deemed appropriate.

## **24. PAYMENT**

24.1 No advance payment will be given. All the documents submitted should be certified by the concerned District Office of ANERT.

24.2 The quotes for the Design, Supply, Installation & Commissioning including 5 years of warranty including Operation and Maintenance, to be provided by the bidders. The L1 bidder will be selected on the basis of their quotes on the EPC part with 5-year warranty and Operation and Maintenance.

24.3 The terms of payment shall be:

### **24.3.1 EPC Payment**

- i. Upon delivery of major components (PV Modules, Inverter, MMS etc) at the respective sites, 60 % of the contract value will be released as first part payment. The supplier shall submit the invoice for the materials (including serial numbers and delivery chalan) duly certified by the concerned District Office along with a report regarding the supply of materials.
- ii. On completion of the installation of power plant and filing application for testing with the electrical utility (incl Energisation order for plant capacity above 30kW), 20% of the contract value 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 district office 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 remaining contract value will be released. All documents related to the completion of the work including commissioning report and commissioning certificate issued by the electrical utility shall be submitted for the release of the amount.
- iv. The remaining 10% shall be retained as performance security and will be released in equal parts of 2% each after completion of each year of operation.

as given below. This period will be considered only from the date of commissioning.

**24.3.2 O&M Payment (if separate work order is issued)**

- i. The O&M charges shall be released on annual basis after completion of the O&M period of the previous year. 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 authorised personnel of ANERT on annual basis.

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

**25. SERVICE AND MAINTENANCE**

- 25.1 The faulty system or components should be replaced/ repaired within 5 days of fault reporting. The servicing should be carried out at the site of installation.
- 25.2 The service personnel should visit the installations at least once in 3 months for preventive maintenance even if no faults are reported. **Reports of these preventive maintenance (Format attached as Annexure - F) visits and generation data should be submitted to the concerned ANERT District Offices on a quarterly basis.**
- 25.3 Any Delay in servicing beyond 10 days of fault reporting would attract penalty at the rate of at the rate fixed by CEO, ANERT and further actions will be initiated against the agency.
- 25.4 A designated contact Telephone Number and address should be submitted for reporting faults during the warranty period.

## 26. 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 525 Wp or above)   | As per the required capacity | IS 14286 - Design Qualification and Type Approval for Crystalline Silicon Terrestrial Photovoltaic (PV) Modules<br>IEC/IS 61730: Part I & II;  |
| 2.  | Solar Hybrid Inverter  | As per the required capacity | IS 16221: Part 1 &2 - Safety of Power Converters for use in Photovoltaic Power Systems<br>IS 16169 - Test Procedure of Islanding Prevention Measures for Utility-Interconnected Photovoltaic Inverters |
| 3.  | Battery (T-GEL)  | As per the required capacity | IS 15549; IEC 61427-1:2013   |
| 4.  | Module Mounting Structure  | As per the required capacity | IS 2062 - Hot Rolled Medium and High Tensile structural Steel<br>IS 4759 - Hot-dip Zinc Coatings on structural steel and other products  |
| 5.  | Cables   | As required                  | IEC 60227 / IS 694<br>IEC 60502 / IS 1554 (Pt. I & II)   |
| 6.  | Switches/ Circuit Breakers   | As required                  | IEC 60947 part I, II, III / IS 60947 Part I, II, III   |
| 7.  | Connectors   |                              | EN 50521   |
| 8.  | Surge Protection Device  |                              | IEC 60364-5-53 / IS 15086-5  |
| 9.  | Junction Boxes/Enclosures for Inverters/ Charge Controllers  | As required                  | IP 54 (for outdoor) or IP 65 / IP 21(for indoor) as per IEC 529  |
| 10. | Energy Meter for Recording Solar Electricity Generated & Two-way meter for Distribution Licensee grid connection |                              | As per CEA Regulations; IEC 60687/ IEC 62052-11 / IEC 62053-22 / IS 14697  |
| 11. | Lightning Protection   | As required                  | As per IEC 62305 / IEC 62561   |
| 12. | Electrical Grounding (Earthing)  | As required                  | As per IS 3043   |

## **28. 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 (Renewable Energy and Net Metering) Regulations, 2020 and amendments thereto
- c. KSERC (Grid interactive Distributed Solar Energy Systems) Regulations, 2014.
- d. CEA Regulation 2010 has to be followed safety and Electricity supply.
- e. Metering should be as per CEA regulation 2006.
- f. Any amendments thereof will also be applicable.

## **29. SPV MODULES**

Only the PV modules with MONO PERC Half cut cells of module capacity 525 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:

- 29.1 The PV modules must be PID compliant, salt, mist & ammonia resistant and should withstand weather conditions for the project life cycle.
- 29.2 The back sheet of PV module shall be 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 vapor transmission rate shall be less than 2 g / m<sup>2</sup>/day and shall have a Partial Discharge > / = 1500V DC
- 29.3 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
- 29.4 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.
- 29.5 Anodized Aluminium module frames of sufficient thickness shall be used which are electrically & chemically compatible with the structural material used for mounting the modules having provision for earthing.
- 29.6 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.
- 29.7 Shading correction/ bypass diode for optimizing PV out to be incorporated in each solar module or panel level.
- 29.8 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.

- 29.9 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.
- 29.10 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.
- 29.11 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.
- 29.12 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.
- 29.13 PV modules used in solar power plant/ 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
- 29.14 Original Equipment Manufacturers (OEM) Warrantee of the PV Modules shall be submitted by the successful bidder when the materials delivered at site.
- 29.15 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>)

29.16 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.

29.17 PV Module of same Make/ Model in the same series shall be considered as a single product while making the payment as per MNRE Order No. 283/54/2018-Grid Solar (ii) Dt. 06- Feb-2020.

### **30. POWER CONDITIONING UNIT (PCU)**

The Power Conditioning Unit shall be String Inverter with power exporting facility to the Grid. Vendors can use on-grid inverter provided the approval for the same are taken separately by submitting all the relevant test certificates and reports as detailed below:

#### **General Specifications:**

30.1 All the Inverters should contain the following clear and indelible Marking Label & Warning Label as per IS16221 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

30.2 The inverter output shall be 415 VAC, 50 Hz, 3 phase.

- 30.3 IS 16169 certificate of Islanding Prevention Measures for Utility – Interconnected Photovoltaic Inverters.
- 30.4 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.
- 30.5 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.
- 30.6 The PCU shall be supplied with in-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.
- 30.7 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
- 30.8 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.
- 30.9 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 utilise this feature
- 30.10 **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°C. The manufacturer to provide the power derating curves to demonstrate the same.**
- 30.11 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.

30.12 The inverter shall have an integrated feature of emergency stop to halt the inverter from operation considering safety scenarios.

30.13 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.

**30.14 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:**

**30.14.1 Finding out optimisation of the system**

**30.14.2 Optimal power distribution on each phase**

**30.14.3 Prevent PCU from unnecessary disconnections**

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

| Specifications of Inverters  |  |
|------------------------------|--|
| Parameters                   | Detailed specification   |
| 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 >99%   |
| Casing protection levels     | Degree of protection: Minimum IP-54 for internal units and IP-65 for outdoor units   |
| Operating ambient Temp range | -10 to + 60 degree Celsius   |
| Operation                    | Completely automatic including wakeup, synchronization (phase locking) and shut down |
| MPPT                         | MPPT range must be suitable to individual array voltages                             |

| Specifications of Inverters            |  |
|--|--|
| Parameters                             | Detailed specification   |
| Protections                            | Over voltage: both input and output<br>Over current: both input and output<br>Over / Under grid frequency<br>Over temperature<br>Short circuit<br>Lightning<br>Surge voltage induced at output due to external source<br>Islanding           |
| Ingress Protection                     | IP 65 for Outdoor / IP 54 for Indoor   |
| Recommended LED indications            | ON<br>Grid ON<br>Under/ Over voltage<br>Overload<br>Over temperature   |
| Recommended LCD Display on front Panel | DC input voltage<br>DC current<br>AC Voltage (all 3 phases)<br>AC current (all 3 phases)<br>Frequency<br>Ambient Temperature<br>Instantaneous power<br>Cumulative output energy<br>Cumulative hours of operation<br>Daily DC energy produced |
| Communication Interface                | RS485/ RS232/Wi-Fi (with or without USB)   |

30.16 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  |

| Sl No | Parameters        | Requirements  | Reference  |
|-------|-------------------|---|--|
| 4     | Safety and Supply | Reference to regulations, (General safety requirements)   | Central Electricity 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 in to 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 isolated 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  |

| 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 system 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   |                                  |

30.17 The IEC Certifications of On-Grid Inverters are summarized below:

| <b>Standard</b>                | <b>Description</b>  |
|--------------------------------|---|
| IEC 61683                      | Photovoltaic systems - Power conditioners - Procedure for measuring efficiency  |
| IEC 61727                      | Photovoltaic (PV) systems- Characteristics of the utility interface   |
| IEC/EN 62109-1                 | Safety of power converters for use in photovoltaic power systems - Part 1: General requirements   |
| IEC/EN 62109-2                 | Safety of power converters for use in photovoltaic power systems - Part 2: Particular requirements for inverters  |
| IEC/EN 61000-3-3/<br>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 62116                      | Utility-interconnected photovoltaic inverters - Test procedure of islanding prevention measures   |
| 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**

### **31. BATTERY BANK**

- a. The battery bank must be 2V or 12V, Tubular GEL battery. The test certificate and reports are to be provided along with the bid.

## b. Technical Requirements

| SI No: | Parameters  |
|--------|---|
| 1.     | Nominal Capacity (Ah) shall be rated @C10         |
| 2.     | T-GEL: 2V or 12V                                  |
| 3,     | Self-discharge (less than 3% per month at 30°C) . |
| 4      | Battery backup of 2 hr - 2400Wh/kW ~ 24 kWh       |

### 21.1 General Specifications:

- a. Test certificate submitted should qualify the minimum requirements as per above standards for capacity test, ampere-hour efficiency test, watt-hour efficiency test, self- discharge test.
- b. Battery shall have a warrantee of minimum 5-years.
- c. Battery capacity is rated C/10 at 27°C
- d. Original Equipment Manufacturers (OEM) Warrantee of Battery shall be submitted.

### 21.2 STANDARDS AND CERTIFICATIONS

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

| Standard      | Description   |
|---------------|---|
| IEC 61427     | IEC 61427 - This series gives general information relating to the requirements for the secondary batteries used in photovoltaic energy systems (PVES) and to the typical methods of test used for the verification of battery performances. |
| IS 15549:2005 | This standard specifies capacities and performance requirements and corresponding test methods for all types of high integrity series stationary Valve regulated lead acid batteries  |
| IS 1651       | Stationary cells and batteries, lead-acid type (with tubular positive plates) - specification   |

*\*Recommended but not mandatory*



### **32. REMOTE MONITORING SYSTEM**

A dedicated Remote Monitoring System (Hardware and software) for monitoring the plant shall be provided. The following weather parameters are to be measured as part of the datalogging system.

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) Invertor 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 ANERT server.

### **33. ELECTRICAL SAFETY, EARTHING AND PROTECTION**

- a. All SPV system should comply with CEA (Measures relating to Safety and Electricity Supply) Regulation 2010.
- b. Internal Faults: In built protection for internal faults including excess temperature, commutation failure, over load 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 30 kW, and additional fire extinguisher per 15 kW or part thereof to be provided by the successful bidder.

### **34. CABLING PRACTICE**

Cable 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.

- 34.1 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
- 34.2 Sizes of cables between any array interconnections, array to junction boxes, junction boxes to inverter etc. shall be so selected to keep the voltage drop (power loss) of the entire solar system to the minimum (2%).
- 34.3 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.
- 34.4 For the AC cabling, PVC or XLPE insulated and PVC sheathed single or, multi-core flexible copper cables shall be used. However, for above 10kWp systems, 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.
- 34.5 All LT XLPE cables shall conform to IS:7098 part I&II.
- 34.6 The total voltage drop on the cable segments from the solar PV modules to the solar grid inverter shall not exceed 2.0%

- 34.7 The total voltage drop on the cable segments from the solar grid inverter to the building distribution board shall not exceed 2.0%
- 34.8 The DC cables from the SPV module array shall run through a UV-stabilized PVC conduit pipe of adequate diameter with a minimum wall thickness of 1.5mm
- 34.9 Cables and wires used for the interconnection of solar PV modules shall be provided with solar PV connectors (MC4) and couplers
- 34.10 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.
- 34.11 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
- 34.12 Cables and conduits that have to pass through walls or ceilings shall be taken through PVC pipe sleeve.
- 34.13 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.
- 34.14 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.

34.15 Bending radii for cables shall be as per manufactures recommendations and IS: 1255.

34.16 For laying/termination of cables latest BIS/IEC Codes/ standards shall be followed.

### **35. FACTORY TESTING**

- a. PCU shall be tested prior to shipment and factory test certificate for relevant parameters should be provided with the PCU supplied. ANERT or authorised representative of ANERT 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 the Purchasers Engineers. Tests may be performed at 25, 50, 75 and 100 percent of the rated nominal power.

### **36. 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 5mm) 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 at least 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 for 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 terrace 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.

**i. 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 module 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 side (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 and 40MM in flange side in 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 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.

**C. Maximum Ground clearance (2000MM – 3000 MM)**

- a. Base Plate – Base plate thickness of the Structure should be minimum 8 MM for this 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.

### **37. 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 in order to protect the installation against fire hazards. The SPD should be provided in the AC Distribution Box as well.

### **38. 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 **IS 732:2019** “Code of practice for electrical wiring installations (Fourth Revision)

- 38.1 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.
- 38.2 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
- 38.3 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. The complete Earthing system shall be mechanically & electrically connected to provide independent return to earth.
- 38.4 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. 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.
- 38.5 Minimum four (04) numbers of interconnected earth pit need to be provided in each location. 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 structure, kiosk and in any other item as required.
- 38.6 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.
- 38.7 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 GI earth strip must be minimum 25mm X 6mm

- 38.8 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.
- 38.9 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.
- 38.10 Necessary provisions shall be made for bolted isolating joints of each earthing pit for periodic checking of earth resistance.
- 38.11 For each earth pit, a necessary test point shall be provided.
- 38.12 Total no of Earth pits required for solar plants shall be as per the Electrical Inspectorate norms.

### **39. 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.
- 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.

#### **40. 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 measurements as per IS 60947 Part I, II, III and IEC 60947 part I, II and III.
- g. Junction boxes, enclosures, panels for inverters/ Controllers shall meet IP 54 (for outdoor)/ IP 65 (for indoor) as per IEC 529.

#### **41. DC DISTRIBUTION BOARD**

- a. DC bus/ cable which can handle the current and the voltage of inverter output safely with necessary surge arrester as per the relevant IS standards. A separate DCDB with standard protection equipment must be provided for Battery bank also.
- b. DC panel should be equipped with an adequate capacity indoor DC circuit breaker along with control circuit, protection relays, fuses, annunciators and remote operating and controlling facility from the main control facility.
- c. 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.

## **42. 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 Part I, II, III and EN 50521 for AC/DC.
- d. Junction boxes, enclosures for inverters/ charge controllers shall meet IP 54 (for outdoor)/ IP 21 (for indoor) as per IEC 529.

## **43. 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 a part of Solar Power Plant installation. Separate drawings for exclusively for the AC/DC Wiring should be provided.

## **44. 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 in to 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 roof top 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 rooftops.
- h. The roof top 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 distemping 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.

#### **45. NET METERING AND UTILITY INTERCONNECTION**

- a. Net metering equipment (an Import-Export Energy Meter) approved and tested by the electrical utility based on the accuracy class required for the proposed capacity of the system must be provided with the necessary data cables if required.
- b. Net Metering and Utility Interconnection should be accomplished according to the Kerala State Electricity Regulatory Commission (Grid Interactive Distributed Solar Energy Systems) Regulations 2014 Clauses (8) & (9) (Notification No. 2096/KSERC/CT/2014 dt. 10<sup>th</sup> June 2014)

#### **46. INTER CONNECTION OF INVERTER OUTPUT WITH UTILITY GRID**

- a. The interconnection of load with inverter output should be done after obtaining permission from Electrical Inspectorate and Electrical Utility.
- b. The plan scheme and drawing related to interconnection details should be submitted to Electrical Inspectorate through a licensed Electrical contractor with the guidance appropriate Engineering Authority.
- c. Licenced contractor has to be engaged for preparation of plan scheme to be submitted to the Kerala State Electricity Licensing Board and necessary fee should be remitted for energisation of Solar Power Plant.
- d. The panel board and distribution board required for AC interconnection should be done as per specification/ instruction given appropriate Engineering Authority.
- e. All the electrical works required for the interconnection of load with inverter output should be done by the successful bidder as a part of the Solar Power Plant installation.
- f. Bidder should visit the actual site and ensure the exact place for providing Solar Modules and Inverter etc. in presence of technical representative from the ANERT.
- g. Net Metering Equipment shall be installed and maintained in accordance with the provisions of The Central Electricity Authority (Installation and Operation of Meters) Regulations, 2006 as amended from time to time. The Contractor shall maintain the Metering System as per metering code and CEA guidelines. The defective meter shall be immediately tested and calibrated.

- h. The accuracy class of the Net Metering Equipment will be selected so that all levels of energy produced or taken by the Solar Power Plant will be measured accurately, and this equipment has applicable accuracy class.
- i. Net Metering Equipment shall be microprocessor-based conforming to the relevant IEC standards with Advanced Metering Infrastructure (AMI) with RS232 cable facility.
- j. Net Metering Equipment shall measure active energy (both import and export) and reactive energy (import) by 3 ph, 4 wire principle suitable for balanced / unbalanced 3 phase load (With KVAh, kWh, KVA measuring registers). Tri-vector based energy meter shall have an accuracy class of energy measurement of at least Class 0.2 for active energy and at least 0.5 Class for reactive energy according to IEC 60687.
- k. Display parameters: LCD test, KWH import, KWH export, MD in KW export, MD in KW import, Date & Time, AC current and voltages and power factor (Cumulative KWH will be indicated continuously by default)

#### **47. PERMISSION FROM KSEBL BY BIDDER**

- a. The procedures for Grid Connectivity of the PV Plants for capacities from 1kWp to 1MWp are governed by the KSEBL Circular No. CE(REES)/Escot/AEE6/Solar-General/16-17/766(1) Dt. 09-09-2016 and its Amendments.
- b. The beneficiary/ANERT will obtain a feasibility certificate by submitting an application form along with the documents and a fee of Rs 1000/- as per the Annexure-I form of KSEBL.
- c. After submitting all the documents and clarification required by KSEBL, the vendors will pay a Registration fee of Rs 1000/- per kW to KSEBL (Eg: If the plant size is 3.65kW then it will be considered as 4kW and the applicant has to pay a sum of Rs 4000/-) to acquire a SPIN (Solar Plant Identification Number). For example, 5501-00001 where 5501 is the section office code for the locality and 00001 is the solar plant number.
- d. Request for the cancellation of Registration by the applicant will be verified by the Assistant Engineer, KSEBL and a decision will be taken on this by division



Executive Engineer, KSEBL and 80% of the amount shall be reimbursed based upon the recommendation of Assistant Engineer.

- e. The application for testing of the installed PV power plant has to be submitted at the Electrical Section office by the contractor. For plant capacities above 10kWp the application must be submitted along with Energization Certificate from Electrical Inspectorate and for the plant capacities below 10kWp the application must be submitted along with a Completion Report of a Certified Electrical Contractor. The minimum qualification for carrying out the installation work of a PV Plant shall be a B-Class contractor licensee and depending upon the capacity of installation, eligible contractors can carry out the work. (Circular no. B2-13958/2017/CEI Dtd 24.07.2018.)
- f. The officials from Electrical Inspectorate and KSEBL will visit the site with prior notice to the beneficiary.
- g. Tests shall be conducted as per system capacity norms issued by KSEBL/Electrical Inspectorate
- h. Test Certificate for Solar Plant Installation as per annexure 9 of KSEBL order will be issued by the Assistant Engineer, once the PV plants is successfully performing as per the standards
- i. Agreement for Connecting Solar Energy System as per Annexure 10 of KSEBL order shall be signed between KSEBL and the applicant as per the Annexure 11 (KSEBL Order) in which the capacity of the net meter should be mentioned. The contractor is required to undertake all the liaison work required for the same.
- j. The import and export will be calculated based upon the Net meter installed at the site of the consumer for which the reading will be taken on every month from the Net meter and Solar meter.
- k. The panel board and distribution board required for AC interconnection should be done as per specification/instruction given by PWD Electrical wing/Electrical Inspectorate Authorities /A. E, L.S.G.D. /appropriate Engineering Authorities

#### **48. LOAD SEGREGATION**

The load segregation works as per the capacity of the PCU and should done by the bidder. Based on the capacity of Power Conditioning Unit necessary load may be

segregated and connected to separate distribution board for connecting with Solar Power Conditioning Unit. All the electrical works required for the interconnection of load with inverter output should be done by the successful bidder as a part of the Solar Power Plant installation.

#### **49. 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. The bidder shall also provide 5-year additional AMC post warranty period of 5 years
- 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 10 years 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

#### **50. OPERATION AND MAINTENANCE**

50.1 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 10-year period is to be quoted by the bidders

50.2 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 concerned ANERT District Offices on a quarterly basis.**

50.3 Maintenance guidelines for various components viz. solar panels, inverter, wiring etc. are discussed below:

##### **50.3.1 SOLAR PV PANELS**

Although the cleaning frequency for the panels will vary from site to site depending on soiling, 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 may be 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 good time for module cleaning.
- i) Check if there are any shade problems due to vegetation or new building. If there are, make arrangements for removing the vegetation or moving the panels to a shade-free place.
- 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.

### **50.3.2 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.

### **50.3.3 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.

#### 50.4 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> </ul>   | Monthly                           |

|             |            |  |           |
|-------------|------------|--|-----------|
|             |            | <ul style="list-style-type: none"> <li>Inspect Inverter housing or shelter for physical maintenance, if required.</li> </ul> |           |
| 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 |

50.5 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.

50.6 Any Delay in servicing beyond 7 days of fault reporting would attract penalty at the rate of at the rate fixed by CEO, ANERT and further actions will be initiated against the agency.

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

## **51. 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 power plant – 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 power plant.

## 52. 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:

| Sl. No. | Item  | Make (if any) | Model & Individual Capacity (If any) | Qty (Nos) | Rating / Capacity |
|---------|---|---------------|--------------------------------------|-----------|-------------------|
| 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                       |               |                                      |           |                   |

## 53. 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 site-specific requirement of ladders for accessing PV modules, pathway facility along with handrails 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 for safety without causing shade on the PV modules.

#### **54. CLEANING**

The bidder shall provide permanent arrangement for module washing in the SPV Plant. Water lines may be 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.

#### **55. 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 logo of ANERT and details of the scheme as specified in the work order.

#### **56. INSURANCE**

52.1 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)**.

52.2 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 ANERT District Office. The annual premium payment receipt must be handed to the authorised person at the site of installation.

## 57. ENGINEERING DRAWINGS

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

- i. Schematic drawing showing the PV panels, Power conditioning Unit(s)/Inverter, Array Junction Boxes (AJBs)/String Combiner Boxes (SJB), AC and DC Distribution Box, Net meters, MSB etc.
- ii. Layout of solar PV Array
- iii. Single Line Diagram (SLD) with specification of all components.
- iv. Design document for Module Mounting Structure (MMS) including certificate showing wind speed withstanding capacity of the structure (STAAD/Equivalent).
- v. Module Mounting Structure (MMS) drawing along with foundation details for the structure.
- vi. Sizes and specification of cables for PV Module interconnections, PV Array to Array Junction Boxes, Array Junction Boxes to Inverter, Inverter to ACDB/ Grid Connection point etc. shall be furnished.

The Vendor shall submit a PVsyst report for PV power plants from 25kWp and above. All PV plant design should contain the following details which should be approved by the concerned officer before installation.

- i. Design of strings including the number of PV modules in series and number of strings
- ii. AC Protection (Circuit Breaker, Switches, Fuses, SPD)
- iii. DC Protection (Switches, Fuses, SPD)
- iv. AJB / SCB details
- v. DC Cable size and length from point to point
- vi. AC Cable size and length from point to point
- vii. Earthing system details and number of pits
- viii. Lightning protection details/specification
- ix. PV Syst / Any other software-based Simulation Report



## FORMAT FOR COVERING LETTER

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*(This letter to be submitted on the official letter head of the tenderer, signed by the authorised signatory.)*

Sir,

I/We hereby e-tender to supply, under annexed terms and conditions of contract, the whole of the articles referred to and described in the attached specification and quantity decided by the Agency for New & Renewable Energy Research and Technology (ANERT), at the rates quoted against each item.

I am/We are remitting herewith the required amount of Rs. .... towards the cost of e-tender and Earnest Money Deposit by electronic payment vide transaction No ..... dtd.....

Yours faithfully,

Place:

Signature

Date:

Name

Designation

(Office Seal)

## ANNEXURE A – SUMMARY OF BID QUALIFICATION REQUIREMENTS

(To be filled in by the bidder)

|    |   |  |
|----|---|--|
| 1. | Name of the bidder  |  |
| 2. | Address in full   |  |
| 3. | Contact Details<br>Mobile<br>: Land<br>Phone Fax<br>Email                             |  |
| 4. | Name and Designation of the authorised signatory                                      |  |
| 5. | Whether Bidder was/is De-barred by ANERT (Yes/No)?<br>If ' Yes' period of De-Barring: |  |
| 6. | Agreement submitted (Yes/ No)?  |  |

Documentary evidence for the bid qualification requirements are submitted along with this document and the details furnished above are true and correct.

Signature  
of authorised signatory

Name

Designation

Date:

(office seal)

## ANNEXURE B – GUARANTEED TECHNICAL PARAMETERS

### TO BE SUBMITTED FOR EACH CAPACITY RANGE

| PV Module |  |                                   |         |
|-----------|--|-----------------------------------|---------|
| #         | Particulars                                    | Required                          | Offered |
| 1         | PV Module Manufacture Name & Country of origin | manufacture name to be specified) |         |
| 2         | PV Module type                                 | Mono Crystalline,<br>PERC         |         |
| 3         | Product Code                                   |                                   |         |
| 4         | No. of PV cells per Module                     |                                   |         |
| 5         | Total number of PV modules                     |                                   |         |
| 6         | Max.Power, Pmp @STC                            | 500 Wp or above                   |         |
| 7         | Max.power tolerance (%)                        | Not more than 3%                  |         |
| 8         | Max.power voltage (Vmp)@STC                    | To be specified                   |         |
| 9         | Max.power current (Imp) @STC                   | To be specified                   |         |
| 10        | Open circuit voltage, Voc@STC                  | To be specified                   |         |
| 11        | Short circuit current, Isc@STC                 | To be specified                   |         |
| 12        | Nominal voltage                                | To be specified                   |         |
| 13        | Nominal Wattage                                | To be specified                   |         |
| 14        | Fill Factor                                    | Not less than 0.7                 |         |
| 15        | Temp. coefficient of Voc (%/C)                 |                                   |         |
| 16        | Temp. coefficient of Pmp (%/C)                 |                                   |         |
| 17        | Temperature Co-efficient of Isc (%/°C)         |                                   |         |
| 18        | Normal Operating Cell Temperature (NOCT) (°C)  |                                   |         |

| <b>PV Module</b> |   |  |                |
|------------------|---|--|----------------|
| <b>#</b>         | <b>Particulars</b>  | <b>Required</b>  | <b>Offered</b> |
| 19               | Operating Temperature (°C)  |  |                |
| 20               | Max Temperature rise of solar cells under severe working conditions over Max. Ambient Temp. | To be specified  |                |
| 21               | Module is suitable to operate at 500 ambient  | Yes/No   |                |
| 22               | Cell efficiency   | %  |                |
| 23               | Module efficiency   | >=17% (Document to prove efficiency shall be furnished with the offer) |                |
| 24               | Maximum System Voltage  |  |                |
| 25               | No. of By-pass Diodes   |  |                |
| 26               | Mounting arrangement for Solar Module   | Fixed Arrangement  |                |
| 27               | Solar Module frame material   | Anodized Aluminum  |                |
| 28               | Finish  |  |                |
| 29               | Types of Sections used  |  |                |
| 30               | Module dimensions cms (LxWxH)   | To be specified  |                |
| 31               | PV panel Weight (kg)  | To be specified  |                |
| 32               | Module Life (minimum)   | 25 years   |                |

| <b>PV Module</b> |   |   |                |
|------------------|---|---|----------------|
| <b>#</b>         | <b>Particulars</b>                              | <b>Required</b>   | <b>Offered</b> |
| 33               | PV array area(sqm)                              |   |                |
| 34               | Standards/Approvals from International Agencies | IEC 61215/IEC 61730/<br>IEC 61701   |                |
| 35               | Guaranteed output confirm                       | Yes   |                |
| 36               | Output Cables                                   | Polarized, UV protected & Weather Proof DC rated multi-contact connector  |                |
| 37               | Output Terminal                                 | PV Connectors   |                |
| 38               | Junction Box                                    | Weather resistant HDPE (IP65)   |                |
| 39               | Construction Front, Back                        | High transmittance glass. Polyester Ethyl Vinyl Acetate (EVA) encapsulate |                |
| 40               | Glass   | Low iron tempered   |                |
| 43               | Copies of test certificates                     | <b>IS 14286</b> and IEC 61215,61730 part 1&2, IEC 61701                   |                |

| <b>INVERTER (To be provided for each capacity)</b> |                    |                 |                |
|--|--------------------|-----------------|----------------|
| <b>#</b>   | <b>Particulars</b> | <b>Required</b> | <b>Offered</b> |
| 1  | Manufacturer       |                 |                |
| 2  | Model name/No.     |                 |                |
| 3  | Number of units    |                 |                |
| 5  | Nominal AC power   |                 |                |
| 6  | Nominal AC voltage |                 |                |

**INVERTER (To be provided for each capacity)**

| #  | Particulars   | Required             | Offered |
|----|---|----------------------|---------|
| 7  | Nominal AC Current  |                      |         |
| 8  | AC grid Frequency range                                   | 50Hz $\pm$ 0.5%      |         |
| 9  | AC grid voltage range                                     |                      |         |
| 10 | Power Factor (+ and -)                                    |                      |         |
| 11 | Total Harmonic Distortion                                 | As per IEEE-519 2014 |         |
| 12 | AC over / under voltage over / under frequency protection |                      |         |
| 13 | Max PV input power  |                      |         |
| 14 | Maximum DC voltage  | Less than 1000 V     |         |
| 15 | MPPT voltage range  |                      |         |
| 16 | Maximum DC current  |                      |         |
| 17 | No. of DC input ports                                     |                      |         |
| 18 | Maximum Efficiency  | as per IEC61683      |         |
| 19 | DC voltage ripple   |                      |         |
| 20 | Ambient temperature range                                 |                      |         |
| 21 | Humidity (non-condensing)                                 | 95%, non-condensing  |         |
| 22 | Degree of protection                                      |                      |         |
| 23 | Dimensions approx. (HxWxD)                                |                      |         |
| 24 | Weight  |                      |         |
| 25 | Protective functions                                      |                      |         |

| <b>INVERTER (To be provided for each capacity)</b> |   |   |                |
|--|---|---|----------------|
| <b>#</b>   | <b>Particulars</b>  | <b>Required</b>                                 | <b>Offered</b> |
|  | AC over/under voltage,<br>AC over/under frequency,<br>overtemperature, AC and<br>DC overcurrent, DC over-<br>voltage, against Islanding |   |                |
| 26   | Communication Interface   | RS485. MPI Profi<br>Bus/Telephone<br>Modem/WiFi |                |
| 27   | User-display standard   | LCD panel with membrane<br>keypad               |                |
| 28   | Enclosure environment<br>rating   |   |                |
| 29   | Safety and EMC  |   |                |
| 30   | Anti-islanding feature  | IS 16169:2014                                   |                |
| 31   | Safety of Power<br>Converters for use in<br>Photovoltaic Power<br>Systems Part 2 (Particular<br>Requirements for<br>Inverters)          | IS 16221 (Part 2):2015                          |                |

Battery Data also to be provided separately

## ANNEXURE C - AGREEMENT

---

ARTICLES OF AGREEMENT executed on this the ..... day of .....  
Two thousand and .....between the **Agency for  
New & Renewable Energy Research and Technology** (hereinafter referred to as  
**ANERT**) 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 ANERT a e-tender for the ***Design, Supply,  
Installation and Commissioning of 10 kW Grid connected SPV Power Plant with  
battery backup at Pazhayannur Grama Panchayat, Thrissur*** specified therein subject  
to the terms and conditions contained in the said e-tender.

In case the bounden fails to execute the agreement as aforesaid incorporating the terms  
and conditions governing the contract, ANERT shall have power and authority to recover  
from the bounden any loss or damage caused to ANERT by such breach as may be  
determined by ANERT by appropriating the moneys inclusive of any payment due to the  
vendor and if it 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 ANERT 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 ANERT may deem fit.

In witness whereof Sri ..... (Name and Designation) for  
and on behalf of the Agency for New & Renewable Energy Research & Technology and  
Sri ..... the bounden have hereunto set their  
hands the day and year shown against their respective signature.



Signed by Sri .....

Signed by Sri .....

(Date) .....

(Date) .....

in the presence of witnesses

in the presence of witnesses

1.

1.

2.

2.

## **ANNEXURE D – DECLARATION BY THE BIDDER**

---

e-Tender Notification No: ....., dtd ..... for  
Design, Supply, Installation and Commissioning of 10 kW Grid connected SPV Power Plant  
with battery backup at Pazhayannur Grama Panchayat, Thrissur

To

The CEO  
ANERT

We, the undersigned, declare that:

1. We have examined and have no reservations to the Bidding Document, including Addenda No.: ..... (if any)
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 13 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 3 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 suppliers for any part of the Contract, has not been declared ineligible by the ANERT 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. We have visited all the sites for which we have quoted and all additional works required for the successful commissioning of the Solar Power Plant will be done by us. In case, we fail to do so, ANERT may initiate the required proceedings against us.

Signature

Date

Name

## **ANNEXURE E – DECLARATION OF RELATIONSHIP WITH ANERT EMPLOYEE**

---

(to be signed and submitted by the bidder along with the bid)

Tender Notification No.: .....

Design, Supply, Installation and Commissioning of 10 kW Grid connected SPV Power Plant with battery backup at Pazhayannur Grama Panchayat, Thrissur

To

The CEO  
ANERT

Name of the ANERT employee with Designation:

Name of the bidder related to the employee:

This is to put on record that Shri/Smt .....  
currently working as ..... in ANERT is related  
to ....., who is the bidder in the bid. We are aware of  
the Anti-corruption policy of ANERT and will observe the highest standards during the  
procurement and the execution of contract and shall retain from corrupt, fraudulent,  
collusive or coercive practices on competing for the contract.

Signature

Name

Date

## ANNEXURE F – SERVICE REPORT

(Format of Service Report to be submitted on Quarterly basis to respective District Offices)

### **SERVICE REPORT**

Fault/ Quarterly Service

(Put ✓ on the number of Periodic service & Month from the date of commissioning)

| Periodic Service |    |    |    |
|------------------|----|----|----|
| 1                | 2  | 3  | 4  |
| 8                | 7  | 6  | 5  |
| 9                | 10 | 11 | 12 |
| 16               | 15 | 14 | 13 |
| 17               | 18 | 19 | 20 |

| Months after commissioning |    |    |    |
|----------------------------|----|----|----|
| 3                          | 6  | 9  | 12 |
| 15                         | 18 | 21 | 24 |
| 27                         | 30 | 33 | 36 |
| 39                         | 42 | 45 | 48 |
| 51                         | 54 | 57 | 60 |

### GENERAL INFORMATION

|                                       |  |                              |  |
|---------------------------------------|--|------------------------------|--|
| Installation Site                     |  |                              |  |
| Address                               |  |                              |  |
| LSG                                   |  |                              |  |
| District                              |  |                              |  |
| Service Executive<br>Name & Contact : |  | Inspection<br>Date &<br>Time |  |
|                                       |  |                              |  |

### VISUAL INSPECTION DATA

#### SOLAR MODULE

|   |                              |                             |
|---|------------------------------|-----------------------------|
| Total capacity Solar Array (kW):            |                              |                             |
| Solar Module size (Watt peak per module) Wp |                              |                             |
| Brand of solar module:                      |                              |                             |
| Model of solar module:                      |                              |                             |
| Cracked glass of PV panel                   | <input type="checkbox"/> Yes | <input type="checkbox"/> No |

|  |                                 |                                     |
|--|---------------------------------|-------------------------------------|
| White or Brown spot, bubble of air, moisture behind the glass                              | <input type="checkbox"/> Yes    | <input type="checkbox"/> No         |
| Junction boxes at backside loose or without cover?   | <input type="checkbox"/> Yes    | <input type="checkbox"/> No         |
| Physical damage to any PV module   | <input type="checkbox"/> Yes    | <input type="checkbox"/> No         |
| Check for loose cable terminations between PV modules                                      | <input type="checkbox"/> Yes    | <input type="checkbox"/> No         |
| PV modules are properly grounded with lugs on each module                                  | <input type="checkbox"/> Yes    | <input type="checkbox"/> No         |
| <b>STRUCTURAL AND ROOF</b>   |                                 |                                     |
| Are the modules mounted securely, and level?   | <input type="checkbox"/> Yes    | <input type="checkbox"/> No         |
| Results of module hand lift test?  | <input type="checkbox"/> Secure | <input type="checkbox"/> Not Secure |
| Are Conductors loose, touching roof surface or in contact with sharp or abrasive surfaces? | <input type="checkbox"/> Yes    | <input type="checkbox"/> No         |
| Conductor plug-and-receptacle connectors are fully engaged between junction boxes ?        | <input type="checkbox"/> Yes    | <input type="checkbox"/> No         |
| Are any dissimilar metals being combined?  | <input type="checkbox"/> Yes    | <input type="checkbox"/> No         |
| corrosion/evidence of rust, when encountered apply the cold galvanization spray            | <input type="checkbox"/> Yes    | <input type="checkbox"/> No         |
| Check for proper earthing of structures  | <input type="checkbox"/> Yes    | <input type="checkbox"/> No         |
| Check for physical damage of structures  | <input type="checkbox"/> Yes    | <input type="checkbox"/> No         |
| <b>INVERTER</b>  |                                 |                                     |
| Inverter Make & Model  |                                 |                                     |
| Power output (kW / kVA) :  |                                 |                                     |
| Is the inverter located in an area which is exposed to direct sun?                         | <input type="checkbox"/> Yes    | <input type="checkbox"/> No         |
| Proper wire sizes ?  | <input type="checkbox"/> Yes    | <input type="checkbox"/> No         |
| Check all meters and control wiring connected as per drawing                               | <input type="checkbox"/> Yes    | <input type="checkbox"/> No         |
| Enclosure cleaned and vacuumed out   | <input type="checkbox"/> Yes    | <input type="checkbox"/> No         |
| Display and indications are working  | <input type="checkbox"/> Yes    | <input type="checkbox"/> No         |

|  |                                 |                               |
|--|---------------------------------|-------------------------------|
| Check for Noise levels of inverter   | <input type="checkbox"/> Normal | <input type="checkbox"/> High |
| Check for ventilation condition<br>(Exhaust fan is working properly or not)  | <input type="checkbox"/> Yes    | <input type="checkbox"/> No   |
| Grounded ?   | <input type="checkbox"/> Yes    | <input type="checkbox"/> No   |
| <b>JUNCTION BOXES</b>  |                                 |                               |
| Check for tightness of clamps, supports, Nut- bolts<br>used for combiner box | <input type="checkbox"/> Yes    | <input type="checkbox"/> No   |
| Check cables are secured from sharp edges                                    | <input type="checkbox"/> Yes    | <input type="checkbox"/> No   |
| Check proper conduit fittings used and adequately<br>tightened               | <input type="checkbox"/> Yes    | <input type="checkbox"/> No   |
| Array box is Vermin and dust proof   | <input type="checkbox"/> Yes    | <input type="checkbox"/> No   |
| <b>MAIN ELECTRICAL DISTRIBUTION PANEL</b>                                    |                                 |                               |
| Electrical Concerns or Code Violations                                       | <input type="checkbox"/> Yes    | <input type="checkbox"/> No   |
| Check cable terminals for burnt marks, hot spot or<br>loose connection       | <input type="checkbox"/> Yes    | <input type="checkbox"/> No   |
| Check for physical damage  | <input type="checkbox"/> Yes    | <input type="checkbox"/> No   |
| <b>BATTERY BANK ( OFF-GRID SYSTEMS ONLY )</b>                                |                                 |                               |
| Make & Model   |                                 |                               |
| Type, Voltage & Capacity   |                                 |                               |
| Number of Series and Parallel  |                                 |                               |
| Terminals Protection from shorting   | <input type="checkbox"/> Yes    | <input type="checkbox"/> No   |
| Are there hot battery cells (hand touch each cell)?                          | <input type="checkbox"/> Yes    | <input type="checkbox"/> No   |
| Proper insulation around battery-to-battery cables?                          | <input type="checkbox"/> Yes    | <input type="checkbox"/> No   |
| Exposed main battery bank combiner terminal?                                 | <input type="checkbox"/> Yes    | <input type="checkbox"/> No   |
| Main cables exposed to physical damage?                                      | <input type="checkbox"/> Yes    | <input type="checkbox"/> No   |
| Signs of sulphide flakes at terminals?                                       | <input type="checkbox"/> Yes    | <input type="checkbox"/> No   |

|                                |                              |                             |
|--------------------------------|------------------------------|-----------------------------|
| Incorrect battery connections? | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
|--------------------------------|------------------------------|-----------------------------|

**SPV POWER PLANT MONITORING SHEET**

| Parameters under Measurement                                  | Data | Remarks if any |
|---|------|----------------|
| <b>GENERATION</b>   |      |                |
| Current Energy Meter Reading (C)                              |      |                |
| Previous Energy Meter Reading (P)                             |      |                |
| Quarterly Generation (C – P) kWh                              |      |                |
| Inverter Cumulative Generation (kWh)                          |      |                |
| Number of days without generation ( <i>in case of fault</i> ) |      |                |
| <b>PV MODULES (AJB Reading using Multimeter)</b>              |      |                |
| i. Watt Peak (Wp)   |      |                |
| ii. Voltage (V)   |      |                |
| iii. Current (A)  |      |                |
| iv. Number of Series  |      |                |
| v. Number of Parallel   |      |                |
| <b>POWER CONDITIONING UNIT (PCU)</b>                          |      |                |
| i. PV Voltage (V)   |      |                |
| ii. PV Current (A)  |      |                |
| iii. PV Power (kW)  |      |                |
| iv. AC Voltage (R Phase)                                      |      |                |
| v. AC Voltage (Y Phase)                                       |      |                |
| vi. AC Voltage (B Phase)                                      |      |                |
| vii. Frequency (Hz)   |      |                |

|   |  |  |
|---|--|--|
| viii. Error log/Warning log Details                               |  |  |
| ix. Connected Load (in kW) <i>For Off-Grid Installations only</i> |  |  |

Special Remarks (if any) Customer / Service Executive :

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The above generation data are verified and the power plant is working satisfactorily. The periodic maintenance is regular and no default in inspection is

Signature with Seal

Authorised Representative of LSG

Name:

Designation:

Signature with Seal

Service Executive

Installed Agency

*To be issued in Triplicate: Original to ANERT DO, copy to beneficiary & One for the installed agency*



## FORMAT A – COMPONENT WISE SPLIT UP OF COSTS

*(On Letterhead of the respective entity for which the below details are provided.)*

*To be provided for all capacity quoted by the bidder*

| S/N   | Component   | Percentage (%) |
|-------|---|----------------|
| 1     | SPV Modules   |                |
| 2     | Module Mounting Structure   |                |
| 3     | Grid Tied Inverter as per specification   |                |
| 4     | Balance of System   |                |
| 5     | Cost for 5 Year Warranty and Preventive Maintenance                               |                |
| 6     | Installation and Commissioning Charges  |                |
| 7     | Insurance (From Material dispatch till 5 years warranty period)                   |                |
| 8     | Any miscellaneous expenses required for the successful commissioning of the plant |                |
| 9     | Remote Data Monitoring and associated costs                                       |                |
| Total |   | 100%           |