



Basic Details

Organisation Chain	ANERT		
Tender Reference Number	ANERT-TSR/18/2022-DE(TSR)		
Tender ID	2024_ANERT_706389_1	Withdrawal Allowed	Yes
Tender Type	Open Tender	Form of contract	EPC Contract
Tender Category	Works	No. of Covers	2
General Technical Evaluation Allowed	No	ItemWise Technical Evaluation Allowed	No
Payment Mode	Online	Is Multi Currency Allowed For BOQ	No
Is Multi Currency Allowed For Fee	No	Allow Two Stage Bidding	No

Payment Instruments

Online Bankers	S.No	Bank Name
	1	SBI MOPS

Cover Details, No. Of Covers - 2

Cover No	Cover	Document Type	Description
1	Fee/PreQual/Technical	.pdf	Technical Bid
		.pdf	All other Documents
		.pdf	PQ Documents
2	Finance	.xls	Financial Bid
		.pdf	Financial bid

Tender Fee Details, [Total Fee in ₹ * - 17,850]

Tender Fee in ₹	17,850		
Fee Payable To	Nil	Fee Payable At	Nil
Tender Fee Exemption Allowed	Yes		

EMD Fee Details

EMD Amount in ₹	1,00,000	EMD Exemption Allowed	Yes
EMD Fee Type	fixed	EMD Percentage	NA
EMD Payable To	Nil	EMD Payable At	Nil

Work /Item(s)

Title	Design, Supply, Engineering, Erection Testing, Commissioning of 1 MWp SPV Power Plant with Grid connectivity along with 5 years of operation and maintenance under CAPEX model at Kerala University of Health Sciences, Thrissur				
Work Description	Design, Supply, Engineering, Erection Testing, Commissioning of 1 MWp SPV Power Plant with Grid connectivity along with 5 years of operation and maintenance under CAPEX model at Kerala University of Health Sciences, Thrissur				
Pre Qualification Details	Please refer Tender documents.				
Independent External Monitor/Remarks	NA				
Tender Value in ₹	4,75,00,000	Product Category	Solar Power Plants	Sub category	NA
Contract Type	Tender	Bid Validity(Days)	120	Period Of Work(Days)	90
Location	Kerala University of Health Sciences, Thrissur	Pincode	680596	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	16-Nov-2024 05:30 PM	Bid Opening Date	13-Jan-2025 02:00 PM
Document Download / Sale Start Date	16-Nov-2024 05:30 PM	Document Download / Sale End Date	13-Jan-2025 01:00 PM



Clarification Start Date	NA	Clarification End Date	NA
Bid Submission Start Date	16-Nov-2024 05:30 PM	Bid Submission End Date	13-Jan-2025 01:00 PM

Tender Documents

NIT Document	S.No	Document Name	Description	Document Size (in KB)
	1	Tendernotice_1.pdf	NIT and Abstract	252.13

Work Item Documents	S.No	Document Type	Document Name	Description	Document Size (in KB)
	1	Tender Documents	TD.pdf	Tender Document	1865.50
	2	BOQ	BOQ_1105852.xls	Financial bid	349.00

Latest Corrigendum List

S.No	Corrigendum Title	Corrigendum Type	View
1	Date Corrigendum - 4	Date	
2	Technical Corrigendum - 2	Technical Bid	

Tender Inviting Authority

Name	CEO ANERT
Address	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 , projects@anert.in

E-TENDER DOCUMENT

***Request for Selection (RFS) of Bidder for the
Implementation of 1 MWp Solar PV System with
Grid connectivity at Kerala University of Health
Sciences, Thrissur, Kerala***

Ref. No.: ANERT-TSR/18/2022-DE(TSR)

Date of Publishing of Bids : - 16/11/2024

Last Date of Submission of Bids : - 06/12/2024

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

Department of Power, Government of Kerala
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E-TENDER DOCUMENT

*Request for Selection (RFS) of Bidder for the
Implementation of 1 MWp Solar PV System with
Grid connectivity at Kerala University of Health
Sciences, Thrissur, Kerala*

Ref. No.: ANERT-TSR/18/2022-DE(TSR)

VOL – 1: GENERAL CONDITIONS

Date of Publishing of Bids : - 16/11/2024

Last Date of Submission of Bids : - 06/12/2024

E-TENDER NOTICE

Competitive e-tenders in two cover system with Earnest Money Deposit (EMD) and Price Bid are invited from experience and eligible bidders to participate in the ***Request for Selection (RFS) of Bidder for the Implementation of 1 MWp Solar PV System with Grid connectivity at Kerala University of Health Sciences, Thrissur, Kerala.*** 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.

Bid documents which include Eligibility criteria, “Technical Specifications”, various conditions of contract, formats, etc. can be downloaded from website www.etenders.kerala.gov.in. Any amendment (s)/corrigendum/clarifications with respect to this Bid shall be uploaded on the above website only. The Bidder should regularly follow up for any Amendment/Corrigendum/Clarification on the above website.

Thiruvananthapuram

16/11/2024

Sd/-

CEO

TENDER ABSTRACT

Ref. No.	ANERT-TSR/18/2022-DE(TSR)
Document Description	Implementation of 1 MWp Grid Connected Solar PV Power Plant for Kerala University of Health Sciences, Thrissur
Name of Work	Design, Supply, Engineering, Erection Testing, Commissioning of 1 MWp SPV Power Plant with Grid connectivity along with 5 years of operation & maintenance under CAPEX model at Kerala University of Health Sciences, Thrissur
Site	Kerala University of Health Sciences,
Download of Tender Form	http://www.etenders.kerala.gov.in
Joint site visit/ Clarification Meeting	To be intimated through separate corrigendum
Last date of submission of Tender	06/12/2024 @ 3.00 PM
Date and Time of Bid opening (Techno-Commercial)	06/12/2024 @ 4.00 PM
Date and Time of Bid opening (Financial)	Conveyed through auto-online message system by tender portal to qualified / shortlisted bidders
Cost of Tender form	Rs. 17,850/- (Including GST)
EMD	Rs. 1,00,000/-
Warranty period	5-year warranty and complete Operation & Maintenance. Minimum guaranteed PR and CUF of the plant as specified in the Technical Specification to be maintained.
Availability of Tender Forms	Website http://www.etenders.kerala.gov.in

Place of opening of tender	Office of CEO, ANERT Law College Road, Vikas Bhavan. PO, Thiruvananthapuram – 695 033, Kerala
Name, Designation, Address and other details (For Submission of response to RFS)	Mr. Vinay P, Project Engineer ANERT, Trivandrum; Ph: +91 9400902550 E mail: projects@anert.in
Thiruvananthapuram 16/11/2024	Sd/- CEO
<p>Important Note: Prospective Bidders are requested to remain updated for any notices/amendments/clarifications etc. to the RFS document through the website www.anert.gov.in/www.etenders.kerala.gov.in. No separate notifications will be issued for such notices/amendments/clarification etc. in the print media or individually.</p>	

DISCLAIMER

1. Though adequate care has been taken while preparing the NIT document, the Bidders shall satisfy themselves that the document is complete in all respect. Intimation regarding any discrepancy shall be given to this office immediately. If no intimation is received from any Bidder within Ten (10) days from the date of notification of NIT / issuance of e-Tender documents, it shall be considered that the document is complete in all respect and has been received / acknowledged by the Bidder(s).
2. Agency for New and Renewable Energy Research and Technology (ANERT) reserves the right to modify, amend or supplement this document.
3. While this tender document has been prepared in good faith, neither ANERT nor their employees or advisors make any representation or warranty, express or implied, or accept any responsibility or liability, whatsoever, in respect of any statements or omissions herein, or the accuracy, completeness or reliability of information, and shall incur no liability under any law, statute, rules or regulations as to the accuracy, reliability or completeness of this document, even if any loss or damage is caused by any act or omission on their part.

GENERAL TERMS AND CONDITIONS FOR E-PROCUREMENT

This e-Tender is being published as the Request for Selection (RFS) of Bidder for the Implementation of 1 MWp Solar PV System with Grid connectivity at Kerala University of Health Sciences, Thrissur, Kerala. The tender is invited in two cover system from experienced manufacturers / EPC contractors through e-procurement portal of Government of Kerala (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

1. ONLINE BIDDER REGISTRATION PROCESS:

- i. 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. Once, the DSC is obtained, bidders have to register on 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.
- ii. 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 / etendershelp@kerala.gov.in for assistance in this regard

1. 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. 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 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. 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 The 2-cover bid shall contain the scanned copies of the following documents which every bidder has to upload:
 - i. The tender document duly signed and sealed downloaded from the website.
 - ii. Summary of Bid documents (Annexure A)
 - iii. Pre-Agreement in the prescribed format (Annexure B) on Govt. of Kerala stamp paper worth Rs. 200/-
 - iv. Copy of Registration Certificate of the bidder firm
 - v. Copy of PAN card of the bidder

- vi. The bidder must have an experience of successful commissioning of at least 5 MW SPV Power Plants in India.
 - vii. Documentary evidence to support the bidders experience in any completed or ongoing SPV contract with a Govt. Department / Govt. undertaking / PSU / Private sector for having a single plant capacity not less than 5 MW. The plant shall be in operation at least 3 months before the date of opening of this bid proposal.
 - viii. Documents to prove the annual Turnover of the bidder (audited statement)
 - ix. Certifications required for proving technical compliance
 - x. Declaration by the Bidder (format as in Annexure C)
 - xi. Declaration of relationship with ANERT employee (format as in Annexure D)
 - xii. Summary of bidders Technical Information (Annexure E)
 - xiii. 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.
 - xiv. Bill of Material
- 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.

4. TENDER DOCUMENT FEES AND EARNEST MONEY DEPOSIT (EMD)

- 4.1 The Bidder shall pay, a tender document fee of Rs. 17,850/- and Earnest Money Deposit or Bid Security or Bid Bond of Rs. 1,00,000/-. The Bid security is required to protect the purchaser against risk of Bidder's conduct, which would warrant the forfeiture of security.

4.2 Online Payment modes: The tender document fees and EMD can be paid in through e-Payment facility provided by the e-Procurement system. Bidders can make payment only via Internet banking facility

State Bank of India Multi Option Payment System (SBI MOPS Gateway): Bidders are required to avail Internet Banking Facility in any of below banks for making tender remittances in eProcurement System.

A) Internet Banking Options (Retail)			
1	Allahabad Bank	32	Kotak Mahindra Bank
2	Axis Bank	33	Lakshmi Vilas Bank
3	Andhra Bank	34	Mehsana Urban Co-op Bank
4	Bandan Bank	35	NKGSB Co-operative Bank
5	Bank of Bahrain and Kuwait	36	Oriental Bank of Commerce
6	Bank of Baroda	37	Punjab and Maharashtra Cooperative Bank
7	Bank of India	38	Punjab National Bank
8	Bank of Maharashtra	39	Punjab and Sind Bank
9	Bassein Catholic Co-operative Bank	40	RBL Bank
10	BNP Paribas	41	Saraswat Cooperative Bank
11	Canara Bank	42	Shamrao Vithal Cooperative Bank
12	Catholic Syrian Bank	43	South Indian Bank
13	Central Bank of India	44	Standard Chartered Bank
14	City Union Bank	45	State Bank of India
15	Corporation Bank	46	Syndicate Bank
16	Cosmos Bank	47	Tamil Nadu Mercantile Bank
17	DCB Bank	48	Tamil Nadu Cooperative Bank
18	Dena Bank	49	The Kalyan Janata Sahakari Bank
19	Deutsche Bank	50	TJSB Bank
20	Dhanalaxmi Bank	51	UCO Bank
21	Federal Bank	52	Union Bank of India
22	HDFC Bank	53	United Bank of India
23	ICICI Bank	54	Vijaya Bank

24	IDBI Bank	55	YES Bank
25	Indian Bank		
26	Indian Overseas Bank		
27	IndusInd Bank		
28	Jammu & Kashmir Bank		
29	Janata Sahakari Bank		
30	Karnataka Bank		
31	Karur Vysya Bank		
B) Internet Banking Options (Corporate)			
1	Bank of Baroda	21	Laxmi Vilas Bank
2	Bank of India	22	Oriental Bank of Commerce
3	Bank of Maharashtra	23	Punjab & Maharashtra Coop Bank
4	BNP Paribas	24	Punjab & Sind Bank
5	Canara Bank	25	Punjab National Bank
6	Catholic Syrian Bank	26	RBL Bank
7	City Union Bank	27	Shamrao Vitthal Co-operative Bank
8	Corporation Bank	28	South Indian Bank
9	Cosmos Bank	29	State Bank of India
10	Deutsche Bank	30	Syndicate Bank
11	Development Credit Bank	31	UCO Bank
12	Dhanalaxmi Bank	32	Union Bank of India
13	Federal Bank	33	UPPCL
14	HDFC Bank	34	Vijaya Bank
15	ICICI Bank	35	Axis Bank
16	Indian Overseas Bank		
17	Janta Sahakari Bank		
18	Jammu & Kashmir Bank		
19	Karur Vysya Bank		
20	Kotak Bank		

During the online bid submission process, bidder shall select **SBI MOPS** option and submit the page, to view the **Terms and Conditions** page. On further submitting the same, the e-Procurement system will re-direct the bidder to MOPS Gateway, where two options namely **SBI** and **Other Banks*** will be shown. Here, Bidder may proceed as per below:

- a) SBI Account Holders shall click **SBI** option to with its Net Banking Facility., where bidder can enter their internet banking credentials and transfer the Tender Fee and EMD amount.
- b) Other Bank Account Holders may click **Other Banks** option to view the bank selection page. Here, bidders can select from any of the 54 Banks to proceed with its Net Banking Facility, for remitting tender payments.

**Transaction Charges for Other Banks vide SBI Letter No. LHO/TVM/AC/2016-17/47 – 1% of transaction value subject to a minimum of Rs. 50/- and maximum of Rs. 150/-*

** Bidders who are using Other Banks option under SBI MOPS Payment Gateway, are advised by SBI to make online payment 72 hours in advance before tender closing time.*

5. SUBMISSION PROCESS:

- 5.1** 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 along with online payment of tender document fees and EMD.
- 5.2** For page-by-page instructions on bid submission process, please visit www.etenders.kerala.gov.in and click “Bidders Manual Kit” link on the home page.
- 5.3** 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.

6. VALIDITY

- 6.1** The tender offer shall be kept valid for acceptance for a period of 3 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

7. DEVIATIONS

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

8. BLACK LIST

8.1 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.

9. BIDDER'S LOCATION

9.1 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.

9.2 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.

10. 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.

11. 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.

12. 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 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. 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

13. 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.

14. 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 and such amendments shall be binding on all the bidders.

15. 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 15 days of Issue of work order.

16. 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.

CONDITIONS OF CONTRACT

17. GENERAL CONDITIONS

- 10.1 The tenders should be submitted online at www.etenders.kerala.gov.in.
- 10.2 The tenders should be as per the prescribed form which should be downloaded from the e-tender website. The cost of tender forms should be paid online, and once paid will not be refunded. Tender forms are not transferable. Tenders that are not in the prescribed form are liable to be rejected.
- 10.3 Intending tenderers should submit their tenders on or before the due date and time mentioned in the tender abstract. Late tender will not be accepted.
- 10.4 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.
- 10.5 The tenderer shall submit a copy of PAN card of the bidding agency.
- 10.6 Tenders subject to conditions will not be considered. They are liable to be rejected on that sole ground.
- 10.7 The tenders will be opened on the specified day and time in the office of the CEO, ANERT in the presence of such of those tenderer's representatives who may be present with proper authorisation issued by the tenderer.
- 10.8 Every tenderer should send along with his tender an Earnest Money Deposit. This may be paid online at the e-tenders website.
- 10.9 If any tenderer withdraws from his e-tender before the expiry of the period fixed for keeping the rates firm for acceptance, the earnest money if any, deposited by him, will be forfeited.
- 10.10 The final acceptance/rejection of the tenders rests entirely with CEO, ANERT who do not bind themselves to accept the lowest or any tender.
- 10.11 In the case of materials of technical nature, the successful tenderer should be prepared to guarantee satisfactory performance for a period of guarantee under a definite penalty. Communication of acceptance of the e-tender normally constitutes a concluded contract. Nevertheless, the successful tenderer shall also execute an agreement for the due 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:

- 10.11.1 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 follow G.O. (P) No.113/2019/TD. dtd. 24.07.2019 with respect to public works. They are to deposit a sum equivalent to 5% 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.
- 10.11.2 In cases where a successful tenderer, after having made partial supplies 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.
- 10.12 Return the Security deposit shall, subject to the conditions specified herein 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.
- (a) All payments to the contractors will be made by CEO ANERT in due course by NEFT transfer only

(b) All incidental expenses incurred by ANERT for making payments outside the State in which the claim arises shall be borne by the contractor.

- 10.13 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.
- 10.14 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.
- 10.15 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.

- 10.16 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.
- 10.17 The tenderer shall undertake the installation and commissioning of the system according to the standards and specification.
- 10.18 No representation for enhancement of rate once accepted will be considered.
- 10.19 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.
- 10.20 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 1B to this tender. Tenders without the agreement in stamped paper will be rejected outright.
- 10.21 Conditions in the technical document, technical specifications and special conditions of this tender document would override these general conditions, wherever applicable.
- 10.22 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 be 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.

- 10.23 The E-tender shall be opened at the time and date announced in the tender notice, and the price bid will be evaluated as intimated vide auto generated email only.
- 10.24 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.
- 10.25 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.

18. SPECIAL CONDITIONS

- 18.1 Each bidder should submit only one (1) bid. Any bidder who submits/participates in more than one bid for the work shall be disqualified.
- 18.2 The tenders will be opened 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.
- 18.3 If the bidder has NOT submitted the requisite EMD OR Agreement, OR if the price bid is not submitted along with the tender, such tenders will be summarily rejected.
- 18.4 During the tender evaluation, ANERT may seek more clarifications/details from any or all of the tenderers, if felt necessary.
- 18.5 The price bids of the tenderers, which submitted the required documents only will be opened and the L1 bidder will be awarded the work of supply and installation of items after fulfilling all the requirements.
- 18.6 If found essential, 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.
- 18.7 **The rate quoted should be all-inclusive including delivery of materials at the location to be specified, and the cost of materials and labour for the civil**

works, installation and commissioning, Warranties, Application fees, O&M charges, GST and all other expenses.

- 18.8 The tender offer shall be kept valid for acceptance for a period of 6 months from the date of opening of bid. The offers with lower validity period are liable for rejection.
- 18.9 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)**

Department of Power, Government of Kerala
Thiruvananthapuram, Kerala – 695 033;
www.anert.gov.in , projects@anert.in

E-TENDER DOCUMENT

*Request for Selection (RFS) of Bidder for the
Implementation of 1 MWp Solar PV System with
Grid connectivity at Kerala University of Health
Sciences, Thrissur, Kerala*

Ref. No.: ANERT-TSR/18/2022-DE(TSR)

VOL – 2: SCHEDULE AND SCOPE OF WORKS

Date of Publishing of Bids : - 16/11/2024

Last Date of Submission of Bids : - 06/12/2024

REQUEST FOR SELECTION (RFS)

FOR

19. Implementation of 1 MWp Grid Connected Solar PV System to be installed at Kerala University of Health Sciences, Thrissur, Kerala

- 12.1 For the purpose of all procurement activities related to the said works, ANERT shall be referred to as 'Employer' and 'KUHS, Thrissur' as "the Owner".
- 12.2 ANERT, therefore, invites bids from eligible bidders to participate in the Request for Selection in the e-tendering platform for Design, Manufacture, Supply, Erection, Testing and Commissioning including Warranty, Operation and Maintenance of Solar PV Power System at proposed location.
- 12.3 For the implementation of above-mentioned work, Bidders should submit their bid proposal online complete in all aspect on or before Last date of Bid Submission.
- 12.4 Bid documents, which include Eligibility Criteria, Technical Specifications, various Conditions of Contract, and Formats etc., can be downloaded from website www.anert.gov.in. It is mandatory to download official copy of E-TENDER Document from Kerala Tenders Portal. Any amendment(s) / corrigendum / clarification(s) with respect to this Bid shall be uploaded on www.etenders.kerala.gov.in. The Bidder should regularly check for any Amendment(s)/Corrigendum/Clarification(s) on the above website only.
- 12.5 Bidder has to apply for the Solar PV System cumulative capacity of 1000 kWp
- 12.6 The detailed scope of work includes:
- 12.6.1 Design, Engineering, Manufacture, Supply, Storage, Civil work, Erection, Testing & Commissioning of the Grid connected Ground Mounted / Rooftop / Floating Solar PV Project including Power evacuation, Operation and Maintenance (O & M) of the project for a period of 5 years for after commissioning of project.

20. DEFINITIONS & ABBREVIATIONS

- a) In this "Bid / RFS Document" the following words and expression will have the

meaning as herein defined where the context so admits:

- 20.1 **"Affiliate"** shall mean a company that either directly or indirectly
- a. controls or
 - b. is controlled by or
 - c. is under common control with
- 20.2 A Bidding Company and **"control"** means ownership by one company of at least twenty-six percent (26%) of the voting rights of the other company.
- 20.3 **"B.I.S"** shall mean specifications of Bureau of Indian Standards (BIS);
- 20.4 **"Bid"** shall mean the Techno Commercial and Price Bid submitted by the Bidder along with all documents/credentials/attachments annexure etc., in response to this RFS, in accordance with the terms and conditions hereof.
- 20.5 **"Bidder/Bidding Company"** shall mean Bidding Company submitting the Bid. Any reference to the Bidder includes Bidding Company / including its successors, executors and permitted assigns as the context may require;
- 20.6 **"Bid Deadline"** shall mean the last date and time for submission of Bid in response to this RFS as specified in the Tender Abstract;
- 20.7 **"Bid Capacity"** shall mean capacity offered by the bidder in his Bid.
- 20.8 **"CEA"** shall mean Central Electricity Authority.
- 20.9 **"Chartered Accountant"** shall mean a person practicing in India or a firm whereof all the partners practicing in India as a Chartered Accountant(s) within the meaning of the Chartered Accountants Act, 1949;
- 20.10 **"Competent Authority"** shall mean (Designation of Competent Authority) of [Name of the Organization] himself and/or a person or group of persons nominated by MD for the mentioned purpose herein;
- 20.11 **"Commissioning,"** means Successful operation of the Project / Works by the Contractor, for carrying out Performance Test(s) as defined in RFS.
- 20.12 **"Company"** shall mean a body incorporated in India under the Companies Act, 1956 or Companies Act, 2013 including any amendment thereto;
- 20.13 **Commercial Operation Date:** The date of successful conducting field acceptance tests and injection of power at delivery point shall be the "Commercial Operation Date"

20.14 **“Capacity Utilization Factor” (CUF)** shall mean the ratio of actual energy generated by SPV project over the year to the equivalent energy output at its rated capacity over the yearly period.

$$CUF = \frac{\text{actual annual energy generated from the plant in kWh}}{(\text{installed plant capacity in kW} * 365 * 24)}$$

20.15 **“Eligibility Criteria”** shall mean the Eligibility Criteria as set forth in Clause 16 of this RFS;

20.16 **“Financially Evaluated Entity”** shall mean the company which has been evaluated for the satisfaction of the Financial Eligibility Criteria set forth in Clause 16.3 hereof;

20.17 **“IEC”** shall mean specifications of International Electro-Technical Commission;

20.18 **“kWp”** shall mean kilo-Watt Peak;

20.19 **“kWh”** shall mean kilo-Watt-hour;

20.20 **“MNRE”** shall mean Ministry of New and Renewable Energy, Government of India;

20.21 **“O&M”** shall mean Operation & Maintenance of Solar PV system for PPA period.

20.22 **“Owner of the project”** shall mean Kerala University of Health Sciences, Thrissur, shall mean anyone who has ownership (including lease ownership also) of the land / roof and is the legal owner of all equipments of the project. Owner of the project can enter into a PPA with the consumer (s) of power for supply of solar power for agreed time (years) from the date of Commissioning of project.

20.23 **“Project Cost / Project Price”** shall mean the price offered by the Bidder for the Scope of work as per RFS document for the site.

20.24 **“Project capacity”** means Capacity in kWp offered by the Bidder. The project capacity specified is on “DC” output Side only.

20.25 **“Performance Ratio” (PR) means**

“Performance Ratio” (PR) means the ratio of plant output versus installed plant capacity at any instance with respect to the radiation measured.

$$PR = \frac{\text{Measured output in kW}}{\text{Installed Plant capacity in kW} * (1000 / \text{Measured radiation intensity in W/m}^2)}$$

20.26 **“Parent”** shall mean a company, which holds more than 51% equity either

directly or indirectly in the Bidding Company or Project Company or a Member in a Consortium developing the Project

20.27 **“Project Company”** shall mean Company incorporated by the bidder as per Indian Laws in accordance with Clause no 16.1.

20.28 **“Price Bid”** shall mean BoQ, containing the Bidder’s quoted Price as per the Volume- IV of this RFS;

20.29 **“Qualified Bidder”** shall mean the Bidder(s) who, after evaluation of their Techno Commercial Bid stand qualified for opening and evaluation of their Price Bid;

20.30 **“RFS”** shall mean Request for Selection (RFS)/Bid document/Tender document

20.31 **“Statutory Auditor”** shall mean the auditor of a Company appointed under the provisions of the Companies Act, 1956 or under the provisions of any other applicable governing law;

20.32 **“Successful Bidder(s) /Contractor/Project Developers(s)”** shall mean the Bidder(s) selected by Owner pursuant to this RFS for Implementation of Grid Connected Ground mounted Solar PV System as per the terms of the RFS Documents, and to whom an Allocation Letter has been issued;

20.33 **“Site”** shall mean the project location at the address mentioned below.

Kerala University of Health Sciences, Medical college PO, Thrissur - 680596

20.34 **“SNA”** shall mean State Nodal Agency, ANERT.

20.35 **“Tendered Capacity”** shall mean the Total aggregate capacity in MW proposed to be tendered by ANERT to the Successful Bidder through this bidding process as per terms and conditions specified therein;

20.36 **“Ultimate Parent”** shall mean a company, which owns at least more than fifty percent (51%) equity either directly or indirectly in the Parent and Affiliates.

20.37 **“Wp”** shall mean Watt Peak.

20.38 **1MWp** for the purpose of conversion in **kWp** shall be considered as 1000kWp.

b) INTERPRETATIONS

- i. Words comprising the singular shall include the plural & vice versa
- ii. An applicable law shall be construed as reference to such applicable law including its amendments or re-enactments from time to time.

- iii. A time of day shall save as otherwise provided in any agreement or document be construed as a reference to Indian Standard Time.
- iv. Different parts of this contract are to be taken as mutually explanatory and supplementary to each other and if there is any differentiation between or among the parts of this contract, they shall be interpreted in a harmonious manner to give effect to each part.
- v. The table of contents and any headings or sub headings in the contract has been inserted for case of reference only & shall not affect the interpretation of this agreement.

INTRODUCTION, BID DETAILS AND INSTRUCTIONS TO THE BIDDERS

21. INTRODUCTION

Kerala, known for its high social development indices, turned a fully electrified state during 2017. The programme of “24x7 power for all” was an important step in this direction and this programme was successfully implemented by Government of Kerala with the objective to connect the unconnected in phased manner by FY 2018-19 to ensure supply of quality, reliable and affordable power to all category of consumers on 24 x 7 x 365 basis.

The Agency for New and Renewable Energy Research and Technology (ANERT) is an autonomous organisation established during 1986 under Societies Act by the Government of Kerala, now functioning under Power Dept, with its Head Quarters at Thiruvananthapuram. ANERT is the State Nodal Agency (SNA) for the Ministry of New and Renewable Energy (MNRE), Govt. of India, to carry out the Centrally Assisted Programmes in Kerala.

ANERT has an objective to make available knowledge and experience to the State Government, Central Government. Local Bodies, Semi-Government and other agencies in the State and elsewhere and also offer consultancy services on all such matters pertaining to alternative sources of energy, energy conservation and rural technology as may be referred to it from time to time and to undertake on its own or in collaboration or on other arrangement with national or international agencies, program of research, application, extension and development of new energy sources, methods of energy conservation and rural technologies.

14.1 OWNER: Kerala University of Health Sciences, Thrissur (herein referred as Owner) is in possession of approx 30 Acres of land (5 acres excluding buildings) in its possession at Medical College Campus, Thrissur. They Intent to put up a 1 MWp capacity of Solar Power Plant at this land and utilize the electricity generated for its captive consumption in the Diary within the premise.

Kerala University of Health Sciences (10°36'35.34" North latitude, 76°11'42.87" East longitude) is located at Mulanthurathukaavu, Thrissur. The RE power generated shall be evacuated through OH/UG cable and injected at 11 kV bus side of the KUHS. The Power

evacuation works, including substation augmentation are also included in the scope of the successful bidder.

In case, KSEBL requires the power injection to be made at their nearest substation, the works shall be done by the successful bidder at the approved DSR rates on reimbursement basis.

14.2 Bidder shall submit bids under CAPEX mode for the project site mentioned in RFS.

14.3 The scheme targets Installation of Ground mounted / Carport / Rooftop Grid-connected Solar Photovoltaic power generation system on the site, under the possession of Kerala University of Health Sciences, Thrissur. The project owner may utilize the generated solar power for captive consumption at the Ernakulam Dairy. The scheme aims to reduce the fossil fuel-based electricity load on main grid and make building self-sustainable from the point of electricity, to the extent possible. The business model envisages power generation for captive consumption, with Banking facility under 'Captive Consumer' category.

14.4 ANERT, on behalf of Kerala University of Health Sciences, Thrissur, hereby invites interested companies to participate in the bidding process for the selection of Successful Bidder(s) for implementation of Grid-connected Solar Photovoltaic Project under CAPEX model in the project location.

14.5 The Bidders are advised to read carefully all instructions and conditions appearing in this document and understand them fully. All information and documents required as per the bid document must be furnished. Failure to provide the information and / or documents as required may render the bid technically unacceptable.

14.6 The bidder shall be deemed to have examined the bid document, to have obtained his own information in all matters whatsoever that might affect the carrying out the works in line with the scope of work specified elsewhere in the document at the offered rates and to have satisfied himself to the sufficiency of his bid. The bidder shall be deemed to know the scope, nature and magnitude of the works and requirement of materials, equipment, tools and labour involved, wage structures and as to what all works, he has to complete in accordance with the bid documents

irrespective of any defects, omissions or errors that may be found in the bid documents.

22. BID DETAILS

22.1 The bidding process under this RFS is for a 1 MWp SPV Power Plant at **Kerala University of Health Sciences, Thrissur.**

22.1.1 Bids are invited from the prospective bidders for the tendered capacity as indicated above, based on the Project Cost (CAPEX Model). The bidder who has quoted lowest Project Cost will be declared as successful bidder

22.1.2 Permanent water supply and auxiliary LT electric power supply at single point shall be arranged by Kerala University of Health Sciences, Thrissur inside the premise on chargeable basis.

BID QUALIFICATION REQUIREMENTS

23. ELIGIBILITY CRITERIA

23.1 General

- i. The Bidder should be either a body incorporated in India under the Companies Act, 1956 or 2013 including any amendment thereto, Sole Proprietorship, Partnership company and engaged in the business of Solar Power.
- ii. A copy of certificate of incorporation shall be furnished along with the bid in support of above.
- iii. Joint Venture/Partnership is allowed. Participant/Bidder must have to qualify the technical qualifying criteria, indicated in point no 23.2 below. The aggregate equity share holding of the successful bidder in the issued and paid-up equity share capital of the project company shall not be less than fifty-one percent (51%) up to period of five (5) years from the date of commissioning of project

23.2 Technical Eligibility Criteria:

The Bidder should have installed & commissioned at least one Grid connected Solar PV Power Project having a capacity of not less than 1 MW and cumulative capacity of above 5 MW, which should have been commissioned at least six months prior to Techno-Commercial Bid Opening date. The list of projects commissioned at least 6 months prior to Techno-Commercial Bid Opening date, indicating whether the project is grid connected, along with a copy of the Commissioning certificate and Work order / Contract / Agreement/ from the Client/Owner shall be submitted in support of Clause 23.2.

23.3 Financial eligibility criteria

The Bidder should have an Annual Turnover or Net worth as indicated below.

- i. The Minimum Average Annual turnover of Rupees 5 Crores in any two of the last 5 financial years preceding the Bid Deadline subject to the condition that the Bidder should at least have completed two financial years.

OR

- ii. Net worth equals to or greater than the value calculated at rate of Rs. 3 Crore per MW of capacity offered by the Bidder in its Bid. The Computation of Net worth shall be based on unconsolidated audited annual accounts of the last financial year immediately preceding the Bid Deadline. Share premium can be included in the Net-worth calculation in case of listed companies in India only.

The formula of calculation of net-worth shall be as follows:

Net-worth = (Paid up share capital) + {(Free reserves - Share premium) + Share premium of listed companies} - (Revaluation of reserves) - (Intangible assets) - (Miscellaneous expenditure to the extent not written off and carry forward losses).

For the purposes of meeting financial requirements, only unconsolidated audited annual accounts shall be used. However, audited consolidated annual accounts of the Bidder may be used for the purpose of financial requirements provided the Bidder has at least twenty-six percent (26%) equity in each company whose accounts are merged in the audited consolidated accounts; and provided further that the financial capability of such companies (of which accounts are being merged in the consolidated accounts) shall not be considered again for the purpose of evaluation of the Bid.

Bidders shall furnish documentary evidence as per the Format - 8, duly certified by Authorized Signatory and the Statutory Auditor / Practising Chartered Accountant of the Bidding Company in support of their financial capability.

23.4 Incorporation of a project company

23.4.1 In case the Bidder wishes to incorporate a Project Company, in such a case, Bidder if selected as a Successful Bidder can incorporate a Project Company. Bidder shall be responsible to get all clearance required/obtained in the name of the Bidding Company transferred in the name of the Project Company.

23.4.2 The aggregate equity share holding of the Successful Bidder in the issued and paid-up equity share capital of the Project Company shall not be less than fifty-one percent (51%) up to a period of two (2) years from the date of commissioning of the entire Sanctioned Capacity of the Project Developer.

23.5 Bid submission by the bidder

- 23.5.1 The Bidder shall submit the information and/or documents as per the formats specified in Volume-IV.
- 23.5.2 Strict adherence to the formats wherever specified, is required. Wherever, information has been sought in specified formats, the Bidder shall refrain from referring to brochures /pamphlets. Non-adherence to formats and / or submission of incomplete information may be a ground for declaring the Bid as non-responsive. Each format has to be duly signed and stamped by the authorized signatory of the Bidder.
- 23.5.3 The Bidder shall furnish documentary evidence in support of meeting Eligibility Criteria as indicated in Clause no. 23.1, 23.2 and 23.3 to the satisfaction of ANERT. They shall also furnish unconsolidated/consolidated audited annual accounts in support of meeting financial requirement, which shall consist of balance sheet, profit and loss account, profit appropriation account, auditors report, etc., as the case may be of Bidding Company or Financially Evaluated Entity for any of the last three(3) financial years immediately preceding the Bid Deadline which are used by the bidder for the purpose of calculation of Annual Turnover or of last Financial Year in case of Net Worth.
- 23.5.4 In case the annual accounts for the latest financial year are not audited and therefore the bidder cannot make it available, the applicant shall give certificate to this effect from their CEOs. In such a case, the Applicant shall provide the Audited Annual Reports for 3 (Three) years preceding the year or from the date of incorporation if less than 3 years for which the Audited Annual Report is not being provided.

23.6 Bid submitted by a bidding company

The Bidding Company should designate one person to represent the Bidding Company in its dealings with ANERT. The person should be authorized to perform all tasks including, but not limited to providing information, responding to enquires, signing of Bid etc. The Bidding Company should submit, along with Bid, a Power of Attorney in original (as per Format-2), authorizing the signatory of the Bid.

23.7 Amendments to RFS

- 23.7.1 At any time prior to the deadline for submission of Bids, ANERT may, for any reason, whether at its own initiative or in response to a clarification requested by a prospective Bidder, modify the RFS document by issuing clarification(s) and/or amendment(s).
- 23.7.2 The clarification(s) / amendment(s) (if any) may be notified on ANERT website www.anert.gov.in at least Two (2) days before the proposed date of submission of the Bid. If any amendment is required to be notified within Two (2) days of the proposed date of submission of the Bid, the Bid Deadline may be extended for a suitable period.
- 23.7.3 ANERT will not bear any responsibility or liability arising out of non-receipt of the information regarding Amendments in time or otherwise. Bidders must check the website for any such amendment before submitting their Bid.
- 23.7.4 In case any amendment is notified after submission of the Bid (prior to the opening of Techno-Commercial Bid.
- 23.7.5 All the notices related to this Bid which are required to be publicized shall be uploaded on website www.etenders.kerala.gov.in

23.8 Bidding process

23.8.1 Bid formats

The Bid shall comprise of the following:

(A) Cover I - Techno-Commercial documents

- i. Covering Letter as per the prescribed Format-1
- ii. Copy of PAN and TAN certificates of Bidding company
- iii. Original power of attorney issued by the Bidding Company in favour of the authorized person signing the Bid, in the form attached hereto as Format-2 or standard power of attorney in favour of authorized person signing the Bid. (Power of Attorney must be supplemented by Board Resolution to above effect for the company). However, ANERT may accept general Power of Attorney

executed in favour of Authorised signatory of the Bidder, if it shall conclusively establish that the signatory has been authorized by the Board of CEOs to execute all documents on behalf of the Bidding Company.

- iv. General particulars of bidders as per Format-3
- v. Shareholding certificate signed by the company secretary of the bidding company and shareholding certificate signed by the company secretary of the Parent company (if parent company credentials are used).
- vi. Document in support of meeting Eligibility Criteria as per Clause no. 23.1 & 23.2.
- vii. Certificates of incorporation of Bidding company and parent company (if parent company credentials are used)
- viii. Certificates of incorporation of bidding consortium, if technical consortium is envisaged in the bid submitted by bidder.
- viii. Details for meeting Financial Eligibility Criteria as per Clause no. 23.3 along with documentary evidence for the same.
- ix. If credentials of Parent company are being used by the Bidding company/lead member of the bidding consortium than Format 4 shall be furnished.
- x. Undertakings from the Financially Evaluated Entity or its Parent Company /Ultimate Parent Company as per Format-5.
- xi. Board Resolution of the Parent Company /Ultimate Parent Company of the Bidding company duly certified by the Company Secretary to provide the Performance Bank Guarantee (PBG) in the event of failure of the Bidding Company to do so.
- xii. Board resolution for Authorised signatory
- xiii. Signed and stamped Copy of RFS Documents including amendments & clarifications by Authorised signatory on each page.

(B) Cover II- Price bid for bid submission under RESCO

The Bidder shall inter-alia take into account the following while preparing and submitting the Price Bid digitally signed by the authorized signatory.

23.9 Validity of Bid

23.9.1 The bid and the Price Schedule included shall remain valid for a period of 3 months from the date of techno-commercial bid opening, with bidder having no right to withdraw, revoke or cancel his offer or unilaterally vary the offer submitted or any terms thereof. In case of the bidder revoking or cancelling his offer or varying any term & conditions in regard thereof or not accepting letter of allocation, ANERT shall forfeit the Bid Bond furnished by him.

23.9.2 In exceptional circumstances when letter of acceptance is not issued, ANERT may solicit the Bidder's consent to an extension of the period of validity. The request and the responses thereto shall be made in writing. The EMD provided shall also be suitably extended. A Bidder may refuse the request without forfeiting its Bid Bond. A Bidder granting the request will neither be required nor permitted to modify its Bid in any manner.

23.10 Cost of bidding

The bidder shall bear all the costs associated with the preparation and submission of his offer, and ANERT will in no case be responsible or liable for those costs, under any conditions. The Bidder shall not be entitled to claim any costs, charges and expenses of and incidental to or incurred by him through or in connection with his submission of bid even though ANERT may elect to modify / withdraw the invitation of Bid.

23.11 Performance Security / Performance Bank Guarantee (PBG)

23.11.1 Within 30 days from the date of issue of Allocation letter, Successful Bidder shall furnish the Performance Security @ 5% of the total contract value.

23.11.2 The Performance Security shall be denominated in Indian Rupees and shall be in one of the following forms:

- a. A demand draft, or a bank guarantee in the format given in Format-7 from the list of banks mentioned in clause 4.
- b. Be confirmed for payment by the branch of the bank giving the bank guarantee at Thiruvananthapuram.

23.11.3 The PBG shall be forfeited as follows without prejudice to the Bidder being liable for any further consequential loss or damage incurred to ANERT, if the Successful Bidder is not able to commission the projects to the satisfaction of ANERT.

23.11.4 The Performance Security shall be valid for a minimum period of 24 months from the date of issue of LoA and shall be renewed / extended till the completion of 5 years of O&M from the date of commissioning.

23.12 Right to withdraw the RFS and to reject any bid

23.12.1 This RFS may be withdrawn or cancelled by ANERT at any time without assigning any reasons thereof. ANERT further reserves the right, at its complete discretion, to reject any or all of the Bids without assigning any reasons whatsoever and without incurring any liability on any account.

23.12.2 ANERT reserve the right to interpret the Bid submitted by the Bidder in accordance with the provisions of the RFS and make its own judgment regarding the interpretation of the same. In this regard ANERT shall have no liability towards any Bidder and no Bidder shall have any recourse to ANERT with respect to the selection process. ANERT shall evaluate the Bids using the evaluation process specified in Volume - III, at its sole discretion. ANERT's decision in this regard shall be final and binding on the Bidders.

23.12.3 ANERT reserves its right to vary, modify, revise, amend or change any of the terms and conditions of the Bid before submission. The decision regarding acceptance or rejection of bid by ANERT will be final.

23.13 Zero Deviation

This is a ZERO Deviation Bidding Process. Bidder is to ensure compliance of all provisions of the Bid Document and submit their Bid accordingly. Tenders with any deviation to the bid conditions shall be liable for rejection.

23.14 Examination of Bid document

23.14.1 The Bidder is required to carefully examine the Technical Specification, terms and Conditions of Contract, and other details relating to supplies as given in the Bid Document.

- 23.14.2 The Bidder shall be deemed to have examined the bid document including the agreement/contract, to have obtained information on all matters whatsoever that might affect to execute the project activity and to have satisfied himself as to the adequacy of his bid. The bidder shall be deemed to have known the scope, nature and magnitude of the supplies and the requirements of material and labour involved etc. and as to all supplies he has to complete in accordance with the Bid document.
- 23.14.3 Bidder is advised to submit the bid on the basis of conditions stipulated in the Bid Document. Bidder's standard terms and conditions if any will not be considered. The cancellation / alteration / amendment / modification in Bid documents shall not be accepted by ANERT.
- 23.14.4 Bid not submitted as per the instructions to bidders is liable to be rejected. Bid shall confirm in all respects with requirements and conditions referred in this bid document.

SCOPE OF WORK

24. SCOPE OF WORKS

The scope of work for the bidder include, Obtaining No Objection Certificates (NOC) from Distribution Company (DISCOM) as well as Distribution wing of KSEBL for grid connectivity, Electrical Inspectorate certification for Energisation of plant and associated electrical, Complete Design, Engineering, Manufacture, Supply, Storage, Civil works, Erection, Testing & Commissioning of the 1 MWp Solar Grid connected PV Power Plant including operation and maintenance (O&M) of the project under CAPEX model for 5 years after Commercial Operation Date (COD).

24.1 LOCATION DETAILS

The location of installation of the proposed 1 MWp Solar Power plant is at the Kerala University of Health Sciences, Thrissur.

Site Name	Kerala University of Health Sciences, Thrissur
Plant Proposed	Ground + Carport + Rooftop
Ownership	Kerala University of Health Sciences, Thrissur
District	Thrissur
State	Kerala
Latitude	10°36'35.34"N
Longitude	76°11'42.87"E
Altitude	41 m
Nearest National Highway	NH-54
Nearest Village/Town	Mulankunnathukavu
Nearest Railway Station	Thrissur (14 km from the site)
Nearest Airport	CIAL, Cochin (65 km from the site)
Water Availability & Source	Available at site

The Proposed power plant is for a capacity of 1 MWp (1000 kWp) and is proposed to be a combination of Ground Mounted, Carport model and Rooftop Solar Power plants. The proposed capacity in each type category is as follows:

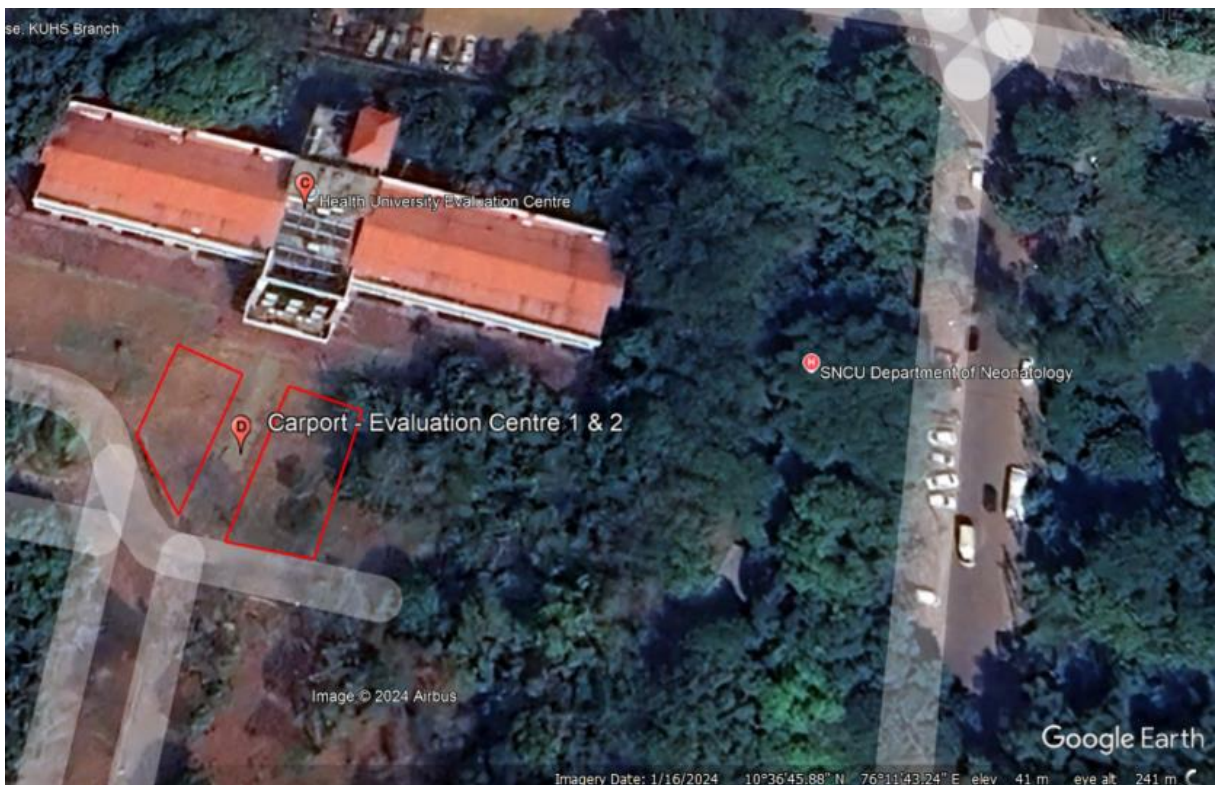
SN	Type of Plant	Capacity (kWp)
1	Rooftop	350
2	Carport Model	350
3	Ground Mounted	300

The Rooftop Power Plants are proposed in the Administrative, Academic and Evaluation Centre buildings of the campus. The same are marked as Cluster A, B & C and the total proposed capacity of 350 kWp can be accommodated within these 3 buildings.





The Ground Mounted / Carport power plants are proposed in the land portions as below. This is a tentative demarcation and ANERT/KUHS reserves the right to alter some (all) portions of the land.



The proposed area for Carports is marked as D, E and F in the pictures above. It is proposed to install Solar Power Plant using carport structures of capacity 50 kWp in front of the Evaluation Centre building, demarcated as Cluster 'D'. Further, Solar Carport is proposed in Cluster E for a capacity of 300kWp and Ground Mounted in Cluster F. In case, sufficient land is not available in Cluster F, excess land from Cluster E may be used. A waterproof structure is expected as the carport, which will act as a roof for the vehicles being parked underneath. It is required to use Bi Facial modules for enhanced generation.

The control room for housing the 11kV, 1.5 MVA Unitised Sub Station can be constructed at a corner of Cluster E, including room for maintenance personnel and the final termination to be done at the 11kV Bus of KUHS substation. Any upgradation required at KUHS substation for the final termination is under the scope of the bidder. The proposed plant comes under 'Captive Consumer' category and the final termination and metering point will depend on the location finalised by KSEBL.

ANERT / KUHS reserves the right to enhance / reduce the capacity of installation in the carport structure / Ground mounted based on the rates being finalised and availability of funds.

24.2 ASSOCIATED WORKS

The Works to be performed by the contractor shall include but not limited to

- a. Survey to be conducted to understand the coordinates, which is to be reflected in construction drawings and further in as Built. Also, elevation details of solar structure & other associated structures to be denoted in the drawings based on this survey. The land levelling and associated civil works for foundation will be done by Kerala University of Health Sciences, Thrissur.
- b. Works of any kind necessary for the due and satisfactory construction, completion and maintenance of the works to the intent and meaning of the drawings adopted, technical specifications, to best Engineering standards and orders that may be issued by the Engineer from time to time, compliance by the agency with all Conditions of Contract,
- c. Supply of all materials, apparatus, plants, equipment, tools, fuel, water, strutting, timbering, transport, offices, stores, workshop, staff, labour and the provision of

proper and sufficient protective works, diversion, fencing, lighting and watching required for the safety of the public and protection of works on adjoining land.

- d. Power infrastructure required for auxiliary and local consumption
- e. Office / Control room, fencing if reqd, surveillance, internal roads, drainage, Approach roads (approx. 150m), water recycling, rain water harvesting etc.
- f. 11 kV bay extension facility at KUHS/KSEBL Substation if required.
- g. First-aid equipment, sanitary accommodation for the staff and workmen, effecting and maintenance of all insurances.
- h. The payment of all wages, salaries, provident fund, fees, royalties, duties or other charges arising out of erection of works, insurance of labours and regular clearance of rubbish, clearing up, leaving the site perfect and tidy on completion & any permission required for clearance and disposal of debris shall be taken up by the contractor.

24.3 For Carport Structure

The detailed design in 2D and 3D are to be submitted by the bidders along with their bid and bids without the detailed drawings will be summarily rejected.

24.4 SUBMITTALS

On commencement of the Project, the Contractor shall submit the following to ANERT:

- a. Since the site clearing and associated foundation works are being done by Kerala University of Health Sciences, Thrissur, the detailed structural drawings and foundation requirements is to be submitted within 10 days of award of work, so that the levelling and foundation works can be done in parallel.
- b. Prior to the technical submittals, the contractor shall submit detailed baseline program and methodology indicating the proposed overall schedule for documentation such as calculations, shop/ working drawings, plan/ procedures and records. Submission of samples, process of fabrication / delivery to site storage yard for the approval of the Employer. Also, Contractor shall submit Method statements and Quality Assurance plan for each activity to be done and get approval from ANERT before commencing the work. Contractor shall maintain the

necessary Quality and Quantity documentation. All the documents shall be submitted to Employer for their review and records.

- c. Detailed work procedures and schedules shall be submitted by contractor at least one month before start of work and shall get necessary approval from ANERT authorities and various entities. If required meeting shall be called to settle all the open issues. Contractor to ensure that all issues are closed one month prior to start of work.
- d. Complete fabrication drawings, materials list, cutting lists, bolt lists, welding schedules and QC schedules, based on the design drawing furnished to him and in accordance with the approved schedule. It is highlighted that structural steel members, dimensions thereof indicated in tender drawings are tentative only, and may be modified during final design stage.
- e. Results of any tests, as and when conducted and as required by Employer.
- f. A detailed list of all constructional Plant & Equipment, such as cranes, derricks, winches, welding sets etc. their makes, model, present condition and location, available to the contractor and the ones he will employ on the job to maintain the progress of work in accordance with the contract.
- g. The total number of experienced personnel of each category, like fitters, welders, riggers etc., which he intends to deploy on the project.
- h. The contractor shall submit complete design calculations for any alternative sections proposed by him, for the approval of Employer and records of Owner.

25. PROJECT COST

- 25.1 The Project cost shall include all the costs related to above Scope of Work. Bidder shall quote for the entire facilities on a “single responsibility” basis such that the total Bid Price covers all the obligations mentioned in the Bidding Documents in respect of Design, Supply, Erection, Testing and Commissioning including Warranty, Operation & Maintenance for a period 5 years under CAPEX model, goods and services including spares required if any during O&M period. The Bidder has to take all permits, approvals and licenses, Insurance etc., provide

training and such other items and services required to complete the scope of work mentioned above.

- 25.2 The Project cost shall remain firm and fixed and shall be binding on the Successful Bidder till completion of work. No escalation will be granted on any reason whatsoever. The bidder shall not be entitled to claim any additional charges, even though it may be necessary to extend the completion period for any reasons whatsoever.
- 25.3 The cost shall be inclusive of all duties and taxes, insurance etc. The prices quoted by the firm shall be complete in all respect and no price variation /adjustment shall be payable during the 5-year period.
- 25.4 The Operation & Maintenance of Solar Photovoltaic Power Plant would include wear, tear, overhauling, machine breakdown, insurance, and replacement of defective modules, invertors / Power Conditioning Unit (PCU), spares, consumables & other parts for a period of 5 years.
- 25.5 The cost shall be specified in sanction letter based on Successful Bidder's quote for the project. The project cost shall be in accordance with all terms, conditions, specifications and other conditions of the Contract as accepted by ANERT and incorporated into the sanction letter.

26. ANERT CHARGES

The contractor shall pay 2.5% of the total project cost as license fee to ANERT. This amount will be deducted from the payment release to the vendor in equal instalments and the contract value for payment will be considered after deducting this amount.

27. TYPE AND QUALITY OF MATERIALS AND WORKMANSHIP

- 27.1 The Design, Engineering, Manufacture, Supply, Installation, Testing and Performance of the equipment shall be in accordance with latest appropriate IEC/Indian Standards as detailed in the Vol- III (Technical specifications) of the bid document. Where appropriate Indian Standards and Codes are not available, other suitable standards and codes as approved by the MNRE / authorised Government agency shall be used.

27.2 The specifications of the components should meet the technical specifications mentioned in Volume III.

27.3 Any supplies which have not been specifically mentioned in this Contract but which are necessary for the design, engineering, manufacture, supply & performance or completeness of the project shall be provided by the Bidder without any extra cost and within the time schedule for efficient and smooth operation and maintenance of the SPV plant.

28. METERING AND GRID CONNECTIVITY

Metering and grid connectivity of the solar PV system under this project would be the responsibility of the Bidder in accordance with the prevailing guidelines of the concerned DISCOM and / or CEA (if available by the time of implementation). The bidder need to connectivity and the entire responsibility lies with bidder only.

29. PLANT PERFORMANCE EVALUATION

The successful bidder shall be required to meet minimum guaranteed generation with Performance Ratio (PR) at the time of commissioning and related Capacity Utilization Factor (CUF) as per the GHI levels of the location during the O&M period. PR should be shown minimum of 75% at the time of inspection for initial commissioning acceptance. Minimum CUF shall not be less than 21% for a period of 5 years. The bidder should send the periodic plant output details to ANERT for ensuring the CUF. The PR will be measured at Inverter output level during peak radiation conditions.

30. PROGRESS REPORT

The bidder shall submit the progress report monthly to ANERT in Prescribed Proforma. ANERT will have the right to depute his/their representatives to ascertain the progress of contract at the premises of works of the bidder.

31. PAYMENT

31.1 No advance payment will be given. All the documents submitted should be certified by the concerned personnel of ANERT.

31.2 The quotes for the Design, Supply, Installation & Commissioning including 5 years of warranty (EPC Part) 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 the O&M quote will not be part of bid evaluation.

31.3 The terms of payment shall be:

31.3.1 EPC Payment

- i. 2.5 % of the invoice amount shall be charged by ANERT as non-refundable license fee and the remaining amount shall be treated as contract value for further payment.
- ii. Upon delivery of major components (PV Modules, Inverter etc) at the site/warehouse, a maximum of 60% of the contract value can be released through Running Accounts Bills of min 10% of the contract value. The supplier shall submit the part invoice for the materials (including serial numbers and delivery chalan) for the materials duly certified by the concerned District Office along with a report regarding the supply of materials. Each RAB shall be accompanied with an item wise statement of work completion with qty, rate & the actual expenditure incurred audited by a Chartered Accountant.
- iii. On completion of installation of the power plant, a maximum of 20% of the contract value can be released as Running Account Bills of min 10% of the contract value. 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 second part invoice can be raised only after submitting application for energization to the Electrical Inspectorate. Each RAB shall be accompanied with an item wise statement of work completion with qty, rate & the actual expenditure incurred audited by a Chartered Accountant.
- iv. After the Inspection and Approval of the Electrical Inspectorate, 5% of the contract value will be released. All documents related to the completion of the work including commissioning report shall be submitted for the release of the amount.

- v. The date of Energisation to the Grid by the DISCOM will be considered as the official Date of Commissioning (CoD) of the project and this will be treated as the commissioning of the system. On commissioning of the grid connected system, 5% of the contract value will be released after proving the Performance ratio (AC). The PR report as per standard is to be provided for release of the amount.
- vi. The balance 10% shall be retained as performance security and will be released in five equal parts after completion of each year of warranty. For releasing these payment, Performance ratio (AC) shall be proved within a period of 7 consecutive days at the end of each year for release of payment. **The plant shall be handed over at the end of 10 years after commissioning after proving the performance ratio (AC).** This period will be considered only from the date of commissioning.
- vii. The security deposit of 5% furnished along with the contract agreement shall be released on successful completion of supply, installation and commissioning.

31.3.2 Maintenance Payment

- i. The amount shall be released on annual basis after completion of the period of the previous year. The start of maintenance 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 payments.
 - iii. The payment shall be released after the inspection by the authorised personnel of ANERT on annual basis.
- 31.4 Income tax, contribution to workers' welfare fund and other statutory deductions shall be made from the payment as per prevailing norms.

32. PROJECT INSPECTION

The project progress will be monitored by ANERT and the projects will be inspected for quality at any time during commissioning or after the completion of the project either by officer(s) from ANERT or any authorized agency/ experts.

33. SETTLEMENT OF DISPUTE

- 33.1 If any dispute of any kind whatsoever arises between ANERT and Successful bidder in connection with or arising out of the contract including without prejudice to the generality of the foregoing, any question regarding the existence, validity or termination, the parties shall seek to resolve any such dispute or difference by mutual consent.
- 33.2 If the parties fail to resolve, such a dispute or difference by mutual consent, within 45 days of its arising, then the dispute shall be referred by either party by giving notice to the other party in writing of its intention to refer to arbitration as hereafter provided regarding matter under dispute. No arbitration proceedings will commence unless such notice is given.
- 33.3 In case the contractor is not a public sector enterprise or a Government department.
- 33.3.1 Any dispute submitted by a party to arbitration shall be heard by an arbitration panel composed of three arbitrators, in accordance with the provisions set forth below.
- 33.3.2 ANERT and the Contractor shall each appoint one arbitrator, and these two arbitrators shall jointly appoint a third arbitrator, who shall chair the arbitration panel. If the two arbitrators do not succeed in appointing a third arbitrator within Thirty (30) days after the latter of the two arbitrators has been appointed, the third arbitrator shall, at the request of either party, be appointed by the Appointing Authority for third arbitrator which shall be the President, Institution of Engineers.
- 33.3.3 If one party fails to appoint its arbitrator within thirty (30) days after the other party has named its arbitrator, the party which has named an arbitrator may request the Appointing Authority to appoint the second arbitrator.
- 33.3.4 If for any reason an arbitrator is unable to perform its function, the mandate of the Arbitrator shall terminate in accordance with the provisions of applicable laws as mentioned in Clause 28 (Applicable Law) and a substitute shall be appointed in the same manner as the original arbitrator.

33.3.5 Arbitration proceedings shall be conducted with The Arbitration and Conciliation Act, 1996. The venue or arbitration shall be New Delhi.

33.3.6 The decision of a majority of the arbitrators (or of the third arbitrator chairing the arbitration panel, if there is no such majority) shall be final and binding and shall be enforceable in any court of competent jurisdiction as decree of the court. The parties thereby waive any objections to or claims of immunity from such enforcement.

33.3.7 The arbitrator(s) shall give reasoned award.

33.4 Notwithstanding any reference to the arbitration herein, the parties shall continue to perform their respective obligations under the agreement unless they otherwise agree.

33.5 Cost of arbitration shall be equally shared between the Successful bidder or Contractor and ANERT

34. FORCE MAJEURE

34.1 Notwithstanding the provisions of clauses contained in this RFS document; the contractor shall not be liable to forfeit (a) Security deposit for delay and (b) termination of contract; if he is unable to fulfill his obligation under this contract due to force majeure conditions.

34.2 For purpose of this clause, "Force Majeure" means an event beyond the control of the contractor and not involving the contractor's fault or negligence and not foreseeable, either in its sovereign or contractual capacity. Such events may include but are not restricted to Acts of God, wars or revolutions, fires, floods, epidemics, quarantine restrictions and fright embargoes etc. Whether a "Force majeure" situation exists or not, shall be decided by ANERT and its decision shall be final and binding on the contractor and all other concerned.

34.3 In the event that the contractor is not able to perform his obligations under this contract on account of force majeure, he will be relieved of his obligations during the force majeure period. In the event that such force majeure extends beyond six months, ANERT has the right to terminate the contract in which case, the security deposit shall be refunded to him.

34.4 If a force majeure situation arises, the contractor shall notify ANERT in writing promptly, not later than 14 days from the date such situation arises. The contractor shall notify ANERT not later than 3 days of cessation of force majeure conditions. After examining the cases, ANERT shall decide and grant suitable additional time for the completion of the work, if required.

35. LANGUAGE

All documents, drawings, instructions, design data, calculations, operation, maintenance and safety manuals, reports, labels and any other data shall be in English Language. The contract agreement and all correspondence between ANERT and the bidder shall be in English language.

36. OTHER CONDITIONS

36.1 The Successful bidder shall not transfer, assign or sublet the work under this contract or any substantial part thereof to any other party without the prior consent of ANERT in writing.

36.2 The Successful bidder shall not display the photographs of the work and not take advantage through publicity of the work without written permission of ANERT and Kerala University of Health Sciences, Thrissur.

36.3 The Successful bidder shall not make any other use of any of the documents or information of this contract, except for the purposes of performing the contract.

36.4 Successors and Assigns:

In case ANERT or Successful bidder may undergo any merger or amalgamation or a scheme of arrangement or similar re-organization & this contract is assigned to any entity (ies) partly or wholly, the contract shall be binding mutatis mutandis upon the successor entities & shall continue to remain valid with respect to obligation of the successor entities.

36.5 Severability:

It is stated that each paragraph, clause, sub-clause, schedule or annexure of this contract shall be deemed severable & in the event of the unenforceability of any

paragraph, clause sub-clause, schedule or the remaining part of the paragraph, clause, sub-clause, schedule annexure & rest of the contract shall continue to be in full force & effect.

36.6 Counterparts

This contract may be executed in one or more counterparts, each of which shall be deemed an original & all of which collectively shall be deemed one of the same instruments.

36.7 Rights and Remedies under the contract only for the parties

This contract is not intended & shall not be construed to confer on any person other than the ANERT & Successful bidder hereto, any rights and / or remedies herein.

BID EVALUATION

37. BID EVALUATION

The evaluation process comprises the following four steps:

Step I - Responsiveness check of Techno Commercial Bid

Step II - Evaluation of Bidder's fulfilment of Eligibility Criteria as per Clause 16

Step III - Evaluation of Price Bid

Step IV - Successful Bidders(s) selection

I. Responsiveness check of Techno Commercial Bid

The Techno Commercial Bid submitted by Bidders shall be scrutinized to establish responsiveness to the requirements laid down in the RFS subject to Clause 16.1 and Clause 16.2. Any of the following may cause the Bid to be considered "non-responsive", at the sole discretion of ANERT:

- a. Bids that are incomplete, i.e. not accompanied by any of the applicable formats inter alia covering letter, power of attorney supported by a board resolution, applicable undertakings, format for disclosure, valid Bid Bond, etc.;
- b. Bid not signed by authorized signatory and /or stamped in the manner indicated in this RFS;
- c. Material inconsistencies in the information /documents submitted by the Bidder, affecting the Eligibility Criteria;
- d. Information not submitted in the formats specified in this RFS;
- e. Bid being conditional in nature;
- f. Bid not received by the Bid Deadline;
- g. Bid having Conflict of Interest;
- h. More than one Member of a Bidding Company using the credentials of the same Parent Company /Affiliate;
- i. Bidder delaying in submission of additional information or clarifications sought by ANERT as applicable;
- j. Bidder makes any misrepresentation.

Each Bid shall be checked for compliance with the submission requirements set forth in this RFS before the evaluation of Bidder's fulfilment of Eligibility Criteria is taken up. Clause 16.2 shall be used to check whether each Bidder meets the stipulated requirement.

37.1 Preliminary Examination

37.1.1 ANERT will examine the Bids to determine whether they are complete, whether any computational errors have been made, whether required sureties have been furnished, whether the documents have been properly signed and stamped and whether the Bids are otherwise in order.

37.1.2 Arithmetical errors will be rectified on the following basis. If there is a discrepancy between the unit price and the total Amount that is obtained by multiplying the unit price and quantity, the unit price shall prevail and the total amount shall be corrected. If there is a discrepancy between words and figures, the amount written in words will prevail.

II. Evaluation of Bidder's fulfilment of eligibility criteria

Evaluation of Bidder's Eligibility will be carried out based on the information furnished by the Bidder as per the prescribed Formats and related documentary evidence in support of meeting the Eligibility Criteria as specified in Clause 16.2. Non-availability of information and related documentary evidence for the satisfaction of Eligibility Criteria may cause the Bid to be non-responsive.

III. Evaluation of Price Bid

The Price Bid of only the Qualified Bidders shall be opened in presence of the representatives of such Qualified Bidders, who wish to be present, on a date as may be intimated by ANERT to the Bidders through ANERT. The evaluation of Price Bid shall be carried out based on the information furnished in the BoQ. The Price Bid submitted by the Bidders shall be scrutinized to ensure conformity with the RFS. Any Bid not meeting any of the requirements of this RFS may cause the Bid to be considered "non-responsive" at the sole decision of the ANERT.

IV. Successful Bidder(s) Selection

- i. Bids qualifying in Clause 16.2 shall only be evaluated in this stage.
- ii. The Price Bids of Qualified Bidders shall be ranked from the lowest to the highest. The lowest bidder will be declared as the successful bidder.
- iii. Letter of Acceptance (LOA): The Letter of Acceptance (LOA) shall be issued to Successful Bidder selected as per the provisions of this Clause 33
- iv. The Successful Bidder shall acknowledge the LoA and return duplicate copy with signature & stamp of the authorized signatory of the Successful Bidder to ANERT within Thirty (30) days of issue of LoA.
- v. If the Successful Bidder, to whom the Letter of Acceptance has been issued does not fulfil any of the conditions specified in Bid document, ANERT reserves the right to annul/cancel the award of the Letter of Acceptance of the Successful Bidder and forfeit the Bid security.
- vi. ANERT at its own discretion, has the right to reject any or all the Bids without assigning any reason whatsoever, at its sole discretion

38. NOTIFICATION TO SUCCESSFUL BIDDERS

The name of Successful Bidder shall be notified indicating the awarded project price individually through letter of acceptance.

39. REQUIREMENT OF APPROVALS ON MAKES OF THE COMPONENTS:

The modules should be manufactured in India only. Rest of the components can be procured from any source. However, these items should meet the Technical specification and standards mentioned in RFS.

40. OPERATION OF THE SYSTEM DURING HOLIDAYS AND CALCULATION OF CUF:

During grid failure, the SPV system stops generating. Any instances of grid failure need to be mentioned in the monthly report and those instances need to be authorised by local DISCOM. Then the period will be excluded in calculation of CUF.

41. PENALTY FOR DELAY IN PROJECT IMPLEMENTATION

- 41.1 The Bidder shall complete the project identification, Design, Engineering, Manufacture, Supply, Storage, Civil work, Erection, Testing & Commissioning of the project within 3 months from the date of issue of WORK ORDER.
- 41.2 If the bidder fails to commission the project capacity within 3 months from date of issue of allocation letter, Penalty on per day basis calculated for the Performance Security on a 6 months' period would be levied.

42. TIME OF COMPLETION OF WORKS

- 42.1 Project completion shall be 3 months from the date of issue of Work order. Failure of non-compliance of same shall lead to forfeiture of PBG.
- 42.2 The period of construction given in Time Schedule includes the time required for mobilisation as well as testing, rectifications if any, retesting and completion in all respects to the entire satisfaction of the ANERT.
- 42.3 A joint programme of execution of the Work will be prepared by the ANERT or its representative nominated for the purpose and Successful bidders based on priority requirement of this project. This programme will take into account the time of completion mentioned in clause 38.1 above and the time allowed for the priority Works by the ANERT.
- 42.4 Monthly/Weekly implementation programme will; be drawn up by the ANERT jointly with the Successful bidder, based on availability of Work fronts. Successful bidder shall scrupulously adhere to these targets /programmes by deploying adequate personnel, tools and tackles and he shall also supply himself all materials of his scope of supply in good time to achieve the targets/programmes. In all matters concerning the extent of targets set out in the weekly and monthly programmes and the degree of achievements, the decision of the ANERT will be final and binding.

43. COMMERCIAL OPERATION DATE

43.1 Document Submission for Issue Commissioning/ Completion Certificate:

The following documents will be deemed to form the completion documents:

- a. Project completion report from successful bidder as per ANERT format
- b. Project completion/satisfaction certificate from ANERT.

43.2 Commercial Operation Date

If the results of system acceptance testing indicate that the System is capable of generating electric energy (at full rated MWp) for 3 continuous days using such instruments and meters as have been installed for such purposes, then the power producer shall send a written notice to Employer to that effect, and the date of successful conducting such tests and injection of power at delivery point shall be the "Commercial Operation Date"

43.3 The energy charges for auxiliary power consumption for lighting, power and for smooth operation of the solar plant shall be paid by the Contractor.



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

Department of Power, Government of Kerala
Thiruvananthapuram, Kerala – 695 033;
www.ANERT.gov.in , projects@ANERT.in

E-TENDER DOCUMENT

*Request for Selection (RFS) of Bidder for the
Implementation of 1 MWp Solar PV System
with Grid connectivity at Kerala University of
Health Sciences, Thrissur, Kerala*

Ref. No.: ANERT-TSR/18/2022-DE(TSR)

VOL – 3: TECHNICAL SPECIFICATIONS

Date of Publishing of Bids : - 16/11/2024

Last Date of Submission of Bids : - 06/12/2024

TECHNICAL SPECIFICATIONS

The proposed projects shall be commissioned as per the technical specifications given below.

44. DEFINITION

A Grid Tied Solar Photo Voltaic (SPV) power plant consists of SPV array, Module Mounting Structure, Power Conditioning Unit (PCU) consisting of Maximum Power Point Tracker (MPPT), Inverter, and Controls & Protections, interconnect cables and switches. PV Array is mounted on a suitable structure. Grid tied SPV system do not have battery backup and should be designed with necessary features to supplement the grid power during day time. Components and parts used in the SPV power plants including the PV modules, metallic structures, cables, junction box, switches, PCUs etc., should conform to the BIS or IEC or international specifications, wherever such specifications are available and applicable.

Solar PV system shall consist of following equipments/components.

- Solar PV modules consisting of required number of **Crystalline** PV modules.
- Grid interactive Power Conditioning Unit with Remote Monitoring System
- Mounting structures
- String Monitoring Units / Junction Boxes.
- Power Transformers and other Substation equipment's
- Power evacuation system
- Earthing and lightening protections.
- IR/UV protected PVC Cables, pipes and accessories
- RTTU / Metering
- SCADA
- Internet facility

The detailed list of certifications and standards to be followed are given in annexure - F

45. SPV MODULES

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

- 45.1 The PV modules must be PID compliant, salt, mist & ammonia resistant and should withstand weather conditions for the project life cycle.
- 45.2 The back sheet of PV modules shall be with minimum of three layers with outer layer (exposure to ambience) and shall be made of PVDF or PVF. The Back sheets for PV Module with 2 layered or 3 layered Polyester types or the back sheets with Polyester (PET type) at Air side material are not permitted for the empanelment; The minimum thickness of the core layers (without adhesive and inner EVA coated) must be 300 microns. The maximum allowed water vapour transmission rate shall be less than 2 g / m²/day and shall have a Partial Discharge > / = 1500V DC
- 45.3 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
- 45.4 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.
- 45.5 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.

- 45.6 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.
- 45.7 Shading correction/ bypass diode for optimizing PV out to be incorporated in each solar module or panel level.
- 45.8 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
- 45.9 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
- 45.10 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.
- 45.11 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.

- 45.12 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.
- 45.13 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
- 45.14 Original Equipment Manufacturers (OEM) Warrantee of the PV Modules shall be submitted by the successful bidder when the materials delivered at site.
- 45.15 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 (NH₃)
- 45.16 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.
- 45.17 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.

46. POWER CONDITIONING UNIT (PCU)

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

General Specifications:

- 46.1 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
- 46.2 The inverter output shall be 415 VAC, 50 Hz, 3 phase.
- 46.3 IS 16169 certificates of Islanding Prevention Measures for Utility – Interconnected Photovoltaic Inverters.
- 46.4 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.
- 46.5 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.
- 46.6 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.

- 46.7 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
- 46.8 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.
- 46.9 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
- 46.10 **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.**
- 46.11 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.
- 46.12 The inverter shall have an integrated feature of emergency stop to halt the inverter from operation considering safety scenarios
- 46.13 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.
- 46.14 **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:**
- 46.14.1 Finding out optimisation of the system**
- 46.14.2 Optimal power distribution on each phase**
- 46.14.3 Prevent PCU from unnecessary disconnections**
- 46.15 The PCU OEM must provide 8 years warranty for the Solar inverter being used

46.16 PCU/inverter shall be capable of complete automatic operation including wake-up, synchronization & shutdown.

46.17 SPV systems shall be provided with adequate rating fuses; fuses on inverter input side (DC) as well as output side (AC) for overload and short circuit protection and disconnecting switches to isolate the DC and AC system for maintenances as needed. Power Conditioners/Inverters should qualify Safety standard IEC 62109-1&2. Inverter shall be protected against earth leakage faults.

46.18 An alarm contact shall be provided for hardware failures, failures of internal and external auxiliary supplies etc. The alarm Signals should be via system fault relay.

46.19 POWER QUALITY REQUIREMENTS: -

46.19.1 DC Injection into the grid: It is proposed to limit DC injection within 1% of the rated current of the inverter as per IEC 61727.

46.19.2 **Harmonics on AC side:** The limits for harmonics shall as follows:

46.19.3 Total Voltage harmonic Distortion as per IEEE-519 2014

46.19.4 Individual Voltage harmonics Distortion as per IEEE-519 2014

46.19.5 Total Current harmonic Distortion as per IEEE-519 2014

46.19.6 Output frequency = 50Hz +/- 0.5Hz

46.20 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 >98%
Casing protection levels	Degree of protection: Min IP-65
Operating ambient Temp range	-10 to + 60 degree Celsius
Operation	Completely automatic including wakeup, synchronization (phase locking) and shut down

Specifications of Inverters	
Parameters	Detailed specification
MPPT	MPPT range must be suitable to individual array voltages
Protection Class	1
Protections	Over voltage: both input and output Over current: both input and output Over / Under grid frequency Over temperature Short circuit Lightning Surge voltage induced at output due to external source Islanding
Ingress Protection	IP 65
Recommended LED indications	ON Grid ON Under/ Over voltage Overload Over temperature
Recommended LCD Display on front Panel	DC input voltage DC current AC Voltage (all 3 phases) AC current (all 3 phases) Frequency Ambient Temperature Instantaneous power Cumulative output energy Cumulative hours of operation Daily DC energy produced
Communication Interface	RS485/ RS232/Wi-Fi (with or without USB)

46.21 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

Sl No	Parameters	Requirements	Reference
3	Equipment	Applicable industry standards	IEC/EN standards
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 isolate itself from the grid	

Sl No	Parameters	Requirements	Reference
9	Flicker	Operation of Photovoltaic system should not cause voltage flicker in excess of the limits stated in IEC 61000 or other equivalent Indian standards if any	Relevant CEA regulations 2013 and subsequent if any, (Technical standards for connectivity of the 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	

Sl No	Parameters	Requirements	Reference
		should restart when normal conditions are restored	

46.22 The Certifications of On-Grid Inverters are summarized below:

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

Standard	Description
IEC 60068-2-30	Environmental testing - Part 2-30: Tests - Test Db:, Damp heat, cyclic (12 h + 12 h cycle)

***Recommended but not mandatory**

47. 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 upper edge of the module must be covered with wind shield so as to avoid build air ingress below the module. Slight clearance must be provided on both edges (upper & lower) to allow air for cooling.
- h. 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 OR Galvalume complying relevant standards.

- i. 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.
- j. The Bolts, Nuts, fasteners, and clamps used for panel mounting shall be of Stainless-Steel SS 304.
- k. 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.
- l. 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
- m. Aluminium structures used shall be protected against rusting either by coating or anodization. Aluminium frames should be avoided for installations in coastal areas.
- n. 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.
- o. Screw fasteners shall use existing mounting holes provided by module manufacturer. No additional holes shall be drilled on module frames
- p. The total load of the structure (when installed with PV modules) on the roof should be less than 60 kg/m².
- q. Minimum distance between the lower level of PV Module and the ground shall be 0.6m from the ground level.
- r. The PV Panel area shall be accessible for cleaning and for any repair work.
- s. 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.
- t. Adequate spacing shall be provided between any two modules secured on PV panel for improved wind resistance.

- u. Installation of structure for solar PV mounting should not tamper with the water proofing of the roofs.

A. Carport Structure

Bidder shall design & install suitable module mounting structure (MMS) for bifacial modules having sufficient strength (safe) & stability. The detailed design must be submitted by the bidder along with their bid for evaluation. **Bids without detailed Engineering drawings and 3D models and 3D model incorporated at the proposed layout will be summarily rejected in the technical evaluation.**

- Car Port with single/ multiple pole aesthetic design will be allowed, whereas the free movement of vehicles must be ensured and at least 2 Nos of 4-wheelers must be comfortably parked in between the poles.
- Pole and other structure members should be hot Dip Galvanized structure and no welding is allowed. The minimum coating thickness of 80 Micron to be ensured.
- All fasteners to be used of SS304.
- Module mounting to be done with Aluminum clamp and short rail system.
- Walkway along with safety lifeline to be provided for maintenance purpose along with drainage arrangement of water and Module Cleaning system to be provided at the carport, **Module to be used minimum of 540Wp.**
- Grade of concrete to be used Minimum M25 and **Minimum ground clearance of Car port should be 12 feet. (May vary by +/- 5%)**
- Car port to be aligned in such a way to absorb maximum sun radiation and simulation report to be submitted.

B. Ground Mounted

Module mounting structure (MMS) may be supported on isolated/ strip footing or pile foundation.

B.1 Bored cast-in situ, Driven precast or under reamed Concrete pile

- i. In case the contractor proposes to provide bored cast-in-situ concrete pile; the type, dia. and length of pile shall be as per recommendations of Geotechnical investigation report corresponding to prevalent soil characteristics at site.

However, the min. dia of the pile shall be 300mm (min. 350 mm for column web depth more than 175 mm) and 1800mm respectively except when very hard strata/ rock ($N > 100$) is encountered at a higher level, the pile shall be extended in to the hard strata minimum 1.5 times the diameter of the pile with total depth of the pile not less than 1200mm below cut-off level. A minimum clear cover of 50 mm shall be available to the steel section or reinforcement in the pile

- ii. As specified above, the MMS support shall project minimum 200mm above FGL (Finished grade level) to avoid any damage to the MMS column/sub support due to direct contact of rain water/ surface run-off. This shall be ensured through either single stage construction of entire pile length including portion above FGL or by two stage construction.
- iii. For proper bonding, the surface of first stage concrete shall be made rough by trowelling and cleaning out laitance and cement slurry by using wire brush on the surface of joint immediately after initial setting of concrete. The prepared surface should be clean watered to get saturated dry condition when fresh concrete is placed against it. The prepared surface shall be applied with a suitable bonding agent before construction of pile cap/ collar as required.
- iv. In case the column post/stub is supported through base plate-anchor bolt assembly, the same shall only be provided through RCC pile cap to be designed as per provisions of relevant BIS standard with min. clear overhang of 75mm. The pile shall embedded min. 50mm in the pile cap and the pile reinforcement shall be extended in to the pile cap for proper anchorage.
- v. In case of collapse of foundation strata during drilling of the pile bore, removable steel liner shall be used to maintain design depth and diameter of the pile for proper concreting.
- vi. The design & installation of piles shall conform to IS: 2911.
- vii. The bore shall be free from water before pouring of pile concrete. For under water concreting tremie shall be used.

B.2 Helical/ Screw Pile

- i. The design, manufacture, testing and installation of Helical/ Screw pile shall conform to ICB-2009 and Practice Note 28- **"Screw Piles: Guidelines for**

Design, Construction & Installation, ISSN 1176-0907 October 2015 (IPENZ Engineers New Zealand)’

- ii. The design of pile shall be undertaken and verified by a suitably qualified geotechnical or structural Chartered Engineer with experience in the design of helical/screw piles.
- iii. The pile shall be designed and manufactured in accordance with accepted engineering practice to resist all stresses induced by installation into the ground and service loads.
- iv. The steel grade for pile shaft, helix plates and other accessories shall be with min. 350 MPa. Min. thickness (BMT) of shaft and helix plate shall be 6 mm and 8 mm respectively in case of coastal installations and soils containing aggressive chemicals and at other project sites it shall be respectively 5 mm and 6 mm. Cap plate and col base plate shall be min. 12 mm thick and of min. grade E-250 conforming to IS:2062.
- v. All materials shall be hot dip galvanized conforming to relevant BIS standard with min. thickness of galvanization 80 microns.
- vi. Wherever the pile shaft is required to be infilled with concrete grout, the same shall be of min. grade M30 (anti shrink).
- vii. The allowable axial design load (Direct compression & Pull out), Pa, of helical piles shall be the least of the following values:
 - a. Sum of the areas of the helical bearing plates times the bearing capacity of the soil or rock comprising the bearing stratum.
 - b. Capacity determined from well-documented correlations with installation torque.
 - c. Load capacity determined from initial load tests.
 - d. Axial capacity of pile shaft.
 - e. Axial capacity of pile shaft couplings.
 - f. Sum of the axial capacity of helical bearing plates affixed to pile.
- viii. The lateral allowable load capacity of the pile shall be calculated using P-Y analysis and shall be verified with field trials. The allowable design lateral load shall be equal to the min. of (i) the total lateral load producing max. lateral

deflection of 5mm and (ii) 50% of the total lateral load at which the lateral displacement increases to 12mm.

- ix. Dimensions of the central shaft and the number, size and thickness of helical bearing plates shall be sufficient to support the design loads.
- x. The Design Report shall include following details.
 - a. Design loads
 - b. Geotechnical Strength Reduction Factors and supporting methodology
 - c. List of design standards
 - d. Design methodology and how specific loads such as seismic, lateral and settlement are addressed
 - e. Founding stratum
 - f. Estimated length
 - g. Connection design and details between pile shaft & pile cap plate and Col base plate
 - h. Pre-production and production load testing to support design including acceptance criteria.
- xi. Helical piles shall be installed to specified embedment depth and torsional resistance criteria as per design. The torque applied during installation shall not exceed the maximum allowable installation torque of the helical pile
- xii. Special inspections shall be performed continuously during installation of helical pile foundations. The information recorded shall include installation equipment used, pile dimensions, tip elevations, final depth, final installation torque and other pertinent installation data as required.
- xiii. The installation of piles shall be done by an agency having adequate experience in helical pile construction.
- xiv. The method statement for pre-production load testing (initial test) and construction of Helical Pile shall be submitted for review and approval. The method statement shall comply following requirements:
 - a. **Helical pile pre-production load testing**

The Piling Contractor shall provide a method statement for the pre-production load testing. The method statement shall be submitted 2 weeks

prior to pile installation for testing and shall contain the following information (as a minimum):

- Programme of the testing, detailing the timing and sequence of each load test including any additional investigations proposed
- The general arrangement of the equipment
- A method for measuring the displacement at the head and toe of each test pile
- Template for the Pile load test report
- Confirming the criteria for determining the acceptability of the compression, tension and lateral load tests
- A contingency plan in the event that a load test is deemed not acceptable
- A procedure for verifying the capacity for each individual pile, this may include correlating the installation torque for each pre-production pile with the load test results
- All pile load tests shall be supervised by suitably experienced personnel, who are competent to operate, monitor and record each test throughout its duration. Each pile load test shall be continuously monitored throughout its duration.

b. Helical Pile Construction

The contractor shall provide a method statement for each piling operation to be undertaken in executing the Works. The method statement shall describe all proposed equipment and detail the construction sequence. The method statement shall be submitted with the tender and shall contain the following information (as a minimum):

- Programme of the works, detailing the timing and sequence of individual portions of the works
- Full details of the installation plant to be used, including manufacturer's information and proof of servicing/recent upkeep and calibration
- Proposed phasing of excavation/filling operations such that the design stresses in the piles (and any supporting frames) are not exceeded

- The contingency plan to be adopted, to minimize disruption and delay, in the event of encountering obstructions
 - Anticipated noise levels (measured in dB) and vibration levels (measured in mm/sec) arising from piling operations (if applicable)
- xv. The Piling Contractor shall nominate a suitably experienced, professionally qualified engineer, as the “Piling Supervisor”.
- xvi. Unless specified else were, the field trials for initial load tests on concrete and helical/ screw pile shall conform to IS: 2911 (Part 4) & Practice Note-28 (IPENZ Engineers New Zealand) as applicable. The no. and location of such tests shall be as per the provisions stipulated under Cl. No. 3.9.3.
- xvii. Contractor shall also carry out routine tests on 0.5 % of the total no. of working/ job piles as per provisions of IS: 2911 (Part 4). In case of unsatisfactory results, min. no. of routine tests may be increased up to 2% of the total no. of working/ job piles per the directions of the Engineer.
- xviii. The Bidder should design the structure height considering highest flood level at the site and the finished grade level. The minimum clearance between the lower edge of the module and the finished grade shall be the higher of
- a. Highest flood level + 100mm and
 - b. 1000 mm, as applicable.
- xix. The length of one unit (Table) of MMS shall not generally be more than 20m.
- xx. The contractor shall submit the detailed design calculations and drawings for MMS structure, bill of materials and their specifications/ standards to the Employer for approval before start of fabrication work

C. Rooftop

C1. The Rooftop Structures maybe classified in three broad categories as follows.

i. Ballast structure

- a. The mounting structure must be Non-invasive ballast type and any sort of penetration of roof to be avoided.
- b. The minimum clearance of the structure from the roof level should be in between 70-150 mm to allow ventilation for cooling, also ease of cleaning and maintenance of panels as well as cleaning of terrace.

- c. The structures should be suitably loaded with reinforced concrete blocks of appropriate weight made out of M25 concrete mixture.

ii. Tin shed

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

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

A. Minimum Ground clearance (300MM – 1000 MM)

- a. The structure shall be designed to allow easy replacement of any module and shall be in line with site requirement. The gap between modules should be minimum 30MM.
- b. Base Plate – Base plate thickness of the Structure should be 5MM for this segment.
- c. Column – Structure Column should be minimum 2MM in Lip section / 3MM in C-Channel section. The minimum section should be 70MM in Web side and 40MM in flange side in Lip section.
- d. Rafter - Structure rafter should be minimum 2MM in Lip section / 3MM in C-Channel section. The minimum section should be 70MM in Web site (y-axis) and 40MM in flange side (x-axis).
- e. Purlin - Structure purlin should be minimum 2MM in Lip section. The minimum section should be 60MM in Web side 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.
- vi. Material standards:
 - a. Design of foundation for mounting the structure should be as per defined standards which clearly states the Load Bearing Capacity & other relevant parameters for foundation design (As per IS 6403 / 456 / 4091 / 875).
 - b. Grade of raw material to be used for mounting the structures so that it complies the defined wind loading conditions (As per IS 875 - III) should be referred as

follows (IS 2062 – for angles and channels, IS 1079 – for sheet, IS 1161 & 1239 for round pipes, IS 4923 for rectangular and square hollow section)

- c. Test reports for the raw material should be as per IS 1852 / 808 / 2062 / 1079 / 811.
- d. In process inspection report as per approved drawing & tolerance should be as per IS 7215.
- e. For ascertaining proper welding of structure part following should be referred:
- f. D.P. Test (Pin Hole / Crack) (IS 822)
- g. Weld wire grade should be of grade (ER 70 S - 6)
- h. For ascertaining hot dip galvanizing of fabricated structure following should be referred:
- i. Min coating required should be as per IS 4759 & EN 1461.
- j. Testing of galvanized material
 - Pierce Test (IS 2633)
 - Mass of Zinc (IS 6745)
 - Adhesion Test (IS 2629)
 - CuSO₄ Test (IS 2633)
 - Superior High-Grade Zinc Ingot should be of 99.999% purity (IS 209) (Preferably Hindustan Zinc Limited or Equivalent).

Foundation Hardware – If using foundation bolt in foundation then it should be as per IS 5624.

48. ARRAY JUNCTION BOXES (JBs)

- a. The junction boxes are to be provided in the PV array for termination of connecting cables. The J. Boxes (JBs) shall be made of GRP/FRP/Powder Coated Aluminum /cast aluminum alloy with full dust, water & vermin proof arrangement. All wires/cables must be terminated through cable lugs. The JB's shall be such that input & output termination can be made through suitable cable glands.
- b. Copper bus bars/terminal blocks housed in the junction box with suitable termination threads Conforming to IP65 standard and IEC 62208 Hinged door with

EPDM rubber gasket to prevent water entry. Single / double compression cable glands, Provision for earthing the box must be provided.

- c. Each Junction Box shall have High quality Suitable Capacity Metal Oxide Varistors (MOVs) / SPDs, suitable Reverse Blocking Diodes. The Junction Boxes shall have suitable arrangement monitoring and disconnection for each of the groups. Each string combiner box/ junction box will have suitable Reverse Blocking Diodes of maximum DC blocking voltage of 600 / 1000V or as per the system requirement with suitable arrangement for its connecting.
- d. Suitable markings shall be provided on the bus bar for easy identification and the cable ferrules must be fitted at the cable termination points for identification
- e. The junction boxes/ enclosures should be IP 65(for outdoor)/ IP 54 (indoor) and as per IEC 529 specifications. The Junction boxes / string combiner boxes shall conform to IEC 60529 (Degrees of Protection provided by Enclosures (IP Code))

49. STRING MONITORING UNIT (SMU)

The control PCB housed in each SMU shall be rugged and proven for reliable performance. Each SMU shall be provided with properly rated Surge Protection Device (SPD). Either precision shunt or Hall sensor can be employed for sensing of string. Maximum of 2 (two) PV strings can be paralleled per channel of SMU for current measurement.

Integrated SCADA shall be provided for the entire plant which includes SMU data and weather station parameters shall be provided. The enclosure shall be Fire Retardant with Self Extinguishing property and free from halogen. It should be UV resistant in accordance with UL 746C suitable for outdoor application. The enclosure rating shall be IP65 or better

50. PCU/ARRAY SIZE RATIO

- a. The combined wattage of all inverters should not be less than 80% of rated capacity of DC power of the plant under STC.
- b. Maximum power point tracker shall be integrated in the PCU/inverter to maximize energy drawn from the array.

51. ELECTRICAL SAFETY AND FIRE PROTECTION

- a. All SPV system should comply with Central Electricity Authority (Measures relating to Safety and Electric Supply) Regulations, 2023 and amendments thereto.
- b. Internal Faults: In built protection for internal faults including excess temperature, commutation failure, overload, and cooling fan failure (if fitted) is obligatory.
- c. Over Voltage Protection: Over Voltage Protection against atmospheric lightning discharge to the PV array is required. Protection is to be provided against voltage fluctuations in the grid itself and internal faults in the power conditioner, operational errors and switching transients.
- d. Earth fault supervision: An integrated earth fault device shall have to be provided to detect eventual earth fault on DC side and shall send message to the supervisory system.
- e. Every combiner box shall be provided with suitable surge protective device with arc extinguishing capability as per the relevant standards to avoid any risk of fire. The input circuits of combiner box shall be provided with over current protection as per the relevant standards.
- f. The output circuits of combiner box shall be provided with isolation protection; Earth Fault protection and insulation monitoring for photovoltaic arrays and inverters shall be provided.
- g. A fire detection system and automatic fire suppression system shall comply with the relevant standards.
- h. Adequate fire-fighting 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/ABC 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 up to 30 kW, and additional fire extinguisher per 15 kW or part thereof to be provided by the successful bidder.
- i. There shall be a manual disconnection switch to isolate the system from grid and shall be situated outside the alternating current combiner box; and protection shall be deployed (for both input and output) on site for overload, surge current, surge

voltage, short circuit, high temperature, over voltage, under voltage and over frequency, under frequency, reverse polarity and lightning.

- j. In case of Ground mounted solar installations shall be protected by fencing not less than 1.8 metre in height so as to prevent unauthorised entry. The chain link fencing provided shall conform to IS-2721.

52. 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.

52.1 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

52.2 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%).

52.3 For the DC cabling, XLPE or XLPO insulated and sheathed, UV stabilized single core flexible copper cables shall be used; multi-core cables shall not be used. The Connectors being used must comply - IS 16781: 2018 | IEC 62852 : 2014 – Connectors for DC Application in Photovoltaic Systems Safety Requirements and Tests.

52.4 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.

52.5 All LT XLPE cables shall conform to IS: 7098 part I&II.

- 52.6** The total voltage drop on the cable segments from the solar PV modules to the solar grid inverter shall not exceed 2.0%
- 52.7** The total voltage drop on the cable segments from the solar grid inverter to the building distribution board shall not exceed 2.0%
- 52.8** The electric cables for DC systems for rated voltage of 1500 V shall conform to BIS 17293:2020
- 52.9** The DC cables from the SPV module array shall run through a UV-stabilized RPVC conduit pipe / HDPE Double Wall Corrugated (DWC) conduits of adequate diameter with a minimum wall thickness of 1.5mm and suitably tagged and marked with proper manner by good quality ferule or by other means so that the cable is easily identified.
- 52.10** Cables and wires used for the interconnection of solar PV modules shall be provided with solar PV connectors (MC4) and couplers.
- 52.11** All cables and conduit pipes shall be clamped to the rooftop, walls and ceilings with thermo-plastic clamps at intervals not exceeding 50cm; the minimum DC cables size shall be 4.0mm² copper; the minimum AC cable size shall be 4.0mm² 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.
- 52.12** Cable Marking: All cable/wires are to be marked in proper manner by good quality ferule or by other means so that the cable can be easily identified. The following colour code shall be used for cable wires
- a. DC positive: red (the outer PVC sheath can be black with a red line marking)
 - b. DC negative: black
 - c. AC single phase: Phase: red; Neutral: black
 - d. AC three phase: phases: red, yellow, blue; neutral: black
 - e. Earth wires: green
- 52.13** Cables and conduits that have to pass through walls or ceilings shall be taken through PVC pipe sleeve.
- 52.14** Cable conductors shall be terminated with tinned copper end ferrules to prevent fraying and breaking of individual wire strands. The termination of the DC and

AC cables at the Solar Grid Inverter shall be done as per instructions of the manufacturer, which in most cases will include the use of special connectors.

52.15 All cables and connectors used for installation of solar field must be of solar grade which can withstand harsh environment conditions including high temperatures, UV radiation, rain, humidity, dirt, salt, burial and attack by moss and microbes for 25 years and voltages as per latest IEC standards. DC cables used from solar modules to array junction box shall solar grade copper (Cu) with XLPO insulation and rated for 1.1 kV as per relevant standards only.

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

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

52.18 The Size of neutral wire shall be equal to the size of phase wires, in a three-phase system.

52.19 The Cable should be so selected that it should be compatible up to the life of the solar PV panels i.e. 25 years.

53. FACTORY TESTING

- a. Solar Modules / 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.

54. SURGE PROTECTION

The system should have installed with Surge Protection Device (SPD) for higher withstand of the continuous PV-DC voltage during earth fault condition. SPD shall have

safe disconnection and short circuit interruption arrangements through integrated DC in-built bypass fuse (parallel) which should get tripped driving failure mode of MOV, extinguishing DC arc safely to protect the installation against fire hazards. The SPD should be provided in the AC Distribution Box as well. Type 2 SPD having maximum Discharge Current (8/20 μ s) of value 40 kA with a minimum response time less than 25ns.

55. 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)

- 55.1** 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. Exothermic / Aluminothermic welding are only allowed for jointing earth electrode.
- 55.2** 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
- 55.3** In any case, the cross-section area or the earthing conductor for PV equipment should not be less than 6 mm² if copper, 10 mm² if aluminium or 70 mm² if hot-dipped galvanized iron. For the earthing of lightning arrestor, cross-section of the earthing conductor should not be less than 16 mm² of copper or 70 mm² if hot-dipped galvanized iron. Copper bonded Earth electrodes of minimum thickness of 250 microns and diameter of 14.2mm and length of 3m must be used in compliance with the National Building Code of India 2016. The complete Earthing system shall be mechanically & electrically connected to provide independent return to earth.

- 55.4** 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. In case FRP based Earth chambers are used, the same must be certified by NABL accredited laboratory for Compression Test/Weight Holding Capacity. Hinged inspection covers of size not less than 300mm X 300mm with locking arrangement shall be provided. Suitable handle shall be provided on the cover by means of welding a rod on top of the cover for future maintenance.
- 55.5** 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.
- 55.6** 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. The use of Earth enhancing compounds of adequate quantity is to be used in case the earth value is high in compliance with IEC 62561-7:2011
- 55.7** There shall be adequate number of interconnected earth pits provided in each location and minimum required gap shall be provided in between earth pits as per relevant standard. The interconnection is to be done using Copper conductors of minimum 25 mm x 3 mm or HDGI conductor of minimum 25mm x 6mm.
- 55.8** Earth resistance shall not be more than 5 ohms. Earthing system must be interconnected through GI strip to arrive equipotential bonding. The size of the HDGI earth strip must be minimum 25mm X 6mm and the coating thickness of minimum 80 microns is to be maintained.
- 55.9** 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.
- 55.10** 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.

55.11 Necessary provisions shall be made for bolted isolating joints of each earthing pit for periodic checking of earth resistance.

55.12 The frame of inverter cabinet shall be connected with the earthing bus bar through the earthing terminals using flexible braided copper wire; all metal casing and shielding of the plant, each array structure of the photovoltaic yard, equipment, inverters and control systems shall be earthed through proper earthing.

55.13 Earthing system shall connect all non-current carrying metal receptacles, electrical boxes, appliance frames, chassis and photovoltaic module mounting structures in one long run and the earth strips shall be interconnected by proper welding and shall not be bolted;

55.14 There shall be adequate number of interconnected earth pits provided in each location and minimum required gap shall be provided in between earth pits as per relevant standard.

55.15 For each earth pit, a necessary test point shall be provided.

55.16 Total no of Earth pits required for solar plants shall be as per the Electrical Inspectorate norms.

56. LIGHTNING PROTECTION FOR PV ARRAY

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

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

- The entire space occupying SPV array shall be suitably protected against lightning by deploying required number of lightning arresters. Lightning protection should be provided as per IS/ IEC 62305.
- Lightning system shall comprise of air terminations, down conductors, test links, earth electrode etc. as per approved drawings.

- The protection against induced high voltages shall be provided by the use of surge protection devices (SPDs) and the earthing terminal of the SPD shall be connected to the earth through the earthing system.
- Separate pipe for running earth wires of Lightning Arrestor shall be used.
- Lightning conductor should be made of 25 mm dia 4000mm long GI spike as per Provision of IS 2309-1969. Necessary concrete foundation to be provided for holding Lightning conductor considering the wind speed. It should be earthed through 25 x 3 GI flat from pit with proper insulation. Height of Lightning conductor from array structure should be min 4 meter.
- 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.

57. 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 panels shall be designed for minimum expected ambient temperature of 45 degree Celsius, 80 percent humidity and dusty weather.
- e. 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.
- f. 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.
- g. 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.

- h. Junction boxes, enclosures, panels for inverters/ Controllers shall meet IP 65 (for indoor) as per IEC 529. The use of PVC enclosures is not permitted.
- i. All combiner boxes shall be provided with suitable surge protective device with arc extinguishing capability as per the relevant standards to avoid any risk of fire.
- j. The inverter output shall have the necessary rated AC surge arrestors, if required and MCB/ MCCB. RCCB shall be used for successful operation of the PV system, if inverter does not have required earth fault/residual current protection.
- k. Disconnection switches or circuit breakers provided in combiner boxes to disconnect the photovoltaic system from all other conductors of the system shall be located at a readily accessible location.

58. 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. Polyamide glands and MC4 Connectors may also be provided. The rating of the junction box shall be suitable with adequate safety factor to interconnect the Solar PV array
- c. DC panel should be equipped with an adequate capacity indoor DC circuit breaker along with control circuit, protection relays, fuses, annunciators and remote operating and controlling facility from the main control facility.
- d. DCDB shall have sheet from enclosure of dust and vermin proof, the busbar/ cables are to be made of copper of desired size. DCDB shall be fabricated to comply with IP 65 protection. The PVC enclosures are not permitted.
- e. All combiner box shall be provided with suitable surge protective device with arc extinguishing capability as per the relevant standards to avoid any risk of fire

59. 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. Armoured cable should be used and overall PVC type 'A' pressure extruded insulation or XLPE insulation should be there for UV protection.
- e. Cables should have Multi Strand, annealed high conductivity copper conductor on DC side and copper/FRLS type Aluminium conductor on AC side. For DC cabling, multi- core cables shall not be used. Size of neutral wire shall be equal to the size of phase wires, in a three-phase system.
- f. Disconnection switches or circuit breakers provided in combiner boxes to disconnect the photovoltaic system from all other conductors of the system shall be located at a readily accessible location.
- g. Clear pathways of minimum seventy five centimetre in width with hand rails for roof access and emergency exit shall be provided for roof top system; There shall be clear pathways, walkways between the rows or columns of solar panels which is necessary for cleaning and maintenance.
- h. All indoor panels will have protection of IP 54 or better, as per site conditions. All outdoor panels will have protection of IP 65 or better, as per site conditions.

60. 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.

- a. Cable installation shall be as per IS 1255.

- b. Only terminal cable joints shall be accepted. No cable joint to join two cable ends shall be accepted. Cable terminations shall be made with connectors complying IEC 62852 / IS 16781.
- c. The connectors shall have degree of protection of IP 68.
- d. Solar cables shall be provided with UV resistant printed ferrules and DC cables shall be provided with punched/ embossed aluminium tags. The marking shall be done with good quality letter and numbers of proper size so that the cables can be identified easily.
- e. Cable terminations shall be made with properly crimped lugs and passed through cable glands at the entry & exit point of the cubicles. Bimetallic lugs shall be used for connecting Cu bus bar and Al cables or vice-versa. Solar cables, wherever exposed to direct sunlight and buried underground, shall be laid through Double Wall Corrugated (DWC) HDPE conduits.
- f. The size of the conduit or pipe shall be selected on the basis of 40% fill criteria.
- g. Solar cables shall be aesthetically tied to Module Mounting Structure using UV resistant cable-ties suitable for outdoor application.
- h. A.C. and D.C. cables shall be kept in separate trenches.
- i. **Cable Sealing System:** Modular multi-diameter cable sealing system consisting of frames, blocks and accessories shall be installed where the underground and over ground cables enter or leave LCR/MCR enclosures/Buildings. The Cable sealing system shall consist of multi-diameter type peel-able blocks of different sizes to suit the various cables. It should be simple, easy and quick to assemble & re-assemble the cable sealing system. Solid blocks shall not be used on frame. Frames & stay-plate material shall be of galvanized steel and for compression, single piece wedge with galvanized steel bolts shall be used. 30% spare blocks on the frame shall be provided for expansion in future. Cable sealing system should have been tested for fire/ water /smoke tightness.

61. INTEGRATION OF PV POWER WITH GRID:

The output power from SPV would be fed to the inverters which converts DC produced by SPV array to AC and feeds it into the main electricity grid after

synchronization. In case of grid failure, or low or high voltage, solar PV system shall be out of synchronization and shall be disconnected from the grid.

62. SCADA / PLANT MONITORING

Integrated SCADA shall be supplied which should be capable of communicating with all inverters and provide information of each PCU. The SCADA shall also provide information of the instantaneous output energy and cumulative energy for each of the inverters. The SCADA system shall perform the following operations, which include the measurement and continuous recording of:

- i. Data Logging Provision for plant control and monitoring, time and date stamped system data logs for analysis with the high quality, suitable PC, Metering and Instrumentation for display of systems parameters and status indication to be provided.
- ii. Solar Irradiance: An integrating Pyranometer / Solar cell-based irradiation sensor (along with calibration certificate) provided with the sensor mounted in the plane of the array and integrated software to readout with data logging system.
- iii. Temperature: Temperature probes for recording the Solar panel temperature and/or ambient temperature to be provided complete with readouts integrated with the data logging system
- iv. The following parameters are accessible via the operating interface display in real time separately for solar power plant:
 - a. AC Voltage.
 - b. AC Output current.
 - c. Output Power
 - d. Power factor.
 - e. DC Input Voltage.
 - f. DC Input Current.
 - g. Time Active.
 - h. Time disabled.
 - i. Time Idle.
 - j. Power produced

- k. Protective function limits (Viz. - AC Over voltage, AC Under voltage, over frequency, under frequency ground fault, PV starting voltage, PV stopping voltage).
- v. All major parameters available on the digital bus and logging facility for energy auditing through the internal microprocessor and read on the digital front panel at any time) and logging facility (the current values, previous values for up to a month and the average values) should be made available for energy auditing through the internal microprocessor and should be read on the digital front panel.
- vi. PV array energy production: Digital Energy Meters to log the actual value of AC/ DC voltage, Current & Energy generated by the PV system provided. Energy meter along with CT/PT should be of 0.5 accuracy class.
- vii. Computerized DC String/Array monitoring and AC output monitoring shall be provided as part of the inverter and/or string/array combiner box or separately.
- viii. String and array DC Voltage, Current and Power, Inverter AC output voltage and current (All 3 phases and lines), AC power (Active, Reactive and Apparent), Power Factor and AC energy (All 3 phases and cumulative) and frequency shall be monitored.
- ix. Computerized AC energy monitoring shall be in addition to the digital AC energy meter.
- x. The data shall be recorded in a common work sheet chronologically date wise. The data file shall be MS Excel compatible. The data shall be represented in both tabular and graphical form.
- xi. All instantaneous data shall be shown on the computer screen.
- xii. Software shall be provided for USB download and analysis of DC and AC parametric data for individual plant.
- xiii. Provision for Internet monitoring and download of data shall be also incorporated.
- xiv. Remote Server and Software for centralized Internet monitoring system shall be also provided for download and analysis of cumulative data of all the plants and the data of the solar radiation and temperature monitoring system.
- xv. Ambient / Solar PV module back surface temperature shall be also monitored on continuous basis.

xvi. Simultaneous monitoring of DC and AC electrical voltage, current, power, energy and other data of the plant for correlation with solar and environment data shall be provided.

SCADA shall store the daily energy produced by the plant, monthly energy and the annual energy. SCADA shall be provided with a reliable power supply and have internal reliable battery backup to record all sorts of data simultaneously round the clock. Further SCADA shall also display the Performance Ratio (PR) of the plant. All the trend and cumulative graphs shall be able to be viewed and stored. Also, all the events including outages and faults shall be logged and stored with time and date stamped. SCADA should also have provision for off line viewing of daily, monthly and annual average of the above parameters. Representation of monitored data shall be displayed in graphics mode or in tabulation form. All instantaneous data can be shown in the computer screen. Provision should be available for remote monitoring through GPRS system.

The SCADA shall have the feature to be integrated with the Network system as well as remotely via the web using either a standard modem or a GSM/ WIFI modem. Compatible software and hardware are to be provided so that data can be transmitted via standard modem. The SCADA system shall conform to IEC 61724 (Photo voltaic system performance monitoring – Guidelines for Measurement) standard.

- **Communication Software:** Graphical user interface software for real time communication and control
- **Data acquisition & logging:** RS232/RS485. MOD Bus/WiFi

Power generation and performance of the solar power plant to be monitored through online system to capture electrical parameters from multiple devices such as meters, Inverters, String Combiner boxes to capture parameters such as AC/DC voltage, power, energy as well as monitoring of Breaker, Performance Ratio (PR) of the plant, daily, monthly, yearly generation summary etc.

The bidder is to ensure the SCADA system supplied is in line with the requirements of the DISCOM – KSEBL and also should have RTU as mandated by the State Load Dispatch Centre.

A. General Requirements

The Contractor shall provide complete SCADA system with all accessories, auxiliaries and associated equipment and cables for the safe, efficient and reliable operation and monitoring of entire solar plant and its auxiliary systems. The Contractor shall provide all the components including, but not limited to, Hardware, Software, Panels, Power Supply, HMI, Laser Printer, Gateway, Networking equipment and associated Cables, firewall etc. needed for the completeness. SCADA System shall have the provision to perform the following features and/or functions:

- i. **Web enabled Operator Dashboards:** Showing key information on Generation, Performance and Current Status of various equipment in Single Line Diagram (SLD) format with capability to monitor PV array Zone level (i.e. SCB/ String Inverter Level) parameters.
- ii. **Real time Data Logging with Integrated Analytics & Reporting:** Logging of all parameters - AC, DC, Weather, System Run Hours, Equipment Status and Alarms as well as derived/ calculated/ integrated values. The SCADA User interface shall be customizable and enable Report Generation and Graphical Analysis.
- iii. Fault and System Diagnostics with time stamped event logging.
- iv. **Support for O&M Activities:** The interface shall allow integration with Module Cleaning System to monitor the water consumption for Module Cleaning
- v. Generate, store and retrieve user configurable Sequence of Event (SOE) Reports.
- vi. Interface with different field equipment in the plant and work seamlessly with field equipment supplied by different companies.
- vii. Transfer of plant data reliably, to a Cloud server on any kind of remote network including low bandwidth and wireless links such as 4G/5G/VSAT (**Note:** Telecom Lease line connection, if required for transferring data from Plant over internet shall be taken by Contractor in the name of EMPLOYER for O&M period). The Control system shall be designed to operate in non-air-conditioned area. However, the Contractor shall provide a Package/ Split AC of suitable capacity decided by heat load requirement in SCADA room at Main Control Room.

B. Architecture

- i. The SCADA System shall be built over Industrial IoT architecture with integrated Analytics, secure web access, enterprise software and Database. The SCADA architecture shall be compliant with principles identified in Article 1 a. of CEA (Cyber Security in Power Sector) Guidelines, 2021.
- ii. Data acquisition shall be distributed across MCR and LCRs while plant level data aggregation shall be done in both local and remote server (as specified by Owner).
- iii. Analog and Digital IO modules shall have integrated processor for distributed IO processing and control.
- iv. Data communication system shall be built over fibre optic cables/ wireless network with high bandwidth TCP/IP communication (Fast Ethernet or 802.11a/b/g/n) across all Inverter and Control Rooms with Internet/Intranet access at Main Control Room. Firewall shall be provided for network security.
- v. Plant SCADA Server shall have Industrial Grade server hardware running SCADA & Monitoring Software with data storage (complete plant data) space for 5 years.
- vi. Plant data for monitoring and control operations should be accessible without dependence on external network.
- vii. A virtual/cloud server running SCADA & Monitoring Software shall be configured in parallel with Plant Server to enable easy access to plant data from outside the plant without having to login to plant server. Effectively, the plant data shall be replicated in both places i.e. between systems at the Plant Server and Remote Server to provide data redundancy for complete plant data.
Note: Configuration of Cloud server and procurement of associated subscription services shall be in the scope of the EPC Contractor.
- viii. Operator Workstation/PC shall be of Industrial Grade for browser-based access to plant data from Plant or remote server. Plant control & SLDC/Utility related operations shall only be initiated through browser-based interface requiring no client software or database to be installed on the Workstation. All critical software and Plant Data shall be installed/stored on local and remote servers only with user access control for protecting the software and data assets from accidental deletion or corruption.

- ix. **Internet/Intranet at Plant:** Public or private network access shall be provided at the plant through any broadband/VSAT connectivity of 2Mbps or higher bandwidth. In case no broadband/VSAT connectivity can be provided at the plant, a 4G/5G data card from any Internet Service Provider (ISP) may be provided. SCADA system shall be capable of sending all plant data in real time to the Remote Server.
- x. **GPS based Time Synchronization System:** The SCADA system shall have a Master/Slave Clock system along with antenna, receiver, cabinet and internal interconnection cables. All SCADA controllers, servers, OWS and communicating equipment shall be synchronized to the GPS clock.

C. Industrial IoT Controllers & Data Acquisition

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

- i. The I-IoT Controllers shall be distributed in nature.
- ii. Shall be capable of supporting wide range of field protocols to communicate with different field equipment (Modbus over RS485/Ethernet, etc.)
- iii. Shall have local storage for a minimum of 2 weeks (in case of network failure).
- iv. Provide web-based interface to configure the controller for various equipment in the field.
- v. **IO Functionality:** Shall support status monitoring of VCBs & Trip relays on GIS/HT & Transformer panels through distributed DI/AI modules.
- vi. Controls: Shall be capable of Controlling breakers (ON/OFF). Both ON/OFF and Parameter control of inverters shall be supported.
- vii. Data Communication with Servers: Shall send the data collected, from all the equipment at Inverter Control Room and/or Main Control Room, to the Monitoring & Control Server.
- viii. Controllers shall be capable of sending data over Internet connections USB data cards.

D. Functionalities

- i. The SCADA system shall enable PV array Zone monitoring i.e. the total current from each String Combiner Box shall be monitored on the DC side.
- ii. The SCADA system shall monitor instantaneous and cumulative electrical parameters from all DC& AC Equipment including inverters, string combiner boxes, weather station, MFM, Transformer and Switchgear (LT & HT Panels) at regular intervals not greater than one minute.
- iii. The SCADA system shall monitor Instantaneous and cumulative environment parameters from weather sensors or data loggers at same interval as electrical parameters and provide PR, CUF on the fly. The SCADA shall also monitor water quality and flow parameters.
- iv. The SCADA system shall provide Alarms and Alerts on equipment faults and failure in less than 5 seconds. Alarms on status change of hardwired DI shall also be provided.
- v. The SCADA system shall provide configurable alerts on any parameter crossing settable thresholds. The list of such parameters shall be finalised in consultation with the Owner.
- vi. The SCADA system shall have user-friendly browser-based User Interface for secure access from anywhere, for minimum ten concurrent connections from the Operator PC or other securely connected laptop/mobile, for plant monitoring, O&M, daily reporting, and analysis.
- vii. A dashboard providing summary details of total plant generation, day's export, irradiance, Inverter Control Room level generation and performance indicators like PR and CUF.
- viii. Reporting: The SCADA system shall provide downloadable reports in Excel/PDF, configurable for equipment parameters across the plant.
- ix. Mobile User Interface: summary of plant performance and issues should be accessible in a mobile Native UI or browser UI.
- x. Data Communication to SLDC: SCADA system shall provide required interface to integrate with State-SLDC, in compliance with grid code, to send any parameters specified by SLDC.

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

- xi. Power Plant Control: SCADA system shall provide required interface to the local SCADA operator to set various power control modes (active/reactive power/frequency/PF) through the inverters over industry standard communication protocols like Modbus over TCP/IP.
- xii. All programming functionalities shall be password protected to avoid unauthorized modification.
- xiii. The Contractor shall provide software locks and passwords to EMPLOYER for all operating & application software. Also, the Contractor shall provide sufficient documentation and program listing so that it is possible for the EMPLOYER to carry out modification at a later date.

E. Earthing

Two isolated electronic earth pits near to SCADA panel at every Inverter and Control Room with < 1 Ohm resistance shall be provided. One earth pit shall be used for protective/body earth and the other to be used for Signal Earth. Apart from providing separate earth pits, manufacturer specified earthing recommendations shall be followed for all communicating equipment connected to SCADA. This includes but is not limited to Inverters, WMS and Switchgear panels.

F. Communication Cable Laying

All RS485, IO and CAT6 cables shall be laid in separate conduits with a minimum separation of 1.5ft from AC/DC power cables all along. Power cables shall be laid deep in the trenches first. Data cables shall be laid in separate conduits after partially filling the trenches to ensure minimum 1.5 ft separation between power and communication cables all along the trench.

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

separate cable trays, with a minimum of 1.5ft separation from trays carrying AC Power cables.

G. Control Cabinets / Panels / Desks at Main Control Room

The cabinets shall be IP 22 protection class. The Contractor shall ensure that the temperature rise is well within the safe limits for system components even under the worst condition and specification requirements for remote I/O cabinets. The cabinets shall be totally enclosed, free standing type and shall be constructed with minimum 2 mm thick steel plate frame and 1.6 mm thick CRCA steel sheet or as per supplier's standard practice for similar applications.

H. Software Licences

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

I. Hardware at Main Control Room

The Hardware as specified shall be based on latest state of the art Workstations and Servers and technology suitable for industrial application & power plant environment. All network components of LAN and Workstations shall be compatible to the LAN, without degrading its performance.

J. Factory Acceptance Test (FAT)

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

63. TRANSFORMER & HT PANEL BOARD:

63.1 Inverter Transformer

- a. Unitized Sub Station with Dry type 1,500 kVA, 11 kV/415V, 50 Hz Step up along with all protections, switchgears, Vacuum circuit breakers, cables etc. along with required civil work. All the SS components shall be KSEBL approved makes only.

- b. Transformers having 11 kV at HV side with breaker on LT and HT side shall be used for stepping up the voltage to 11 kV for the Solar Power Plant.
- c. Transformers shall be of reputed make and should have relevant IS or international certifications. Transformers shall have all relevant monitoring and protection devices as per the relevant Indian Standards.
- d. Rating of each transformer shall be standard type. The transformer manufacturer shall provide test certificates carried out on the transformers as per relevant IS standards.
- e. LV windings voltage is decided based on the inverter output voltage. The rating of transformer (kVA) is decided based on combined rating of Inverters.
- f. The high voltage power from the transformers is routed through 11kV HT cable and to be connected in the 11 kV bay in the KUHS substation
- g. The Transformer shall conform to IS: 2026 & IS:
- h. The bidirectional electronic energy meter (0.2 S class) shall be installed for the measurement of Import/Export of energy.
- i. The bidder must take approval/NOC from the Electrical Inspectorate and from the Concerned DISCOM for the connectivity, technical feasibility, and synchronization of SPV plant with distribution network and submit the same to ANERT before commissioning of SPV plant.

K. Standards and Codes

Standard	Description
IS:2026, IEC:60076	Specification of Power Transformers
IS 11171	Dry-Type Power Transformers
IS:2099, IEC:60137	Bushings for alternate voltage above 1000 V
IS: 335, IEC 60296	Insulating oil
IS: 3639	Fittings and Accessories for Power Transformers

CEA Regulations and other statutory regulations with any latest amendments
CBIP publication no. 295
Additional for Auxiliary Transformers: MoP Notification on Energy Consumption Standards for Star Labelled Distribution Transformer dated 12 th January, 2009 and subsequent amendments BEE (Particulars and Manner of their Display on Labels of Distribution Transformers) Regulations, 2009 and subsequent amendments

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

L. 5.2 Technical Requirements

Parameters	Inverter Transformer	Auxiliary Transformer
Type	Oil-Type / Dry Type	Oil Type/Dry-type
VA Rating	1.5 MVA (1 nos.)	As per system design
Voltage Ratio	11 kV/ Inverter output voltage	As per system design
Duty, Service & Application	Continuous Solar Inverter application and converter Duty (Outdoor)	Continuous application (Outdoor/Indoor)
Winding	2	2
Frequency	50 Hz	50Hz
Nos. of Phase	3	3
Vector Group & Neutral earthing	As per system/inverter manufacturer requirement	DYN 11
Cooling	ONAN	ONAN/ AN
Tap Changer	OCTC, No. of steps shall be as per system requirement	OCTC, No. of steps shall be as per system requirement
Impedance at 75°C	As per Inverter Manufacturer requirement	As per system requirement
Permissible Temperature rise over an ambient of 50°C (irrespective of tap)		
Top Oil	As per IS/IEC	As per applicable IS/IEC
Winding	As per IS/IEC	As per applicable IS/IEC

Parameters	Inverter Transformer	Auxiliary Transformer
SC withstand time (thermal)	2 second	2 second
Short Circuit Apparent Power	As per system requirement	As per system requirement
Termination	As per system requirement	As per system design
Bushing rating, Insulation class (Winding & bushing)	HV side - 24 kV porcelain LV side - 1.1 kV epoxy	As per system requirement
Noise level	As per NEMA TR-1	
Loading Capability	Continuous operation at rated MVA on any tap with voltage variation of +/-3%, also transformer shall be capable of being loaded in accordance with IEC 60076-7	
Flux density	Not to exceed 1.9 Wb/sq.m. at any tap position with combined frequency and voltage variation from rated V/f ratio by 10% corresponding to the tap. Transformer shall also withstand following over fluxing conditions due to combined voltage and frequency fluctuations: a) 110% for continuous rating b) 125% for at least one minute c) 140% for at least five seconds. Bidder shall furnish over fluxing characteristic up to 150%	
Air Clearance	As per IS/IEC	

M. Construction

- i. It is the responsibility of the Contractor to ensure that the inverter transformer comply with all the requirements of inverter provided by the inverter manufacturer.
- ii. Inverter Transformer shall be designed for at least 5% total harmonic distortion (THD) to withstand distortion generated by the inverter as well as possible outside harmonics from the network.
- iii. The transformer shall be suitable for continuous operation with a frequency variation of $\pm 2.5\%$ from nominal frequency of 50 Hz without exceeding the specified temperature rise.
- iv. Inverter Transformer shall have shield winding between LV & HV windings.

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

- v. Neutral bushing of Inverter duty transformer shall be brought outside the tank for the testing purpose. It shall be covered with MS sheet and a sticker "For testing purpose only. Do not earth". Neutral bushing of auxiliary transformer shall be brought outside the tank and earthed.
- vi. For Dry-type Auxiliary Transformer: Transformer shall be cast resin encapsulated, and made of cold rolled grain-oriented silicon steel laminations of M4 grade or better. Winding conductor shall be electrolytic grade Copper/Aluminium and insulation shall be Class F or better.
- vii. The transformer shall be housed in a metal protective housing having minimum degree of protection of IP 55 (Outdoor). Enclosure shall be of a tested quality sheet steel of minimum thickness 2 mm and shall also accommodate cable terminations. The housing door shall be interlocked such that it should be possible to open the door only when transformer is off. The enclosure shall be provided with lifting lugs and other hardware for floor mounting. Suitable bi-directional skids with pre-drilled holes shall be provided integral with the enclosure or bi-directional rollers shall be provided with suitable locking arrangement.
- viii. Neutral earthing shall be done as per system requirement. In case neutral is earthed, it shall be brought outside the cable box through bushing for connection to earth grid

N. Testing and Inspection

i. Type Tests and Special Tests

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

a. Type Tests

- Lightning impulse (Full & Chopped Wave) test on windings as per IEC 60076-3 (Oil-type)/ IS 1180-1 or IS 11171 / IEC 60076-11 (Dry-type)
- Temperature Rise test at a tap corresponding to maximum losses as per IEC 60076-2 (Oil-type)/ IS 1180-1 or IS 11171 / IEC 60076-11 (Dry-type)

b. Special Tests

- (i) Measurement of zero-sequence impedance as per IEC 60076-1
- (ii) Measurement of harmonics of no-load current as per IEC 60076-1
- (iii) Measurement of acoustic noise level as per NEMA TR-1
- (iv) Short-circuit withstand test as per IEC 60076-5

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

c. Routine Tests

For completed Dry-type Auxiliary transformers, Routine tests as per the latest edition of IS 1180-1 or IS 11171 / IEC 60076-11 shall be conducted.

O. Tests at Site

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

- (i) Measurement of voltage ratio
- (ii) Check of vector group
- (iii) Magnetic balance test
- (iv) Measurement of insulation resistance

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

63.2 HT Switchgear

A. Standards and Codes

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

shall comply with the following standards and codes.

Standard/Code	Description
IS/IEC 62271-1	High Voltage Switchgear and Control gear - Part 1: Common Specifications
IS/IEC 62271-100	High Voltage Switchgear and Control gear - Part 100: AC Circuit Breakers
IS/IEC 62271-102	High Voltage Switchgear and Control gear - Part 102: AC Disconnectors and Earthing Switches
IS/IEC 62271-200	High Voltage Switchgear and Control gear - Part 200: AC Metal Enclosed Switchgear and Control gear for Rated Voltages Above 1 kV and Up to and Including 52 kV
IEC 62271-206	High-voltage Switchgear and Control gear - Part 206: Voltage presence indicating systems for rated voltages above 1 kV and up to and including 52 kV
IEC 61869	Instrument Transformers
IS 3231	Electrical relays for power systems protection
IEC 60255	Measuring relays and protection equipment
IEC 61850	Communication networks and systems for power utility automation
IEC 61131-3	Programmable controllers - Part 3: Programming languages
IS 9385	High voltage fuses
IS 9431	Indoor post insulators of organic material for systems with nominal voltages greater than 1000 V up to and including 300 kV
IEC 60099-4	Surge arresters - Part 4: Metal-oxide surge arresters without gaps for A.C. systems
IS 3070-3	Lightning Arresters for Alternating Current Systems - Part 3 : Metal Oxide Lightning Arresters Without Gaps
IEC 62052-11	Electricity metering equipment (A.C.) - General requirements, tests and test conditions - Part 11: Metering equipment
IEC 62053	Electricity metering equipment (A.C.) - Particular requirements
IS 14697	AC Static Transformer Operated Watthour and Var-hour Meters, Class 0.2S and 0.5S

B. Technical Parameters

Parameter	Specification
System Parameters	
Highest system voltage	24 kV
Rated system voltage	22 kV
Rated frequency	50 Hz

Number of phases	3
Power frequency withstand voltage	50 kV (r.m.s.)
Lightning impulse withstand voltage	125 kV (peak)
System fault current	As per system requirement
Internal Arc Classification	IAC-A, FLR, System fault current for 1s
Circuit Breaker	
Type	Vacuum type
Operating duty cycle	O - 0.3sec - CO - 3min - CO
Short circuit breaking current	As per system requirement
Re-strike performance class	C2
Mechanical endurance class	M1
Current Transformer	
Accuracy class	0.2 for metering (0.2s for metering at outgoing feeder) 5P20 for protection
Rated VA burden	As per requirement
Insulation class	Class E or better
Voltage Transformer	
Accuracy class	0.2 for metering 3P for protection
Rated VA burden	As per requirement
Insulation class	Class E or better

C. Switchgear Panel

- i. The switchgear panel shall be free standing, floor mounted, single front, single tier fully compartmentalized, metal enclosed construction. Each panel shall have separate compartments for circuit breaker, bus bars, cable termination and auxiliary circuit.
- ii. The circuit breakers shall be mounted on horizontally withdrawable trucks with locking facility in SERVICE and TEST positions.
- iii. The panel enclosure shall be constructed with CRCA steel/Aluzinc sheet. The thickness of load bearing members shall be minimum 3 mm and that of non-load bearing members shall be minimum 2 mm.
- iv. All surfaces shall be painted with two coats of epoxy-based paint of colour shade RAL 7032. The minimum dry film thickness (DFT) shall be 100 micron.

- v. The circuit breaker and auxiliary circuit compartments provided on the front side shall have separate concealed hinged doors. Cable and bus bar compartments provided on the rear side shall have separate bolted covers. All doors and covers shall be provided with neoprene/synthetic rubber gaskets to prevent entry of vermin and dust.
- vi. Pressure relief device shall be provided in each high voltage compartment of a panel to safely vent the gases in the event of internal arc. Seal-off bushing arrangement shall be provided between the breaker compartment and bus bar/cable compartments to prevent transfer of arc from one compartment to other.
- vii. Automatic safety shutters shall be provided to cover up the fixed high voltage contacts on bus bar and cable sides when the truck is moved to TEST position.
- viii. Degree of protection shall not be less than IP 5X for auxiliary circuit compartment. However, for remaining compartments it shall not be less than IP 4X. For outdoor panels, degree of protection shall not be less than IP 55.
- ix. Mechanical /Electrical interlocks shall be provided to prevent mal-operation and in particular to ensure the following.
 - a. The breaker shall be operated only if it is in SERVICE or TEST position.
 - b. Movement of the breaker truck between SERVICE and TEST positions shall be possible only if the breaker is OFF.
 - c. It shall be possible to open the door only when the breaker is in TEST position.
- x. Panel shall be provided with local bus-bar protection.
- xi. Each switchgear panel shall be provided with thermostatically controlled space heaters, separately for breaker, cable and bus bar compartments, to prevent condensation within the compartment. The space heater shall be connected to 240 V, 50 Hz, single phase AC supply through suitable switch and fuse.
- xii. 240 V, 5 A, SPN industrial socket-outlet with ON/OFF switch shall be provided in each panel.
- xiii. Each panel shall be provided with LED lamp rated for 240 V, 50 Hz, single phase AC supply for interior illumination controlled by door switch.
- xiv. Gapless, metal-oxide surge arrestors shall be provided between line and earth

in cable compartment of the switchgear panel.

- xv. Suitable lifting hooks shall be provided for each panel.

C.1 Circuit Breakers

- i. Circuit breakers shall be of vacuum type. It shall comprise of three separate identical single pole units operated through the common shaft and shall be fully interchangeable both electrically and mechanically.
- ii. The circuit breaker operating mechanism shall be based on motor operated spring charging and it shall be re-strike free, trip free both electrically and mechanically, with anti-pumping feature.
- iii. The rated control voltage of the spring charging motor shall be 110 VDC/220 VDC. Closing coil shall operate at all values of voltages between 85% and 110% of rated voltage. Opening coil shall operate correctly under all operating conditions of the circuit breaker up to the rated breaking capacity and at all values of supply voltage between 70% and 110% of rated voltage.
- iv. The spring charging motor shall have adequate thermal rating such that continuous sequence of the closing and opening operations is possible as long as power supply is available to the motor. It shall also be possible to charge the spring manually and close the breaker in the event of failure of motor / control supply to motor. Operating handle shall be provided for charging the operating mechanism. After failure of control supply to the motor, one open-close-open operation shall be possible with the energy contained in the operating mechanism.
- v. The motor rating shall be such that it requires not more than 30 seconds for full charging of the closing spring. Closing action of the circuit breaker shall compress the opening spring ready for tripping. When closing springs are discharged after closing the breaker, they shall be automatically charged for the next operation.
- vi. Mechanical indicators shall be provided to indicate OPEN/CLOSED positions of the circuit breaker and CHARGED/ DISCHARGED positions of the closing spring. An operation counter shall also be provided. These indicators and counter shall be visible from the panel front door without opening it.

C.2 Relays

- i. All relays shall be microprocessor based numerical type. However, auxiliary relays can be static or electromechanical type. The relays shall be flush mounted on panel front with connections from the inside
- ii. The relays shall be capable of operating continuously between 80 - 120% of auxiliary voltage.
- iii. All numerical relays shall have adequate number of freely configurable, optically isolated, Binary Inputs (BI) and potential free Binary Outputs (BO).
- iv. All numerical relays shall have minimum four no. of current inputs, three for phase current and one for earth current, suitable for CT secondary current of 1A. The current inputs shall be compatible with both residual connected CT and Core Balance CT (CBCT). In addition, numerical relay in main outgoing feeder shall have three no. of voltage inputs for Under Voltage/Over Voltage protection.
- v. All I/O's shall have galvanic isolation. Analog inputs shall be protected against switching surges and harmonics.
- vi. Making, breaking and continuous capacity of the relay contacts shall be adequate enough for the circuits in which they are used.
- vii. The numerical relay shall have the following protection functions with at least two independent protection setting groups. The protection functions shall be selectable from any of the IEC characteristic curves.
 - a. Definite time (DT) phase over current protection
 - b. Inverse Definite Minimum Time (IDMT) phase over current protection
 - c. Definite time (DT) earth fault current protection
 - d. Inverse Definite Minimum Time (IDMT) earth fault current protection
 - e. Under Voltage protection
 - f. Over Voltage protection
- viii. Each feeder shall have two lock out relays powered through two independent DC supplies. Each lock out relay shall send through two separate potential free output contacts signals to each of the two independent trip coils.
- ix. Transformer feeder protection relay shall have provision for the following

protection functions, as applicable (depending on Type of Transformer).

- a. Buchholz alarm & trip
 - b. Temperature Indicator (OTI) alarm & trip
 - c. Winding Temperature Indicator (WTI) alarm & trip
 - d. Pressure Relief Valve (PRV) trip
- x. All numerical relays shall have provision for measurement and storage of electrical parameters such as voltage, current, frequency, active power, reactive power etc.
 - xi. The numerical relay shall be able to record faults and events in non-volatile memory.
 - a. Fault record - At least 5 recent faults including the protection function operated, operating phase(s), voltages and currents along with date and time stamp.
 - b. Event record - with date and time stamp.
 - xii. The numerical relay shall have trip circuit supervision facility to monitor the circuit breaker trip circuit both in pre-trip and post-trip conditions. The relay shall also be able to provide circuit breaker monitoring, CT and VT supervision.
 - xiii. The numerical relay shall have self-diagnostic feature with separate output contact for indication of any internal relay failure.
 - xiv. The numerical relays and meters at 11kV and above voltage level shall be IEC 61850 compliant for communicating with the SCADA system.
 - xv. The numerical relay shall have feature for time synchronization through the SCADA System / networking.
 - xvi. The numerical relay shall be provided with backlit alphanumeric LCD to access protection settings, measurement parameters, fault and event records. Read and write access to protection settings shall be password protected.

63.3 Instrument Transformers

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

- ii. Polarity marks shall indelibly be marked on each instrument transformer and at the lead terminals at the associated terminal block.
- iii. Voltage transformers shall be single phase units. Bus voltage transformers shall be housed in a separate panel on withdrawable truck.
- iv. HRC fuses of suitable rating shall be provided on primary side of voltage transformers. For secondary side, four pole Miniature Circuit Breakers (MCB) shall be provided.

63.4 Earthing

- i. An earth bus made of copper shall be provided throughout the length of the panel. It shall be bolted to the framework of each panel and brazed to each breaker earthing contact bar.
- ii. The earth bus shall have sufficient cross section to carry maximum fault current without exceeding the allowable temperature rise.
- iii. All non-current carrying conductors of the panel shall be connected to the earth bus. All joints to the earth bus shall be made through at least two bolts. Hinged doors shall be earthed through flexible earthing braid of adequate cross section. Suitable provision shall be provided at each end of the earth bus for connection with Owner's Earth conductor.
- iv. Positive earthing of the breaker truck and frame shall be maintained when it is in the connected position and in all other positions whilst the auxiliary circuits are not totally disconnected.
- v. All metallic cases of relays, instruments and other panel mounted equipment shall be connected to earth bus by independent copper wires of size not less than 2.5 sq. mm with green colour insulation.
- vi. Instrument transformer secondary neutral point shall be earthed at one place only on the terminal block. Such earthing shall be made through links so that earthing of one circuit may be removed without disturbing the earthing of other circuits.
- vii. Separate earthing trucks shall be provided for earthing of busbars and incoming/outgoing feeders. The trucks shall have voltage transformer to indicate presence of voltage prior to earthing. An audible alarm shall also be

provided in case of voltage on the earthing terminal. Integral earth switches may also be considered instead of earthing trucks. The earthing truck/switch shall have short circuit withstand capability equal to that of the associated switchgear panel.

- viii. The interlocks shall be provided to ensure the following.
 - a. It is not possible to rack-in the earthing truck/close the earthing switch when the breaker truck is in SERVICE position.
 - b. It is not possible to rack-in the breaker truck into SERVICE position when earthing truck is connected/earthing switch is in closed position.

63.5 Bus bar

- i. Bus bar shall be made of copper or aluminium with uniform cross section throughout their length. They shall be adequately supported on insulators to withstand electrical and mechanical stresses due to specified short circuit current.
- ii. All bus bars joints shall be thoroughly cleaned and anti-oxide grease shall be applied. Plain and spring washers shall be provided to ensure good contacts at the joints and taps. Wherever aluminium to copper connections are required, suitable bimetallic connectors or clamps shall be used.
- iii. Bus bars shall be provided with heat shrinkable sleeves of suitable insulation class throughout their length with proper colour coding. All bus bar joints and taps shall be shrouded.
- iv. Bus bar support insulators shall be made of non-hygroscopic, arc and track resistant, high strength material suitable to withstand stresses due to over voltage and short circuit current.
- v. The Contractor shall submit busbar sizing calculation for specified continuous and short time current ratings during detailed engineering.

63.6 Measuring Instruments

- i. All the measuring instruments shall be digital, flush mounting type with communication facility. Meters at 11 kV and above voltage level shall be IEC

- 61850 compliant for communicating with the SCADA system.
- ii. All feeders except main outgoing feeder shall be provided with digital Multi-Function Meter (MFM). Tri Vector Meter (TVM) shall be provided for the main outgoing feeder (in the HT Panel). Accuracy class of MFM shall be 0.2 and that of TVM shall be 0.2S.
 - iii. Measuring instruments shall have provision to display the following parameters.
 - a. Line and phase voltages
 - b. Line and phase currents
 - c. Active power, Reactive power, Apparent power
 - d. Frequency
 - e. Power factor
 - f. Total Harmonic Distortion (THD)

63.7 Wiring and Terminal blocks

- i. All internal wiring shall be done with 650 V grade, 1.5 sq.mm. PVC insulated stranded flexible copper wire. For CT secondary circuits, 2.5 sq.mm copper wire shall be used.
- ii. Wire terminations shall be made with solderless crimping type tinned copper lugs, which shall firmly grip the conductor. Insulation sleeves shall be provided at all the wire terminations.
- iii. Printed identification ferrules, marked to correspond with panel wiring diagram shall be provided at both ends of each wire. The ferrules shall be firmly located on each wire so that they cannot move or turn freely on the wire. Wire identification shall be done in accordance with IS 11353.
- iv. The Contractor shall be solely responsible for the completeness and correctness of the internal wiring and for the proper functioning of the connected equipment.
- v. All internal wiring to be connected to the external equipment shall terminate on terminal blocks. Terminal blocks shall be rated for 650 V, 10 A and made of non-inflammable material.
- vi. CT and VT secondary circuits shall be terminated on stud type, disconnecting terminal blocks.

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

63.8 Testing and Inspection

A. Type Tests

The switchgear panel shall be of type tested design. The following type test reports shall be submitted during detailed engineering. The tests should have been conducted on the similar equipment by NABL accredited laboratory. Validity period of type tests conducted on the equipment shall be as per 'CEA Guidelines for the Validity Period of Type Test(s) conducted on Major Electrical Equipment in Power Transmission'.

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

requirements		
Product safety requirements	IEC 60255-27	
Common requirements	IEC 60255-1	
Functional requirements	Relevant parts of IEC 60255-100 series	
Communication requirements	IEC 61850	
Current Transformers		
Temperature-rise test	IEC 61869-2	7.2.2
Impulse voltage withstand test on primary terminals	IEC 61869-2	7.2.3
Tests for accuracy	IEC 61869-2	7.2.6
Short-time current tests	IEC 61869-2	7.2.201
Voltage Transformer		
Temperature-rise test	IEC 61869-3	7.2.2
Impulse voltage withstand test on primary terminals	IEC 61869-3	7.2.3
Test for accuracy	IEC 61869-3	7.2.6
Short-circuit withstand capability test	IEC 61869-3	7.2.301

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

63.9 LT Switchgear

The LT switchgear specifications mentioned in this section are applicable for auxiliary supply distribution panel, AC combiner box and LT switchgear panels in case of string inverter configuration.

A. Standards and Codes

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

Standard/Code	Description
IS/IEC 61439-1	Low-voltage switchgear and control gear assemblies - Part 1: General rules
IS/IEC 61439-2	Low-voltage switchgear and control gear assemblies - Part 2: Power switchgear and control gear assemblies

IEC 60947-1	Low-voltage switchgear and control gear - Part 1: General rules
IEC 60947-2	Low-Voltage Switchgear and Control gear: Circuit Breakers
IEC 60947-3	Low voltage switchgear and control gear: Part 3 Switches, disconnectors, switch-disconnectors and fuse combination units
IEC 60947-4-1	Low-voltage switchgear and control gear - Part 4-1: Contactors and motor-starters - Electromechanical contactors and motor-starters
IEC 60947-5-1	Low-voltage switchgear and control gear - Part 5-1: Control circuit devices and switching elements - Electromechanical control circuit devices
IEC 62052-11	Electricity metering equipment (a.c.) - General requirements, tests and test conditions - Part 11: Metering equipment
IS 694	Polyvinyl chloride insulated unsheathed-and sheathed cables/cords with rigid and flexible conductor for rated voltages - up to and including 450/750V
IEC 61869	Instrument Transformers
IS 3043	Code of practice for earthing
IEC 60255	Measuring relays and protection equipment - Part 1: Common requirements

B. Technical Specifications

System Details	
Rated system voltage	415 V \pm 10%, 3 Phase, 4 wire, Neutral Solidly Earthed
Rated frequency	50 Hz \pm 5%
System fault current	As per system requirement
Air Circuit Breaker (ACB)	
Type	Air break
Rated Current	As per system requirement
Rated Ultimate Short-Circuit Breaking Capacity & Rated Service Short-Circuit Breaking Capacity	As per system fault current
Rated short-time withstand current duration	1s
Moulded case circuit breaker (MCCB)	
Rated Voltage	415 V

Release	Thermal-Magnetic/Microprocessor
Rated current	As per system requirement
Poles	4 poles
Rated insulation level	690 V
Rated Ultimate Short-Circuit Breaking Capacity & Rated Service Short-Circuit Breaking Capacity	As per system fault current
Rated Short-Circuit Making Capacity	2.1 X Short circuit breaking Capacity
Rated short-time withstand current duration	1s
Utilization category	A
Current transformer (CT)	
Type	Cast Resin Bar Primary
Voltage class and frequency	650 V, 50 Hz
CT Secondary Current	1 A
Class of insulation	Class F
Accuracy class & burden	
a) For Protection	5P20, 5 VA PS Class for REF and core balance CT (CBCT)
b) For Metering	Class 0.5, 5 VA (min)
Minimum primary earth fault current to be detected by CBCT	1 A
Instrument Security Factor for metering CT	5
Voltage Transformer (VT)	
Type	Cast Resin
Accuracy Class	0.5
Rated Voltage Factor	1.1 Continuous, 1.5 for 30 seconds
Class of Insulation	E or better
Digital Multifunctional Meter (MFM)	
Accuracy class	0.5 class

C. Constructional Details

The panel shall be metal enclosed, free standing, floor mounted, modular type with compartmentalized construction having degree of protection of IP 2X (Indoor) and IP 54 (Outdoor) as per IS/IEC 60529. All doors and covers shall be provided with neoprene gaskets to prevent entry of vermin and dust.

- i. All switches, push buttons etc. shall be operated front and shall be flush/semi-flush mounted.
- ii. The panel shall be fabricated from 2 mm CRCA sheet steel for frame & load bearing surfaces. Partitions may be fabricated from 1.6 mm CRCA if no components are mounted on them.
- iii. Cable entries shall be from bottom. The opening of cable entry shall be covered by 3mm thick gland plates with proper sealing to avoid water and rodent entry.
- iv. Earthing bus bar of suitable cross section shall be provided throughout the length of panel.
- v. The panel shall be duly wired with suitable size of 1.1kV, PVC insulated cable and terminals shall be brought out for cable connections. 10% spare terminals subjected to minimum one of each rating shall be provided on each distribution switchgear. All wire shall have ferrules as per wiring diagram.
- vi. The panel shall be painted with 2 coats of primer after pre-treatment and 2 coats of Polyurethane / epoxy paint with shade as decided by the Owner.
- vii. The panel shall be of dead front construction suitable for front operated and back maintained functioning.
- viii. 240 V, 5 A, 3 pin industrial socket-outlet with ON/OFF switch shall be provided in each panel.
- ix. Each panel shall be provided with LED lamp rated for 240 V, 50 Hz, single phase AC supply for interior illumination controlled by door switch.
- x. Suitable lifting hooks shall be provided for each panel.
- xi. Each switchgear panel shall be provided with thermostatically controlled space

heaters to prevent condensation within the enclosure. The space heater shall be connected to 240 V, 50 Hz, single phase AC supply through suitable switch and fuse.

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

63.10 Air Circuit Breaker

- i. The circuit breaker shall be three pole, air break, horizontal draw-out type.
- ii. The circuit breaker shall have three positions, i.e. SERVICE, TEST and ISOLATED.
- iii. The circuit breaker operating mechanism shall be based on motor operated spring charging and it shall be re-strike free, trip free both electrically and mechanically, with antipumping feature
- iv. The rated control voltage of the spring charging motor shall be 110 VDC. Closing coil shall operate at all values of voltages between 85% and 110% of rated voltage. Opening coil shall operate correctly under all operating conditions of the circuit breaker up to the rated breaking capacity and at all values of supply voltage between 70% and 110% of rated voltage.
- v. The spring charging motor shall have adequate thermal rating such that continuous sequence of the closing and opening operations is possible as long as power supply is available to the motor. It shall also be possible to charge the spring manually and close the breaker in the event of failure of motor / control supply to motor. Operating handle shall be provided for charging the operating mechanism. After failure of control supply to the motor, one open-close-open operation shall be possible with the energy contained in the operating mechanism.
- vi. The motor rating shall be such that it requires not more than 30 seconds for full charging of the closing spring. Closing action of the circuit breaker shall compress the opening spring ready for tripping. When closing springs are discharged after closing the breaker, they shall be automatically charged for

the next operation.

- vii. Mechanical indicators shall be provided to indicate OPEN/CLOSE, SERVICE/TEST positions of the circuit breaker and CHARGED/ DISCHARGED positions of the closing spring. An operation counter shall also be provided.
- viii. The circuit breaker shall be provided with microprocessor based front adjustable protection release for overload, short circuit and earth fault.
- ix. Mechanical/Electrical interlocks shall be provided to prevent mal-operation and in particular to ensure the following.
 - a. It shall be possible to close the circuit breaker only if it is in SERVICE or TEST position.
 - b. It shall be possible to open the door only when the breaker is in TEST position.
 - c. Movement of the circuit breaker between SERVICE and TEST positions shall be possible only if the breaker is OFF.
 - d. Racking in the circuit breaker from TEST to SERVICE position shall be possible only if door is closed.
- x. Telescopic trolley or suitable arrangement shall be provided for maintenance of circuit breaker. The trolley shall be such that the top most breaker module can be withdrawn on the trolley and can be lowered for maintenance purpose. The telescopic trolley shall be such that all type, size and rating of breaker can be withdrawn/inserted.
- xi. The circuit breaker shall have suitable provision for integration with SCADA.

64. PROTECTIONS

The system should be provided with all necessary protections like earthing, Lightning, and grid islanding as follows:

64.1 LIGHTNING PROTECTION

The SPV power plants shall be provided with lightning & overvoltage protection. The main aim in this protection shall be to reduce the over voltage to a tolerable value before it reaches the PV or other sub system components. The source of over voltage can

be lightning, atmosphere disturbances etc. The entire space occupying the SPV array shall be suitably protected against Lightning by deploying required number of Lightning Arrestors. Lightning protection should be provided as per IS/IEC 62305 standard. The protection against induced high-voltages shall be provided by the use of metal oxide varistors (MOVs) and suitable earthing such that induced transients find an alternate route to earth.

64.2 SURGE PROTECTION

Internal surge protection shall consist of three MOV type surge-arrestors connected from +ve and -ve terminals to earth (via Y arrangement)

64.3 EARTHING PROTECTION

- i. Each array structure of the PV yard should be grounded/ earthed properly as per IS:3043-1987. In addition, the lightning arrester/masts should also be earthed inside the array field. Earth Resistance shall be tested in presence of the representative of ANERT as and when required after earthing by calibrated earth tester. PCU, ACDB and DCDB should also be earthed properly.
- ii. Earth resistance shall not be more than 5 ohms. It shall be ensured that all the earthing points are bonded together to make them at the same potential.
- iii. 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.
- iv. Masonry enclosure with the earth pit of size not less than 400mm X 400mm (width) complete with cemented brick work (1:6) of minimum 500 mm depth 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.
- v. 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.

- vi. The complete earthing system shall be mechanically and electrically connected to provide independent return to earth. All three-phase equipment shall have two distinct earth connections. An earth bus shall be provided inside the control facility. For each earth pit, necessary test point shall have to be provided.

64.4 GRID ISLANDING:

- i. In the event of a power failure on the electric grid, it is required that any independent power-producing inverters attached to the grid turn off in a short period of time. This prevents the DC-to-AC inverters from continuing to feed power into small sections of the grid, known as “islands.” Powered islands present a risk to workers who may expect the area to be unpowered, and they may also damage grid-tied equipment. The PV system shall be equipped with islanding protection. In addition to disconnection from the grid (due to islanding protection) disconnection due to under and over voltage conditions shall also be provided.
- ii. A manual disconnect 4pole isolation switch beside automatic disconnection to grid would have to be provided at utility end to isolate the grid connection by the utility personnel to carry out any maintenance. This switch shall be locked by the utility personnel

64.5 HT EQUIPMENT

- i. The 11 kV side equipment and parts shall be earthed as required under provisions of IS 3043. The system shall be designed with appropriate CTs & PTs to have all relevant protection. In addition, CTs and PTs shall also be provided for metering and protection purposes as elsewhere specified.
- ii. The HT side shall have the following protections provided:
Over current & earth fault relay with under voltage & over voltage protection
under and over frequency protection relay.
- iii. The Solar PV system and associated power evacuation system shall be protected as per relevant Indian Standards.

65. CONNECTIVITY

The connectivity to the State Grid for the proposed power plant is as per provisions in the KSERC (Connectivity and Intra State Open Access) Regulations, 2013, as amended from time to time.

- a. The Captive Generating plant is required to install Special Energy Meters (SEM) as specified in the Central Electricity Authority (Installation and Operation of Meters) Regulations, 2006 as amended from time to time, for accounting the quantum of energy generated, the quantum of energy injected into the transmission and/or distribution system and the quantum of energy consumed.
- b. Special Energy Meters installed shall be capable of measuring the 15 minutes time-block-wise 'active energy and reactive energy', in accordance with the Central Electricity Authority (Installation and Operation of Meters) Regulations, 2006 as amended from time to time and the provisions of State Grid Code. The metering system shall have remote terminal unit (RTU) to facilitate real time monitoring by the SLDC as and when specified by the Commission.
- c. The successful bidder is to undertake all the documentation works pertaining to the connectivity of the power plants as per criteria mentioned in KSERC (Connectivity and Intra State Open Access) Regulations, 2013, including the statutory fees for the applications.

66. PERMISSION FROM ELECTRICAL INSPECTORATE BY BIDDER

- a. The bidders are to follow all the norms set by the Chief Electrical Inspector to Government for electrical installations in the State from time to time.
- b. The electrical scheme approval for the proposed system incorporating the final termination point must be taken before start of works. Bidders are to plan for material delivery of solar modules and Module Mounting Structures (MMS) in parallel with this approval.
- c. Upon completion of installation, the as fitted scheme along with completion need to be submitted for energisation approval.

- d. All the documentation works and liaison required as part of the commissioning need to be done by the successful bidder, including payment of all statutory charges.
- e. The bidder has to submit the approvals through A / B Class Electrical contractor approved by CEIG Kerala.

67. WARRANTY

- a. 5 years' warranty should be provided by the supplier for the system and components, or part of the system has to be provided as per the special conditions of the contract.
- b. PV modules used in solar power plants/ systems must be warranted for their output peak watt capacity, which should not be less than 90 % at the end of 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

68. CIVIL WORKS

i. Land Development for site activities

All the Civil works required for the installation of a Photo Voltaic plant shall be within the scope of the bidder. The land development required for the ground mounted and carport structure including ground levelling, retiling, etc and all other works are under the scope of the bidder. If fencing is not there for the sites that are not situated in the substation compound, providing the same will be in the scope of the contractor.

ii. Inverter Accommodation

The layout of Inverter accommodation (if central inverter is used for any cluster) shall be designed so as to enable adequate heat dissipation and space availability within the existing infrastructure available in consultation with the Site in charge. The infrastructure shall be kept in adequate enclosure locked, to avoid public intrusion. One Key of the same shall be given for the custody of the site in charge. All access to the installed infrastructure shall be made in concurrence with the Engineer in charge binding safety.

iii. Pipe & Cable Trenches

- a. All trenches inside the building and transformer area shall be of RCC. The min. wall and base slab thickness shall be 100mm for depth \leq 850mm and 150mm for depths $>$ 850mm.
- b. The trench shall be designed for loads as required at site. External trenches shall be kept min. 100mm above FGL to avoid entry of rain water. In case of straight length of the trench being more than 40m, suitable expansion joints with PVC water stop shall be provided.
- c. Internal trenches (inside buildings) shall be provided with chequered plate (min. 8mm thick with stiffening angle ISA 50x50x6 @ 750 mm c/c for trench width greater than 800 mm) covers while external trench shall have precast concrete covers.
- d. Min. thickness of precast cover shall be 50mm. Both bearing edges of the cable trench and all edges of pre-cast concrete covers shall be provided with min. 50x50x6 mm edge protection angle with lugs.
- e. The trench cover (chequered or pre - cast both) shall be provided with suitable lifting hooks.
- f. As required, suitable MS insert plates shall be provided on trench wall to support the cable rack/ pipe.
- g. The trench bed shall have a slope of approx. 1(V):250(H) along and 1(V):50(H) across the length of the trench. The cable trench shall have a dewatering sump(s) of size 450x450x450 mm depth at suitable location to facilitate collection & pumping out of rain water from the trench.
- h. The external buried cables shall be laid in excavated trench as specified under specifications for Electrical works.

iv. Illumination System

Supply and providing of suitable illumination system for inverter accommodation is in bidder's scope. The bidder shall opt for lighting fixtures and accessories based on energy saving concept technology such as LED.

v. Control Room Building

A control room to be constructed for housing the SCADA unit, inverters, Battery for protective relaying and storage for other materials, with minimum of 6m x 10 m size, painted with interior and exterior Emulsion, flooring with industrial floor tiles, doors /windows as specified to have sufficient ventilation, cable trenches etc. as per approved specifications. A toilet cum rest area of 2m x 6m shall also be included in the above area. ie; 6m x 8m for Control room and 2m x 6m for the rest area. The rest area can either be included in the first floor in case of space restriction in the available land. The size of the control room shall be designed to accommodate all the requirement of the solar plant. Suitable Panels and enclosures as per standards and weather proof enclosures as applicable in outdoor installations to be provided for inverters placing in outside systems.

The detailed drawings and construction design based on actual site condition need to be submitted and get it approved from ANERT before starting Construction.

The construction of the same shall be as under and according to the relevant BIS standards.

a. RCC Works

Reinforcement shall be high strength TMT Fe 450 or Fe 500 conforming approved quality as per standard Civil Engineering Practices.

b. Brick Works

Brick works in cement mortar (cm) 1:6 for 9" thick and 4½" thick wall respectively. Bricks of approved quality as per standard Civil Engineering Practices.

c. Doors & Windows:

Air Tight Aluminum framed doors, windows and ventilators with necessary glass panels including of all fixtures etc complete shall be provided in all buildings.

d. Plastering

Plastering in cement mortar 1:5, 1:6 and 1:3 shall be applied to all internal, external walls and ceiling of slab respectively.

e. Flooring

Flooring for stores shall be of cement flooring in concrete mix 1:2:4 using 10 mm aggregates. Flooring for office building, security hut control Room, offices rooms for stay of officers and staff shall be of vitrified tiles 8 mm. For toilet area, the floor shall be of ceramic tiles 8 mm thicknesses. The wall tiles shall be glazed tiles of 6 mm thickness and provided up to lintel level.

f. Roofing

The roof of the building shall be insulated and waterproofing shall be done as per standard Civil Engineering Practices.

g. Plinth Protection

Plinth protection 1000mm wide shall be provided around all the buildings

h. Painting of Walls & Ceilings

The paint shall be anti-fungal quality of reputed brand suitable for masonry surfaces for high rainfall zone. Approval of colours etc. shall be taken from ANERT while approval of Drawings of Building.

i. Plumbing and Sanitary

Sanitary fittings, which include water closet (EWC/IWC), wash basins, sink, urinal fitting including flushing tank, and necessary plumbing lines shall be provided for office cum stores building.

j. Stairs

Contractor to provide stairs with adequate load bearing capacity to access the roof of the control room.

k. Electrification of Building

Electrification of building shall be carried out as per IS 732 and other relevant standards. Only energy efficient LED light fixtures shall be used. The design of lighting system in the buildings shall be carried out as per IS 3646. The building shall be provided with adequate quantity of light fittings, 5A/ 15A 1 phase sockets, fans etc., controlled by required ratings of MCBs and MCB DBs.

vi. Water for Cleaning

The EPC Contractor shall provide permanent arrangement for module washing in the SPV Plant. The source of water for the proposed Solar PV plant would be the water from the Water Treatment Plant within the Kerala University of Health Sciences, Thrissur premise. Adequate size network of CPVC pipe in each row of SPV panels shall also be provided for the supply of water for cleaning the solar PV modules on a periodic base. Opening from the CPVC pipe with manual isolating valves with nozzles should be provided at regular interval in each row of SPV panels. The pipe network also shall include appropriate arrangement for easy sprinkling of water on to the panels. Water optimization will be carried out during detailed engineering stage to meet the water consumption allocation for cleaning of the panels. Contractor shall provide the single line diagram of water washing arrangement along with location of pump to ANERT for approval. Contractor has to provide facility including pipeline and motor for pumping to the overhead tank if required for cleaning the SPV modules, depending on the site conditions.

vii. UPS System

Adequate capacity UPS with DC battery bank should be provided for emergency control supply of control / protection system & emergency lighting. An appropriate capacity battery charger with relevant IS / IEC standards & protection and automatic change over system should be provided to charge the battery bank along with relay circuit, fuses, annunciations and remote operating and controlling facility from Main Control Room. A DC power supply Distribution panel/ board should be supplied along with the charger as per relevant IS standards.

viii. CCTV Camera

CCTV Cameras along with monitoring station and all other accessories required for its proper operation must be installed to have complete coverage of following areas for 24 hours.

- a. Main Control Room: Covering Entry/Exit and Equipment Rooms
- b. Switchyard
- c. Main entry: covering all entry/exits

- d. Along the Plant Perimeter: Covering complete perimeter of Plant Area to capture all possible intrusion
 - e. Security Cabin
- A. Monitoring station of the CCTV Network shall be installed in Main Control Room.
 - B. The CCTV system shall be designed as a standalone IP based network architecture. System shall use video signals from different cameras at defined locations, process the video signals for viewing on monitors at control room and simultaneously record all video streams using latest compression techniques.
 - C. Camera shall be colour, suitable for day and night surveillance (even under complete darkness) and network compatible.
 - D. It shall be possible to control all cameras i.e., PTZ auto/ manual focus, selection of pre-sets, video tour selection etc. The software shall support flexible 1/2/4 windows split screen display mode or scroll mode on the display monitor for live video.
 - E. The system shall support video analytics in respect of the following:
 - a. Video motion detection
 - b. Object tracking
 - c. Object classification
 - d. Camera server shall be provided with sufficient storage space to storage recordings of all cameras at HD mode for a period of 15 days. All recordings shall have camera ID, location, date and time of recording.
- ix. **Peripheral Fence & Main Gate**
- a. The plant peripheral boundary shall be provided with chain link fence as per specifications along with Main Gate for the ground mounted system as per the approved diagram.
 - b. The fencing shall be of galvanized iron chain link mesh fabric with internal, corner and stay posts of hot dipped GI angle (min. ISA 65x65x6 mm).
 - c. All GI posts shall be supported with min. 300 mm dia. and 850 mm deep (below GL) piles in M20 cement concrete (nominal mix 1:1.5:3).

- d. The column posts shall be extended into the pile up to 800mm with 50mm cover at the bottom. The pile shall project 150mm above GL.
- e. The intermediate, corner and stay posts shall be supported by angle struts that shall have the same foundation as that of the main posts. Spacing of intermediate posts shall not be more than 2.5m.
- f. Every 10th intermediate post shall be provided with a stay post while every corner post shall be provided with two stay posts on either side.
- g. The GI chain link mesh fabric (40x40 mm with min. wire gauge 3.15mm, both ends twisted) and fencing shall conform to IS: 2721.
- h. Each fence panel, in lieu of tie wire, shall be provided with 35x35x3mm GI edge angle at top and bottom with mesh fabric firmly secured to them and to intermediate support angles.
- i. All MS sections shall be painted with 2 coats of epoxy paint of approved make and shade over 2 coats of suitable primer.
- j. The Gate of size 3.5m shall be of MS pipe (medium class conforming to IS: 1161) frame with hard drawn steel wire fabric mesh (50x50mmx3mm thick conforming to IS: 1566) including all accessories and fittings. MS angle posts shall conform to IS 2062.
- k. In addition to main gate, a wicket gate of MS pipe (medium class conforming to IS: 1161) frame with 1.0 m width with hard drawn steel wire fabric (50x50x3mm thick conforming to IS: 1566) shall be provided for man entry for maintenance purpose.
- l. The transformer yard fencing work shall conform to CEIG requirements.
- m. The requirement of fire barrier wall between transformers shall be as per Electricity Rules and IS: 1646 recommendations. Minimum wall thickness shall be 230mm for RCC wall and 300mm for masonry wall.

69. TESTING & COMMISSIONING

- a. The contractor shall provide necessary drawings and documents required by statutory authorities and obtain the approval before taking up erection.

- b. Any modification in the equipment or installation that may be demanded by the inspecting authorities shall be carried out by the contractor at no additional cost to the KSEBL
- c. In accordance with the specific installation instruction as per the manufacturers drawings or as directed by the KSEBL, the successful Bidder shall unload, assemble, erect, install test, commission and hand over all electrical equipments included in this contract after O&M of 5 years.
- d. Erection materials including all consumables, tools, testing instruments or any other equipment required for successful commissioning shall be arranged by the successful Bidder in a timely manner.
- e. All equipment and instruments, indoor and outdoor, shall be marked with No. and provided with danger boards before commissioning.
- f. All Power equipments shall be handled and erected as per the relevant codes of practice and manufacturer's drawings and instruction manuals.
- g. The Contractor shall obtain the temporary Electrical connection for construction purposes and the same has to be dismantled off the premises after completion of erection of plant.

70. PERFORMANCE RATIO TEST (PR TEST)

The Plant should run minimum two weeks without any major equipment failure to start the PR test. The EPC Contractor shall submit two copies of O&M manual with soft copy before the start of PR Test. Depending on the requirement, capacity and suitable Pyranometer shall be installed at locations suggested by ANERT or else METEONORM data shall be considered for calculating PR.

- i. The PR test shall be conducted at site by the Contractor in presence of the ANERT / KUHS officials as per IEC 61724. The PR test procedure shall be submitted by the Contractor for review and approval. Any special equipment, instrumentation tools and tackles required for the successful completion of the performance test shall be arranged by the Contractor at his own cost.
- ii. The procedure for PR demonstration test shall be as follows:

The Weather monitoring station installed in the plant shall be in working condition for minimum 2 weeks and all the parameters shall be available for analysis and verification. The test report for the calibration shall be submitted by the Contractor for approval. After the successful verification of the initial parameters by ANERT, PR test shall be conducted. The Following factors shall be excluded for calculation;

- Generation loss due to grid outage.
- Irradiance below 250 W/m²
- The measured global solar radiation of the period of the outage of the power evacuation system shall be excluded to calculate average global solar radiation for the period of PR test.

PR is to be calculated as per the below formula:

$$PR = \frac{\text{Measured output in kW}}{\text{Installed Plant capacity in kW} * (1000 / \text{Measured radiation intensity in W/m}^2)}$$

The EPC Contractor shall demonstrate minimum PR of 75% (measured at output of the inverter/solar meter level) in the initial PR test within 7 consecutive days. If the contractor fails to prove the desired performance ratio at the time of completion and during any of the consecutive years of defect liability period, he will be given a second chance to demonstrate the PR within another 7 consecutive days. Still if it is not achieved, the same shall be demonstrated within another 7 consecutive days and still if it is not achieved, EPC contractor shall improve the quality of the plant by replacement of module/other components with all suitable modification requirements on balance of systems at his own cost to achieve the performance ratio. After obtaining Energisation Approval from Electrical Inspectorate and demonstration of minimum specified PR, the solar plant shall be commissioned which shall be the date of completion of the project.

71. DATE OF COMMISSIONING

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

72. SOLAR PV SYSTEM FOR MEETING THE ANNUAL ENERGY REQUIREMENT

Key Performance Indicators

The following KPIs would be monitored by the ANERT/Owner throughout the contract tenure and the contractor shall furnish monthly reports on above, without fail.

- PV Array Energy Yield
- Final System Yield
- PV System Efficiency (DC/AC)
- Performance Ratio (PR): The performance ratio test as per IS/IEC 61724 has to be carried out at site by the agency in presence of authorized officials of ANERT, deriving sample data within a period of 7 consecutive days sufficient to provide operational data representing insolation and ambient conditions as desired by the agreement authority to prove the Performance ratio of 75%. If a Solar Plant achieves the Minimum Performance Ratio, then the ANERT will issue Commercial Operation Date Certificate.
- Capacity Utilization Factor (CUF)
- Plant uptime
- Reactive Power Consumption
- Auxiliary Energy Consumption
- CO₂ Savings
- Environment, Health & Safety

73. QUALITY ASSURANCE

The successful bidder shall establish a Quality Assurance system for the Work as per standards and specifications mentioned in the tender document and shall be subject to the approval of the ANERT or authorised personnel designated. Strict compliance with the approved, proven & established quality assurance systems and procedures during the different stages of the plant starting from sizing, selection of make, storage (at site), during erection, testing and commissioning have to be ensured by the successful bidder.

- i. The material to be supplied for the plant should be tested as per the technical specification of the tender. The successful bidder in the presence of the authorized personnel designated shall carry out all factory acceptance tests of equipment as per the specification and relevant standards. The successful bidder shall arrange for the same through online mode and this will be applicable for major components such as PV modules and inverters. Random factory tests shall be arranged for other components of the plant
- ii. ANERT at his own discretion may undertake the quality checks during the manufacturing stages also.
- iii. All works shall be undertaken with the highest levels of quality and workmanship. Work shall be carried out in conformity with quality and safety norms.
- iv. Any materials or work found to be defective or which does not meet the requirements of the specification will be rejected and shall be replaced at successful bidder's cost.
- v. One of the staff / workers employed by the successful bidder may be trained under Solar PV installer course conducted by ANERT/MNRE under Skill Council for Green Jobs or under Surya Mithra programme of NISE for module erection and allied electrical works.

A. General Quality requirements of Solar PV Plant

The bidder shall use SPV modules of adequate capacity, Inverters etc. to ensure generation of power as per design estimates.

- a. This is to be done by applying de-rating factors for the array mentioned and recognizing the efficiency parameters of inverters.
- b. Use of equipment and systems with proven design and performance that have a high
- c. availability record of accomplishment under similar service conditions.
- d. Selection of the equipment and adoption of a plant layout to ensure ease of maintenance.
- e. Strict compliance with the approved and proven quality assurance norms and procedures
- f. during the different phases of the plant.

- g. Proper monitoring in the synchronizations, which ensures the availability of power to the grid.
- h. The DC injection limit shall be as per IEEE 519, IEC 61727, CEA (Technical Standards for Connectivity of the Distributed Generation Resources) Regulations 2013 and CEA (Technical Standards for connectivity to grid) Regulations, 2007 and amendments thereof. It shall not inject DC current greater than the 0.5% full rated output of the inverter at interconnection point.
- i. Ripple content should not exceed as specified in IEEE-519 2014.
- j. Limits for harmonics as per CEA technical standard on Grid connectivity are: Total Voltage harmonic Distortion, Individual Voltage harmonics Distortion and total Current harmonic Distortions are as per IEEE-519 2014
- k. The power plant has to operate in parallel with the grid system, which is an infinite electrical system. The Solar Power Plant design should be equipped with requisite protective measures/ relays / breakers to protect equipment in solar power plant against any of possible fault or other disturbances from the grid.
- l. The Solar plant shall be equipped with necessary protection systems to ensure isolation of the solar power plant from the grid at the time of any fault.
- m. The inverter shall have internal protection arrangement against any sustained fault in the feeder line and against lightning in the feeder line. MOV type surge arrestors shall be provided on AC and DC terminals for over voltage protection from lightning induced surges.
- n. Successful bidder shall provide manual disconnect four pole isolation switch beside the automatic disconnection to grid to isolate the grid connection provided by the utility, so that the utility personnel can carry out maintenance of grid. The utility personnel shall lock this switch.
- o. The alarm contact shall be provided for hardware failures, failures of internal and external auxiliary supplies etc. The alarm signals should be via system fault relay (voltage free contact)
- p. The plant shall be capable of supplying dynamically varying reactive power support as per the grid requirement to maintain power factor within the range of 0.95 lagging and 0.95 leading.

- q. The plant shall be in accordance with solar photovoltaic systems, devices and component Goods (Requirement for Compulsory Registration) order 2017 of MNRE or any amendment thereof.

The Bidder must submit an offer, based upon their own design with requirement mentioned in this bid document. The bidders should be familiar of the site condition before designing the plant and offer their bid. The bidders are also required to incorporate all the system required for realizing Grid tied solar Plants at different locations and efficient operation in parallel with KSEB Ltd supply. The successful bidder shall submit the location wise detailed design of the complete solar generating plant by using their software to optimize the string sizing considering the specific location, isolation, nature of load etc.

Civil Works

i. INITIAL TEST PILES

In order to confirm the load bearing capacity of the design pile the Contractor shall install and test specially installed initial piles in advance of the main piling operation for installation of working piles. The locations, sizes, lengths, test loads and instrumentation required for the initial piles shall be submitted by the contractor for approval before start of the work.

Initial piles shall be installed with the same plant and in a similar manner as that to be used in the construction of the working piles. All initial piles shall be instrumented in accordance with that indicated in the drawings and specification. After testing, the Contractor shall be responsible to hack away the initial test pile if it is obstructing the construction of other foundation works.

ii. LOADING TEST PILES

The load steps and duration as per IS: 2911(Part-4) are given in the specification for guidance. The rate of application and removal of the load may be altered or modified solely by the Engineer. Unless otherwise decided by the Engineer the load steps and duration are as indicated in approved Test Procedure.

iii. READINGS

Take readings of time, load and settlement and record immediately before and after the application of each load increment or decrement, or as directed by the Engineer. A minimum of another two readings shall be recorded at intermediate intervals.

iv. **INSTALLATION OF A TEST PILE**

- a. **Inclusive Works** - The works for the load tests shall include the construction and subsequent demolition of all necessary pile caps to the contractor's design which shall be subjected to the Engineer's approval.
- b. **Notice of Construction** - The Contractor shall give the Engineer at least 48-hour notice prior to commencement of casting of any initial test pile.
- c. **Method of Construction** - Each initial test pile shall be constructed in a manner similar to that to be used for the construction of the working pile, and by the use of similar equipment and materials. Any variation will only be permitted with prior agreement. Extra reinforcement and concrete of increased strength shall be provided as required in the shafts or initial piles as per approved design of test piles to this effect.
- d. **Boring Record** - For each initial test pile which is to be tested, a detailed record of the conditions experienced during boring shall be made and submitted daily, not later than the next working day. Where the Engineer requires soil samples to be taken or in-situ tests to be made, the Contractor shall present the results without delay. All submission shall also include a scan copy (in PDF format) to be emailed to the Engineer's office.
- e. **Concrete test cubes** - At least 1 sample (six test cubes) shall be made from the concrete used in the initial test pile. If a concrete pile is extended or capped for the purpose of testing, a further 1 sample (six test cubes) shall be made from the corresponding batch of concrete. The cubes shall be made and tested in accordance with IS: 516. The pile test shall not start until the compressive strength of pile concrete is established equal or greater than the design strength through tests on the test cubes. As a general rule the pile test shall be carried out after 28 days of casting the pile without special permission for early testing obtained from Engineer.

- f. **Pile Connection for Lateral Test** - For a pile that is tested under lateral load, means shall be provided for transmitting the test load horizontally to the pile along its center line. The connection between the pile and the loading equipment shall be constructed in such a manner as to provide strength equal to the maximum load which is to be applied to the pile during the test with an appropriate factor of safety on the structural design.

74. OPERATION & MAINTENANCE OF THE PLANT

The contractor shall be responsible for Comprehensive Operation and maintenance of the Solar Power Plants of for a period of five (5) years from the date of commissioning of this solar project. The EPC contractor will operate the solar Plant and shall provide for, at a minimum, the following services:

Performing routine and non-routine maintenance on the solar Plant for a period of five years from the date of commissioning of solar project;

- i. Operating the solar Plant;
- ii. Providing all materials and services necessary for solar Plant maintenance;
- iii. Performing all duties for the safe and efficient operation and maintenance as per the standards;
- iv. Complying with all regulatory obligations;

The contractor shall supply manual for Operation and Maintenance of all the system in English. Contractor shall perform the Work and supply all required spare parts in a prudent and efficient manner and in accordance with-

- i. Manufacturers and systems designers' specifications, the Annual Operating Plan for the Plant and all operation and maintenance manuals,
- ii. All Indian applicable laws including environmental protection, pollution, sanitary,
- iii. employment and safety laws, ("Government Rules").
- iv. Prudent Utility Practice.

The Contractor shall be responsible for all the required activities for the successful running, optimum energy generation & maintenance of all the Solar Photovoltaic Power Plants covering:

- a. Monitoring controlling, troubleshooting maintaining of records, registers.

- b. Supply of all spares, consumables and fixing/application, inverters, indoor panels, cables terminals kits, Circuit Breakers, Isolators switch, and all other associated equipment of solar plant etc, for a period of 5 (five) years. Cost of these items (including Cost of spares) shall be included in the price quoted.
- c. Supply & use of consumables throughout the maintenance period as per recommendations of the equipment manufacturers.
- d. Conducting periodical checking, testing, over hauling and preventive action.
- e. Monthly General up keeping including cleaning of all equipment, PV Station, amenities, Solar Photovoltaic array area, transformer etc.
- f. Submission of Monthly reports to KSEBL on the energy generation & operating conditions of the solar plant by 2nd day of every month to the Engineer in Charge by 5th of every month.
- g. Taking care of the full security aspects of the Solar Power Plant.
- h. Replacement of damaged modules if any, during the period of 5(five) years.
- i. Replacement of Inverter and all type of Battery if any used and any other equipments in solar plant time to time if required, during the period of 5(five) years.
- j. Insurance covering all risks (Fire & allied perils, earth quake, terrorists, and burglary.
- k. Maintaining and replacement of Lightning Arrestors.
- l. Continuous monitoring the performance of the Solar Power Plant and regular inspection and maintenance of the whole system including Modules, INVERTER's, junction boxes, underground cables, outdoor/indoor Distribution Board and all associated equipment etc. necessary for extracting and maintaining the maximum energy output from the Solar Power Plant.
- m. Successful running of Solar Power Plant for the desired Performance ratio
- n. Routine and other maintenance works needed for transformers
- o. Contractor personnel shall arrange the Annual Calibration of Energy Meters shall be done by the respective TMR Divisions. Meters with net metering mechanism should be provided by the contractor. It shall be the responsibility of the contractor to promptly rectify/ replace the defective meter so as to ensure that the errors in the energy meters are within specified limit. Cost of calibration and rectification/

replacement, if any shall be borne by the Contractor. Shortfall on the account of metering error to meet the Generation Guarantee shall only be the responsibility of the Contractor.

- p. Periodic Testing/ calibration of all measuring devices as per respective manufacturer's instruction/ guideline. Operation and Maintenance of the Solar Photovoltaic Power Plant is required for a period of 5(five) years from the date of commissioning of the project which shall be carried out at fixed cost. The period of Operation and Maintenance will be deemed to commence from the date of commissioning of solar Photovoltaic Power Plant.

The Monthly work of the operators in the Solar Photovoltaic Power Plants involves:

- i. Cleaning of Modules, logging the voltage, current, power factor, power and energy output of the solar Power Plant.
- ii. Note down failures, interruption in supply and tripping of different relays, reason for such tripping, duration of such interruption etc.
- iii. The operator shall record monthly energy output, down time, etc.

Maintenance

The contractor shall carry out the periodical/plant maintenance as given in the manufacturer's service manual and perform at least minimum requirement. Preventive/Routine Maintenance shall be done by the Contractor at least once in a every three months and shall include activities such as, cleaning and checking the health of the SPV system, cleaning of module surface, tightening of all electrical connections, mounting structure, Inverter operations and any other activity that may be required for proper functioning of the SPV system as a whole. The contractor shall ensure the generation data availability for proper monitoring of the system.

Regular periodic checks of the Modules, Inverters, transformers shall be carried out as a part of routine preventive maintenance. In order to meet the maintenance requirements stock of consumables are to be maintained as well as various spare as recommended by the manufacturer at least for 5 years to be kept for usage.

Particular care shall be taken for outdoor equipment to prevent corrosion. Cleaning of the junction boxes, cable joints, insulators etc shall also be carried out at every three-month interval. Resistance of the earthing system as well as individual earthing is to be measured and recorded every month. If the earth resistance is more than 3-ohm, suitable action is to be taken to bring down the same. According to the recommendations stock of special tools and tackles shall be maintained for Modules, INVERTER's and other major electrical equipment.

A maintenance record is to be maintained by the contractor to record the regular maintenance work carried out as well as any breakdown maintenance along with the date of maintenance, reasons for the breakdowns, steps taken to attend the breakdown, duration of the breakdown etc.

The installation / Maintenance of the grid connected solar PV plant during the non-office hours and holidays should be carried out only with the prior written approval of Kerala University of Health Sciences, Thrissur / concerned official. The Contractor shall deploy enough manpower at Solar Photovoltaic Power Plant site to carryout work instructions and preventive maintenance schedules as specified. The Contractor will attend to any breakdown jobs immediately for repair/replacement /adjustments and complete at the earliest working round the clock. The details of the emergency assistance personnel of the contractor shall be displayed in the location. During breakdowns (not attributable to normal wear and tear) at O&M period, the Contractor shall immediately report the accidents, if any, to the parties involved showing the circumstances under which it happened and the extent of damage and or injury caused.

The Contractor shall comply with the provision of all relevant acts of Central or State Governments including payment of Wages Act 1936, Minimum Wages Act 1948, Employer's Liability Act 1938, Workmen's Compensation Act 1923, Industrial Dispute Act 1947, Maturity Benefit Act 1961, Mines Act 1952, Employees State Insurance Act 1948, Contract Labour (Regulations & Abolishment) Act 1970, Electricity Act 2003, Grid Code, Metering Code, MNRE guide lines or any modification thereof or any other law relating whereto and rules made there under from time to time.

The contractor shall at his own expense provide all amenities to his workmen as per applicable laws and rules. The Contractor shall ensure that all safety measures are taken at the site to avoid accidents to his Workmen. If negligence / mal-operation of the contractor's operator results in failure of equipment such equipment should be repaired replaced by contractor at free of cost. If any jobs covered in O&M Scope are not carried out by the contractor during the O&M period pro-rata deduction will be made based on the quantum of work from the O&M contract bills.

Handing Over

At the end of the Operation and Maintenance period of 5 years, the Contractor shall hand over the complete system to Kerala University of Health Sciences, Thrissur /ANERT in the best working condition. Any component found defective/inefficient/worn out shall be rectified/ replaced/ made good at contractor's cost before handing over the system to the ANERT. In order to ensure longevity & safety of the core equipment and optimum performance of the system the Contractor should use only genuine spares of high-quality standards.

75. DANGER BOARDS AND SIGNAGES

Danger boards should be provided as and where necessary as per IE Act. /IE rules as amended up to date. Three signage shall be provided one each at battery –cum- control room, solar array area and main entry from administrative block. Text of the signage may be finalized in consultation with ANERT/ owner.

76. FIRE ALARM SYSTEM & FIRE EXTINGUISHERS

The Contractor shall ensure the compliance of fire detection and alarm system as per relevant standards and regulations. The installation shall meet all applicable statutory requirements and safety regulations of state/central fire department/body or any other competent authority in terms of fire protection. ‘

The firefighting system for the proposed power plant for fire protection shall be consisting of:

- a. Portable fire extinguishers in the control room for fire caused by electrical short circuits (CO2 and dry powder type)

- b. Sand buckets in the control room
- c. Microprocessor based fire alarm panel
- d. Multi sensor smoke detectors
- e. Hooter cum strobe
- f. Manual call points
- g. Cables from sensor to fire Panel

The installation of Fire Extinguishers should confirm to TAC regulations and BIS standards. The fire extinguishers shall be provided in the control room housing PCUs. Four numbers of stand with four sand buckets on each stand shall be provided in the Transformer Yard. Sand buckets inside the building shall be provided at strategic locations as decided during detailed engineering. The Digital output from the fire detection system shall be integrated with SCADA.

77. DRAWINGS & MANUALS

- i. Two sets of Electrical drawings installation and O&M manuals are to be supplied. Bidders shall provide complete technical data sheets for each equipment giving details of the specifications along with make/makes in their bid along with basic design of the power plant and power evacuation, synchronization along with protection equipment.
- ii. Approved ISI and reputed makes for equipment be used.
- iii. For complete electro-mechanical works, bidders shall supply complete design, details and drawings for approval to ANERT before progressing with the installation work

78. PLANNING AND DESIGNING

- i. The bidder should carry out Shadow Analysis at the site and accordingly design strings & arrays layout considering optimal usage of space, material and labour. The bidder should submit the array layout drawings along with Shadow Analysis Report to ANERT for approval.

- ii. ANERT reserves the right to modify the landscaping design, Layout and specification of sub-systems and components at any stage as per local site conditions / requirements.
- iii. The bidder shall submit preliminary drawing for approval & based on any modification or recommendation, if any. The bidder submits three sets and soft copy in CD of final drawing for formal approval to proceed with construction work.

79. DRAWINGS TO BE FURNISHED BY BIDDER AFTER AWARD OF CONTRACT

The Contractor shall furnish following documents/ information along with the offer.

- i. Simulation and Sizing report utilising Meteonorm / 3-Tier Solar Radiation Resource Data with the offered make and model of the components of the 2 MW PV Power Plant. If the contractor is offering more than one configuration for the PV Power Plant, the corresponding design/simulations are also to be enclosed. The successful bidder should submit the soft copy of the Solar Radiation Data that they have used for Simulation of the Solar PV Power Plant.
- ii. General description of equipment offered specifying the important features, make, data sheet, materials of construction, etc. to enable the owner to have proper understanding of the equipment offered and its operation.
- iii. Technical literature, catalogue and publications.
- iv. Type test certificates of all major equipment like transformers, switchgear, Inverters, Solar PV Modules including the required IEC Certificates for PV Modules, Inverters etc.
- v. The list of drawings to be submitted to ANERT by the successful bidder for approval is given below:

NO.	TYPE	PARTICULARS
ELECTRICAL DRAWINGS		
1.	Electrical	Overall Single Line Diagram of the PV power Plant
2.	Electrical	Overall PV power Plant Lay out
3.	Electrical	Module Interconnection Details

4.	Electrical	Solar Array layout
5.	Electrical	General String Combiner Box (S.C.B)/Array Junction Box (A.J.B) Wiring Layout
6.	Electrical	DC Cable layout
7.	Electrical	DC Earthing System Lay out
8.	Electrical	AC Cable Lay out
9.	Electrical	Inverter Ducting
10.	Electrical	Inverter Room Earthing
11.	Electrical	Inverter Room Illumination
12.	Electrical	Cable Trench Layout for Inverter Room
13.	Electrical	Overall, Cable Trench lay out
14.	Electrical	Lightning Protection Scheme/layout
15.	Electrical	Transformer yard Lay outs
16.	Electrical	Switch yard Layout
17.	Electrical	SLD of Switch Yard
18.	Electrical	Overall Plant Illumination Drawing
19.	Electrical	Power Evacuation Scheme
20.	Electrical	Data Acquisition System
CIVIL DRAWINGS		
1.	Civil	Plot Plan details with Boundary showing Eastings and Northings of each corner
2.	Civil	Compound Wall (Fencing) - Plan & Elevation
3.	Civil	PV Module Mounting Structure details and Layout Plan
4.	Civil	PV Module Mounting Foundation drawings
5.	Civil	Inverter Room Plan & Elevation
6.	Civil	Column & Footing details of Inverter Room
7.	Civil	Roof Slab Drawing of Inverter Room
8.	Civil	Internal access Roads & Drainage
9.	Civil	Transformer plinth/Foundation

10.	Civil	Substation Building - Plan & Elevation and other details
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- vii. Itemized bill of material for complete PV plant covering all the components and associated accessories.
- viii. Shadow analysis of the area proposed

80. INSURANCE

- a. The power plant must be insured at every stage of operation – from Material dispatch, storage, completion of installation and till 5 years after commissioning. The insurance coverage on handing over of the system. The Bidder shall also take insurance for Third Party Liability covering loss of human life, engineers and workmen and also covering the risks of damage to the third party/material/equipment/properties during execution of the Contract. Before commencement of the work, the Bidder will ensure that all its employees and representatives are covered by suitable insurance against any damage, loss, injury or death arising out of the execution of the work or in carrying out the Contract. Liquidation, Death, etc., shall be the responsibility of bidder.
- b. Without limiting his obligations and responsibilities under the contract the contractor shall insure in the joint names of the ANERT/Concerned beneficiary institution and the contractor against all loss or damages from whatever cause arising other than the risks, for which he is responsible under the terms of contract and in such a manner that the ANERT/Concerned Beneficiary Institution and contractor are covered for the period stipulated in this document and are also covered during the period of maintenance for loss or damage arising from a cause, occurring prior to the commencement of the period of maintenance and for any loss or damage occasioned by the contractor in the course of any operations carried out by him for the purpose of complying with his obligations under clause.
 - i. The works for the time being executed to the estimated current Contract value thereof, or such additional sum as may be specified together with the materials for incorporation in the works at their replacement value.

- ii. The constructional plant and other things brought on to the site by the contractor to the replacement value of such constructional plant and other things.
- iii. Such insurance shall be affected with an insurer and in terms approved by the ANERT which approval shall not be unreasonably withheld and the contractor shall whenever require to be produced to the ANERT, the policy of insurance and the receipts for payment of the current premiums.
- c. The insurance premium for the 5 years of warranty is to be paid by the bidder. 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.
- d. Third Party Insurance
 - i. Before commencing the execution of the work the contractor but without limiting his obligations and responsibilities shall insure against his liability for any material or physical damage, loss, or injury which may occur to any property including that of ANERT / beneficiary institution, or to any person, including any employee of the ANERT / beneficiary institution, by or arising out of the execution of the works or in the carrying out of the contract,
 - ii. Minimum Amount of Third-Party Insurance: Such insurance shall be affected with an insurer and in terms approved by the ANERT / beneficiary institution which approval shall not be reasonably withheld and for at least the amount stated below. The contractor shall, whenever required, produce to the ANERT the policy or policies of insurance cover and receipts for payment of the current premiums.
- e. Minimum Insurance Cover The minimum insurance cover for physical property, injury, and death is Rs.5.0 lacs per occurrence with the number of occurrences limited to four. After each occurrence contractor will pay additional premium necessary to make insurance valid for four occurrences always.
 - i. Accident or Injury to Workmen: - The ANERT/beneficiary institution shall not be liable for or in respect of any damages or compensation payable at law in

respect or in consequence of any accident or injury to any workmen or other person in the employment of the contractor or any sub-contractor, save and except an accident or injury resulting from any act or default of the ANERT or their agents, or employees. The contractor shall indemnify and keep indemnified ANERT against all such damages and compensation, save and except as aforesaid and against all claims, proceedings, costs, charges and expenses whatsoever in respect thereof or in relation thereto.

- ii. Insurance against accidents etc. to workmen: - The contractor shall insure against such liability with an insurer approved by the ANERT during the whole of the time any person employed by him on the works and shall, when required, produce to the ANERT / beneficiary institution such policy of insurance and receipt for payment of the current premium. Provided always that, in respect of any persons employed by any sub- contractor the contractor's obligation to insure as aforesaid under this sub-clause shall be satisfied if the sub-contractor shall have insured against the liability in respect of such persons in such manner that ANERT is indemnified under the policy but the contractor shall require such sub-contractor to produce to the ANERT when required such policy of insurance and the receipt for the payment of the current premium.

81. SAFETY MEASURES

The bidder shall take entire responsibility for electrical safety of the installation(s) including connectivity with the grid and follow all the safety rules & regulations applicable as per Electricity Act, 2003 and CEA guidelines etc.



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

Department of Power, Government of Kerala
Thiruvananthapuram, Kerala – 695 033;
www.ANERT.gov.in , projects@ANERT.in

E-TENDER DOCUMENT

*Request for Selection (RFS) of Bidder for the
Implementation of 1 MWp Solar PV System
with Grid connectivity at Kerala University of
Health Sciences, Thrissur, Kerala*

Ref. No.: ANERT-TSR/18/2022-DE(TSR)

VOL – 4: ANNEXURES

Date of Publishing of Bids : - 16/11/2024

Last Date of Submission of Bids : - 06/12/2024

FORMAT 1 - COVERING LETTER

(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 and Renewable Energy Research & Technology (ANERT), at the rates quoted against each item. The articles will be delivered and installed/commissioned operated and maintained for 25 years thereafter under a CAPEX Business Model within the time and at the place(s) specified in the schedule.

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)

FORMAT 2 - POWER OF ATTORNEY

(To be on non-judicial Kerala stamp paper of appropriate value as per Stamp Act relevant to place of execution)

Power of Attorney to be provided by the Bidding Company in favour of its representative as evidence of authorized signatory's authority.

Know all men by these presents, We (name and address of the registered office of the Bidding Company as applicable) do hereby constitute, appoint and authorize Mr./Ms. (name & residential address) who is presently employed with us and holding the position of as our true and lawful attorney, to do in our name and on our behalf, all such acts, deeds and things necessary in connection with or incidental to submission of our Bid for Implementation of Grid connected Ground Mounted Solar PV Power Plant at Kerala University of Health Sciences, Thrissur, Kerala in response to the RFS. No dated issued by ANERT including signing and submission of the Bid and all other documents related to the Bid, including but not limited to undertakings, letters, certificates, acceptances, clarifications, guarantees or any other document which the ANERT may require us to submit. The aforesaid Attorney is further authorized for making representations to the ANERT and providing information / responses to ANERT representing us in all matters before ANERT and generally dealing with ANERT in all matters in connection with this Bid till the completion of the bidding process as per the terms of the above mentioned RFS.

We hereby agree to ratify all acts, deeds and things done by our said attorney pursuant to this Power of Attorney and that all acts, deeds and things done by our aforesaid attorney shall be binding on us and shall always be deemed to have been done by us.

All the terms used herein but not defined shall have the meaning ascribed to such terms under the RFS.

Signed by the within named

..... **(Insert the name of the executant company)**

through the hand of Mr.

duly authorized by the Board (vide Board Resolution No____) to issue such Power of Attorney

Dated this day of

Accepted

.....

Signature of Attorney

(Name, designation and address of the Attorney)

Attested

.....

(Signature of the executant)

(Name, designation and address of the executant)

.....

Signature and stamp of Notary of the place of execution

Common seal of has been affixed in my/our presence pursuant to Board of CEO's Resolution dated.....(Board of CEO's Resolution is also enclosed)

WITNESS

1.

(Signature)

Name.....

Designation

2.

(Signature)

Name.....

Designation

Notes:

The mode of execution of the power of attorney should be in accordance with the procedure, if any, laid down by the applicable law and the charter documents of the executant(s) and the same should be under common seal of the executant affixed in accordance with the applicable procedure. Further, the person whose signatures are to be provided on the power of attorney shall be duly authorized by the executant(s) in this regard.

The person authorized under this Power of Attorney, in the case of the Bidding Company / Lead Member being a public company, or a private company which is a subsidiary of a public company, in terms of the Companies Act, 1956, with a paid up share capital of more than Rupees Five crores, should be the Managing CEO / whole time CEO/manager appointed under section 269 of the Companies Act, 1956. In all other cases the person authorized should be a CEO duly authorized by a board resolution duly passed by the Company. Also, wherever required, the executant(s) should submit for verification the extract of the chartered documents and documents such as a Board resolution / power of attorney, in favour of the person executing this power of attorney for delegation of power hereunder on behalf of the executant(s).

FORMAT 3 – GENERAL PARTICULARS

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

Name of the Agency	
Registered Office	
Nature of Agency (Ltd. Co., Partnership etc.) Attach Copy of partnership Deed/ Certification of Incorporation	
Year of Establishment	
Registration of Number	
Address for Communication	
Telephone number of Contact person(Mobile if any)	
Name of CEOs/ Proprietor/Partners(with address and Telephone No)	
GST Registration Number (Copy to be Attached)	
PAN Number	
TAN Number	
Whether the bidder wishes to form a project company for execution of work	
Whether any Civil Suit / Litigation arisen in the contract executed during the last five years/being executed. If yes, please furnish the name of the Contract, employer nature of work, contract value,	

work order and date and brief details of litigation.	
Details of Total Experience in general since inception(Details of similar systems installed till the date of bid)	
Details of Turnover for last Two years. (Copy Audited Statements has to be submitted for last two financial years)	
Details of offices in Kerala, India and abroad- address and contact details	

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)

FORMAT 4 - CONSORTIUM AGREEMENT

(To be on non-judicial Kerala stamp paper of appropriate value as per Stamp Act relevant to place of execution)

THIS Consortium Agreement (“Agreement”) executed on this _____ day of _____ 2020 between M/s [insert name of Lead Member] _____ a Company incorporated under the laws of _____ and having its Registered Office at _____ (hereinafter called the “Lead Member”, which expression shall include its successors, executors and permitted assigns)

and

M/s _____ a Company incorporated under the laws of _____ and having its Registered Office at _____ (hereinafter called the “Technical Member”, which expression shall include its successors, executors and permitted assigns), which expression shall include its successors, executors and permitted assigns)

WHEREAS, each Member individually shall be referred to as the “Member” and both the Members shall be collectively referred to as the “Members” in this Agreement.

WHEREAS the [Name of the Organisation] (hereinafter called [NAME OF THE ORGANISATION] or [NAME OF THE ORGANISATION]), a section __ Company incorporated under the Company’s Act, 1956 has invited response to RFS No. ____ dated ____ for Design, manufacture, supply, erection, testing and commissioning including warranty, operation & maintenance for a period of 5 years under CAPEX of Solar PV Power plant in Kerala University of Health Sciences, Thrissur, Kerala.

WHEREAS the RFS documents stipulates that the Lead Member may enter into a Technical Consortium Agreement with another Company / Corporate entity to fulfill the Technical Eligibility Criteria as stipulated in the RFS document. The Members of the Bidding Consortium will have to submit a legally enforceable Consortium Agreement in a format enclosed with the RFS document.

NOW THEREFORE, THIS AGREEMENT WITNESSTH AS UNDER:

In consideration of the above premises and agreements all the Members in this Consortium do hereby mutually agree as follows:

1. We, the Members of the Consortium and Members to the Agreement do hereby unequivocally agree that (M/s_____), shall act as the Lead Member as defined in the RFS for self and agent for and on behalf of Technical Member _____.
2. The Lead Member is hereby authorized by the Technical Member of the Consortium to bind the Consortium and receive instructions for and on their behalf.
3. The Lead Member shall be liable and responsible for ensuring the individual and collective commitment of each of the Members of the Consortium in discharging all of their respective obligations. Each Member further undertakes to be individually liable for the performance of its part of the obligations without in any way limiting the scope of collective liability envisaged in this Agreement.
4. Subject to the terms of this Agreement, the Technical member shall be responsible for providing technical knowledge for “Design, Manufacture, Supply, Erection, Testing and Commissioning including Warranty, Operation & Maintenance for a defined period as per RFS to the lead member.
5. In case of any breach of any commitment by any of the Consortium Members, the Lead Member shall be liable for the consequences thereof.
6. This Agreement shall be construed and interpreted in accordance with the Laws of India and courts at Delhi alone shall have the exclusive jurisdiction in all matters relating thereto and arising there under.
7. It is hereby further agreed that in case of being shortlisted, the Members do hereby agree that they shall abide by the terms & conditions of the RFS document.
8. It is further expressly agreed that this Agreement shall be irrevocable and shall form an integral part of the RFS submitted to [NAME OF THE ORGANISATION] and shall remain valid till completion of the job assigned to the Contractor.
9. The Lead Member is authorized and shall be fully responsible for the accuracy and veracity of the representations and information submitted by the Members respectively from time to time in the response to RFS.

10. It is hereby expressly understood between the Members that no Member at any given point of time, may assign or delegate its rights, duties or obligations under this agreement without the explicit permission of [NAME OF THE ORGANISATION].

11. This Agreement

- a. Has been duly executed and delivered on behalf of each Member hereto and constitutes the legal, valid, binding and enforceable obligation of each such Member;
- b. Sets forth the entire understanding of the Members hereto with respect to the subject matter hereof; and
- c. May not be amended or modified except in writing signed by each of the Members and with prior written consent of [NAME OF THE ORGANISATION].

IN WITNESS WHEREOF, the Members have, through their authorised representatives, executed these present on the Day, Month and Year first mentioned above.

For M/s-----[Lead Member]

(signature, Name & Designation of the person authorized vide Board Resolution Dated)

Witnesses: 1) Signature-----

Name:

Address: 2) Signature -----

Name:

Address:

For M/s-----[Technical Member]

(signature, Name & Designation of the person authorized vide Board Resolution Dated)

Witnesses:

FORMAT 5 - CERTIFICATE OF RELATIONSHIP OF PARENT COMPANY OR AFFILIATE WITH THE BIDDING COMPANY

(On the Letter Head of the Financially Evaluated Entity or its Parent Company/Ultimate Parent Company)

To,

CEO ANERT

Thiruvananthapuram, Kerala

Dear Sir,

Sub: Bid for Implementation of Grid connected Solar PV Power Plant at Kerala University of Health Sciences, Thrissur, Kerala.

We hereby certify that M/s.....,M/s.....,M/s.....are the Affiliate(s) /Parent Company of the Bidding Company as per the definition of Affiliate/Parent Company as provided in this RFS and based on details of equity holding as on seven (7) days prior to the Bid Deadline.

The details of equity holding of the Affiliate/Parent Company/Bidding Company or vice versa as on seven (7) days prior to the Bid Deadline are given as below: Name of Bidding Company/applicant company	Name of the Affiliate of the Bidding Company/Applicant company/ Name of the Parent Company of the Bidding Company	Name of the Company having common control on the Affiliate and the Bidding Company	Percentage of Equity Holding of Parent Company in the Bidding Company/ Applicant company
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(Insert Name and Signature of Statutory Auditor or practising Company Secretary of the Bidder)

FORMAT 6 - UNDERTAKING FROM THE FINANCIALLY EVALUATED ENTITY OR ITS PARENT COMPANY/ ULTIMATE PARENT COMPANY

(On the Letter Head of the Financially Evaluated Entity or its Parent Company/Ultimate Parent Company)

Name:

Full Address:

Telephone No.:

E-mail address:

Fax/No.:

To,

.....

Dear Sir,

We refer to the RFS No.....dated.....for “Implementation of Grid connected Solar PV Power Plant at Kerala University of Health Sciences, Thrissur, Kerala.”.

“We have carefully read and examined in detail the RFS, including in particular, Clauseof the RFS, regarding submission of an undertaking, as per the prescribed Format ___of the RFS.

We confirm that M/s.....(Insert name of Bidding Company/) has been authorized by us to use our Technical and or financial capability for meeting the Technical and or Financial Eligibility as specified in Clause....of the RFS referred to above.

We have also noted the amount of the Performance Guarantee required to be submitted as per Clause....of the RFS the(Insert the name of the Bidding Company) in the event of it being selected as the Successful Bidder”.

In view of the above, we hereby undertake to you and confirm that in the event of failure of(Insert name of the Bidding Company) to submit the Performance Guarantee in

full or in part at any stage, as specified in the RFS, we shall submit the Performance Guarantee not submitted by(Insert name of the Bidding Company)”.

We have attached hereto certified true copy of the Board Resolution Whereby the Board of CEOs of our Company has approved issue of this Undertaking by the Company.

All the terms used herein but not defined, shall have the meaning as ascribed to the said terms under the RFS.

Signature of Managing CEO/Authorised signatory

Common seal ofhas been affixed in my/our presence pursuant to Board of CEO’s Resolution dated.....

WITNESS

.....

(Signature)

Name.....

Designation.....

.....

(Signature)

Name.....

Designation.....

FORMAT 7 - PERFORMANCE SECURITY GUARANTEE

(To be on non-judicial Kerala stamp paper of appropriate value as per Stamp Act relevant to place of execution)

BG No. :

Amount :

Date :

Valid up to :

In consideration of the Agency for New & Renewable Energy Research and Technology, therein after called "ANERT") have allotted work to M/s..... (hereinafter called the said Contractor) under the terms and conditions of Supply Order No..... issued by ANERT and the agreement dated made between (name of contractor) and ANERT for covering (hereinafter called the said agreement) of Security Deposit for the due fulfilment by the said contractor of the terms and conditions.

Contained in the said agreement, on production of the Bank Guarantee for Rs..... (Rupees..... only) we,Bank having our Head Office at (herein after referred to as "the Bank") at the request of M/s.(name of contractor) do hereby undertake to pay to the ANERT an amount not exceeding Rs..... (Rupees only), against any loss or damage caused to or suffered or would be caused to or suffered by the ANERT by reason of any breach by the said contractor of any of the terms and conditions contained in the said agreement

We,Bank, do hereby undertake to pay the amount due and payable under this Guarantee without any demur, merely on a demand from the ANERT stating that the amount claimed is due by way of loss or damage caused to or would be caused to or suffered by the ANERT by reasons of breach by the said contractor of any of the terms or conditions contained in the said agreement. Any such demand made on the Bank shall be conclusive as regards the amount due and payable by the Bank under this guarantee. However, our liability under this guarantee shall be restricted to an amount not exceeding Rs. (Rupees only).

This guarantee will not be discharged due to change in the constitution of the bank or the contractor/supplier.

Notwithstanding anything contained hereinbefore:

- 1) Our liability under this Bank Guarantee shall not exceed Rs.....(Rupees only)
- 2) This Bank Guarantee shall be valid upto
- 3) We are liable to pay the guaranteed amount or any part thereof under this Bank Guarantee amount only and only if you serve us a written claim or demand on or before.....

Dated at this ... day of 2024

FORMAT 8 – FINANCIAL CRITERIA

(certified by Authorized Signatory and the Statutory Auditor / Practising Chartered Accountant of the Bidding Company)

Financial Qualification Certificate

(Rupees in Crores)

S/N	Financial parameters	FY 19-20	FY 20-21	FY 21-22	FY 22-23	FY 23-24
1.	Net Worth					
a)	Paid up Capital					
b)	Free Reserves and Surplus*					
c)	Misc expenses to the extent not written off					
	Net Worth (a+b-c)					
2.	Annual Turnover **					

* Free Reserve and Surplus shall be Exclusive of Revaluation Reserve, written back of Depreciation Provision and Amalgamation.

** Annual total Income/ turnover as incorporated in the Profit and Loss Account excluding non-recurring income, i.e., sale of fixed asset etc.

It is certified that all the figures are based on audited accounts read with auditors report and Notes to Accounts etc.

(Signature & Seal of Authorized Signatory

Name of Authorized Signatory:

Designation:

Date:

Place:

Certifying Chartered Accountant:

Name of Firm:

UDIN No:

Date:

Place:

Note:

1. In addition to above certificate from Chartered Accountant, Bidder is required to submit Firm's Annual Audit Report, Balance sheet, Profit & Loss and Income Tax Returns / CA certificate for last Five years i.e., F.Y: 2019-20, 2020-21, 2021-22, 2022-23 & 2023-24.

FORMAT 9 – FINANCIAL BID (BILL OF QUANTITY)

(This is a sample of the BoQ, bidders are requested not to use this and use the excel file available along with the documents for uploading)

ANNEXURE A –SUMMARY OF BID DOCUMENTS

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

Sir,

I/We hereby submit the required documents as desired by the Agency for New and Renewable Energy Research & Technology (ANERT) for the implementation of Ground Mounted Solar PV System with Grid Connectivity under CAPEX Model in Moongilmada, Palakkad, Kerala.

Project Report (As per TOC provided by [NAME OF THE ORGANISATION])

(Project report should contain the following Table of Contents)

- Context / background / Introduction
- Project objectives
- Target beneficiaries
- Project strategy / Approach of work & methodology
- Site details including photographs with date & time stamping
- Solar resource assessment
- Technology selection (Module, Inverter and BOS)
- Design, Simulation, BOM and layout of SPV plant
- Grid connectivity and metering scheme
- Means of financing and project budget
- Time frame / schedule of implementation

Signature
of authorised signatory

Name

Designation

Date: (office seal)

ANNEXURE B – PRE-AGREEMENT

(To be on non-judicial Kerala stamp paper of value Rs. 200)

ARTICLES OF AGREEMENT executed on this the day of
Two thousand andbetween 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 ***Request for
Selection (RFS) of Bidder for the Implementation of 1 MWp Solar PV System with Grid
connectivity at Kerala University of Health Sciences, Thrissur, Kerala*** specified therein
subject to the terms and conditions contained in the said e-tender.

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

In case the e-tender submitted by the bounden is accepted by ANERT and the contract
for is
awarded to the bounden, the bounden shall within Fifteen days of acceptance of this e-
tender, execute an agreement with ANERT incorporating all the terms and conditions
under which ANERT accepts this 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 Earnest Money deposited by the bounden and if the Earnest Money is found to be inadequate the deficit amount may be recovered from the bounden and his properties movable and immovable in the manner hereinafter contained.

All sums found due to 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 and 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 C – DECLARATION BY THE BIDDER

e-Tender Notification No:, dtd for Request for Selection (RFS) of Bidder for the Implementation of 1 MWp Solar PV System with Grid connectivity at Kerala University of Health Sciences, Thrissur, Kerala

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 6 months from the date fixed as deadline for the submission of tenders in accordance with the Bidding Document, and it shall remain binding upon us and may be accepted at any time before the expiration of that period;
4. If our Bid is accepted, we commit to submit a Security Deposit in the amount of 5 percent of the Contract Price for the due performance of the Contract;
5. We are not participating, as Bidders, in more than one Bid in this bidding process;
6. Our firm, its affiliates or subsidiaries, including any subcontractors or 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. Our firm has obtained the certifications from MNRE or NABL approved Test laboratories that the goods and services are satisfying the technical criteria specified in the bid.

Signature

Date

Name

ANNEXURE D – DECLARATION OF RELATIONSHIP WITH ANERT EMPLOYEE

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

Tender Notification No.:

Request for Selection (RFS) of Bidder for the Implementation of 1 MWp Solar PV System with Grid connectivity at Kerala University of Health Sciences, Thrissur, Kerala

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 E – BIDDERS TECHNICAL INFORMATION

TECHNICAL PARTICULAR DATA

Solar PV Module

Sl. No	Particulars	Required	Offered
1	PV Module Manufacture name & Country of origin	Manufacture name to be specified	
2	PV Module type	Poly/Mono Crystalline, Mono PERC	
3	No. of PV cells per Module		
4	Total number of PV modules		
5	Max. Power, P_{mp} @STC	330 Wp or above	
6	Max. Power tolerance (%)	Not more than 3%	
7	Max. Power voltage (V_{mp}) @STC	To be specified	
8	Max. Power current (I_{mp}) @STC	To be specified	
9	Open circuit voltage, V_{oc} @ STC	To be specified	
10	Short circuit current, I_{sc} @STC	To be specified	
11	Nominal voltage	To be specified	
12	Nominal Wattage	To be specified	
13	Fill Factor	Not less than 0.7	
14	Temp. coefficient of V_{oc} (%/C)		
15	Temp. coefficient of P_{mp} (%/C)		
16	Temperature Co-efficient of I_{sc} (%/°C)		
17	Normal Operating Cell Temperature (NOCT) (°C)		
18	Operating Temperature (°C)		
19	Module efficiency	$\geq 17\%$	
20	No. of By-pass Diodes		
21	Mounting arrangement for Solar Module	Fixed Arrangement	

Sl. No	Particulars	Required	Offered
22	Solar Module frame material	Anodized Aluminium	
23	Module dimensions' cm (L x W x H)	To be specified	
24	PV panel Weight (kg)	To be specified	
25	Output Cables	Polarized, UV protected &Weather Proof DC rated multi-contact connector	
26	Output Terminal	PV Connectors	
27	Junction Box	Weather resistant HDPE (IP65)	
28	Copies of test certificates	IS 14286/IEC 61215,61730 part 1&2, IEC 61701	

INVERTER

Sl. No.	Particulars	Required	Offered
1	Manufacturer		
2	Model name/No.		
3	Number of units		
4	Nominal AC power		
5	Nominal AC voltage		
6	Nominal AC Current		
7	AC grid Frequency range	50Hz \pm 0.5%	
8	AC grid voltage range		
9	Power Factor (+ and -)		

Sl. No.	Particulars	Required	Offered
10	Total Harmonic Distortion	As per IEEE-519 2014	
11	AC over / under voltage over / under frequency protection		
12	Max PV input power		
13	Maximum DC voltage	Less than 1000 V	
14	MPPT voltage range		
15	Maximum DC current		
16	No. of DC input ports		
17	Maximum Efficiency	as per IEC61683	
18	DC voltage ripple		
19	Ambient temperature range		
20	Humidity (non-condensing)	95%, non-condensing	
21	Protective functions - AC over/under voltage, AC over/under frequency, over temperature, AC and DC overcurrent, DC over-voltage, against Islanding		
22	Communication Interface	RS485, MPI Profi-Bus/Telephone Modem/WiFi	
22	User-display standard	LCD panel with membrane keypad	
23	Enclosure environment rating		
24	Safety and EMC		
25	Anti-islanding feature	IEEE1547/UL1741/IEC62116	

TRANSFORMER

Sl. No.	Particulars	Required	Offered
1	Manufacturer		

ANNEXURE F – CERTIFICATIONS & STANDARDS

QUALITY CERTIFICATION, STANDARDS AND TESTING FOR GRID-CONNECTED SOLAR PV POWER PLANTS

Solar PV Modules/Panels	
IEC 61215	<i>Design Qualification and Type Approval for Crystalline Silicon Terrestrial Photovoltaic (PV) Modules</i>
IS 14286	<i>Design Qualification and Type Approval for Crystalline Silicon Terrestrial Photovoltaic (PV) Modules</i>
IEC 61646	<i>Design Qualification and Type Approval for Thin-Film Terrestrial Photovoltaic (PV) Modules</i>
IS 16077	<i>Design Qualification and Type Approval for Thin-Film Terrestrial Photovoltaic (PV) Modules</i>
IEC 62108	<i>Design Qualification and Type Approval for Concentrator Photovoltaic (CPV) Modules and Assemblies</i>
IEC 61701	<i>Salt Mist Corrosion Testing of Photovoltaic (PV) Modules</i>
IEC 61725	<i>Analytical expression for Daily Solar Profiles</i>
IEC 61853-1	<i>Photovoltaic (PV) Module performance testing and energy rating Part-1: Irradiance and temperature performance measurements, and power rating</i>
IS 16170: Part 1	<i>Photovoltaic (PV) Module performance testing and energy rating Part-1: Irradiance and temperature performance measurements, and energy rating</i>
IEC 62716	<i>Photovoltaic (PV) Modules - Ammonia (NH₃) Corrosion Testing</i>
IEC 60721-2-1	<i>Classification of environmental conditions - Part 2-1 : Environmental conditions appearing in nature - Temperature and humidity</i>
IEC 61730-1	<i>Photovoltaic (PV) Module Safety Qualification - Part 1: Requirements for Construction</i>
IEC 61730-2	<i>Photovoltaic (PV) Module Safety Qualification - Part 2: Requirements for Testing</i>
IEC 60904-2	<i>Photovoltaic devices - Part 2: Requirements for photovoltaic reference devices (STC Performance, 1-V)</i>
IEC 60891	<i>Photovoltaic devices - Procedures for temperature and irradiance corrections to measured I-V characteristics (STC Performance)</i>
IEC TS 62548	<i>Photovoltaic (PV) Arrays - Design requirements</i>
IEC 61829	<i>Crystalline silicon photovoltaic (PV) array- on-site measurement of I-V characteristics</i>

Solar PV String Inverters/INVERTERS

IEC 62109-1, IEC 62109-2	<i>Safety of power converters for use in photovoltaic power systems- Part 1: General requirements, and Safety of power converters for use in photovoltaic power systems - part 2 : Particular requirements for inverters. Safety compliance (Protection degree IP 65 for outdoor mounting, IP 54 for indoor mounting)</i>
IEC/IS 61683	<i>Photovoltaic systems - Power conditioners: Procedure for measuring Efficiency (10%, 25%, 50%, 75% & 90-100% loading conditions)</i>
IEC 62093	<i>Balance-of-system components for photovoltaic systems – Design qualification natural environments for solar inverters (grid-connected)</i>
IEC 62116	<i>Utility-interconnected photovoltaic inverters- Test procedure of Islanding prevention measures Standard for Inverters, Converters, Controllers and</i>
UL1741	<i>interconnection system Equipment for use with Distributed Energy Resources</i>
IEEE 1547	<i>Standard for interconnecting Distributed Resources with Electric Power Systems</i>
IEEE 1547.1	<i>Standard for Conformance Test procedures for</i>
	<i>Equipment interconnecting Distributed Resources with Electric Power Systems</i>
IEC 60255-27	<i>Measuring relays and protection equipment - Part 27 : Product safety requirements</i>
IEC 60068-2 (1,2,14,27,30 & 64)	<i>Environmental Testing of PV System – Power Conditioners and Inverters</i>
	<i>IEC 60068 -2-1: Environmental testing - part 2-1: Tests - Test A: Cold</i>
	<i>IEC 60068 -2-2: Environmental testing - part 2-2: Tests - Test B: Dry heat</i>
	<i>IEC 60068 -2-14: Environmental testing - part 2-14: Tests - Test N: Change of temperature</i>
	<i>IEC 60068 -2-27: Environmental testing - part 2-27: Tests - Test Ea and guidance: shock</i>
<i>IEC 60068 -2-30: Environmental testing - part 2-30: Tests - Test Db: Damp heat, cyclic (12h+12h cycle)</i>	
<i>IEC 60068 -2-64: Environmental testing - part 2-64: Tests - Test Fh : Vibration, broadband random and guidance</i>	
IEC 61727	<i>Photovoltaic (PV) systems - characteristics of the utility interface (Parallel operation)</i>
CEA Guidelines / Regulations	<i>Technical standards for connectivity of the distributed Generation Resources at Voltage - level of below 33kV</i>
IEC 62103	<i>Electronic equipment for use in power installations</i>
BS EN 50438	<i>Requirements for micro-generating plants to be connected in parallel with public low-voltage distribution networks</i>

IEC 61000 Series	<i>Electromagnetic Interference (EMI), and Electromagnetic Compatibility (EMC) testing of PV inverters</i>
IEC61850	<i>Inverters with Reactive Power Control</i>
IEC 62124	<i>Photovoltaic (PV) Stand -alone systems- Design verification</i>
Fuses	
IS/IEC 60947 (Part 1,2 &3) EN 50521	<i>General safety requirements for connectors, switches, circuit breakers (AC/DC) Low-voltage switchgear and Control-gear, Part-1: General rules Low-voltage switchgear and Control-gear, Part-2: Circuit Breakers Low-voltage switchgear and Control-gear, Part-3: Switches, disconnectors, switch-disconnectors and fuse- combination units EN. 50521: Connectors for photovoltaic systems - Safety requirement</i>
Surge Arrestors	
IEC 60364-5-53	<i>DC surge protection device (SPD), class 2</i>
IEC 60364-5-53	<i>AC surge protection device (SPD), class 2</i>
IEC 60364-5-53	<i>Electrical installations of buildings-Part 5-53: Selection and erection of electrical equipment - Isolation, switching and control</i>
IS 15086-5	<i>Surge Arrestors, Part 5: Selection and Application Recommendations</i>
Cables	
IEC 60227/IS 694, IEC 60502/IS 1554 (Part 1 & 2)	<i>General test and measuring method for PVC (Polyvinyl chloride) insulated cables (for working voltage up to and including 1100V, and UV resistant for outdoor installation)</i>
Earthing	
IS 3043-1986	<i>Earthing shall be done in accordance with IS-3043-1986, provided that earthing conductors shall have a minimum size of 6.0 mm² copper, 10 mm² aluminum or 70mm² hot dip galvanized steel</i>
IEC 60364-5-53	<i>The SPDs earthing terminal shall be connected to earth through the above-mentioned dedicated earthing system; The SPDs shall be of type 2 as per IEC 60364-5-53</i>
IS 3043	<i>Code of practice for earthing (ETD 20: Electrical Installation)</i>
IEC 62561 Series	<i>IEC 62561-1 - Lightning protection system components (LPSC)- Part 1: Requirements for connection components IEC 62561-2 - Lightning protection system components (LPSC)- Part 2: Requirements for conductors and earth electrodes IEC 62561-7 - Lightning protection system components (LPSC)- Part 2:</i>

	<i>Requirements for earthing enhancing compounds</i>
Junction Boxes	
IEC 529	<i>Junction boxes and solar panel terminal boxes shall be of the thermo plastic type with IP 65 protection for outdoor use, and IP 54 protection for indoor use</i>
IE 62208, IP 54 as per IEC 529	<i>General requirements for junction boxes, charge controllers</i>
CEA Regulations	<i>Energy Meter Installation and operation of Energy Meters Regulations 2006, and as amended in 2010 & 2014</i>
IS 13779	<i>AC Static watt-hour Meters Class 1 and 2 - specification</i>
IS 14697	<i>AC Static Transformer Operated Watt-hour and Var- hour Meters, Class 0.2 S and 0.5 S - specification</i>
IS 15884	<i>Alternating Current Direct connected static Prepayment Meters for Active Energy (Class 1 and 2) - Specification</i>
IS 15959	<i>Data exchange for electricity meter reading, tariff and load control-companion specification</i>
IS 16444	<i>AC Static direct connected watt-hour Smart Meter Class 1 and 2 specifications (with Import & Export/Net energy measurements)</i>
System Performance Monitoring	
IS/IEC 61724	<i>Guidelines for PV System Performance Monitoring- measurement, Data Exchange, and Analysis</i>
Rooftop PV System/Power Plant inspection	
IEC 62446	<i>Grid connected Solar PV Systems-Minimum requirements for system Documentation, Commissioning Tests, and Inspection</i>
IEC 61557-1	<i>Electrical Safety in low voltage distribution systems up to 1000 V AC. and 1500 V DC - Equipment for testing, measuring or monitoring of protective measures – Part 1: General requirements</i>
IEC 60364-6	<i>Low-voltage electrical installations - part 6: Verification</i>
IEC 61829	<i>Crystalline silicon photovoltaic (PV) array- on-site measurement of I-V characteristics</i>
Battery/Electrical Storage	
IEC 61427-1	<i>Secondary cells and batteries for renewable energy storage-General requirements and methods of test- Part 1: Photovoltaic off-grid application</i>
IS 13369	<i>Stationary lead acid batteries (with tubular positive plates) in monobloc containers</i>