



Hamdard Institute of Medical Sciences & Research & Associated HAH Centenary Hospital

Hamdard Nagar, New Delhi-110 062

Website: www.himsr.co.in

**TENDER FOR SUPPLY, INSTALLATION, TESTING
AND COMMISSIONING OF 500 KW ROOFTOP
SOLAR POWER PLANT CONNECTED TO HT & LT
PANEL OF HAMDARD INSTITUTE OF MEDICAL
SCIENCES & RESEARCH**



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Ref No. HIMSR/SOLAR PLANT/04/2022

NOTICE INVITING TENDER

For Supply, Installation, Testing and Commissioning of 500KW Rooftop Solar Power Plant at HIMSR Building

Sealed tenders are invited in two bid system (Technical Bid & Financial Bid) from the reputed registered agencies having license and experience in Supply, Installation, Testing and Commissioning of 500 kW Rooftop Solar Power Plant at **Hamdard Institute of Medical Sciences & Research (HIMSR), Hamdard Nagar, New Delhi – 110 062**. Tender documents can be downloaded from institute's official website www.himsr.co.in.

Name of Work : Supply, Installation, Testing and Commissioning of 500kW Rooftop Solar Power Plant connected to LT & HT Panel of Hamdard Institute of Medical Sciences & Research (HIMSR), Hamdard Nagar, New Delhi-110062

Earnest Money Deposit : Rs. 5,00,000.00 (Rupees Five Lacs)

Tender Fee : Rs. 5,000.00 (Rupees Five Thousand) (Non-refundable)

Issue of Tender Document : 21st May 2022

Last Date of Submission : 26th May 2022

Duly filled tenders in two separate sealed envelopes (Technical & Financial Bids) put into a main sealed envelope along with **Tender Fee and E.M.D. in the form of Banker's Demand Draft drawn in favor of "HIMSR" payable at New Delhi** put with Technical Bid duly super scribed as **"Tender for Supply, Installation, Testing and Commissioning of 500 KW Rooftop Solar Power Plant"** should submitted in the tender box kept at 9th Floor of HAH Centenary Hospital Block-B, **on or before 26th May 2022 by 03.00 p.m.** The Technical Bids will be opened on same day at 03.30 p.m. in the presence of HIMSR committee only.

HIMSR reserves the right to reject one or all tenders without assigning any reasons.

Sd/-
Medical Superintendent
HAH Centenary Hospital, HIMSR
New Delhi – 110062



BACKGROUND

A growing worldwide concern for the conservation of energy has reawakened interest in ecologically sustainable materials, processes and sources of energy.

Solar photovoltaic is one such system that is highly consistent and reliable throughout the year that is ideally suited for supplying power at remote locations in countries like India, which is blessed by sunlight for most part of the year.

With continuing efforts to use of environment friendly sources of energy, HIMSR has planned to install 500 kWp capacity SPV based power plant at HIMSR through this tender.

Installation capacity may be varied depend upon your solar PV size and configuration.



GENERAL TERMS AND CONDITIONS:

1. Tender documents shall be submitted in the tender box on or before 26th May 2022 by enclosing in a sealed cover superscripted with the name of the work and addressed to "The Medical Superintendent, HAH Centenary Hospital, Hamdard Institute of Medical Sciences & Research, Hamdard Nagar, New Delhi-110 062". The demand draft in favour of "HIMSR" of Rs. 5,000/- (Rupees Five Thousand only) as tender fee and Rs. 5,00,000/- (Rupees Five Lacs only) as Earnest Money Deposit shall also be enclosed with the Technical Bid (Earnest money deposit will be refunded to unsuccessful agencies without interest after finalization of successful agency/s by HIMSR).
2. Tender received without Tender Fee and Earnest Money Deposit (EMD) and with incomplete details shall be rejected.
3. The agency shall visit the site to understand the nature and type of works prior to submitting the tender.
4. The agency should have valid License / Registrations whichever are applicable by law and required for providing services mentioned in this tender.
5. The tender is not transferable.
6. The Earnest money deposit shall be refundable at the end of the defect liability period of 5 years without interest after deducting the dues from the agency if any.
7. The Agency should have experience of undertaking such projects for Commercial/ Education/Government establishments of not less than three years.
8. The agency shall submit the details of four Contracts / Clients wherein contract is preferably exceeding Rs. 1.5 Crore. Annual turnover of Rs. 5 Crore is desirable for the agency.
9. The agency must bid for whole quantity. Partial bidding will not be accepted and will not be considered for further process.
10. Assigning or Subletting full or any portion of the contract shall not be allowed under any circumstances.
11. The bidder must quote the prices strictly in the matter as indicated in the document, failing which tender is liable for rejection. The rate/ cost shall be entered in words as well as in figures.
12. Tender with incomplete details / false details / with omissions & errors etc. shall be rejected. Conditional tender will be rejected.
13. The Prices quoted should be having inclusive of all applicable taxes and all other applicable charges related with providing services mentioned in tender.
14. Tenders offer shall be valid for a period of 90 days from the date of submission of tender.



- 15. HIMSR does not bind to accept the lowest or any tender and reserves the right to accept or reject any or all the tenders, either in whole or in part, without assigning any reasons thereof. HIMSR may finalise the agency based on the criteria which deemed to be fit as per HIMSR requirements.**
- 16. Direct or indirect canvassing in any form is strictly prohibited.**



SPECIAL TERMS AND CONDITIONS:

1. The agency shall be responsible for complete design, engineering, procurement, erection, testing and commissioning of the SPV based Power Plants. This would also include site, arrangement & provisions of suitable power evacuation facility and connection of the SPV based Power Plant with DISCOM's HT/ LT connection as applicable.
2. The Agency shall have to be obtained the necessary approvals from DISCOM's and complete the required formalities. HIMSR will assist administratively in case required. Agency shall have to arrange for all equipment/ meters etc. (with testing certificate from govt. approved laboratory) required for the connection of Solar Power system to DISCOM's distribution network/ system.
3. The successful bidder shall do the needful to avail benefit of exemption of custom and excise duty on the materials from Central/ State Government.
4. The agency shall not display the photograph of the work and shall not take advantage through publicity of the work without written permission of HIMSR.
5. In the event of breach of any of the conditions of the contract at any time on the part of the agency the contract may be terminated summarily by HIMSR, New Delhi without compensation to the contractor.
6. While making the risk purchases, HIMSR may exercise its own discretion. In all cases where orders are cancelled due to non-supply of stores, it will be treated as breach of contract and the HIMSR shall take action accordingly. It is clarified that HIMSR may resort to risk purchase without granting any extension.
7. The contract for the supply of various items can be repudiated at any time by HIMSR if the supplies are not made to its satisfaction. In case of non-performance in any form and shape of the terms & conditions of the agreement the HIMSR has power to cancel the contract pertaining to the supply.
8. Any dispute between the parties will be referred to the Competent Authority of HIMSR. The outcome will be binding on both the parties and shall be final.
9. In case of any disputes related with this tender process and tender work the decisions of Convener (Building Committee) shall be final and binding to the agency.



SPECIAL CONDITIONS FOR SUPPLY, ERECTION, TESTING & COMMISSIONING

❖ GENERAL

1. Competent authority of the HIMSR reserves the right to reduce the scope of work and split the tender in two parts or more without assigning any reason, even after award of contract, if necessary for any site or all sites and thus variations in contract value shall be applicable. The quoted rates shall remain firm for the above said variation.
2. The materials, design and workmanship shall satisfy the applicable standards, specifications contained herein and codes referred to. Where the Technical Specifications stipulate requirements in addition to those contained in the standard codes and specifications, those additional requirements shall be satisfied.

In case of contradiction between Indian Standards, General Conditions of Contract, Special Conditions of Contract, specifications, drawings, instructions of Engineer-in charge, the following shall prevail in order of precedence:

- (i) Detailed Letter of Intent along with Statement of Agreed variations and its enclosures.
- (ii) Special Conditions of Contract
- (iii) Job specifications
- (iv) Drawings
- (v) General Conditions of Contract

❖ QUALIFYING REQUIREMENTS

- (i) The agency must have minimum 3 years of experience of supplying, installing and commissioning solar PV systems in India. Appropriate evidences in terms of completion certificate/ handover certificate must be provided for the same.
- (ii) The agency must have its own office as well as authorized sales & service centers. Bidders should have an authorized exclusive service center in Delhi-NCR (proof for registered address is required). Appropriate evidences must be provided for the same.
- (iii) The agency must have executed work(s) for **Solar Photovoltaic based power plants** during last 5 years. (list of completed projects must provided)
- (iv) The net yield of system per kW/ Annum should not be less than **1,000 kWh**.
- (v) Sound financial health of company is a prerequisite.
- (vi) Preference shall be given to the agency who has ISO 9001, ISO 14001 certification.



❖ RESPONSIBILITY OF THE AGENCY

1. All expenses towards mobilization at site and demobilization including bringing in equipment, work force, materials, dismantling the equipment, clearing the site after completion of work and liaisoning for interconnection of SPV based Power Plant with the internal LT & HT Panel of HIMR with concerned departments/ agencies etc. shall be deemed to be included in the prices quoted and no separate payments on account of such expenses shall be entertained.
2. Contractor may have to work in energized or partly energized conditions. In such cases, it shall be responsibility of the contractor to arrange for necessary permits or shuts downs and provide skilled and responsible persons for the execution of works. Contractor shall organize his works during the shutdown periods properly and complete the programmed works within the time given. Contractor shall not be paid any extra payments for working under the above said circumstances.
3. It shall be entirely the contractor's responsibility to provide, operate and maintain all necessary construction equipment, scaffoldings and safety gadgets, cranes and other lifting tackles, tools and appliances to perform the work in a workman like and efficient manner and complete all the jobs as per time schedules. However, if any equipment/ facility is provided by HIMSR, the same shall be on chargeable basis.
4. The procurement and supply, in sequence and at the appropriate time, of all materials and consumables shall be entirely the contractor's responsibility and his rates for execution of work will be inclusive of supply of all these items.
5. In case any material is issued by the HIMSR, then it will be properly used and maintained. Subsequent to completion of its use, it will be returned to HIMSR in good condition. In case of damage or misuse of such stores, HIMSR will recover the cost from the contractor from the payments due to the agency.

❖ COMPLETION TIME

1. The completion time is deemed to be essence of the Contract and shall be firm and binding. The Bidder shall complete the design, engineering, manufacture, supply, storage, civil work, erection, testing & commissioning within a period of **8 weeks from the date of award of contract.**
2. The Bidder shall indicate the duration of all the activities in activity chart in conformity with the overall schedule of the completion of project. Bidder shall submit the activity chart which shall be discussed and finalized and shall form an integral part of the Contract.

❖ CONTRACTOR/ REPRESENTATIVES AT THE SITE

During the execution of the contract the agency shall ensure responsible person with authority to take decisions to be available at site. Such person deputed by the agency shall report to the engineer in-charge for smooth execution and timely completion of the



work. The contractor available at all reasonable hours to receive instructions, notices or other communications. The contractor shall be responsible for any misconduct/ indiscipline by his employees or subcontractor & its workmen. The contractor shall abide by the instructions of the engineer in charge, if given in this regard.

❖ **SUB-LETTING OF WORK**

“In the eventuality sub-letting of work HIMSR, will be informed **in advance**. However, the contractor’s liability or obligations will not get altered/ delegated to sub-contractor. If any subcontractor engaged upon the work at the site executes any work which in the opinion of the engineer in-charge is not in accordance with the contract documents, the HIMSR may give written notice to the contractor requesting him to terminate such sub-contracts and the contractor on the receipt of such notice shall terminate such contracts.”

❖ **USE OF COMPLETED PORTIONS:**

1. Whenever in the opinion of the HIMSR the work or any part thereof is in a condition suitable for use and in the best interest of the HIMSR requires use, the HIMSR may take possession of the same. The contractor shall, however, be not relieved of his pending obligations.
2. Prior to the date of final acceptance of the work by the HIMSR, all necessary repairs or renewals in the work or part thereof so used on account of defective materials or workmanship or due to the operations failure except normal wear & tear shall be at the expenses of the contractor. Such use shall neither relieve the contractor or any of his responsibilities under the contract, nor act as waiver by the HIMSR of the conditions thereof. However, if in the opinion of the HIMSR the use of the work or the part thereof delays the completion of the remainder of the work, the HIMSR may grant such extensions of time as it may consider reasonable. The decision of the HIMSR in the matter shall be final. The contractor shall not be entitled to claim any compensation on account of such use by the HIMSR.

❖ **POWER OF THE ENGINEER-IN-CHARGE TO ORDER SUSPENSION OF WORK**

The Engineer-in-charge may, from time to time by direction in writing and without invalidating the contract, order the contractor to suspend the work or any part thereof at such time or times and for such reasons as he may consider necessary. After such directions to suspend the work or any part thereof has been given, then proceed with the work or part thereof, directed to be suspended until he receives a written order from the Engineer-in-charge to so proceed. In the event of suspension, the HIMSR may under the provisions of the contract, extend the time for completion of the work or part thereof by such period as it may find reasonable. The decision of the HIMSR in the matter shall be final and binding on the contractor.



❖ PAYMENT TERMS

- 50% After receive all materials of solar PV plant at HIMSR
- 30% After Successful Installation of solar PV plant
- 20% After satisfactorily commissioning period of Power plant (After 60 days) and installation of bi-directional meter

❖ RATES TO BE INCLUSIVE

1. The rates quoted by the agency shall remain firm and fixed and binding till the issue of completion certificate and shall not be subject to escalation. Rates shall be deemed to include and cover all costs, expenses, taxes, construction cess, any kind of cess, duties, levies, royalties, foreign exchange variation, etc. and liabilities of every description and all risk of every kind to be taken in execution, completing and handing over the work to the HIMSR by the agency. The HIMSR shall deduct income tax, Sales tax or Works Contract as applicable on the indivisible works contract & other applicable taxes as per the prevailing rates from the bills of the contractor. HIMSR shall not be responsible for any such liability on the contractor in respect of this contract and exclusion of any applicable taxes at prescribed rates due to ignorance or otherwise shall not form a reason for claiming anything extra at a later date.
2. The contractor shall guarantee the SPV based power plant & installation work for a period of 25 years from the date of completion stabilization period. Any damage or defect that may arise or lie undiscovered at the time of issue of completion certificate, connected in any way with the equipment or materials supplied by him or in the workmanship shall be rectified or replaced by the contractor at his own expenses as deemed necessary by the Engineer-in-charge or in default, the engineer-in-charge may cause the same to be made good by other workman and deduct expenses of which the certificate of Engineer-in-charge shall be final from any sums that may be then or at any time thereafter, become due to the agency or from his security deposit.
3. If the agency feels that any variation in work or in quality of materials or proportions would be beneficial or necessary to fulfil the guarantee called for, he shall bring this in writing to the notice of the Engineer-in-charge

❖ DEFECTS PRIOR TO TAKING OVER:

1. If at any time before the work is taken over, the Engineer- in-charge shall:
 - i) Decide that any work done or materials used by the contractor or any sub-contractor is defective or not in accordance with the contract, or that the works or any portion thereof are defective, or do not fulfil the requirements of contract (all such matters being hereinafter, called 'Defects' in this clause) and
 - ii) As soon as reasonably practicable notice given to the contractor in writing of the said decision specifying particulars of the defects alleged to exist or to have occurred then the contractor shall at his own expense and with all efforts would make good the defects so specified.



2. In case the contractor fails to do so after 2 written notice of Engineer in charge, the HIMSR may take, at the cost and risk of the contractor, such steps as may in all circumstances be reasonable to make good such defects. The expenditure so incurred by the HIMSR will be recovered from the amount due to the contractor. The decision of the Engineer-in charge with regard to the amount to be recovered from the contractor will be final and binding on the contractor. As soon as the works have been completed in accordance with the contract and have passed the tests on completion, the Engineer-in-charge shall issue a certificate in which he shall certify the date on which the works have been so completed and have passed the said tests and the HIMSR shall be deemed to have taken over the works on the date so certified.

❖ DEFECTS AFTER TAKING OVER

1. In order that the contractor could obtain a completion certificate, he shall rectify any defect arising from the defective materials supplied by the contractor or workmanship or any act or omission of the contract or that may have been noticed or developed after the works or group of the works has been taken over, the period allowed for carrying out such works will be normally 15 days. If any defect be not remedied within a reasonable time the HIMSR may proceed to do the work at contractor's risk and expense and deduct from the final bill such amount as may be decided by the HIMSR.
2. If by reason of any default on the part of the contractor a completion certificate has not been issued in respect of every portion of the works within one month after the date fixed by the contract for the completion of the work, the HIMSR shall be at liberty to use the works or any portion thereof in respect of which a completion certificate has not been issued, provided that the works or the portion thereof so used as aforesaid shall be afforded reasonable opportunity for completion of these works for the issue of completion certificate.
3. All the aforesaid safeguards/ rights provided for the HIMSR shall not prejudice its other rights/ remedies elsewhere provided herein and/ or under law.

❖ COMPLETION CERTIFICATE

1. **On satisfactory completion of work the contractor shall apply to the State/ local Power Utility/IREDA, as the case may be, for the issue of commissioning certificate and the same shall be arranged within 15 days of the commissioning of work in all respects (if required),** after verifying from the completion documents and satisfying himself that the work has been completed in accordance with details set out in the construction and erection drawings, and the contract documents. No completion certificate shall be given nor shall the work be deemed to have been executed until the export of generated solar power commenced, statutory requirements are completed and all scaffolding, surplus materials and rubbish is cleaned off the site completely.



2. The following documents will form the completion certificate documents:
- The technical documents as per scope of work & technical specifications according to which the work was carried out.
 - Two sets of as built drawings showing therein the modification and corrections made during the course of execution signed by the Engineer-in-charge. One digitized soft copy of as built drawings shall also be submitted.
 - Certificates of type/ routine tests performed for various equipment at works along with O&M manuals
 - Statutory clearances/ permissions.
 - Payment of all statutory duties, taxes, labour wages & others. (The document (s) having evidence of paying statutory duties, taxes etc. as per requirement of concerned statutory authorities).
 - The copy of certified initial meter reading of main meter and back up meters signed by power utility, etc.
 - Certificate regarding completion of the facility in all respect by the Engineer In charge.
 - Copy of Power Purchase Agreement executed with the supply agency.
 - Guarantee/warranty card of the equipment installed

❖ **ESTIMATED ANNUAL ENERGY GENERATION**

Agency is required to furnish estimated annual energy generation as per attached **Annexure – B** along with their offer failing which his offer is liable to be rejected.

No change in data supplied by the Agency at the time of submission of the bid related to estimation of the generation like Module type, module size, Location of site etc. shall be permitted. However, during the execution, in case it becomes absolutely inevitable for the Agency then minor changes may be accepted by HIMSR but this should not affect the annual energy estimation. However, HIMSR will again get the estimation of generation of the SPV based power plant checked with the changes of data and if the generation is found to be less than what was considered for financial evaluation then the Agency will have to modify the parameters in such a way that estimated generation with changes does not fall below the generation considered for financial evaluation.

Note:- The Solar Energy generation shall be calculated on the basis of meter reading of Bi-directional Energy Meter installed at each site at 415 V busbar on A.C. side.

❖ **TEST/INSPECTION**

All the standard tests in accordance with the standards adopted shall be carried out at the manufacturer's works on all the major equipment and accessories covered by this specification so as to ensure efficient operation and satisfactory performance of all the component/ parts. The Agency shall furnish a complete list and details of all such tests to



be conducted on different equipment. The contractor will furnish a schedule of testing so that HIMSR may associate his representative to witness the tests on any one set of major components. The contractor shall also furnish copies of all test/ inspection reports for reference to the HIMSR.

Any special test to be performed shall be mutually agreed upon between the Bidder and the HIMSR.

All equipment shall be further tested at site, as recommended, before commissioning.

The work is subject to inspection at all times and at all places by the Engineer In charge. The contractor shall carry out all instructions given during inspection and shall ensure that the work is being carried out according to the relevant codes of practice during the performance of the work.

The decision of the Engineer-in-charge in regard to the quality of work and materials and performance to the specifications and drawings shall be final.

If any item is rejected during test/ inspection, the same shall be replaced/ rectified by contractor without any cost

Third party inspection of all major items shall be done by agency appointed/ authorised by HIMSR, if required. All expenses incurred for third party inspection shall be borne by HIMSR

❖ **GUARANTEE**

1. The manufacturer's guarantee for all bought out items shall be made available to HIMSR and shall be valid at least for the entire defect liability period. If manufacturer's guarantee is not so available to the HIMSR, the contractor himself shall guarantee the items supplied for the entire defect liability period. However, in case the manufacturer's guarantee period is in excess of the defect liability period, such guarantees for such excess period shall be passed on by the contractor to the HIMSR.
2. Any material and/ or equipment and/ or accessories which shall prove defective or which shall fail to meet the desired design guarantee or performance guarantee during the defects liability period, the contractor shall replace/ rectified at his own cost that material and/ or equipment and/ or accessories with another of make approved by HIMSR. Manufacturer's/ contractor's guarantee for such replaced equipment shall also be made available to HIMSR and should be kept valid at least for five year from the date of last replacement
3. The contractor shall guarantee the satisfactory performance of the SPV based power plant for a period of 25 years from the date of completion of stabilization period of 60 days. Any damage or defect, that may arise after or remain undiscovered at the time of issue of commissioning certificate, same shall be rectified or replaced by the contractor at his own expenses as deemed necessary by the engineer-in-charge. This guarantee shall be applicable for the quality of works executed as well as for the equipment/ fittings supplied by the contractor.



❖ STATUTORY APPROVAL FOR WORKS

1. All statutory approvals for the works (from power utility/ Electrical Inspector or any other approval required as per applicable law, rules thereof shall be obtained by the Bidder. The statutory fees applicable till warranty period shall be included in the offered price.
2. The Inspection and acceptance of the work as above shall not absolve the contractor from any of his responsibility under this contract.
3. If any penalty/ levy becomes payable to the State Electricity Utility on account of low power factor of the SPV based power plant, the same has to be borne by the contractor only.
4. The contractor shall be responsible for interconnection of photovoltaic based power plant with the internal LT & HT Panel of HIMSR, so as to export power from photovoltaic based power plant.

❖ SCOPE OF WORK

The Scope of Work covered under this specification shall be but not limited to the followings:-

To offer for 500 kWp Rooftop SPV based Power Plants

1. DESIGN, MANUFACTURING & TESTING

Design, engineering, manufacture, testing at works and supply at sites of suitable **Mono PERC Crystalline Silicon Solar Cell Module** in the total capacity of 500 kWp rating complete with accessories as may be required for erection, commissioning and successful continuous operation of 500 kWp capacity SPV based Power Plants with the internal LT & HT Panel of HIMSR. The SPV based Power Plants shall be equipped with current limiting devices and capacitors so as to maintain power factor as required by the LT & HT Panel.

Design & manufacture of Module mounting structure for SPV module(s) along with design of Module mounting structure foundation, erection, testing & commissioning of all the SPV module(s).

Design, manufacturing, testing at works, transportation, supply, erection, testing at sites and commissioning of SPV based Power Plants' Internal electrical system.

LT & HT Panel connection, kiosks, protection equipment, metering equipment, LT lines for the evacuation point of the SPV based Power Plant.

Design and construction of control room adequate for housing power and control panels, CMS etc. (if required).

VAR drawn compensation system, if required.

Laying of appropriate evacuation system (through proper conduits, cable tray as applicable best practices) for inter connection with the internal LT & HT Panel.



2. SAFETY EQUIPMENTS/ CHARTS, MISC. ITEMS ETC. PROVIDED AT SITES

Rubber mats of appropriate size, electrical shock treatment chart, fire extinguisher, firebuckets, danger notice board/ stickers etc. confirming relevant IS shall be provided at sites.

Suitable arrangement of ladder of sufficient strength and made of MS material with hot-dip galvanized shall be provided at site(s).

It is contractor's responsibility to observe & implement safety rules & practices as per prevailing acts. HIMSR will not be responsible for any kind of accident/ damage done person(s) or property(ies) during the entire contract period. No compensation of any kind shall be given to contractor on breaching of any kind of safe working practice during the contract period.

3. STATUTORY APPROVALS

Obtaining statutory approvals/ clearances from Government departments but not limited to the following: -

- Pollution Control Board Clearance, if required
- Delhi Electricity Regulatory Commission
- State Power utilities viz. DISCOMS
- Chief Electrical Inspector (CEI)
- Any other concerned authority

4. MANPOWER & UTILITIES

Deployment of manpower, required consumables, testing equipments during erection till commissioning, arrangement of power & water as required for this contract shall be arranged by the bidder.

5. DOCUMENTS

- i Submission of following documents drawings data design and engineering information to HIMSR for review and approval in four copies.
- ii Detailed technical specification.
- iii Design criteria.
- iv General arrangement
- v Schematic diagram for entire evacuation system up to interfacing with LT/ HT distribution at site
- vi GA drawings for all types of structures, PCU & Interfacing, metering with LT/HT distribution panels at site.



- vii Quality assurance plans.
- viii Test report (for type, acceptance, and routine tests) for major items.
- ix Two sets of all the drawings shall be fully corrected to agree with the actual "as built" site conditions and submitted to HIMSR after commissioning of the project for record purpose. One digitized soft copy of as built drawings shall also be submitted.
- x O & M Manuals of all the important equipment (in 02 sets)

6. TRAINING

Providing a detailed training to HIMSR technicians for all operations, maintenance procedures.



TECHNICAL SPECIFICATION

1. DEFINITION

The Solar Power Generating System consists of mainly three components viz. the SPV (SPV) array, module mounting structure and the power conditioning unit (PCU)/ inverter. The SPV array converts the solar energy into DC electrical energy. The module mounting structure holds the modules in required position and the DC electrical energy is converted to AC power by the PCU, which is connected to the internal LT & HT Panel of HIMSR. The AC power output of the inverter is fed to the AC distribution board through metering panel and isolation panel. The 415 V AC output-3Ø of the system can be utilized or as an option it could be stepped up to the required voltage level and after synchronizing with internal LT & HT Panel.

i	Location / Site Details for the SPV Power Project:-	Rooftop of HIMSR Building, HIMSR Campus, Hamdard Nagar, New Delhi – 110 062
ii	Available Roof space	As applicable
iii	Ambient Temp.	Site specific
iv	Lat. / Long.	Site specific
v	Elevation	Site specific
vi	Tilt Angle	Suggested as per the Latitude, however best fit as per the roof orientation.
vii	Feeding Point	Internal LT & HT Panel

NOTE: BIDDERS MUST VISIT THE SITE BEFORE QUOTING THE RATES.

2. PV MODULE (S)

- Each solar PV plant array capacity should not be less than the capacity of the same SPV Plant capacity and total aggregate SPV array capacity should not be less than the respective peak capacity of 8 sites as mentioned above, on max. radiation day and should comprise of solar mono crystalline modules of minimum 380-400 Watts. The Photovoltaic modules must be tested & approved by one of the IEC authorized test centres, Test Certificates can be from any of the NABL / BIS accredited testing / calibration laboratories the module type must be qualified as per IEC 61215 (Second Edition). In-addition, PV modules must qualify to IEC 61730 Part I to II for safety qualification testing, IEC 61701-Salt Mist Corrosion Testing of Photovoltaic (PV) Modules, IEC 62716-Photovoltaic (PV) Module - Ammonia (NH₃) Corrosion Testing, IEC 62804 (Technical Specifications)- Photovoltaic (PV) modules - Test methods for the detection of potential-induced degradation, and IEC 62759-1-Photovoltaic (PV) modules – Transportation testing, Part 1: Transportation and shipping of module package units. SPV module conversion efficiency should not be less than 15.0% under STC. The SPV Modules to be supplied should be tested from MNRE.



- The PV module used in Solar Power system should have the latest addition of following BIS-PV Module qualification test or, equivalent IEC Standards:
- The power output of the module(s) under STC should be as given in section scope of work. Modules of minimum 380-400 Watts output each or above output should be used. Photo/ electrical conversion efficiency of SPV module shall be greater than 15% under STC.
- All materials used shall have a proven history of reliable and stable operation in external applications. It shall perform satisfactorily in relative humidity up to 100% with temperatures between 0° C and +85° C and with stand gust up to 200 km/h from back side of the panel. The terminal box on the module should have a provision for opening for replacing the cable, if required.
- Aluminum extruded frame structures with adequate strength and in accordance with relevant BIS standards can also be used with proof that the design of the structure can withstand the wind speed of 170 km per hour as per BIS Standards.
- A strip containing the following details should be laminated inside the module so as to be clearly visible from the front side.

IDENTIFICATION AND TRACEABILITY

Each PV module used in any solar power project must contain the following Information:

- a. Name of the Supplier or distinctive Logo
 - b. Model or Type No.
 - c. Serial No.
 - d. Year of make.
 - i. Name of the manufacturer of PV Module
 - ii. Name of the manufacturer of solar cells
 - iii. Month and year of the manufacturer (separately for solar cells and modules.
 - iv. I-V Curve for the module
 - v. Peak wattage, I_m , V_m and FF for the module
 - vi. Unique Serial No and Model No of the Module
 - vii. Date and year of obtaining IEC PV module qualification certificate.
 - viii. Name of the test lab issuing IEC certificate
- The rated output power of any supplied module shall not vary more than 3- 5% from the average power rating of all modules.
 - The module frame is made of corrosion resistant materials, which is electrolytically compatible with the structural material used for mounting the module.
 - Protective devices against surges at the PV module shall be provided, if required. Low voltage drop bypass and / or blocking diode(s) may also be provided, if required.



- Module Junction box (weather resistant) shall be designed for long life out door operation in harsh environment.
- A minimum warranty of 25 (Twenty-five) years shall be given with degradation of power generated not exceeding 10% (Ten) over the entire period of 10 (Ten) years.
- The module shall have warranty of 25 years with degradation of power generated not exceeding 20% of the minimum rated power over the 25 years period and not more than 10% after 10 years period. The Bidder will have to furnish a CORPORATE GURANTEE on a required stamp paper for the same.
- The solar modules shall have suitable encapsulation and sealing arrangements to protect the silicon cells from the environment. The arrangement and the material of encapsulation shall be compatible with the thermal expansion properties of the Silicon cells and the module framing arrangement/material. The encapsulation arrangement shall ensure complete moisture proofing for the entire life of the solar modules.
- Each module shall have low iron tempered glass front for strength and superior light transmission. It shall also have tough multi layered polymer back sheet for environment protection against moisture and provide high voltage electrical insulation.
- Data sheet of the offered module along with their IEC certificate and third party test results must be submitted along with the offer giving details of peak power, peak current, short circuit current, fill factor, open circuit voltage, peak power voltage etc.

Orientation and Tilt of PV Module(s): -

Modules alignment and tilt angle shall be calculated to provide the maximum annual energy output. This shall be decided based on the location of array installation.

SLANTED ROOF MOUNTED FIXED TYPE PV PANEL STRUCTURES

The supplier shall specify installation details of the PV modules and the support structures with appropriate diagrams and drawings. Such details shall include, but not limited to the following:

- Array tilt angle to the horizontal, with permitted tolerance
- Details with drawings for fixing the modules;
- Details with drawings of fixing the junction/terminal boxes;
- Interconnection details inside the junction/terminal boxes;
- Structure installation details and drawings;
- Electrical grounding (earthling);
- Inter-panel/Inter-row distances with allowed tolerances; and
- Safety precautions to be taken.



- The array structure shall support SPV modules at a given orientation to absorb and transfer the mechanical loads to the roof of porta cabin properly. The portion of array structure if any lying within the column shall be of aluminum extruded section of superior quality. All nuts and bolts shall be of very good quality stainless steel. Detailed design and Drawing of the module mounting structures shall have to be submitted to CREST for acceptance before execution of work. Self-drilling fasteners with SS and rubber washers should be provided to fix SPV panels. Silicon sealant around the fasteners should also be provided. Strict care should be taken during execution to avoid any damage to the roof surface of the porta cabins and to ensure no leakage should occur.
 - i Structures shall be supplied complete with all members to be compatible for allowing easy installation at the rooftop site.
 - ii The Structure shall be made out of Aluminum member as per design to be submitted by firm. The structures shall be designed to allow easy replacement of any module.
 - iii Each structure should have angle of inclination as per the site conditions to take maximum insolation.
 - iv Each panel frame structure be so fabricated as to be fixed on the rooftop, column/wall structures. The structure should be capable of withstanding a wind load of 170KM/hr after installation. The certificate about structure capable to withstand 170KM per Hour wind speed should be provided from Chartered Structural Engineer on his letter pad with his registration No.
 - v The structures shall be designed for simple mechanical and electrical installation. There shall be no requirement of welding or complex machinery at the installation site. If prior civil work or support platform is absolutely essential to install the structures, the supplier shall clearly and unambiguously communicate such requirements along with their specifications in the bid. Detailed engineering drawings and instructions for such prior civil work shall be carried out prior to the supply of Goods. All self- drilling fasteners, nuts and bolts shall be of very good quality stainless steel.
 - vi No damage in any way should be caused to the porta cabins slanting rooftops, terrace while installation of SPV Power Plant. If any damage done it will wholly be the responsibility of the bidder and cost shall be recovered from the bidder.

3. EARTHING AND SURGE PROTECTIONS:

- The array structure of the PV modules shall be grounded properly using adequate numbers of earthing pits suggested by government authority. All metal casing/shielding of the plant shall be thoroughly grounded to ensure safety of the power plant. All the power conditioning unit and electricity metering unit having any exposed metal part must be grounded.



- **Two separate earthing must be provided for safer & reliable operations.**
- The SPV power plant shall be provided with lightning & over voltage protection. The source of over voltage can be lightning, atmosphere disturbance etc.

Earthing and lightning protection

- a) The array structure of the PV yard shall be grounded properly using adequate number of earthing kits. All metal casing/ shielding of the plant shall be thoroughly grounded to ensure safety of the power plant.
- b) The SPV Power Plant shall be provided with lightning & over voltage 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.
- c) Metal oxide variators shall be provided inside the Array Junction Boxes. In addition, suitable MOV's also shall be provided in the Inverter to protect the inverter from over voltage.

4. MECHANICAL COMPONENTS:

Metallic frame structure of galvanized steel with stands to be fixed on the roof of the building to hold the SPV module (s) one foot above roof level. The inclination angle should be best suitable to get the maximum output. All hardware, nuts, bolts should be cadmium passivated/ plated.

5. MODULE MOUNTING STRUCTURE:

- The array structure shall be made of hot dip galvanized MS angles of size not less than 50 mm x 50 mm x 6 mm size. The minimum thickness of galvanization shall be at least 70 (seventy) microns. All nuts & bolts shall be made of very good quality ISI grade stainless steel. The minimum clearance of the lowest part of the module structure and the developed ground level shall not be less than 500 mm or as per site situation(s).
- Leg assembly of module mounting structure made of different diameter galvanized tubes may be accepted. The work should be completed with supply, fitting fixing of clamps, saddles, nut & bolts etc. While quoting the rate, the bidder may mention the design & type of structure offered. All nuts & bolts shall be made of very good quality stainless steel.
- The structure shall be designed to allow easy replacement of any module and shall be in line with site requirements. The structure shall be designed for simple mechanical and electrical installation. It shall support SPV modules at a given orientation, absorb and transfer the mechanical loads to the ground properly. There shall be no requirement of welding or complex machinery at site.
- The array structure shall be so designed that it will occupy minimum space without sacrificing the output from SPV panels at the same time it will withstand wind speed up to maximum 170 km/h.



- The supplier/ manufacturer shall specify installation details of the PV modules and the support structures with appropriate diagrams and drawings.
- After taking in to consideration all aspects of the site, roof top strength etc., the bidder shall quote for civil works. The foundation design of module structure design shall be submitted to HIMSR for approval. The work will have to be carried out as per designs approved by HIMSR.

6. JUNCTION BOXES:

- The junction boxes shall be dust, vermin and waterproof and made of FRP. The terminals shall be connected to copper bus bar arrangement of proper sizes. The junction boxes shall have suitable cable entry points fitted with cable glands of appropriate sizes for both incoming and outgoing cables. Suitable markings shall be provided on the bus bar for easy identification and cable ferrules shall be fitted at the cable termination points for identification. The junction boxes shall have suitable arrangement for the following:
- Combine groups of modules into independent charging sub-arrays that shall be wired to the PCU.
- Provide a test point for each sub-group for quick fault location.
- To provide group array isolation.
- The rating of the JB's shall be suitable with adequate safety factor to inter connect the Solar PV array.

7. DC DISTRIBUTION BOARD (DCDB):

Solar array side breaker shall be housed in enclosure. These can also be housed within the PCU to save spaces.

8. OTHER FEATURES:

- The PV module (s) will be warranted for a minimum period of 25 years from the date of supply with maximum 10% degradation in 10 years. Solar PV power plant will be warranted for a period of ten years from the date of supply.
- An Operation, Instruction and Maintenance Manual in English and Hindi should be provided with the system.
- The following minimum details must be provided in the Manual:
 - a) About Photovoltaic
 - b) About solar PV system– its components and expected performance.
 - c) About PV module(s)
 - d) Clear instructions about mounting of PV module(s)
 - e) About electronics



- f) DO's and DON'T's
- g) Clear instructions on regular maintenance and troubleshooting of solar power plant.
- h) Name and address of the person or service center to be contacted in case of failure or complaint
- The details of the Power Conditioning Unit are as given below:

Inverter of the suitable capacity has to be used.

The inverter must comply with the following standards:

The power conditioning units (in multiple string inverters) totaling should not be less than 500 kVA should be provided to convert DC power produced by SPV modules, in to AC power. The power conditioning unit should have multiple MPPT controls for multiple strings. The Individual Inverter should not be less than 10kVA (3-phase) and not be greater than 50kVA (3-phase).

IEC 62109-1, IEC 62109-2: 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)

IEC/IS 61683: Photovoltaic Systems – Power conditioners: Procedure for Measuring Efficiency (10%, 25%, 50%, 75% & 90-100% Loading Conditions)

BS EN 50530: Overall efficiency of photovoltaic inverters: This European Standard provides a procedure for the measurement of the accuracy of the maximum power point tracking (MPPT) of inverters. In that case the inverter energizes a low voltage LT & HT Panels of stable AC voltage and constant frequency. Both the static and dynamic MPPT efficiency is considered.

IEC 62116 or, IEEE 1547: Utility-interconnected Photovoltaic Inverters - Test Procedure of Islanding Prevention Measures

In-addition, "IEC 61727:2004 Photovoltaic (PV) systems - Characteristics of the utility interface" is being added, along-with "Technical Standards for Connectivity of the Distributed Generation Resources" as published by Central Electricity Authority (CEA), Ministry of Power, Govt. of India.

IEC 60068-2 (1, 2, 14, 30 & 64): Environmental Testing of PV System – Power Conditioners and Inverter.



- a) IEC 60068-2-1:
Environmental testing - Part 2-1: Tests - Test A: Cold
- b) IEC 60068-2-2:
Environmental testing - Part 2-2: Tests - Test B: Dry heat
- c) IEC 60068-2-14:
Environmental testing - Part 2-14: Tests - Test N: Change of temperature
- d) IEC 60068-2-30:
Environmental testing - Part 2-30: Tests - Test Db: Damp heat, cyclic (12 h + 12 h cycle)
- e) IEC 60068-2-64:
Environmental testing - Part 2-64: Tests - Test Fh: Vibration, broadband random and guidance.

IEC 61000: Part 2 (Environment), Part 3 (Limits) & Part 6 (Generic standards): Electromagnetic Interference (EMI), and Electromagnetic Compatibility (EMC) testing of PV Inverters (as applicable)

9. THE DETAILS OF THE POWER CONDITIONING UNIT ARE AS GIVEN BELOW:

Type & Technology	IGBT based. Utilize a circuit topology and components suitable for meeting the specifications.
Type	Self-commuted, current regulated, high frequency IGBT based with
Frequency	50 Hz \pm 1 Hz
Continuous rating	Not less than system capacity individually
DC input Operating range	200 V to 1000V nominal
Total Harmonic Distortion	less than 3 %
Operating temperature Range	5 to 60 degree Celsius
Housing cabinet	PCU to be housed in suitable cabinet with minimum IP65 standard
Inverter efficiency	>95 % at full load.
Power Control	MPPT
Output Voltage Range on AC Side	415 +10%, -15% V AC A dedicated isolation transformer housed in the PCU enclosure shall be supplied to match the PCU output voltage to the utility



	Panel voltage. PCU/ Solar Inverter voltage range should be configured as per site requirements.
Output Frequency Range	50 +1.5 Hz, -3.5 Hz
DC System Voltage	The electrical safety of the array installation is of the utmost importance. Array electrical configuration shall be in such way, that, the MPPT shall operate with maximum efficiency, between the, low and high temperature of the site.
Maximal Current Ripple	5% PP
Power Factor	0.95 inductive to 0.95 capacitive
Ambient Temperature Range	5° to 55° C
Housing Cabinet	PCU shall be housed in suitable switch cabinet, with min IP 21 degree of Ingress Protection. Weatherproof, rodents & insect proof Components and circuit boards mounted inside the enclosures clearly identified with appropriate permanent designations, which shall also serve to identify the items on the supplied drawings. All doors, covers, panels and cable exists shall be gasketed or otherwise designed to limit the entry of dust and moisture. All doors shall be equipped with locks. All openings shall be provided with grills or screens with openings no larger than 0.95cm (about 3x8 inch).
Electrical safety Protection	The PCU shall include appropriate self-protective devices/ Arrangements
General	Diagnostic feature to protect itself and the PV array from damage in the event of PCU component failure or from parameters beyond the PCU"s safe operating range due to internal or external causes. The self-protective features shall not allow signals from the PCU front panel to cause the PCU to be operated in a manner that may be unsafe or damaging. Faults due to malfunctioning within the PCU, including commutation failure, shall be cleared by the PCU protective devices and not by the existing site utility service circuit breaker.
Over/ Under Voltage	Mains over-under voltage and frequency protection. Over voltage protection against atmospheric lightning. Protection against voltage fluctuations in the Panels itself and internal faults in the power conditioner, operational errors and switching transients.



Fool Proof Protection	Against ISLANDING. Note: - MOV type surge arrestors on AC and DC terminals for over voltage protection from lightning-induced surges.
Accidental Open Circuit	Full protection against accidental open circuit and reverse polarity at the input.
Internal faults	Inbuilt protection for internal faults including excess temperature, commutation failure, overload and cooling fan failure is obligatory.
Galvanic Isolation	Galvanic isolation is provided to avoid any DC component being injected into the panels and the potential for AC components appearing in the array.
Earth Fault Supervision	An integrated earth fault detection device is provided to detect eventual earth fault on DC side and shall send message to the supervisory system.
Disconnection and Islanding	Disconnection of the PV generator in the event of loss of the main LT & HT supply is achieved by in built protection within the power conditioner. This may be achieved through rate of change of current, phase angle, unbalanced voltages, or reactive load variants. Operation outside the limits of power quality as described in Technical data sheet shall cause the power conditioner to dsconnect the panels. 1. Additional parameters requiring automatic disconnection are:- 2. Neutral voltage displacement 3. Over current 4. Earth fault & Reverse power In each of the above cases, tripping time shall be less than 0.5 seconds.
Array Tracking	Included authentic tracking of the Solar array's maximum power operation voltage (MPPT).
Array Ground Fault	Provided
Operator Interface	LCD and key pad operator interface are provided.
Fault Conditions	Automatic fault conditions reset for all the parameters like voltage, frequency and/ or black-out.
Control Logic Failure Detection	Via watch dog timers
Parameter Access	All parameters accessible through an industry standard communication link.
DC-AC Conversion Efficiency	93% output ranging from 20% to full load. Idling current at no load shall not exceed 2% of the full load current.



DC Isolation	Provided at the output by means of a suitable isolating transformer
Unbalanced Output Load	PCU is able to withstand and unbalanced output load to the extent of 30%.
PCU Generated Harmonics	Shall not exceed a total harmonic current distortion of 5%, a single frequency current distortion of 3% and single frequency current distortion of 1%, when the first through the fiftieth integer harmonics of 50 Hz are considered
Circuit Separation	High voltage & power circuits separated from low voltage and control circuits.
Special Features	PCU must have a single phasing protection with auto islanding. PCU must be totally isolated (except for minor detection circuit) during non-production of energy. PCU must have power factor correction. PCU should have the KVAR import & export less than 5%
Internal Wiring	Standard CU wiring, with flame resistant insulation
Cabling Practice	Cables: PVC Cu cables as per relevant international Standards Cable connections: suitable terminations PVC channel with covers to house the cables
High Voltage Test	PCU with stand high voltage test of 2,000 Vrms between either the input or the output terminals and the cabinet (chassis).
EMI (Electromagnetic Interface)	PCU shall not produce EMI which cause malfunctioning of electronic & electrical instruments including communication equipment which are located within the facility in which the PCU is housed.
Display on Front Panel and Indicators	Instantaneous PCU ac power output and the DC voltage current and power input Accuracy of display: 3% of full scale factor or better Display visible from outside the PCU enclosure. Operational status of the PCU, alarms, trouble indicators and AC and DC disconnect switch positions shall also be communicated by appropriate messages or indicator lights on the front cover of the PCU enclosure.
Emergency OFF	Emergency OFF button is located at an appropriate position on the unit.
Grounding	PCU includes ground lugs for equipment and PV array groundings. The DC circuit ground is a solid single point ground connection.
Exposed Surfaces	Exposed surfaces of ferrous parts are thoroughly cleaned, primed, and painted and suitably protected to survive a nominal 30 years design life of the unit
Factory Testing	Tested to demonstrate operation of its control system and the ability to be automatically synchronized and connected in



	<p>parallel with utility service, prior to its shipment.</p> <p>Operation of all controls, protective and instrumentation circuits demonstrated by direct test if feasible or by simulation operation conditions for all parameters that cannot be directly tested.</p> <p>Demonstration of utility service interface protection circuits and functions, including calibration and functional trip tests of faults and isolation protection equipment.</p> <p>Operation of startup, disconnect and shutdown controls also to be tested and demonstrated, stable operation of the PCU and response to control signals shall also be tested and demonstrated.</p> <p>Factory testing includes measurement of phase currents, efficiencies, harmonic content and power factor. All tests shall be performed 25, 50, 75 and 100% of the rated nominal power.</p> <p>Factory test report: Should be supplied with the unit after all tests. The FTR shall include detailed description of all parameters tested qualified and warranted</p>
Operating Modes	<p>Night or sleep mode : where the Inverter is almost completely turned off, with just the timer and control system still in operation, losses < 2 W per 5 kW</p> <p>Standby mode: where the control system continuously monitors the output of the solar generator until pre-set value is exceeded (typically 10 W). Operational of MPP tracking mode: the control system continuously adjust the voltage of the generator to optimize the power available. The power conditioner shall automatically re-enter standby mode input power reduces below the standby mode threshold. Front panel display providing the status of the PCU, including AC power output & DC current voltage and power input, and unit fault indication</p>
Inverter/ Array Size Ratio	<p>The ratio of the Inverter continuous power rating and the array peak power rating shall be between 80 to 90% or any other value found suitable. This is because better overall annual yield can be obtained by allowing the Inverter to operate for longer periods closer to optimal efficiency. Inverter efficiency should exceed 90% except when operating at less than 10% of maximum output</p>
MPPT	<p>Maximum power point tracker is integrated in the power conditioner unit to maximize energy drawn from the array. The MPPT shall be microprocessor based to minimize power losses. The MPPT shall have provision (manual setting) for constant voltage operation.</p>



<p>Metering</p>	<p>PV array energy production: Meter to log the actual amount of AC energy generated/ consumed by the PV system shall have to be provided.</p> <p>Solar irradiance: An integrating pyranometer (Class II or better) to be provided, with the sensor mounted in the plane of the array. Readout shall be integrated with data logging.</p>
<p>Data Logging</p>	<p>All major parameters available on the digital bus and logging facility for energy auditing through the internal microprocessor and can be read on the digital front panel at any time the current values, previous values for up to a month and the average values.</p> <p>In case of network failure, the inverter must be able to store the power data.</p> <p>The following parameters shall be accessible via the operating interface display:</p> <p>AC voltage, AC output current, Output power, DC input voltage, DC input current, Time active, Time disabled, Time Idle, Temperatures (C), Converter status, Protective function limits (i.e. AC over voltage, AC under voltage, Over frequency, under frequency, ground fault, PV Starting voltage, PV stopping voltage, over voltage delay, under voltage delay over frequency, ground fault delay, PV starting delay, PV stopping delay.</p>
<p>Remote Monitoring System</p>	<p>A remote monitoring system shall be included with each photovoltaicsystem.</p> <p>Usually such monitoring systems are connected and synchronizedwith the inverters.</p> <p>The monitoring system should transmit the following data in real-timeto a central server and store it:</p> <p>DC currents, voltages and power.</p> <p>AC currents, voltages and power.</p> <p>Irradiation, ambient temperature, module temperature and wind speed.</p> <p>Error logs.</p> <p>This data may be transmitted either using the available LAN or Ethernet RJ45.</p> <p>This data shall be accessible by HIMSR through a secure login account.</p> <p>The stored data should be represented through hourly, daily, monthly,etc. graphs and easily downloadable in .csv or .xls format</p>



Codes and Standards	<p>The quality of equipment supplied shall be controlled to meet the guidelines for engineering design include in the standards and codes listed in the relevant ISI and other standards, such as IEEE 928: Recommended criteria for terrestrial PV power systems.</p> <p>IEEE 929 Recommended practice for utility interface of residential and intermediate PV systems.</p> <p>IEEE 519 Guide for harmonic control and reactive compensation of static power controllers.</p> <p>National Electrical NFPA 70-1990 (USA) or equipment national standard.</p> <p>National Electrical Safety Code ANSI C2 (USA) or equipment national standard.</p> <p>Modules should be of MNRE approved make only.</p>
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INVERTER MUST HAVE SPP FEATURE WITH PROVISION OF DISCONNECTION OF ENTIRE POWER INJECTION SYSTEM IN CASE OF FAILURE OF ANY PHASE FROM BOTH ENDS i.e. POWER GENERATION & LT & HT PANELS.

INVERTER MUST HAVE PROVISION/ FEATURE TO DISCONNECT POWER INJECTION SYSTEM DURING NON- GENERATION PERIOD I.E. WHEN ENERGY INJECTION IS ZERO THEN POWER INJECTION SYSTEM MUST BE ISOLATED SO THAT POWER COULDN'T BE DRAWN BY THE POWER INJECTION SYSTEM/ TRANSFORMER(If any).

APPROPRIATE POWER CORRECTION FACILITY/ CAPACITORS SHOULD BE PROVIDED TO LIMITS THE KVARH EXPORT/ IMPORT TO 5% OF TOTAL NET ENERGY INJECTION BY THE SPV BASED POWER PLANT(S).

- Since the PCU is to be used in solar photo voltaic energy system, it should have high operational efficiency. The idling current at no load must not exceed 2 percent of the full-load current.
- A suitable Surge Protection Device separately at output (A.C. side) shall be provided for SPV Power Plant.
- The PCU shall include appropriate self-protective and self-diagnostic features to protect itself and the PV array from damage in the event of PCU component failure or from parameters beyond the PCU's safe operating range due to internal or external causes. The self-protective features shall not allow signals from the PCU front panel to cause the PCU to be operated in a manner which may be unsafe or damaging. Faults due to malfunctioning within the PCU, including commutation failure, shall be cleared by the PCU protective devices and not by the existing site utility service circuit breaker.
- The PCU shall restart after an over or under frequency shutdown when the utility panels voltage has returned to the within limits for minimum of two minutes.



- The PCU generated harmonics measures at the point of connection to the utility services when operating at the rated power shall not exceed a total harmonic current distortion of 3 percent, a single frequency current distortion of 3 percent and single frequency voltage distortion of 1 percent, when the first through the fiftieth integer harmonics of 50 Hz are considered.
- The PCU Power factor at the point of utility service connection shall be 0.95 lagging or leading when operating at above 25 percent of the rated output, but may be less than 0.95 lagging below 25 percent of the rated output.
 - Electrical safety, earthing and protection:

A) Internal Faults: In built protection for internal faults including excess temperature, commutation failure, overload and cooling fan failure (if fitted) is obligatory.

B) 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 LT & HT Panels itself and internal faults in the power conditioner, operational errors and switching transients

C) 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.

D) Cabling practice: Cable connections must be made using PVC Cu cables, as per BIS standards. All cable connections must be made using suitable terminations for effective contact. The PVC Cu cables must be run in GL trays with covers for protection.

E) Fast acting semiconductor type current limiting fuses at the main bus-bar to protect from the panels short circuit contribution.

Operating Modes:

The following operating modes are to be made available:

Night or Sleep mode: Where the inverter is almost completely turned off, with just the timer and control system still in operation, losses should not exceed 2 watts per 5 kilowatt.

In case of Panels Failure, the PCU should go in sleep mode/ turned off immediately.

Standby mode: Where the control system continuously monitors the output of the solar generator until pre-set value is exceeded (typically 20 watts)

Operational or MPP tracking mode: The control system continuously adjust the voltage of the generator to optimize the power available. The power conditioner must automatically re-enter stand-by mode when input power reduces below the



standby mode threshold. Front Panel display should provide the status of the PCU, including AC Voltage, Current, Power output & DC Current, Voltage and Power input, pf and fault Indication (if any)

Factory Testing:

- A) Preparation of all controls, protective and instrumentation circuits shall be demonstrated by direct test if feasible or by simulation operation conditions for all parameters that cannot be directly tested.
- B) Operation of startup, disconnect and shutdown controls shall also be tested and demonstrated. Stable operation of the PCU and response to control signals shall also be tested and demonstrated.
- C) Factory testing shall include measurement of phase currents, efficiencies, harmonic content and power factor.
- D) A factory Test Report (FTR) shall be supplied along with the unit. The FTR shall include detailed description of all parameters tested qualified and warranted.

10. MCCB, ISOLATOR & CABLES FOR LT & HT PANELS CONNECTION:

- 4 Pole, 440 V, 50 Hz AC MCCB, of suitable current & protection rating with spreader terminals, extendable rotary handle, thermal & electro-magnetic protection along with appropriate quality & size steel enclosure must be provided for LT & HT panel connection.

Array Junction Box with Surge Protection Device (SPD) & Fuses:

There should be a separate Array Junction Box with Metal Oxide Varistors (MOV) based Surge Protection Device to be provided for each string inverter on D.C. Side. Further, on A.C. Side, the Surge Protection Device should be provided in ACDB, besides the existing SPD device of PCU.

- 1.1 kV grade, 4 Core, XLPE insulated, aluminium conductor armoured cables confirming IS: 7098 (Part- I) of appropriate rating/ size shall be provided for interconnection of Inverter with MCCB & LT & HT Panel.
- Cable termination shall be done using appropriate size lugs & cable glands.

11. CABLES & ACCESSORIES:

All the cables which shall be supplied shall be conforming to relevant & shall be of 1.1 kV grade as per requirement. The cables used in the system should be ISI marked anti rodent, XLPE insulated FRLS unarmoured/ armoured copper conductor as per requirements.



The size of the cables between array interconnections, array to junction boxes, junction boxes to PCU etc. shall be so selected to keep the voltage drop and losses to the minimum.

12. ENERGY METERING:

Energy meters shall be provided by DISCOMS as per prevailing DERC's tariff orders & regulations.

- **Solar Irradiance:** An integrating Pyranometer (Class II or better) should be provided, with the sensor mounted in the plane of the array. Readout should be integrated with data logging system for SPV Power Plant.
- **Temperature:** Temperature probes for recording the Solar panel temperature and ambient temperature for SPV Power Plant.
 - An independent data logging system for plant control and monitoring shall be provided for SPV Power Plant
 - nos. class(0.5s), 3 phase 4wire, HT(11kV) Bi-directional Energy Meter along with necessary CTs & PTs approved by UT Elect. Department will be provided to measure the Energy produced by the SPV Power Plant and check meter also. The expenditure on testing and calibrating of Energy Meter shall be borne by the bidder. All major parameters should be available on the digital bus and logging facility for energy auditing through the internal microprocessor and can be read on the digital front panel at any time the current values, previous values for up to a month and the average values. The parameters should be accessible via the operating interface display.

Protective function limits (Viz-AC Over voltage, AC Under-voltage, Over-frequency, Under-frequency, ground fault, PV starting voltage, PV stopping voltage, Over-voltage delay, under voltage delay over frequency, Ground fault delay, PV starting delay, PV stopping delay).

If required, 11kV VCB Isolator panel / 11kV CTs & PTs / protection device/ adapter panel/ breaker/ switchgear/ metering compartment box be provided to terminate the SPV Power Plant output on HT side, for gross metering arrangement, will be provided by the bidder

COMMON AC DISTRIBUTION PANEL BOARD (ACDPB)

- a) Common AC Distribution Panel Board (DPB) shall control the AC power from inverter. AC Distribution panel (ACDP) should consist of appropriate size of MCCB with appropriate breaking capacity as incomer and suitable numbers of MCCB with appropriate size breaking capacity out going switches. The panel should be provided 3 Phase copper bus bar of suitable capacity.



- b) Common AC DPB shall have the arrangement for measuring all electrical quantities such as Voltage, Current, Frequency, of different feeder line & energy supplied to the main or different feeder. Common ACDPB shall have sheet iron enclosure of dust & vermin proof & shall have adequate cooling arrangement. The bus-bars are to be made of copper of desired size. Design & Drawing is to be submitted before manufacturer assembly on installation for obtaining necessary approval from HIMSR.

IS/IEC 60947 (Part 1, 2 & 3), EN 50521	<p>FUSES General safety requirements for connectors, switches, circuitbreakers (AC/DC):</p> <p>a) Low-voltage Switchgear and Control-gear, Part 1: General rules</p> <p>b) Low-Voltage Switchgear and Control-gear, Part 2: Circuit Breakers</p> <p>c) Low-voltage switchgear and Control-gear, Part 3: Switches, disconnectors, switch-disconnectors and fuse-combination units</p> <p>d) EN 50521: Connectors for photovoltaic systems – Safety requirements and tests</p>
IEC 60269-6	Low-voltage fuses - Part 6: Supplementary requirements for fuse-links for the protection of solar photovoltaic energy systems
Surge Arrestors	
IEC 61643-11:2011/ IS 15086-5 (SPD)	<p>Low-voltage surge protective devices - Part 11: Surge protective devices connected to low-voltage power systems - Requirements and test methods</p> <p>Remarks: Type 1 & Type 2 are being recommended for use.</p>
IEC 60227/IS 694, IEC 60502/IS 1554 (Part 1 & 2)	General test and measuring method for PVC (Polyvinyl chloride) insulated cables (for working voltages up to and including 1100 V, and UV resistant for outdoor installation)
BS EN 50618	Electric cables for photovoltaic systems (BT(DE/NOT)258), mainly for DC cables
Lightning Protection System Components	
IEC 62561 Series (Chemical earthing) or, equivalent Indian Standards	<p>IEC 62561-1 Lightning protection system components (LPSC) - Part 1: Requirements for connection components</p> <p>IEC 62561-2 Lightning protection system components (LPSC) - Part 2: Requirements for conductors and earth electrodes</p> <p>IEC 62561-7</p>



	Lightning protection system components (LPSC) - Part 7: Requirements for earthing enhancing compounds Remarks: In-addition, "IEC 62305:2013 Protection against lightning - All Parts" will be followed.
Junction Boxes	
IEC 60529	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 Remarks: For Outdoor environment IP 54 or, above, and for Indoor environment IP 31 or, above.

13. SPARE PARTS:

One set of essential spares for the PCU shall be provided and made available at the plant.



ANNEXURE – A

TECHNICAL PARTICULARS OF 500 kWp SPV BASED POWER PLANT **FOR QUOTED MODEL ONLY**

Please attach a technical specification for the following Items (Please make a tick mark)

1.	SPV Cell/Module	
2.	Inverter/PCU	
3.	Structure	
4.	DC DB.	
5.	AC DB.	
6.	Earthing & LA	
7.	Cables	
8.		

DRAWINGS TO BE ENCLOSED BY THE AGENCY

The Agency should enclose the following drawings with the bid:

- (a) Layout of SPV based power plant project
- (b) SPV module structure Foundation

Single line schematic diagram of electrical system for panel interfacing and LT & HT Panel interconnection from SPV based power plant to LT/HT distribution board.



ANNEXURE – B

DETAILS OF ESTIMATED ENERGY GENERATION OF PROPOSED SPV BASED POWER PLANTS

Project Details	Unit	Values
Total Capacity	kWp	
Total Generation (1 st Year)	kWp	
Total Losses (1 st Year)	%	
Estimated Net Energy Generation:		
1 st Year	%	
2 nd Year	kWh	
3 rd Year	kWh	
4 th Year	kWh	
5 th Year	kWh	
6 th Year	kWh	
7 th Year	kWh	
8 th Year	kWh	
9 th Year	kWh	
10 th Year	kWh	
11 th Year	kWh	
12 th Year	kWh	
13 th Year	kWh	
14 th Year	kWh	
15 th Year	kWh	
16 th Year	kWh	
17 th Year	kWh	
18 th Year	kWh	
19 th Year	kWh	
20 th Year	kWh	
21 st Year	kWh	
22 nd Year	kWh	
23 rd Year	kWh	
24 th Year	kWh	
25 th Year	kWh	

NOTE: -

- AGENCY HAS TO FURNISH SEPARATE SHEET FOR EVERY POWER PLANT
- FILLING OF THESE VALUES IS MUST OTHERWISE OFFER OF SUCH AGENCY SHALL BE REJECTED



ANNEXURE – C

List of Preferred suppliers for Bought out Items

1)	SOLAR MODULE	:	Vikram/APS/Waaree/Jacson/Jinko or MNRE Approved.
2)	INVERTER	:	Ksolare/Polycab/Growatt/Waaree or MNRE approved.
3)	Module Mounting Structure	:	As per MNRE Specification
4)	DC distribution box with accessories & cables	:	Phoenix/L&T/BUSMAN or MNRE Approved
5)	AC DISTRIBUTION BOX with accessories & cables	:	Phoenix/L&T/BUSMAN or MNRE Approved
6)	CABLES (LT)	:	Polycab/Havells/Dowells or MNRE Approved
7)	EARTHING	:	3D RDM/JMB/GRAVING EARTHING SOLUTION ETC.
8)	PROTECTION UNIT, WIRES/CABLES, CONNECTORS, LUGS, OTHER ACCESSORIES	:	Polycab/Havells/Dowells or MNRE Approved

- * The warranty on solar module will be for 25 years
- * The warranty on inverter will be for 5 years
- * The warranty on other components will be for 5 years



TECHNICAL BID

SN	Particulars	<u>Please fill the details and enclose documents wherever required</u>
1	Name of the organization/Agency/Firm	
2	Year of Registration / Establishment	
3	Type of Agency: (i.e. Proprietorship, Partnership, Ltd,etc.)	
4	Name of the Proprietor/Director/ Head/Manager/Contact Persons of the Organization	
	Phone No.	
	Mobile No.	
	Email address	
	PAN No.	
	GST Registration Number	
	Details of EMD / Bank Draft No.:	
	Website	
	Address for Communication (with pin code).	
	Copy of INCOME TAX returns of last Three assessment years	
	Any other details need to be specified	



FINANCIAL BID

Sr. No.	Site Details	Proposed Installation Capacity*# (KWp)
1	HIMSR Building Proposed Capacity	500
Rate per KWp (In Rupees)		Rs. _____
Amount for Proposed Capacity (In Rupees)		Rs. _____
GST		Rs. _____
Total Amount for Proposed Capacity inclusive of GST (In Rupees)		Rs. _____

Annual Maintenance Contract for components	Rs. _____
GST	Rs. _____
Total Amount for AMC inclusive of GST (In Rupees)	Rs. _____

Annual Comprehensive Maintenance Contract for components	Rs. _____
GST	Rs. _____
Total Amount for CMC inclusive of GST (In Rupees)	Rs. _____

* Installation capacity may be varied depend upon Solar PV size and configuration area.

* Price list of component to be attached.

* The AMC/CMC shall be started after the completion of defect liability period of 5 years

The rate should include all the series equipments required in case of increase in installed capacity.