

**INQUIRY FOR DESIGN, SUPPLY, INSTALLATION AND
COMMISSIONING OF ROOF TOP SOLAR PLANT**

FOR

**CORE PROCESSING FACILITIES, WAREHOUSE AND ADMIN
BUILDING
AT MUDARDA VILLAGE,
MEHSANA,
GUJARAT.**

JUNE, 2018

**OWNER
FANIDHAR MEGA FOOD PARK PVT LTD.
10/11, SECOND FLOOR,
ORCHID THE SHOPPING MALL,
THALTEJ SHILAJ ROAD,
THALTEJ, AHMEDABAD
GUJARAT-380059**

**PROJECT MANAGEMENT CONSULTANT
TECHNOPAK ADVISERS PVT. LTD.
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SECTION - A: INVITATION TO TENDER FOR DESIGN, SUPPLY, INSTALLATION, AND COMMISSIONING WORKS OF ROOF TOP SOLAR PLANT

1.0 Tenders are invited for Design, Supply, Installation, and Commissioning of Roof Top Solar plant for various CPC components in MFP at Mudarda Village, Mehsana, Gujarat, as mentioned in "Scope of Works" for Fanidhar Mega Food Park Pvt. Ltd. ("Owner").

2.0 Tender Documents shall be download from the website www.fmfp.co.in. A Tender processing fee (non-refundable) of Rs 5,000 to be submitted in form of cash or DD at the time of submission of tender.

3.0 Tender Documents will be submitted to

(A) Mr. Ajit Dhranga
+91-9586432323
E-Mail: info@fmfp.co.in

**FANIDHAR MEGA FOOD PARK PVT LTD.
10/11, SECOND FLOOR,
ORCHID THE SHOPPING MALL,
OPP. THALTEJ LAKE,
THALTEJ, AHMEDABAD
GUJARAT-380059**

All inquiries and correspondence shall be directed in writing to the above **address**.

4.0 The tenderers should return their completed Tender in two parts – separately and distinctly marked (i) Volume – 1 of 2 (ii) Volume – 2 of 2 ("Tender"). The Tender will be received at the address given above by 3.00 p.m. local time on **29.06.2018**.

Submission of tender:	<p>1. The tenderer shall submit the documents in two separate envelopes marked as</p> <p>ENVELOPE 'A' –EMD and other all documents except price bid</p> <p>AND</p> <p>ENVELOPE 'B' – Technical Specification and Price Bid</p> <p>2. These two envelopes shall be packed in one cover envelope addressed as under – ADDRESS AS PER ABOVE</p> <p>3. Only the "ENVELOPE A" shall be opened first and eligibility of the tenderer shall be evaluated as per criteria defined above. "ENVELOPE B" shall be opened only for those tenderers who qualify as per the eligibility criteria.</p>
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5.0 Documents To Be Submitted –

- 5.01 Envelope A –
- 5.01.1 CA Certificate of last three years Turn Over
- 5.01.2 CA Certificate of company net worth

- 5.01.3 List of successfully completed projects of last three years with client name and contract value.
- 5.01.4 EMD of Rs 1 Lakh in the form of DD or BG in favor of Fanidhar Mega Food Park Pvt Ltd ; payable at Ahmedabad.
- 5.01.5 ITR last three years
- 5.01.6 Verifiable Client References
- 5.01.7 List of technical manpower
- 5.01.8 List of machines in manufacturing facility
- 5.01.9 Proof of technology association if any
- 5.01.10 Proof of international exposure if any

- 5.02 Envelope B
- 5.02.1 Data Sheet of PV module, Inverter, Monitoring system to be used
- 5.02.2 Tentative Layout of PV Modules on roof
- 5.02.3 Projected Annual Kwh Generation as per simulation
- 5.02.4 Payback period calculation considering 70% energy generated from system shall be utilized within plant and remaining 30% energy shall be sold to grid.
- 5.02.5 Specifications
- 5.02.6 Itemized Quotation

6.0 Eligibility Criteria

- 6.01 Turnover of past three years (each) should be more than Quoted price
- 6.02 Organization must be profitable.
- 6.03 Should have completed two projects of similar size in past three years.
- 6.04 The cumulative installations should be equal to or more than capacity planned in this tender.
- 6.05 JV is allowed with proper justification.

7.0 Typical Payment Terms

- 7.01 Mobilization advance to a max of 50 % against submission of equivalent amount of BG or a corporate guarantee
- 7.02 Max 40 % Payment against dispatch of Solar PV modules and other equipments.
- 7.03 Max 5 % against installation and commissioning

8.0 Max 5 % against submission of BG valid for 12 months after acceptance of installation and commissioning report. The BG shall be released after completion of this defect liability period.

9.0 The Owner reserves the right to accept or reject any or all Tenders without giving any reasons thereof, in their sole discretion and without any liability or costs to the tenderer. The Owner clearly states that this is merely an invitation to an offer and is not an offer, and therefore makes no obligation in any way to pay any tenderer for any response or to award the tender or make any commitment to any tenderer whatsoever. The Owner may further waive any deviations which do not constitute a material modification in the Tenders received. In the event that there are any other material deviations in the Tender, the Owner may in its sole discretion reject and remove such deviations from the Tender and accept the same. The decision whether the deviation constitutes a material modification shall solely be that of the Owner and such decision shall be binding on the tenderer(s).

10.0 One Bid per Bidder

- a. Each bidder shall submit only one bid for one contract. A bidder who submits or participates in more than one Bid (other than as a Sub-contractor or in cases of

alternatives that have been permitted or requested) shall cause all the proposals with the Bidder's participation to be disqualified.

- b. Tender documents are not transferable.

11.0 Cost of bidding

The bidder shall bear all costs associated with the preparation and submission of his Bid, and the Employer shall in no case be responsible and liable for those costs.

12.0 Site visit

The Bidder may visit the site and examine the Site of Works and its surroundings and obtain all information that may be necessary for preparing the Bid and entering into a contract for construction of the Works. The costs of visiting the Site shall be at the Bidder's own expense.

13.0 Clarification of Bidding Document

- a. A prospective bidder requiring any clarification of the bidding documents may notify the Employer in writing by mail at the PMC's and Employer's mail address & indicated in the invitation to bid. The Employer shall respond to any request for clarification which he received earlier than 7 days prior to the deadline for submission of bids. Copies of the Employer's response shall be forwarded to all purchasers of the bidding documents, including a description of the enquiry but without identifying its source.

14.0 Amendment of Bidding Documents

- a. Before the deadline for submission of bids, the Employer may modify the bidding documents by issuing tender addends.
- b. Any addendum thus issued shall be part of the bidding documents and shall be communicated in writing through email or by fax to all the purchasers of the bidding documents. Prospective bidders shall acknowledge receipt of each addendum by fax to the Employer. Addenda shall be incorporated in the bids submitted by the Bidder

General Conditions

1. Co-ordination between different Agencies

The Contractor shall submit the details of Erection works programme to the engineer who will co-ordinate with the programme of the Civil / Mechanical / Electrical contractor separately submitted to him. Such co-ordination of Civil / Mechanical / Electrical and Erection works programme shall be agreed between the engineer, erection and civil works contractors and the agreed programme shall then be mutually binding on Contractors for Civil / Mechanical / Electrical & PEB Erection.

2. Insurance

- a. The Contractor shall indemnify the Owner and every member, Officer, and Employee thereof and the Engineer and the Engineer's Agents and Representative and every member of his staff from any claim or demand from accident, injury,

damage, loss and/or compensation of any kind whatsoever arising out of or in connection with all claims and demands which may be made against the Owner or the Engineer for or in respect of or arising out of failure by the Contractor in the performance of his obligation under any of the provisions of the Contract. The Contractor shall take necessary insurance to protect himself against claim or demand.

- b. Without prejudice to his liability to indemnify the Owner under Article (a) of these Conditions, the Contractor shall maintain and shall cause any Sub- Contractor to maintain: -

Such insurances as are necessary to cover the liability of the Contractor or as the case may be of such Subcontractor, in respect of personal injuries or deaths arising out of or in the course of or caused by the carrying out of the work; and

Such insurances as may be specifically required by the Contract Bills in respect of injury or damage to property real or personal arising out of or in the course of or by reason of the Contractor or his Sub-Contractor carrying out the work, and caused by any negligence, omission or default of the Contractor, his servants or agents or, as the case may be of such Sub- Contractor, his servants or agents.

- c. The Contractor shall obtain and maintain a comprehensive all risk policy which should also cover insurance against loss or damage by fire, storm, tempest, lightning, flood, earthquake, aircraft or anything dropped there from, aerial objects, riot and civil commotion for the full value thereof all work executed and all unfixed materials and goods intended for, delivered to and placed on or adjacent to the work until Virtual Completion of the work. Should the Contractor make default in insuring or continuing to insure as aforesaid the Owner may himself insure against any risk with respect of which the default shall have occurred and deduct a sum equivalent to the amount paid by him in respect of premium from any monies due to or to become due to the Contractor.

3. Approval by the Owner / the Engineer

Any approval given with changes, by the Owner, Engineer or their representative shall not relieve the Contractor of any of its obligation, responsibility and liability for the safety, correctness and performance of the Works and his obligations hereunder.

4. Storage

It will be Contractor's responsibility to unload and store materials/Equipments properly. Storage of materials/Equipments received at site will be Contractor's responsibility. Contractor will be responsible for it till the handover of site.

5. Safety

- a. Workers required to work at higher elevations shall be provided with safety belts and shall be instructed not to work without wearing the Belt.
- b. Good quality safety helmets shall be provided to Workers posted at Site of operations and Contractor will take adequate measures to make usage of these helmets mandatory.
- c. Where there is danger of falling from a height exceeding 3.25 m., suitable precaution shall be taken to prevent the fall of persons or material. Suitable precautions shall also be taken to prevent persons being struck by articles, which might fall from scaffolds or other working places.

- d. In general, the Contractor shall adhere to safe construction practice and guard against hazardous and unsafe working conditions and shall comply with Owner's safety rules.
- e. The Contractor shall adhere to all safety rules and regulations as indicated under attached OHS Manual.

Scope of Works

- The scope of work for the bidder mainly includes Site survey, Shadow analysis, complete design for optimal uses of space, engineering, manufacture, supply, storage, insurance, civil work, erection, testing & commissioning of the grid connected rooftop solar PV project including operation and maintenance (O&M) of the project for a period of two years after commissioning. Obtaining No Objection Certificate (NOC) from Distribution Company (DISCOM) for grid connectivity also covered in the scope of work.
- Project shall have three different buildings Packhouse, Warehouse and Admin building. But solar system for Packhouse and warehouse shall be common and separate for Admin building.
- **Capacity of Solar PV project shall be determined by Bidders as per available Roof area. Bidder shall only consider roof which will be most optimised area for solar power generation.**
- There will be one HT connection from UGVCL in Pack house building which also common for Warehouse, entire solar power (Packhouse+Warehouse) shall be connected to PCC (Main Panel) located within electrical room of Pack house building.
- There will be separate HT connection for Admin building, entire admin building Solar power shall be connected to main panel located in Ground floor electrical room.
- Refer to Drawings provided for Packhouse, Warehouse and Admin building.

SECTION – B: TECHNICAL SPECIFICATION FOR ROOF TOP SOLAR PLANT

1. TECHNICAL SPECIFICATION

A Grid Tied Solar Rooftop 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 is without battery 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 Polycrystalline PV modules.
- Grid interactive Power Conditioning Unit with Remote Monitoring System
- Mounting structures
- Junction Boxes.
- Earthing and lightning protections.
- IR/UV protected PVC Cables, pipes and accessories

A. SOLAR PHOTOVOLTAIC MODULES:

- The PV modules shall be made in India.
- The PV modules used must qualify to the latest edition of IEC PV module qualification test or equivalent BIS standards Crystalline Silicon Solar Cell Modules IEC 61215/IS14286. In addition, the modules must conform to IEC 61730 Part-1- requirements for construction & Part 2 – requirements for testing, for safety qualification or equivalent IS.
- PV modules to be used in a highly corrosive atmosphere throughout their lifetime of 25 years, they must qualify to IEC 61701/IS 61701
- The total solar PV array capacity should not be less than allocated capacity (kWp) and should comprise of solar crystalline modules of minimum 300 Wp (STC)/230 Wp (NOTC) and above wattage. Module capacity less than minimum 300 watts (STC) and 230 watts (Notc) shall not be accepted
- Max Power current shall be >8 Amps.
- Minimum 72 Cells in PV module.
- Module shall have efficiency more than 16%
- Protective devices of PV module at string level are surge protection devices & Low voltage drop bypass diodes at module level shall be provided.
- PV modules must be tested and approved by one of the IEC authorized test centers.
- The module frame shall be made of corrosion resistant materials, preferably having anodized aluminium.
- The bidder shall carefully design & accommodate requisite numbers of the modules to achieve the rated power in his bid. Client/Consultant shall allow only minor changes at the time of execution.

- High tempered Anti-reflective glass with strength of 5400 pa
- Other general requirement for the PV modules and subsystems shall be the Following:
 - The rated output power of any supplied module shall have tolerance of +/-3%.
 - The peak-power point voltage and the peak-power point current of any supplied
 - Module and/or any module string (series connected modules) shall not vary by more than 2 (two) per cent from the respective arithmetic means for all modules and/or for all module strings, as the case may be.
 - Module shall be provided with a junction box with either provision of external screw terminal connection or sealed type and with arrangement for provision of by-pass diode. The box shall have hinged, weather proof lid with captive screws and cable gland entry points or may be of sealed type and IP-66 rated.
 - IV curves at STC (Standard Test Condition) should be provided by bidder.
- Modules deployed must use a RF identification tag. The following information must be mentioned in the RFID used on each modules (This can be inside or outside the laminate, but must be able to withstand harsh environmental conditions).
 - Name of the manufacturer of the PV module.
 - Name of the manufacturer of Solar Cells.
 - Month & year of the manufacture (separate for solar cells and modules).
 - Country of origin (separately for solar cells and module).
 - I-V curve for the module Wattage, Im, Vm and FF for the module.
 - Unique Serial No and Model No of the module.
 - Date and year of obtaining IEC PV module qualification certificate.
 - Name of the test lab issuing IEC certificate.
 - Other relevant information on traceability of solar cells and module as per ISO 9001 and ISO 14001.

B. MOUNTING STRUCTURE FOR SOLAR PHOTOVOLTAIC MODULES:

- Hot dip galvanized MS mounting structures to be used for mounting the modules/ panels/arrays. Each structure should have angle of inclination as per the site conditions to provide maximum output. However to accommodate more capacity the angle inclination may be reduced until the plant meets the specified performance ratio requirements.
- Minimum thickness of galvanizing shall be 86 microns.
- All PV modules for PACKHOUSE and WAREHOUSE shall be installed on PEB roof (metal sheet), all PEB roof sheet shall be **standing seam type**. Angle of Module shall be as per roof inclination. **ANY PUNCTURE ON ROOF SHALL NOT BE ALLOWED.**
- All PV modules for ADMIN BUILDING shall be installed on RCC roof. Angle of Module shall be set to gain maximum efficiency.

- The Mounting structure shall be so designed to withstand the speed for the wind zone of the location where a PV system is proposed to be installed. Suitable fastening arrangement such as grouting and calming should be provided to secure the installation against the specific wind speed. Design of structure shall be approved from VMS Structure department.
- The mounting structure steel shall be as per latest IS 2062: 1992 and galvanization of the mounting structure shall be in compliance of latest IS 4759.
- Structural material shall be corrosion resistant and electrolytically compatible with the materials used in the module frame, its fasteners, nuts and bolts. Aluminium structures also can be used which can withstand the wind speed of respective wind zone. Necessary protection towards rusting need to be provided either by coating or anodization.
- The fasteners used should be made up of stainless steel. The structures shall be designed to allow easy replacement of any module. The array structure shall be so designed that it will occupy minimum space without sacrificing the output from the SPV panels.
- Regarding civil structures the bidder need to take care of the load bearing capacity of the roof and need arrange suitable.
- 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 S PV 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.

C. JUNCTION BOXES (JBs)

- 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 Aluminium /cast aluminium 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.
- Copper bus bars/terminal blocks housed in the junction box with suitable termination threads conforming to IP65 standard, TUV-UL and IEC 62208 Hinged door with EPDM rubber gasket to prevent water entry. Double compression cable glands. Provision of earthings. It should be placed at 5 feet height or above for ease of accessibility.
- Each Junction Box shall have High quality Suitable capacity Metal Oxide Varistors (MOVs) / surge arrestors, suitable Reverse Blocking Diodes. The Junction Boxes shall have suitable arrangement monitoring and disconnection for each of the groups.
- 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.

D. DC DISTRIBUTION BOX

- DC Distribution panel to receive the DC output from the array field.
- DC DPBs shall have sheet enclosure of dust & vermin proof conform to IP 65 protection. The bus bars are made of copper of desired size. Suitable capacity

MCBs/MCCB shall be provided for controlling the DC power output to the PCU along with necessary surge arrestors.

E. AC DISTRIBUTION BOX

- AC Distribution Panel Board (DPB) shall control the AC power from PCU/ inverter, and should have necessary surge arrestors. Interconnection from ACDB to mains at LT Bus bar while in grid tied mode.
- All switches and the circuit breakers, connectors should conform to IEC 60947, part I, II and III/ IS60947 part I, II and III. All MCCBs/ACBs shall have MP based releases and protections.
- All the Panel's shall be metal clad, totally enclosed, rigid, floor mounted/wall mounted, air - insulated, cubical type suitable for operation on three phase / single phase, 415 or 230 volts, 50 Hz, with all protective devices.
- The panels shall be designed for minimum expected ambient temperature of 45 degree Celsius, 80% humidity and dusty weather.
- Should conform to Indian Electricity Act and rules (till last amendment).
- All the single & three phase devices / equipment like bus support insulators, circuit breakers, VTs etc., mounted inside the switchgear shall be suitable for continuous operation and satisfactory performance under the following supply conditions.
- The Switchboards shall be fabricated from CRCA sheet steel of minimum thickness 2mm for load bearing members, 1.6 mm for non- load bearing members & 3mm for steel gland plates (4mm thick gland plate made from non-magnetic material). Removable type undrilled gland plates shall be provided at top / bottom of the panel.
- The height of Switchboards shall be constant throughout the length, but not exceeding 2400mm. The arrangement of feeders shall ensure that operating height of components shall be above 450mm & below 1800mm from finished floor level. Cable alley width shall be min 250mm. The minimum height of outgoing feeder module shall be 200mm. Size of cable alley shall be designed considering ease of Cable termination as per SLD.
- Busbars shall not be exposed when Circuit breaker / Starter module is removed. Insulated and isolated vertical busbars are required. Barriers shall be provided to separate the bus compartment from wiring space at top, bottom and sides of each section and shall be adequate to prevent accidental contact and restrict propagation of unit originated arc into the busbar compartment.
- For operator safety IP2 X (touch proof) protection to be available even after opening the feeder compartment door.
- All Switchboards shall have separation form 3b, for form of separation only metallic covers shall be used, Hylem / PVC sheets shall not be allowed.
- All indoor panels will have protection of IP54 or better. All outdoor panels will have protection of IP65 or better.
- Busbars shall be of high conductivity aluminum (E91E) (or Copper if mentioned in SLD) supported on insulators made of non-hygroscopic, non-inflammable material with tracking index equal to or more than that specified in IS. The main busbars shall have uniform current ratings throughout their length as specified in data sheet/job specification. The current rating of the neutral shall be the same / half that of the phase busbars as mentioned in the datasheets. Removable neutral links shall be provided on feeders to permit isolation of the

neutral busbar. All busbars shall be insulated with heat shrinkable PVC sleeves or epoxy painted in black colour. All busbars shall be colour coded such that on removal of any door the phases shall be identifiable. All busbars shall be accessible for inspection & easily replaceable.

- Busbar size shall be determined by taking into consideration the specified continuous current rating & fault level for 1 sec, without exceeding the bus bar final temperature of 95 degree C. The busbars shall be supported by insulators of non-carbonizing material resistant to acid and alkali and having non-hygroscopic characteristics, adequate mechanical & high dielectric strength and braced to withstand fault level specified. Power & Control bus bars shall be segregated. Neutral busbar shall include taps for each outgoing cable connection in each vertical section. The clearance between live parts & earth shall be as per IS and IEC.
- The material and the spacing of the Busbar supports should be same as per CPRI type tested assembly
- Only zinc passivated or cadmium plated high tensile strength steel bolts, nuts and washers (8.8 Grade) shall be used for all bus bar joints and supports.
- Minimum clearance between live parts, between live parts/neutral to earth shall be 25 mm. However clearances between terminals at components shall be as per applicable individual standards for components.

F. INVERTER/ POWER CONDITIONING UNIT (PCU)

- As SPV array produce direct current electricity, it is necessary to convert this direct current into alternating current and adjust the voltage levels to match the grid voltage. Conversion shall be achieved using an electronic Inverter and the associated control and protection devices. All these components of the system are termed the “Power Conditioning Unit (PCU)”. In addition, the PCU shall also house MPPT (Maximum Power Point Tracker), an interface between Solar PV array & the Inverter, to the power conditioning unit/inverter should also be DG set interactive. If necessary. Inverter output should be compatible with the grid frequency. Typical technical features of the inverter shall be as follows:

Switching devices	IGBT/MOSFET
Control	Microprocessor /DSP
Nominal AC output voltage and frequency	415V, 3 phase, 50 Hz
Grid Frequency Synchronization range	+ / - 3 Hz
Ambient temperature considered	- 20°C to 50°C
Humidity	95 % Non-condensing
Protection of Enclosure	IP-20(Minimum) for indoor IP-65(Minimum) for outdoor.
Grid Frequency Tolerance Range	+/- 3 Hz
Grid Voltage tolerance	- 20% & + 15 %
No-load losses	Less than 1% of rated power
Inverter efficiency (minimum)	>95%(In case of 5Kw or above)
Inverter efficiency (minimum)	>93%(In case of less than 5 Kw)
THD	< 3%
PF	> 0.9

- PCU/inverter shall be capable of complete automatic operation including wake-up, synchronization & shutdown.
- The output of power factor of PCU inverter is suitable for all voltage ranges or sink of reactive power, inverter should have internal protection arrangement against any sustainable fault in feeder line and against the lightning on feeder.
- Built-in meter and data logger to monitor plant performance through external computer shall be provided.
- The power conditioning units / inverters should comply with applicable IEC/ equivalent BIS standard for efficiency measurements and environmental tests as per standard codes IEC 61683/IS 61683 and IEC 60068- 2(1,2,14,30) /Equivalent BIS Std.
- The charge controller/ MPPT units environmental testing should qualify IEC 60068-2(1, 2, 14, 30)/Equivalent BIS std. The junction boxes/ enclosures should be IP 65(for outdoor)/ IP 54 (indoor) and as per IEC 529 specifications.
- The PCU/ inverters should be tested from the MNRE approved test centres / NABL /BIS /IEC accredited testing- calibration laboratories. In case of imported power conditioning units, these should be approved by international test houses.
- 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. Once the DG set comes into service PV system shall again be synchronized with DG supply and load requirement would be met to the extent of availability of power. 4 pole isolation of inverter output with respect to the grid/ DG power connection need to be provided. Necessary reverse power relay shall be provided for safety purpose.
- 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 Rooftop 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.

G. DATA ACQUISITION SYSTEM/PLANT MONITORING SYSTEM

- Data Acquisition System shall be provided for each of the solar PV plant.
- 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.
- Solar Irradiance: An integrating Pyranometer (Class II or better, along with calibration certificate) provided, with the sensor mounted in the plane of the array. Readout integrated with data logging system.
- Temperature: Temperature probes for recording the Solar panel temperature and ambient temperature to be provided complete with readouts integrated with the data logging system.

- 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).
- 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
- 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. A Bi- directional meter in addition to the display of PCU shall be installed.
- 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.
- 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.
- The time interval between two sets of data shall not be more than 15 minutes. (A min. of 4 samples of data shall be recorded per hour)
- Data Acquisition System shall have real time clock, internal reliable battery backup (2 hours) and data storage capacity to record data round the clock for a period of minimum 1 year.
- Computerized AC energy monitoring shall be in addition to the digital AC energy meter.
- 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.
- All instantaneous data shall be shown on the computer screen.
- Software shall be provided for USB download and analysis of DC and AC parametric data for individual plant.

- Provision for Internet monitoring and download of data shall be also incorporated.
- 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 environment monitoring system.

H. SOLAR RADIATION AND ENVIRONMENT MONITORING SYSTEM

(NOT APPLICABLE FOR ADMIN BUILDING)

- Centralized computerized solar radiation and environment monitoring system shall be installed on one of the buildings along with the solar PV power plant.
- The system shall consist of various sensors, signal conditioning, data acquisition, LCD display and remote monitoring.
- Global and diffuse beam solar radiation in the plane of array (POA) shall be monitored on continuous basis.
- Ambient temperature and relative humidity near PV array at the level of array plane shall be monitored on continuous basis.
- Solar PV module back surface temperature shall be also monitored on continuous basis.
- 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.
- Solar radiation and environment monitoring system shall have real time clock, internal reliable battery backup and data storage capacity to record data round the clock for a period of min. 1 year.
- The data shall be recorded in a common work sheet chronologically date wise. The data file should be MS Excel compatible. The data shall be represented in both tabular and graphical form.
- All instantaneous data shall be shown on the computer screen.
- Historical data shall be available for USB download and analysis.
- Provision for Internet monitoring and download of data shall be incorporated.
- Remote Monitoring and data acquisition through Remote Monitoring System with latest software/hardware configuration and service connectivity for online / real time data monitoring/control complete to be supplied and operation and maintenance/control to be ensured by the supplier. Provision for interfacing these data on server and portal in future.

I. METERING:

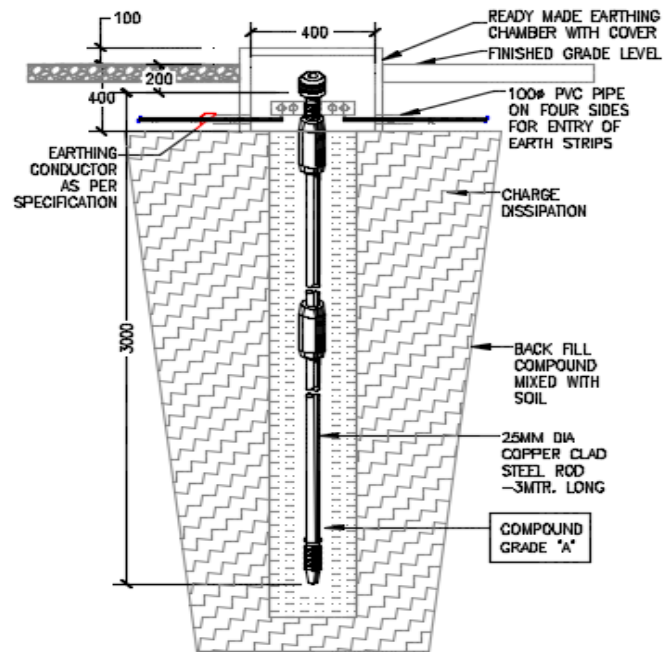
- The bidirectional electronic energy meter (0.2S class) shall be installed for the measurement of import/Export of energy at HT level (11KV/33KV/66KV) as per site requirement.
- The bidder must take approval/NOC from the Concerned DISCOM for the connectivity, technical feasibility, and synchronization of SPV plant with distribution network and submit the same to client before commissioning of SPV plant.
- Reverse power relay shall be provided by bidder (if necessary), as per the local DISCOM requirement.

J. LIGHTNING/SURGE 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.
 - Lightning protection level shall be determined as per IS/IEC-62305, necessary data shall be provided by Client/Consultant.
 - No of Air terminals shall be calculated based on Angle of protection / Mesh size or Rolling Sphere methods.
 - Aluminium Conductor of appropriate size shall be used for forming grid over roof.
- 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.

K. EARTHING

- 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 Engineer-In-Charge as and when required after earthing by calibrated earth test.
- 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.
- Earth Electrode shall be installed as per below detail and layout drawings. The location shown on the layout drawings are indicative.
- The exact location of earth electrodes in the field shall be determined by contractor in consultation with the Owner, depending on the soil strata and resistivity. Earth electrodes shall be located avoiding interferences with road, building foundation, column, pipelines etc. The civil area drawings shall be referred for this. The distance between two electrodes shall not be less than twice the depth of electrode.
- Electrodes shall preferably be located in a moist soil which has a fine texture, grain size and distribution. Wherever practicable the soil shall be dug up, all lumps broken and stones removed from the immediate vicinity of the electrodes and treated earth pit with all accessories shall be provided as per drawings.
- The electrodes shall have a clean surface, not covered by paint, enamel, grease or other materials of poor conductivity.
- All earth electrodes shall be tested for earth resistance by means of standard earth test meter. The tests shall take place in dry months, preferably after a protracted dry spell.
- The disconnect facility shall be provided for the individual earth electrode to check its earth resistance periodically.



**COPPER CLAD STEEL ROD- MAINTENANCE
FREE TYPE- EARTH ELECTRODE**

L. CABLES

- All Cable shall meet IEC 60227/IS 694, IEC 60502/IS1554 standards and with below specification
 - Temp. Range: -10°C to $+80^{\circ}\text{C}$
 - Voltage rating 660/1000V
 - Excellent resistance to heat, cold, water, oil, abrasion, UV radiation
 - Flexible
 - Shall be TUV certified
- Sizes of cables between 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. The cables (as per IS) should be insulated with a special grade PVC compound formulated for outdoor use.
- Cable Routing/ Marking: All cable/wires are to be routed in a Perforated GI cable tray and suitably tagged and marked with proper manner by good quality ferule or by other means so that the cable easily identified.
- The Cable should be so selected that it should be compatible up to the life of the solar PV panels i.e. 25years.
- Bidder to indicate size and length as per system design requirement. All the cables required for the plant to be provided by the bidder. Any change in cabling sizes if desired by the bidder/ approved after citing appropriate reasons. All cable schedules/layout drawings approved prior to installation be got approved from Engineer in-charge prior to installation.
- Each cable shall be sized with but not limited to derating factor applicable as per site condition, method of laying, grouping, Max. Ambient temperature and Voltage drop.

- Multi Strand, Annealed high conductivity copper conductor PVC type 'A' pressure extruded insulation or XLPE insulation. Overall PVC/XLPE insulation for UV protection Armoured cable for underground laying. All cable trays including covers to be provided. All
- Cables conform to latest edition of IEC/ equivalent BIS Standards
- Cable shall be PVC/XLPE insulated cables for working Voltage up to and including 1100 V ,UV resistant for outdoor installation IS /IEC 69947.
- The size of each type of DC cable selected shall be based on minimum voltage drop however; the maximum drop shall be limited to 2%.
- The size of each type of AC cable selected shall be based on minimum voltage drop however; the maximum drop shall be limited to 2 %.

2. MATERIAL & PERFORMANCE WARRANTY:

- **Warranty of Solar PV Modules:**
 - 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.
 - Vender also provide guarantee of system performance in terms of annual Kwh generation for five years. Actual generation shall be calculated based on Pre-tender simulated data.
- **Performance Warranty for other equipments / accessories (Except Solar PV Module)**
 - The mechanical structures, electrical works including power conditioners/ investors/ charge controllers/ maximum power point tracker units/ distribution boards/ digital meters/ switch gear/ storage batteries, cables etc. and over all workmanship of the SPV power plants/ systems must be warranted against any manufacturing/ design / installation defects for a minimum guaranteed period of 5 years.

3. TOOLS & TACKLES AND SPARES:

- After completion of installation & commissioning of the power plant, necessary tools & tackles are to be provided free of cost by the bidder for maintenance purpose. A list of tools and tackles to be supplied by the bidder for approval of specifications and make before supply of the same.
- A list of requisite spares in case of PCU/inverter comprising of a set of control logic cards, IGBT driver cards etc. Junction Boxes. Fuses, MOVs / arrestors, MCCBs etc. along with spare set of PV modules be indicated, which shall be supplied along with the equipment. A minimum set of spares shall be maintained in the plant itself for the entire period of warranty and Operation & Maintenance which upon its use shall be replenished

4. 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 signages shall be provided one each at battery – cum- control room, solar array area and main entry from administrative block. Text of the signages may be finalized in consultation with Client/Consultants

5. FIRE EXTINGUISHERS:

- The firefighting system for the proposed power plant for fire protection shall be consisting of.
 - Portable fire extinguishers in the control room for fire caused by electrical short circuits.
 - Sand buckets in the control room.
- The installation of Fire Extinguishers should confirm to TAC, NBC-2016 regulations and BIS standards. The fire extinguishers shall be provided in the control room housing PCUs as well as on the Roof or site where the PV arrays have been installed.

6. PLANNING AND DESIGNING:

- For complete electro-mechanical works, bidders shall supply complete design, details and drawings for approval to Client/Consultant before progressing with the installation work.
- The Contractor shall furnish the following drawings after Award/Intent and obtain approval.
 - Data sheets of selected equipments
 - General arrangement and dimensioned layout.
 - Schematic drawing showing the requirement of SPV panel, Power conditioning Unit(s)/ inverter, Junction Boxes, AC and DC Distribution Boards, meters etc.
 - Structural drawing along with foundation details for the structure.
 - Itemized bill of material for complete SPV plant covering all the components and associated accessories.
 - Layout of solar Power Array.
 - Shadow analysis of roofs.
 - Cable Tray Layout
 - Layout and calculation of earthing system
 - Layout and calculation of Lightning protection system
- The bidder should carry out Shadow Analysis at the site and accordingly design strings & arrays layout considering optimal usage of space, material and labor. The bidder should submit the array layout drawings along with Shadow Analysis Report to Client/Consultant for approval after award of work.
- Client/Consultant 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.
- The bidder shall submit preliminary drawing for approval & based on any modification or recommendation, if any. The bidder submit three sets and soft copy in CD of final drawing for formal approval to proceed with construction work

7. DRAWINGS & MANUALS TO BE SUBMITTED BY BIDDER AFTER COMPLETION OF WORK:

- Two sets of Engineering, electrical drawings and 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 with basic design of the power plant and power evacuation, synchronization along with protection equipment.

8. 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.

9. SCHEDULE OF QUANTITY FOR SOLAR ROOF TOP PLANT

Sr. No.	Item Description	Qty.	Unit Rate	Total Amount
7700	ROOF TOP SOLAR PV PLANT			
7701	Design, Planning, Detail engineering, calculation, Manufacturing, Supply, Installation, testing and Commissioning of Grid Connected Solar PV Power Plant for PACKHOUSE and WAREHOUSE with monitoring system as per tender Specification and Drawings. Rates shall be included but not limited to Transportation, insurance, transit insurance, Civil/fabrication work, Storage of materials, statutory approvals and clearance, Training to Staff and any other Materials and Work required doe successful commissioning of Power Plant on Turnkey/Single responsibility basis.	1 Lot		
7702	Operation and Maintenance of all equipments/system covers under item 7701 for 2 Years including but not limited to Replacement of parts/equipments covered under warranty/guarantee, providing tools and tackles required for the maintenance purpose for 2 years from the date of commissioning for PACKHOUSE and WAREHOUSE.	1 Lot		
7703	Design, Planning, Detail engineering, calculation, Manufacturing, Supply, Installation, testing and Commissioning of Grid Connected Solar PV Power Plant for ADMIN BUILDING with monitoring system (Not radiation and environment data) as per tender Specification and Drawings. Rates shall be included but not limited to Transportation, insurance, transit insurance, Civil/fabrication work, Storage of materials, statutory approvals and clearance, Training to Staff and any other Materials and Work required doe successful commissioning of Power Plant on Turnkey/Single responsibility basis.	1 Lot		
7702	Operation and Maintenance of all equipments/system covers under item 7703 for 2 Years including but not limited to Replacement of parts/equipments covered under warranty/guarantee, providing tools and tackles required for the maintenance purpose for 2 years from the date of commissioning for ADMIN BUILDING.	1 Lot		
			Total GST Final Total	

Bidder Shall Furnish following Data/Document along with Bid

- Data Sheet of PV module, Inverter, Monitoring system to be used
- Tentative Layout of PV Modules on roof
- Projected Annual Kwh Generation as per simulation
- Payback period calculation considering 70% energy generated from system shall be utilised within plant and remaining 30% energy shall be sold to grid.

10. LIST OF APPROVED MAKE

SR. NO.	EQUIPMENT / MATERIAL	APPROVED MAKES
1.	PV MODULE	VIKRAM SOLAR/ ADANI SOLAR/ TATA POWER SOLAR/ WAREE / NAVITAS / GOLDI GREEN
2.	SOLAR INVERTER AND MONITORING SYSTEM	DELTA / SMA / ABB / SCHNEIDER
3.	POLYCARBONATE / UPVC JUNCTION BOXES	HENSEL / SPELSBERG / FIBOX / OBO
4.	415V AC SWITCHBOARDS	PANEL BUILDER SHALL CPRI AND ERDA APPROVED
5.	LT SWITCHGEAR	SIEMENS / SCHNEIDER / ABB / L&T
6.	AC AND DC CABLES	POLYCAB / RAVIN CABLES / RPG / AVOCAB / HAVELLS / RR KABEL
7.	CABLE GLANDS	COMET / HMI / ELECTROMAC
8.	CABLE LUGS	DOWELLS / HMI
9.	CABLE TRAYS	OBO / INDIANA CABLE TRAY / PROFAB / VATCO / LEGRAND
10.	FRLS PVC WIRES	FINOLEX / L&T / RR CABLES / HAVELLS / POLYCAB / AVOCAB / LAPP CABLE
11.	PVC CONDUIT & ACCESSORIES	PRECISION PLASTIC / NIHIR / AKG
12.	MCB / RCCB / RCBO	LEGRAND / SCHNEIDER / L&T / SIEMENS / ABB
13.	COPPER CLAD STEEL ROD EARTH ELECTRODE	ERRICO / FURSE / OBO / ASHLOK / NATIONAL / CONNECT / CAPE ELECTRIC
14.	LIGHTNING PROTECTION SYSTEM – NBC 2016	OBO / DEHN / ERRICO / CAPE ELECTRIC
15.	LIGHTNING PROTECTION SYSTEM – EARLY STREAMER	INDELEC / ANTELEC / FURSE / LPI /

Final choice of the make from the above list shall be decided by the Owner / Consultant. Make of any other equipment / components not mentioned above shall have to be approved by Owner / Consultants.