



**INSTITUTIONAL DEVELOPMENT PLAN**  
**NATIONAL AGRICULTURAL HIGHER EDUCATION PROJECT**  
**Maharana Pratap University of Agriculture & Technology**  
 Udaipur - 313 001



No: MPUAT/NAHEP(1A)/Proc./2022-23/371-74  
 Reference No.- IN-MPUAT-UDAIPUR-336646-GO-RFQ

Dated- 06.02.2023

To

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Dear Sirs,

**Sub : INVITATION FOR QUOTATIONS FOR SUPPLY OF SOLAR POWER PLANT 40 KW (GRID CONNECTED SPV SYSTEMS 40 KW)**

1. You are invited to submit your most competitive quotation for the following equipment:-

S. No.	Brief Description of the Goods	Specifications*	Qty. (No.)	Delivery Period	Place of Delivery	Installation Requirement if any
1.	<b>SOLAR POWER PLANT 40 KW (GRID CONNECTED SPV SYSTEMS 40 KW)</b>	Annexure 1	1	20 Days	College of Agriculture (COA), Bhilwara	Complete installation, training of scientists & technical persons

2. Government of India has received a financing from the International Bank for Reconstruction and Development (IBRD) in various currencies towards the cost of the National Agricultural Higher Education Project (NAHEP) and intends to apply part of the proceeds of this Loan to eligible payments under the contract for which this invitation for quotations is issued.

**3. Bid Price**

- The contract shall be for the full quantity as described above. Corrections, if any, shall be made by crossing out, initialing, dating and rewriting.
- All duties, taxes and other levies payable on the raw materials and components shall be included in the total price.
- Sales tax in connection with the sale shall be shown separately.
- The rates quoted by the bidder shall be fixed for the duration of the contract and shall not be subject to adjustment on any account.
- The prices shall be quoted in Indian Rupees only.


4. Each bidder shall submit only one quotation.

5. **Validity of Quotation**  
Quotation shall remain valid for a period not less than 15 days after the deadline date specified for submission.
6. **Evaluation of Quotations**  
The Purchaser will evaluate and compare the quotations determined to be substantially responsive i.e. which  
(a) are properly signed ; and  
(b) confirm to the terms and conditions, and specifications.
- The Quotations would be evaluated for the individual item including installation and training at **College of Agriculture (COA), Bhilwara.**  
Sales tax/ any other taxes in connection with sale of goods shall not be taken into account in evaluation.
7. **Award of contract**  
The Purchaser will award the contract to the bidder whose quotation has been determined to be substantially responsive and who has offered the lowest evaluated quotation price.
- 7.1 Notwithstanding the above, the Purchaser reserves the right to accept or reject any quotations and to cancel the bidding process and reject all quotations at any time prior to the award of contract.
- 7.2 The bidder whose bid is accepted will be notified of the award of contract by the Purchaser prior to expiration of the quotation validity period. The terms of the accepted offer shall be incorporated in the purchase order.
8. Payment shall be made immediately after delivery of the goods and satisfactory installation.
9. Normal commercial warranty/ guarantee shall be applicable to the supplied goods.
10. If the supplier fails to deliver the desired goods within period specified in the purchase order, the tender will be treated as cancelled and bidder cannot claim for payment in any case.
11. **You are requested to provide your offer latest by 1.00 PM hours on 17.02.2023.**
12. We look forward to receiving your quotations and thank you for your interest in this project.



(Purchaser)

**IDP Coordinator & Dean**  
**National Agricultural Higher Education Project (Comp. - 1A)**  
**College of Technology and Engineering**  
**Maharana Pratap University of Agriculture & Technology**  
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## Annexure 1

### Specifications :-

### **Solar Power Plant (Grid Connected SPV Systems 40 KW)**

*The proposed projects shall be commissioned as per the technical specifications given below. Any shortcomings will lead to cancellation of the Bid.*

#### **1. DEFINITION**

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, junction boxes, distribution boxes 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 daytime. 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 equipment's/components:

- Solar PV modules consisting of required number of Crystalline 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;
- Solar Meter and Bi-directional Energy Meter.

#### **SOLAR PHOTOVOLTAIC MODULES:**

**The PV modules used should be made in India using only domestic manufactured Solar cells as per MNRE requirement. The empaneled Vendor shall require to submit the self-declaration regarding SPV Modules and Solar Cells used are "Made in India" from the manufacturer of SPV Modules, supplied before commissioning of the System.**

Module manufacturer should be in the list of Bloomberg as Tier 1 module manufacturer.

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.

- a) For the PV modules to be used in a highly corrosive atmosphere throughout their lifetime, they must qualify to IEC 61701.
- b) 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 and above wattage. Module capacity less than minimum 300 watts peak should not be accepted.
- c) Adequate protective devices against surges at the PV module shall be provided. Low voltage drop bypass diodes shall be provided.



- d) PV modules must be tested and approved by one of the IEC authorized test centers.
- e) The module frame shall be made of corrosion resistant materials, preferably having anodized aluminum.
- f) The bidder shall carefully design and accommodate requisite numbers of the modules to achieve the rated power in his bid.
- g) Other general requirement for the PV modules and subsystems shall be the following:
  - I. The rated output power of any supplied module shall have tolerance of +/- 5 W.
  - II. 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.
  - III. The 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 bypass 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-65 rated.
  - IV. I-V curves at STC should be provided by the Bidder.
- h) Plants installed must have the solar modules tested with relevant dust standards (Applicable standard would be IEC 60068-2-68).

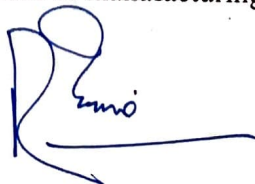
Modules deployed must use a RF identification tag. The following information must be mentioned in the RFID used on each module (This should be inside the laminate only and must be able to withstand harsh environmental conditions).

- a) Name of the manufacturer of the PV module;
- b) Name of the manufacturer of Solar Cells;
- c) Month & year of the manufacture (separate for solar cells and modules);
- d) Country of origin (separately for solar cells and module);
- e) I-V curve for the module Wattage,  $I_m$ ,  $V_m$  and FF for the module;
- f) Unique Serial No and Model No of the module;
- g) Date and year of obtaining IEC PV module qualification certificate;
- h) Name of the test lab issuing IEC certificate;
- i) Other relevant information on traceability of solar cells and module as per ISO 9001 and ISO 14001.

*Warranties:*

**a) Material Warranty:**

- i. Material Warranty is defined as: The manufacturer should warrant the Solar Module(s) to be free from the defects and/or failures specified below for a period not less than five (05) years from the date of sale to the original customer ("Customer").
- ii. Defects and/or failures due to manufacturing.

A handwritten signature in blue ink, appearing to be 'R. S. Rao', with a long horizontal line extending to the right from the bottom of the signature.

- iii. Defects and/or failures due to quality of materials.
- iv. Non-conformity to specifications due to faulty manufacturing and/or inspection processes. If the solar Module(s) fails to conform to this warranty, the manufacturer will repair or replace the solar module(s), at the Owners sole option.

b) *Performance Warranty:*

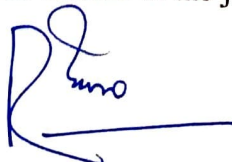
- i. The predicted electrical degradation of power generated not exceeding 20 % of the minimum rated power over the 25-year period and not more than 10 % after ten years period of the full rated original output.

2. *ARRAY STRUCTURE*

- a) Hot dip galvanized MS mounting structures may be used for mounting the modules/ panels/arrays. Each structure should have angle of inclination as per the site conditions to take maximum insolation. However, to accommodate more capacity the angle inclination may be reduced until the plant meets the specified performance ratio requirements.
- b) 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 in Rajasthan. It may be ensured that the design has been certified by a recognized Lab/ Institution in this regard and submit wind loading calculation sheet to RREC. Suitable fastening arrangement such as grouting and calming should be provided to secure the installation against the specific wind speed.
- c) The mounting structure steel shall be as per latest IS 2062: 1992 and galvanization of the mounting structure shall be complying of latest IS4759.
- d) 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.
- e) 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
- f) Regarding civil structures the bidder need to take care of the load bearing capacity of the roof and need arrange suitable structures based on the quality of roof.
- g) The total load of the structure (when installed with PV modules) on the terrace should be less than **60kg/m<sup>2</sup>**.
- h) The minimum clearance of the structure from the roof level should be **300 mm**.

3. *JUNCTION BOXES (JBs)*

- a) The junction boxes are to be provided in the PV array for termination of connecting cables. The J. Boxes (JBs) shall be made of GRP/FRP/Powder Coated 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.
- b) Copper bus bars/terminal blocks housed in the junction box with suitable termination



threads conforming to IP 65 standard and IEC 62208 Hinged door with EPDM rubber gasket to prevent water entry. Single/double compression cable glands. Provision of earthing. It should be placed at 5 feet height or above for ease of accessibility.

- c) Each Junction Box shall have High quality Suitable capacity Metal Oxide Varistors (MOVs)/SPDs, suitable Reverse Blocking Diodes. The Junction Boxes shall have suitable arrangement monitoring and disconnection for each of the groups.
- d) Suitable markings shall be provided on the bus bar for easy identification and the cable ferrules must be fitted at the cable termination points for identification.
- e) All fuses shall have DIN rail mountable fuse holders and shall be housed in thermoplastic IP 65 enclosures with transparent covers.

4. DC DISTRIBUTION BOARD:

- a) DC Distribution panel to receive the DC output from the array field.
- b) DC DPBs shall have sheet from 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.

5. AC DISTRIBUTION PANEL BOARD:

- a) AC Distribution Panel Board (DPB) shall control the AC power from PCU/inverter and should have necessary surge arrestors. Inter connection from ACDB to mains at LT Bus bar while in grid tied mode.
- b) All switches and the circuit breakers, connectors should conform to IEC 60947, part I, II and III/ IS 60947 part I, II and III.
- c) The changeover switches, cabling work should be undertaken by the bidder as part of the project.
- d) All the Panel's shall be metal clad, totally enclosed, rigid, floor mounted, air-insulated, cubical type suitable for operation on three phase/single phase, 415 or 230 volts, 50 Hz.
- e) The panels shall be designed for minimum expected ambient temperature of 45 degree Celsius, 80 percent humidity and dusty weather.
- f) All indoor panels will have protection of IP 54 or better. All outdoor panels will have protection of IP 65 or better.
- g) Should conform to Indian Electricity Act and Rules (till last amendment).
- h) All the 415 AC or 230 volts devices/equipment like bus support insulators, circuit breakers, SPDs, VTs etc., mounted inside the switchgear shall be suitable for continuous operation and satisfactory performance under the following supply conditions.

Variation in supply voltage = +/-10 % Variation  
in supply frequency = +/- 5 Hz

6. PCU/ARRAY SIZE RATIO:

- a) The combined wattage of all inverters should not be less than rated capacity of power plant under STC.



- b) Maximum power point tracker shall be integrated in the PCU/inverter to maximize energy drawn from the array.

#### 7. PCU/ Inverter:

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, the 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 (In case single phase inverters are offered, suitable arrangement for balancing the phases must be made.)
  - Output frequency: 50 Hz
  - Grid Frequency Synchronization range: +/-5 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: +/-5 Hz
  - Grid Voltage tolerance: - 20 % & +15 %
  - No-load losses: Less than 1% of rated power
  - Inverter efficiency (Min.): > 93% (In case of 10 kW or above with in-built galvanic isolation) > 98% (In case of 10 kW or above without inbuilt galvanic isolation).
  - THD: < 3%
  - PF: > 0.9
- a) Three phase PCU/ inverter shall be used with each power plant system (10 kW and/or above).
- b) PCU/inverter shall be capable of complete automatic operation including wake-up, synchronization & shutdown.
- c) 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.
- d) Built-in meter and data logger to monitor plant performance through external computer shall be provided.
- e) Anti-islanding (Protection against Islanding of grid): The PCU shall have anti islanding



protection in conformity to IEC 1547/UL 1741/ IEC 62116 or equivalent BIS standard.

- f) Successful Bidders shall be responsible for limiting dc injection into the grid and load as per the CEA/state regulations.
- g) The PCU/ inverter generated harmonics, flicker, DC injection limits, Voltage Range, Frequency Range and Anti-Islanding measures at the point of connection to the utility services should follow the latest CEA (Technical Standards for Connectivity Distribution/Generation Resources) Guidelines.
- h) 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.
- i) The charge controller (if any)/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.
- j) The PCU/inverters should be tested from the MNRE approved test centers/NABL/BIS/IEC accredited testing- calibration laboratories. In case of imported power conditioning units, these should be approved by international test houses.

**8. INTEGRATION OF PV POWER WITH GRID:**

The output power from SPV would be fed to the inverters which converts DC produced by SPV array to AC and feeds it into the main electricity grid after synchronization. In case of grid failure or low or high voltage, solar PV system shall be out of synchronization and shall be disconnected from the grid. 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.

**9. DATA ACQUISITION SYSTEM/PLANT MONITORING**

- i. Data Acquisition System shall be provided for each of the solar PV plant.
- ii. 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.
- iii. 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. Performance ratio
  - l. Specific yield
  - m. Historical data
  - n. Inverter data
  - o. Sensor data
  - p. Protective function limits (Viz-AC Over voltage, AC Under voltage, over frequency, under frequency ground fault, PV starting voltage, PV stopping voltage).
- iv. 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.
  - v. Solar Meter: Digital Energy Meters to log the actual value of Energy generated by the PV system be provided. Energy meter if required with CT/PT should be of 0.5 accuracy class/as per DISCOM guidelines.
  - vi. Computerized DC Array monitoring and AC output monitoring shall be provided as part of the inverter and/or string/array combiner box or separately.
  - vii. Array DC Voltage, Current and Power, Inverter AC Output Voltage and Current (all three phases and lines), AC Power (Active, Reactive and Apparent), Power Factor and AC Energy (All three Phases and Cumulative) and Frequency shall be monitored.
  - viii. Computerized AC energy monitoring shall be in addition to the digital AC Energy Meter.
  - ix. 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.
  - x. All instantaneous data shall be shown on the computer screen.
  - xi. Software shall be provided for USB download and analysis of DC and AC parametric data for individual plant.
  - xii. Provision for instantaneous Internet monitoring and download of data shall be also incorporated.



- xiii. Remote Server and Software for centralized Internet monitoring system shall be also provided for download and analysis of cumulative data of all the plants. The data of the solar radiation and temperature monitoring system should also be available on Remote Monitoring server.
- xiv. Ambient/Solar PV module back surface temperature shall be also monitored on continuous basis.
- xv. 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.
- xvi. Remote Monitoring and data acquisition through Remote Monitoring System software at the owner/the Purchaser's location 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 the Purchaser's server and portal in future shall be kept.

**10. TRANSFORMER "IF REQUIRED" & METERING:**

- a) Dry/oil type relevant kVA, 11kV/415V, 50 Hz Step up along with all protections, switchgears, Vacuum circuit breakers, cables etc. along with required civil work. **(If the transformer is required, the cost of the same will be borne by beneficiary and will not be the part of project cost).**
- b) The bi-directional electronic energy meter (0.5 S class) shall be installed for the measurement of import/Export of energy.
- c) 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 the Purchaser before commissioning of SPV plant.
- d) Reverse power relay shall be provided by bidder (if necessary), as per the local DISCOM requirement.

**11. POWER CONSUMPTION:**

- a) Regarding the generated power consumption, priority need to give for internal consumption first and thereafter any excess power can be exported to grid.

**12. PROTECTIONS**

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

**LIGHTNING PROTECTION**

The SPV power plants 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. 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 NFC17-102:2011 standard. The protection against induced high-voltages shall be provided by the use of metal oxide varistors (MOVs) and suitable earthing such that induced transients find an alternate route to earth.



#### *SURGE PROTECTION*

Internal surge protection shall consist of three SPD type-II surge-arresters connected from live and -ve terminals to earth (via Y arrangement).

#### *EARTHING PROTECTION*

- i. Each array structure of the PV yard should be grounded/earthed properly as per IS:3043-1987. In addition, the lighting arrester/masts should also be earthed inside the array field. Earth Resistance shall be tested in presence of the representative of the Purchaser as and when required after earthing by calibrated earth tester. PCU, ACDB and DCDB should also be earthed properly.
- ii. Earth resistance shall not be more than 5 ohms. It shall be ensured that all the earthing points are bonded together to make them at the same potential.

#### *GRID ISLANDING:*

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

### **13. CABLES**

Cables of appropriate size to be used in the system shall have the following characteristics:

- i. Shall meet IEC 60227/IS 694, IEC 60502/IS1554 standards
- ii. Temp. Range:  $-10^{\circ}\text{C}$  to  $+80^{\circ}\text{C}$ .
- iii. Voltage rating 660/1000V
- iv. Excellent resistance to heat, cold, water, oil, abrasion, UV radiation
- v. Flexible
- vi. 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 (2 %).
- vii. For the DC cabling, XLPE or, XLPO insulated and sheathed, UV-stabilized single core multi-stranded flexible copper cables shall be used; Multi-core cables shall not be used.
- viii. For the AC cabling, PVC or, XLPE insulated and PVC sheathed single or, multi-core multi-stranded flexible copper cables shall be used; Outdoor AC cables shall have a UV-stabilized outer sheath.



- ix. The cables (as per IS) should be insulated with a special grade PVC compound formulated for outdoor use. Outer sheath of cables shall be electron beam cross-linked XLPO type and black in colour.
- x. The DC cables from the SPV module array shall run through a UV-stabilized PVC conduit pipe of adequate diameter with a minimum wall thickness of 1.5mm.
- xi. Cables and wires used for the interconnection of solar PV modules shall be provided with solar PV connectors (MC4) and couplers.
- xii. All cables and conduit pipes shall be clamped to the rooftop, walls and ceilings with thermo-plastic clamps at intervals not exceeding 50 cm; the minimum DC cable size shall be 4.0 mm<sup>2</sup> copper; the minimum AC cable size shall be 4.0 mm<sup>2</sup> copper. In three phase systems, the size of the neutral wire size shall be equal or half to the size of the phase wires.
- xiii. Cable Routing/ Marking: All cable/wires are to be routed in a 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. In addition, cable drum no./Batch no. to be embossed/printed at every one meter.
- xiv. Cable Jacket should also be electron beam cross-linked XLPO, flame retardant, UV resistant and black in colour.
- xv. All cables and connectors for use for installation of solar field must be of solar grade which can withstand harsh environment conditions including High temperatures, UV radiation, rain, humidity, dirt, salt, burial and attack by moss and microbes for 25 years and voltages as per latest IEC standards. DC cables used from solar modules to array junction box shall be solar grade copper (Cu) with XLPO insulation and rated for 1.1 kV as per relevant standards only.
- xvi. The ratings given are approximate. Bidder to indicate size and length as per system design requirement. All the cables required for the plant shall be provided by the bidder. Any change in cabling sizes if desired by the bidder shall be approved after citing appropriate reasons. All cable schedules/layout drawings shall be approved prior to installation.
- xvii. 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 as specified below: BoS item / component Standard Description Standard Number Cables General Test and Measuring Methods, PVC/XLPE insulated cables for working Voltage up to and including 1100 V, UV resistant for outdoor installation IS/IEC 69947.
- xviii. The total voltage drop on the cable segments from the solar PV modules to the solar grid inverter shall not exceed 2.0%.
- xix. The total voltage drop on the cable segments from the solar grid inverter to the building distribution board shall not exceed 2.0%.

#### 14. CONNECTIVITY

The maximum capacity for interconnection with the grid at a specific voltage level shall



be as specified in the distribution code/supply code of the state regulation for Grid connectivity and norms of DISCOM and amended from time to time.

- i. The maximum permissible capacity for rooftop shall be 1 MW for a single net metering point.
- ii. Utilities may have voltage levels other than above, DISCOMS may be consulted before finalization of the voltage level and specification be made accordingly.
- iii. For large PV system (Above 100 kW) for commercial installation having large load, the solar power can be generated at low voltage levels and stepped up to 11 kV level through the step-up transformer. If the transformer is required, the cost of the same will be borne by beneficiary separately and will not be the part of project cost.

**15. TOOLS & TACKLES AND SPARES:**

- i. 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. List of tools and tackles to be supplied by the bidder for approval of specifications and make from RREC.
- ii. 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 or can be maintained at Supplier's end. A minimum set of spares shall be maintained in the plant itself or can be maintained at Bidder's end for the entire period of warranty and Operation & Maintenance which upon its use shall be replenished

**16. DANGER BOARDS AND SIGNAGES:**

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

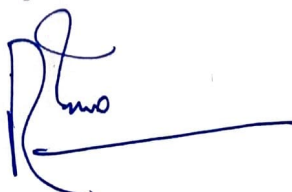
**17. FIRE EXTINGUISHERS:**

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

- a) Portable fire extinguishers in the control room for fire caused by electrical short circuits;
- b) Sand buckets in the control room;
- c) The installation of Fire Extinguishers should confirm to TAC regulations and BIS standards. The fire extinguishers shall be provided in the control room housing PCUs as well as on the Roof or site where the PV arrays have been installed.

**18. DRAWINGS & MANUALS:**

- i. Two sets of Engineering, electrical drawings and Installation and O&M manuals are to be supplied to beneficiaries. Bidders shall provide complete technical datasheets for each equipment giving details of the specifications along with make/makes in their bid along with basic design of the power plant and power evacuation, synchronization along with protection equipment.



ii. Approved ISI and reputed makes for equipment be used.

**19. PLANNING AND DESIGNING:**

- i. The bidder should carry out Shadow Analysis at the site and accordingly design strings & arrays layout considering optimal usage of space, material and labor. The bidder should submit the array layout drawings along with Shadow Analysis Report to the Purchaser for approval.
- ii. The Purchaser reserves the right to modify the landscaping design, Layout and specification of sub-systems and components at any stage as per local site conditions/requirements.
- iii. The bidder shall submit preliminary drawing for approval & based on any modification or recommendation, if any. The bidder submits three sets and soft copy of final drawing for formal approval to proceed with construction work.

**20. SOLAR PV SYSTEM ON THE ROOFTOP FOR MEETING THE ANNUAL ENERGY REQUIREMENT**

The Solar PV system on the rooftop of the selected buildings will be installed for PV capacity permissible by DISCOM as per regulation issued by RERC.

**21. 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.

*Note: The Technical Standards for Grid Connected SPV Rooftop Plants are revised/updated time to time by Ministry of New and Renewable Energy, New Delhi, the same will also be applicable on issuance of revised/updated standards by MNRE.*



### 3. QUALITY CERTIFICATION, STANDARDS AND TESTING FOR GRID CONNECTED ROOFTOP SOLAR PV SYSTEMS/ POWER PLANTS

Quality certification and standards for Grid-Connected Rooftop Solar PV Systems are essential for the successful mass-scale implementation of this technology. It is also imperative to put in place an efficient and rigorous monitoring mechanism, adherence to these standards. Hence, all components of Grid-Connected Rooftop Solar PV System/ Plant must conform to the relevant standards and certifications given below:

<b>Solar PV Modules/ Panels</b>	
IEC 61215/ IS 14286	Design Qualification and Type Approval for Crystalline Silicon Terrestrial Photovoltaic (PV) Modules
IEC 61701	Salt Mist Corrosion Testing of Photovoltaic (PV) Modules
IEC 61853-Part 1/ IS16170: Part 1	Photovoltaic (PV) module performance testing and energy rating: Irradiance and temperature performance measurements and power rating
IEC 62716	Photovoltaic (PV) Modules – Ammonia (NH <sub>3</sub> ) Corrosion Testing (As per the site condition like dairies, toilets)
IEC 61730-1,2	Photovoltaic (PV) Module Safety Qualification – Part 1: Requirements for Construction, Part 2: Requirements for Testing
<b>Solar PV Inverters</b>	
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 (as applicable)	Photovoltaic Systems – Power conditioners: Procedure for Measuring Efficiency (10%, 25%, 50%, 75% & 90-100% Loading Conditions)
IEC 62116/ UL 1741/IEEE 1547 (as applicable)	Utility-interconnected Photovoltaic Inverters - Test Procedure of Islanding Prevention Measures
IEC 60255-27	Measuring relays and protection equipment – Part 27: Product safety requirements
IEC 60068-2 / IEC 62093 (as applicable)	Environmental Testing of PV System – Power Conditioners and Inverters
<b>Fuses</b>	
IS/IEC 60947 (Part 1, & 3), EN 50521	General safety requirements for connectors, switches, circuit breakers (AC/DC):

	<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 energysystems
<b>Surge Arrestors</b>	
BFC 17-102:2011	Lightening Protection Standard
IEC 60364-5-53/ IS15086-5 (SPD)	Electrical installations of buildings - Part 5-53: Selection and erection of electrical equipment - Isolation, switching and control
IEC 61643-11:2011	Low-voltage surge protective devices - Part 11: Surge protective devices connected to low-voltage power systems - Requirements and test methods
<b>Cables</b>	
IEC 60227/IS 694, IEC 60502/IS 1554 (Part 1 & 2)/IEC69947 (as applicable)	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
<b>Earthing/ Lightning</b>	
IEC 62561 Series (Chemical earthing) (as applicable)	<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 Lightning protection system components (LPSC) - Part 7: Requirements for earthing enhancing compounds</p>
<b>Junction Boxes</b>	
IEC 60529	Junction boxes and solar panel terminal boxes shall be of the thermoplastic type with IP 65 protection for outdoor use, and IP54 protection for indoor use
<b>Energy Meter</b>	
IS 16444 or as specified by the DISCOMs	A.C. Static direct connected watt-hour Smart Meter Class 1 and 2 Specification (with Import & Export/Net energy measurements)
<b>Solar PV Roof Mounting Structure</b>	
IS 2062/IS 4759	Material for the structure mounting

Note- Equivalent standards may be used for different system components of the plants.



#### 4. DRAWINGS/DOCUMENTS

The Bidder shall furnish the following drawings/documents for each power plant after award of contract:

- i. O&M Manual/User Manual;
- ii. General arrangement and dimensional layout;
- iii. Schematic drawing showing the requirements of SPV panel, power conditioning units/inverter, junction boxes, Ac and DC distribution boards, meters etc.;
- iv. Structural drawing along with foundation details for the structure;
- v. Itemized bill of material for complete SV plant covering all the components and associate accessories;
- vi. Layout of solar power array;
- vii. Shadow analysis of the roof.

A handwritten signature in blue ink, consisting of a stylized initial 'R' followed by a cursive name and a horizontal line extending to the right.

**FORMAT OF QUOTATION**

To,  
IDP Coordinator & Dean  
National Agricultural Higher Education Project (Comp. - 1A)  
College of Technology and Engineering  
Maharana Pratap University of Agriculture & Technology  
Udaipur - 313 001

**Sub: Quotations for supply of Solar Power Plant (Grid Connected SPV Systems 40 KW)**

**Ref: Your invitation No: MPUAT/NAHEP(1A)/Proc./2022-23/**

dated- \_\_\_\_\_

Dear Sir,  
In response to above referred subject, we are submitting our offer for supply **Solar Power Plant (Grid Connected SPV Systems 40 KW)**. The details are as under:

1. Name of the Bidder:.....

2 Complete Address of the Bidder: .....

Sl. No.	Description Goods	Specifications	Qty.	Unit	Quoted Unit Rate in Rs.	Total Amount	
						In Figures	In Words
	<b>TOTAL</b>						
	<b>GST @</b>						

**Gross Total Cost : Rs. ....**

We agree to supply the above goods in accordance with the technical specifications for a total contract price of Rs. ....(amount in figures) (Rs. .... amount in words) within the period specified in the Invitation for Quotations.

We also confirm that the normal commercial warrantee/guarantee of ..... months shall apply to the offered goods.

We hereby certify that we have taken steps to ensure that no person acting for us or on our behalf will engage in bribery.

**Signature of Supplier**

