

Technical Specification of 10 KW ongrid solar power system

A Grid Tied Solar Rooftop Photovoltaic (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 should be designed with necessary features to supplement the grid power during day time. Components and parts used in the SPV power plants including the PV modules, metallic structures, cables, junction box, switches, PCUs etc., should conform to the BIS or IEC or international specifications, wherever such specifications are available and applicable. Solar PV system shall consist of following equipments/components. Solar PV modules consisting of required number of Crystalline PV cells. 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

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 250 Wp and above wattage. Module capacity less than minimum 250 watts shall 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 centres.
- e. The module frame shall be made of corrosion resistant materials, preferably having anodized aluminium.

f. The EoI holder shall carefully design & accommodate requisite numbers of the modules to achieve the rated power in his EoI. MEDA/owners shall allow only minor changes at the time of execution.

g. Other general requirement for the PV modules and subsystems shall be the Following: The rated output power of any supplied module shall have tolerance within +/-3%. M:\t\16-02-2017\forms for downloads and hard copy\documents\Technical specifications.doc Page 3 of 22 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. 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 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-65 rated. I-V curves at STC should be provided by EoI holder.

SOLAR PV MODULES :- • Modules deployed must use a RF identification tag. The following information must be mentioned in the RFID used on each modules. This should be inside the laminate only.

- a. Name of the manufacture of the PV module
- b. Name of the manufacture 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 :- • Material Warranty:

a. Material Warranty is defined as: The project developer 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")

b. Defects and/or failures due to manufacturing

c. Defects and/or failures due to quality of materials

d. Non conformity to specifications due to faulty manufacturing and/or inspection processes. If the solar Module(s) fails to conform to this warranty, the project developer will repair or replace the solar module(s), at the Owners sole option.

• Performance Warranty:

a. 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.

ARRAY STRUCTURE :- • Hot dip galvanized MS mounting structures may be used for mounting the modules / panels / arrays. Minimum thickness of galvanization should be at least 120 microns. • 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.

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

DC DISTRIBUTION BOARD :- • DC Distribution panel to receive the DC output from the array field. M:\t\16-02-2017\forms for downloads and hard copy\documents\Technical specifications.doc Page 7 of 22 • 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. •

AC DISTRIBUTION PANEL BOARD :- • 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/ IS 60947 part I, II and III. • The changeover switches, cabling work should be undertaken by the EoI holder as part of the project. • 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 • The panels shall be designed for minimum expected ambient temperature of 45 degree Celsius, 80 percent humidity and dusty weather. • All indoor panels will have protection of IP54 or better. All outdoor panels will have protection of IP65 or better. • Should conform to Indian Electricity Act and rules (till last amendment).

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. Inverter output should be compatible with the grid frequency. Three phase PCU/ inverter shall be used with each power plant system (10kW and/or above) but in case of less than 10kW single phase inverter can be used.

e. **Anti-islanding (Protection against Islanding of grid):** The PCU shall have anti islanding protection in conformity to IEEE 1547/UL 1741/ IEC 62116 or equivalent BIS standard. f. Channel Partner shall be responsible for galvanic isolation of solar roof top power plant (>100kW) with electrical grid or LT panel.

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.

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

LIGHTNING PROTECTION :- M:\t\16-02-2017\forms for downloads and hard copy\documents\Technical specifications.doc Page 15 of 22 • 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 IEC 62305 standard. The protection against induced high-voltages shall be provided by the use of metal oxide varistors (MOVs) and suitable earthing such that induced transients find an alternate route to earth.

SURGE PROTECTION :- • Internal surge protection shall consist of three MOV type surge-arrestors connected from +ve and –ve terminals to earth (via Y arrangement). ▪

EARTHING PROTECTION :- • 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 Department/MEDA as and

when required after earthing by calibrated earth tester. PCU, ACDB and DCDB should also be earthed properly. • 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 :- • 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 M:\t\16-02-2017\forms for downloads and hard copy\documents\Technical specifications.doc Page 16 of 22 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. • 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.

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 EoI holder for maintenance purpose. List of tools and tackles to be supplied by the EoI holder for approval of specifications and make from MEDA/ owner. • 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 M:\t\16-02-2017\forms for downloads and hard copy\documents\Technical specifications.doc Page 20 of 22 maintained in the plant itself for the entire period of warranty and Operation & Maintenance which upon its use shall be replenished.

▪**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 MEDA/ owner.