

approved after citing appropriate reasons. All cable schedules/ layout drawings shall be approved prior to installation.

- q. Multi Strand, Annealed high conductivity copper conductor PVC type 'A' pressure extruded insulation or XLPE insulation. Overall PVC/XLPE insulation for UV protection armored 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.
- r. The total voltage drop on the cable segments from the solar PV modules to the solar grid inverter shall not exceed 2.0%.
- s. The total voltage drop on the cable segments from the solar grid inverter to the building distribution board shall not exceed 2.0%.

➤ **CONNECTIVITY:-**

- a. 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 and amended from time to time. Following criteria have been suggested for selection of voltage level in the distribution system for ready reference of the solar suppliers.

Plant Capacity	Connecting voltage
Up to 10 kW	240V-single phase or 415V-three phase at the option of the consumer
Above 10kW and up to 100 kW	415V – three phase
Above 100kW	At HT/EHT level DISCOM rules (11kV/33kV/66kV)

- a. The maximum permissible capacity for rooftop shall be 1 MW for a single net metering point.

- b. Utilities may have voltage levels other than above; DISCOMS may be consulted before finalization of the voltage level and specification to be made accordingly.

➤ **TOOLS & TACKLES AND SPARES :-**

- a. After completion of installation & commissioning of the power plant, necessary tools & tackles are to be provided free of cost by the Eol holder for maintenance purpose. List of tools and tackles to be supplied by the Eol 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 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:-**

- a. Danger boards should be provided as and where necessary as per IE Act. /IE rules as amended up to date. Three signage's 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.

➤ **FIRE EXTINGUISHERS:-**

- a. 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 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.

➤ **DRAWINGS & MANUALS:-**

- a. Two sets of Engineering, electrical drawings and Installation and O&M manuals are to be supplied. Eol holders shall provide complete technical data sheets for each

equipment giving details of the specifications along with make/makes in their EoI along with basic design of the power plant and power evacuation, synchronization along with protection equipment.

- b. Approved ISI and reputed makes for equipment be used.
- c. For complete electro-mechanical works, EoI holders shall supply complete design, details and drawings for approval to owners before progressing with the installation work.

➤ **PLANNING AND DESIGNING:**

- a. The EoI holder should carry out Shadow Analysis at the site and accordingly design strings & arrays layout considering optimal usage of space, material and labor. The EoI holder should submit the array layout drawings along with Shadow Analysis Report to owner for approval.

➤ **DRAWINGS TO BE FURNISHED BY CONTRACTOR**

- a. The Contractor shall furnish the following drawings Award/Intent and obtain approval
- b. General arrangement and dimensioned layout.
- c. Schematic drawing showing the requirement of SV panel, Power conditioning Unit(s)/ inverter, Junction Boxes, AC and DC Distribution Boards, meters etc.
- d. Structural drawing along with foundation details for the structure.
- e. Itemized bill of material for complete SV plant covering all the components and associated accessories.
- f. Layout of solar Power Array
- g. Shadow analysis of the roof

➤ **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 meeting upto 90% of the annual energy requirements depending upon the area of rooftop available and the remaining energy requirement of the buildings will be met by drawing power from grid at commercial tariff of DISCOMs.

➤ **SAFETY MEASURES:-**

- a. The EoI holder 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.

➤ **DISPLAY BOARD:-**

- a. The EoI holder has to display a board at the project site (above 10 kWp) mentioning the following:
  - a. Plant Name, Capacity, Location, Type of Renewable Energy plant (Like solar wind etc.), Date of commissioning, details of tie-up with transmission and distribution companies, Power generation and Export FY wise.
  - b. Financial Assistance details from MEDA/MNRE/Any other financial institution apart from loan. This information shall not be limited to project site but also be displayed at site offices/head quarter offices of the successful EoI holder.
  - c. The size and type of board and display shall be appropriate.

**General Information**

- 1) The operating life of the plant shall be minimum 25 years.
- 2) The plant shall monitor solar generated energy using plant DC / AC energy meter/Bidirectional energy meter independent of load energy monitoring. Remote monitoring facility must be made available.
- 3) The plant shall consist of PV array, fixed PV array support structure, String/Array combiner boxes, if required; DC cabling, DC distribution box, if required; Inverter, AC cabling, AC distribution box, plant AC energy meter, load energy meter and data acquisition system.
- 4) The individual Solar PV array shall be installed on existing roof top of the building using fixed PV array support structure.
- 5) The individual string / array combiner boxes and DC cabling shall be installed on roof top of the building.
- 6) The inverter shall be installed in the control room / open space provided in the building.
- 7) The DC and AC distribution boxes, DC and AC cabling, energy meters and data acquisition system shall be installed in the control room / open space provided in (or near) the building.

## QUALITY CERTIFICATION, STANDARDS AND TESTING

### 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 61646/ IS 16077	Design Qualification and Type Approval for Thin-Film Terrestrial Photovoltaic (PV) Modules
IEC 62108	Design Qualification and Type Approval for Concentrator Photovoltaic (CPV) Modules and Assemblies
IEC 61701- As applicable	Salt Mist Corrosion Testing of Photovoltaic (PV) Modules
IEC 61853- Part 1/ IS 16170 : Part 1	Photovoltaic (PV) module performance testing and energy rating –: Irradiance and temperature performance measurements, and power rating
EC 62716	Photovoltaic (PV) Modules – Ammonia (NH <sub>3</sub> ) Corrosion Testing ( <b>Advisory - As per the site condition like dairies, toilets</b> )
IEC 61730-1,2	Photovoltaic (PV) Module Safety Qualification – Part 1: Requirements for Construction, Part 2: Requirements for Testing
IEC 62804 (Draft Specifications)	Photovoltaic (PV) modules - Test methods for the detection of potential-induced degradation (PID). IEC TS 62804-1: Part 1: Crystalline silicon ( <b>Mandatory for system voltage is more than 600 VDC and advisory for system voltage is less than 600 VDC</b> )
IEC 62759-1	Photovoltaic (PV) modules – Transportation testing, Part 1: Transportation and shipping of module package units
<b>Solar PV Inverters</b>	

IEC 62109-1, IEC 62109-2	Safety of power converters for use in photovoltaic power systems Safety compliance (Protection degree IP 65 for outdoor mounting, IP 54 for indoor mounting)
IEC/IS 61683 <b>(For stand Alone System)</b>	Photovoltaic Systems – Power conditioners: Procedure for Measuring Efficiency (10%, 25%, 50%, 75% & 90-100% Loading Conditions)
BS EN 50530  (Will become IEC 62891)  <b>(For Grid Interactive system)</b>	Overall efficiency of grid-connected photovoltaic inverters:  This European Standard provides a procedure for the measurement of the accuracy of the maximum power point tracking (MPPT) of inverters, which are used in grid-connected photovoltaic systems. In that case the inverter energizes a low voltage grid of stable AC voltage and constant frequency. Both the static and dynamic MPPT efficiency is considered.
IEC 62116/ UL 1741/ IEEE 1547	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 (1, 2, 14, 27, 30 & 64)	Environmental Testing of PV System – Power Conditioners and Inverters
<b>IEC 61000- 2,3,5</b>	Electromagnetic Interference (EMI), and Electromagnetic Compatibility (EMC) testing of PV Inverters (as applicable)
<b>Fuses</b>	
IS/IEC 60947 (Part 1, 2 & 3), EN 50521	General safety requirements for connectors, switches, circuit breakers (AC/DC)
IEC 60269-6	Low-voltage fuses - Part 6: Supplementary requirements for fuse-links for the protection of solar photovoltaic energy systems
<b>Surge Arrestors</b>	
IEC 61643-11:2011 / IS 15086-5(SPD)	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	General test and measuring method for PVC (Polyvinyl chloride) insulated cables (for working voltages up to and including 1100 V, and UV resistant for