TECHNICAL SPECIFICATIONS

Grid Tied Solar Rooftop Photovoltaic (SPV) Power Plant

1. DEFINITION: -

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 equipment's / 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 lightening protections.
- IR/UV protected PVC Cables, pipes and accessories

1.1. SOLAR PHOTOVOLTAIC MODULES: -

1.1.1. The PV modules used should be made in India.

1.1.2. SPV array contains specified number of same capacities, type and specifications modules connected in series or parallel to obtain the required voltage or current output.

1.1.3. 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 (Mono-Crystalline Solar Panel) IEC 61215/IS14286 or equivalent National or International / Standards. In addition, the modules must conform to EC 61730 Part-1 - requirements for construction & Part 2 – requirements for testing, for safety qualification or equivalent IS. STC performance data supplied with the modules shall not be more than one year old.

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a) For the PV modules to be used in a highly corrosive atmosphere throughout their lifetime, they must qualify to IEC 61701.

b) The name plate of SPV module shall conform to IS 14286/IEC 61215.

c) The minimum module efficiency should be minimum 19 percent and fill factor shall be more than 75 percent.

d) 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 Wp shall not be accepted.

e) Modules must qualify to IS 170210 (Part 1) for the detection of potential-induced degradation - Part 1: Crystalline silicon (Mandatory in case the SPV array Open Circuit voltage is more than 600 V DC)

f) The SPV modules must be warranted for output wattage, which should not be less than 90% of the rated wattage at the end of 10 years and 80% of the rated wattage at the end of 25 years.

g) Adequate protective devices against surges at the PV module shall be provided. Low voltage drop bypass diodes shall be provided.

h) PV modules must be tested and approved by one of the IEC authorized test centers.

i) The module frame shall be made of corrosion resistant materials, preferably having anodized aluminium.

j) The RFID tag shall be placed inside the glass laminate of the SPV modules.

k) SPV plant shall be carefully designed & accommodate requisite numbers of the modules to achieve the rated power. MEDA/owners shall allow only minor changes at the time of execution.

l) 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 within +/-3%.

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

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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 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.

IV. I-V curves at STC should be provided by Project developer.

SOLAR PV MODULES: -

1.1.4. 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.

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, Im, Vm 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.

1.1.5. Other relevant information on traceability of solar cells and module as per ISO 9001 and ISO 14001

1.1.6. WARRANTIES: -

a) Material Warranty:

i. 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")

ii. Defects and/or failures due to manufacturing

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

iv. Non-conformity to specifications due to faulty manufacturing and/or inspection

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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.

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.

1.2. ARRAY STRUCTURE: -

a) 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.

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 (wind speed of 150 kM/ hour). 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 MEDA. 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 comply of latest IS 4759.

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) Aluminium frames should be avoided for installations in coastal areas.

f) 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.

g) Regarding civil structures the Project developer need to take care of the load bearing

capacity of the roof and need arrange suitable structures based on the quality of roof.

h) The total load of the structure (when installed with PV modules) on the terrace should be less than 60 kg/m^2.

i) The minimum clearance of the structure from the roof level should be 300 mm.

j) Ballast type structures can be used only for plants for capacity more than 40kWp.

1.3. 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 JBs 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 IP65 standard and IEC 62208 Hinged door with EPDM rubber gasket to prevent water entry. Single / double compression cable glands. Provision of earthing's. 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.

1.4. 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.

1.5. AC DISTRIBUTION PANEL BOARD :-

a) AC Distribution Panel Board (DPB) shall control the AC power from PCU/ inverter, and should have necessary surge arrestors. Interconnection 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 Project developer 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 IP54 or better. All outdoor panels will have protection of IP65 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	+/- 3 Hz

1.6. 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.

1.7. 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

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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 (In case single phase inverters are offered, suitable arrangement for balancing the phases must be made.)
output frequency	50 Hz
Grid Frequency Synchronization range	+ 3 Hz or more
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 or more
Grid Voltage tolerance	-0.20.15
No-load losses	Less than 1% of rated power
Inverter efficiency(minimum)	>93% (In case of 10 kW or above with in-built galvanic isolation) >97% (In case of 10 KW or above without in-built galvanic isolation)
Inverter efficiency (minimum)	.> 90% (In case of less than 10 kW)
THD	< 3%
PF	> 0.9

a) 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.

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 IEEE 1547/UL 1741/ IEC 62116 or equivalent BIS standard.

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f) Channel Partner shall be responsible for galvanic isolation of solar roof top power plant (>100kW) with electrical grid or LT panel.

g) In PCU/Inverter, there shall be a direct current isolation provided at the output by means of a suitable isolating transformer. If Isolation Transformer is not incorporated with PCU/Inverter, there shall be a separate Isolation Transformer of suitable rating provided at the output side of PCU/PCU units for capacity more than 100 kW.

h) 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.

i) 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.

j) The 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.

k) The PCU / inverters should be tested from the MNRE approved test center's / NABL / BIS / IEC accredited testing- calibration laboratories. In case of imported power conditioning units, these should be approved by international test houses.

2. 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.

3. DATA ACQUISITION SYSTEM / PLANT MONITORING: -

i. Data Acquisition System shall be provided for each of the solar PV plant above 10 kWp

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capacity.

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. Solar Irradiance: An integrating Pyranometer/ Solar cell-based irradiation sensor (along with calibration certificate) provided, with the sensor mounted in the plane of the array. Readout integrated with data logging system.

iv. Temperature: Temperature probes for recording the Solar panel temperature and/or ambient temperature to be provided complete with readouts integrated with the data logging system.

v. 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.

vi. 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.

vii. PV array energy production: Digital Energy Meters to log the actual value of AC/ DC

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voltage, Current & Energy generated by the PV system provided. Energy meter along with CT/PT should be of 0.5 accuracy class.

viii. 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.

ix. 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.

x. Computerized AC energy monitoring shall be in addition to the digital AC energy meter.

xi. 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.

xii. All instantaneous data shall be shown on the computer screen.

xiii. Software shall be provided for USB download and analysis of DC and AC parametric data for individual plant.

xiv. Provision for instantaneous Internet monitoring and download of historical data shall be also incorporated.

xv. 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 temperature monitoring system.

xvi. Ambient / Solar PV module back surface temperature shall be also monitored on continuous basis.

xvii. 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.

xviii. Remote Monitoring and data acquisition through Remote Monitoring System software at the owner / MEDA 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 shall be provided.

xix. The Project developer shall be obligated to push real-time plant monitoring data on a specified interval (say 15 minute) through open protocol at receiver location (cloud server) in

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XML/JSON format, preferably.

4. 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.

b) The Bi-Directional electronic energy meter (0.5 S class) shall be installed for the measurement of import/Export of energy.

c) The Project developer must take approval/NOC from the Concerned DISCOM for the connectivity, technical feasibility, and synchronization of SPV plant with distribution network before commissioning of SPV plant.

d) Reverse power relay shall be provided as per the local DISCOM requirement.

5. 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. Finalization of tariff is not under the purview of MEDA or MNRE. Decisions of appropriate authority like DISCOM, state regulator may be followed.

6. PROTECTIONS: -

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

6.1 LIGHTNING PROTECTION: -

a) 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 and IEC 63227 standards including its amendments and updated versions. 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.

b) An external lightning Rod, of height sufficient to meet the requirement of Lightning

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Protection System (LPS) designed to comply with the class III or higher (Class-I / Class-II), based on the site requirement including the area-specific lightning activity, shall be installed.

c) The cross-section of the metal sub-structures used for the connection of the lightning arrestor to the earth electrode should be no less than 16 mm2 Cu or 25 mm2 Al or GI of equivalent current carrying capacity should be used, which will also depend upon the class of the Lightning protection system.

6.2 SURGE PROTECTION: -

a) For SPDs IEC 63227 and its updated versions or amendments should be followed.

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

c) At the DC Input side of the controller, it should have protection from an External Surge Protection Device of Type-2 or higher (i.e. Type-1) in accordance with the IEC 61643-31.

d) The rated voltage of SPDs on the DC side, depends on the type of protective circuit and the magnitude of the maximum operating voltage of the SPV modules.

6.3 EARTHING PROTECTION: -

a) 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 Department/owner as and when required after earthing by calibrated earth tester. PCU, ACDB and DCDB should also be earthed properly.

b) The Earthing system should be designed in such a way that it should be able to restrict the potential of each conductor according to the level of insulation applied and magnitude of the current conducted through human body should be less than the value that can cause ventricular fibrillation of heart.

c) Earth connections shall be done in such a way that they are visible for inspection and all the earth electrodes can easily be tested at any point of time.

d) 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.

e) All the materials, fittings etc. used for doing earthing shall conform to the Indian standard,

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wherever exists.

f) For the maintenance of the earth electrode and measurement of the Earth electrode resistance the provisions of IS 3043 shall be referred.

6.4 GRID ISLANDING: -

a) 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.

b) 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.

7 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: $-10^{O}C$ to $+80^{O}C$.

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-

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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 color.

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^2 copper; the minimum AC cable size shall be 4.0 mm2 copper. In three phase systems, the size of the neutral wire size shall be equal 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 color.

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 1.1kV as per relevant standards only.

xvi. The ratings given are approximate. Project developer to indicate size and length as per system design requirement. All the cables required for the plant shall be provided by the Project developer. Any change in cabling sizes if desired by the Project developer 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

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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.

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%.

8 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 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 phases
Above 100kW	At HT/EHT level (11kV/33kV/66kV) as per DISCOM rules

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 be made accordingly.

c) For large PV system (Above 100kW) 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. The transformers and associated switchgear would require to be provided by the SPV bidders.

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9 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 Project developer for maintenance purpose. List of tools and tackles to be supplied by the Project developer for approval of specifications and make from MEDA/ owner.

b) 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.

10 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 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 owner.

11 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.

12 DRAWINGS & MANUALS: -

a) Two sets of Engineering, electrical drawings and Installation and O&M manuals are to be supplied. Project developer shall provide complete technical data sheets for each equipment giving details of the specifications along with make/makes along with basic design of the power plant and power evacuation, synchronization along with protection equipment.

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b) Approved ISI and reputed makes for equipment be used.

c) For complete electro-mechanical works, Project developer shall supply complete design, details and drawings for approval to owners before progressing with the installation work.

13 PLANNING AND DESIGNING:

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

b) MEDA 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.

c) The bidder shall submit preliminary drawing for approval &based on any modification or recommendation, if any. The bidder submits three sets and soft copy in CD of final drawing for formal approval to proceed with construction work.

14 DRAWINGS TO BE FURNISHED BY PROJECT DEVELOPER AFTER AWARD OF CONTRACT FROM BENEFICIARY: -

a) The Project developer 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

15 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

Head of Department
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PRINCIPAL