

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	+/- 5 Hz

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.

Power Conditioning Unit / 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. 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	-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 IEEE1547/UL1741/IEC62116 or equivalent BIS standard.
- f) Successful Bidders 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 100kW.
- 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 IEC60068-2 (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 centres / NABL/ BIS/ IEC accredited testing- calibration laboratories. In case of imported power conditioning units, these should be approved by international test houses.

INTEGRATION OF PV POWER WITH GRID:

The output power from SPV would be fed to the inverters which convert DC produced by SPV array to AC and feed 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.

PROTECTIONS

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 NFC 17-102:2011 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 MOV type surge-arrestors connected from +ve and -ve terminals to earth (via Y arrangement).

EARTHING PROTECTION

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

b) Earth resistance shall not be more than 3 ohms. It shall be ensured that all the earthing points are bonded together to make them at the same potential.

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 Solar 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.

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°C to $+80^{\circ}\text{C}$
- iii. Voltage rating 660/1000V
- iv. Excellent resistance to heat, cold, water, oil, abrasion, UV radiation
- v. 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%)
- vi. 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.
- vii. 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.
- viii. 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.
- ix. 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.
- x. Cables and wires used for the interconnection of solar PV modules shall be provided with solar PV connectors (MC4) and couplers
- xi. All cables and conduit pipes shall be clamped to the appropriate place, 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 mm^2 copper. In three phase systems, the size of the neutral wire size shall be equal to the size of the phase wires.
- xii. 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.
- xiii. Cable Jacket should also be electron beam cross-linked XLPO, flame retardant, UV resistant and black in color.
- xiv. 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.
- xv. 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.
- xvi. 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 /IEC69947.

xvii. The total voltage drop on the cable segments from the solar PV modules to the solar grid inverter shall not exceed 2.0%.

xviii. The total voltage drop on the cable segments from the solar grid inverter to the building distribution board shall not exceed 2.0%.

METERING:- Metering shall be done as accordance with the Hon'ble UERC , RE REGULATION-2018 (as amended time to time).

CONNECTIVITY

The maximum capacity for interconnection with the grid at a specific voltage level shall be as specified in the UERC RE REGULATION 2018 and amended from time to time.

SAFETY MEASURES:

The contactor 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.

DECLARATION BY THE EPC FIRM
(On non- judicial stamp paper of Rs. 100/-)

I/We(Hereinafter referred to as Bidder/Firm) being desirous of participating for the work, under this EoI and having fully understood the nature of the work and having carefully noted all the terms and conditions, specifications etc. as mentioned in the EoI document do hereby declare that-

1. The Bidder/firm is fully aware of all the requirements of the EoI document and agrees with all provisions of the EoI document and accepts all risks, responsibilities and obligations directly or indirectly connected with the performance of the tender.
2. The Bidder/firm is capable of executing and completing the work as required in the EoI and is financially solvent and sound to execute the EoI work. The Bidder is sufficiently experienced and competent to perform the work to the satisfaction of UREDA/applicant. The firm gives the assurance to execute the work as per specifications, terms and conditions of the EoI on award of work.
3. The Bidder/firm has no collusion with other Bidders, any employee of UREDA or with any other person or firm in the preparation of the EoI.
4. The Bidder/firm has not been influenced by any statement or promises by UREDA or any of its employees but only by the EoI document.
5. The Bidder/firm is familiar with all general and special laws, acts, ordinances, rules and regulations of the Municipal, District, State and Central Government that may affect the work, its performance or personnel employed therein.
7. That the order of debar or blacklisting by MNRE/ any other Government undertaking /Department/Institutions/autonomous Organizations is not presently in force against me.
8. All the information and the statements submitted with the offer are true and no information has been concealed by the Bidder/firm.
9. The bidder/firm shall deploy PV modules/inverter systems etc with applicable latest IEC standards, BIS standards and with applicable standard as specified by Central Electricity Authority and shall meet various other technical requirements specified by MNRE for Grid connected Solar Power Plant.