



## TECHNICAL SPECIFICATIONS

**The proposed projects shall be commissioned as per the technical specifications given below**

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 to be mounted on a suitable structure. Grid tied SPV system is without battery and should be designed with necessary features. 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.

### **SPECIFICATIONS OF MAJOR COMPONENTS OF THE SYSTEM**

#### **1. PV MODULES:**

- a) The PV modules Mono-PERC half cut solar panel (Manufactured in India) to be employed shall be of minimum 144 cell configuration with rated power (Min 540 Wp +) at STC as certified for solar PV module power performance test as prescribed by latest edition of IEC 61215 / IS14286 and as tested by IEC / MNRE recognized test laboratory. The Solar Modules should be IEC Certified and BIS Approved.

In addition, the modules must conform to IEC 61730 Part 1-requirements for construction & Part 2 - requirements for testing, for safety qualification.

The bidder shall carefully design & accommodate requisite numbers of the modules to achieve the rated power in the project proposal submitted to the Bank.

#### **Technical Requirements:**

Make	:WARIEE/GOLDI/VIKARAM/LUXRA/NOVASYS/RENEWSYS/UTL SOLAR/ PIXON or as per latest approved ALMM list of MNRE
Type	: Mono-PERC half cut solar panel
Rated power at	: Minimum 540 Wp, Max. Tolerance +3%
STC	As per MNRE Standards
Cell size	As per MNRE Standards
Cell Qty.	: 144 pcs per Module
Module size	: As per MNRE Standards
Junction Box	: As per MNRE Standards
Diode	: As per MNRE Standards
Nominal Rating: 540 W or above under STC	
Vmax	: As per MNRE Standards
I <sub>max</sub>	: As per MNRE Standards
Voc	: As per MNRE Standards
Isc	: As per MNRE Standards

FF	: As per MNRE Standards
Efficiency (Module)	: As per MNRE Standards
Power Tolerance	: As per MNRE Standards
RFID Tag	: As per MNRE Standards
PV Module standard:	IEC 61215 and IEC 61730-1 & IEC 61730-2
Weight	: 28-29 kg. (approximate)

**b) IDENTIFICATION AND TRACEABILITY**

Each PV module used in the solar power project must use a RF identification tag (RFID), which must contain the following information. The RFID can be inside or outside the module Laminate, but must be able to withstand harsh environmental conditions.

- i) Name of the manufacturer of PV Module
- ii) Name of the Manufacturer of Solar cells of PV Module
- iii) Month and year of the manufacture (separately for solar cells and module).
- iv) Country of origin (separately for solar cells and module)
- v) I-V curve for the module
- vi) Peak Wattage,  $I_m$ ,  $V_m$  and field factor (FF) for the module
- vii) Unique Serial No. and Model No. of the module
- viii) Date and year of obtaining IEC PV module qualification certificate
- ix) Name of the test lab issuing IEC certificate
- x) Other relevant information on traceability of solar cells and module as per ISO 9000 series.

It may be noted that from 1st April 2013 onwards; RFID shall be mandatorily placed inside the module laminate.

- c) Each module shall have low iron tempered glass front for strength & superior light transmission. It shall also have tough multi-layered polymer back sheet for environmental protection against moisture & provide high voltage electrical insulation.
- d) Solar module shall be laminated using lamination technology using established polymer (EVA) and Tedlar /Polyester laminate.
- e) The module frame shall be made of aluminium or corrosion resistant material, which shall be electrically compatible with the structural material used for mounting the modules.
- f) 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 more than 3 (three) per cent from the respective arithmetic mean for all modules and/or for all module strings, as the case may be.

- g) The module frame shall be made of anodized Aluminium, which shall be electrically & chemically compatible with the structural material used for mounting the modules. It is required to have provision for earthing to connect it to the earthing grid. The anodisation thickness shall not be less than 15 micron.
- h) Minimum three number of bypass diodes (Schottky type) and two number of MC4 connectors with appropriate length of TUV 2 Pfg 1169/08.2007 certified 4 sq.mm, Cu. armoured cable should be used only.
- i) Photon conversion efficiency of SPV Module should be greater than 17%. Module shall be made of high transmittance glass front surface giving high encapsulation gain.

j) **Technical Requirements:**

- i. The modules should be 100% PID (Potential Induced Degradation) tolerant and should comply with IEC 62804.
- ii. Modules shall perform satisfactorily in relative humidity up to 85% and temperature between 10° C and 85°C (module temperature).
- iii. Modules should have rugged design to withstand tough environmental conditions and high wind speeds (minimum up to 270 km/h). Fill Factor should be 0.72 minimum.
- iv. SPV module shall have module safety class-II and should be highly reliable, light weight and must have a service life of more than 25 years.
- v. Modules only with the same rating and of same manufacturer and model shall be supplied.

k) **Component Specifications:**

- i. The glass used to make the PV modules shall be toughened low iron glass with minimum thickness of 4.0 mm for 144 cell module. The glass used shall have transmittance of above 90%. Glass must have bending of less than 0.3%.
- ii. The back sheet used in the PV modules shall be of three layered or mono layered structure. The back sheet used in the crystalline silicon based modules shall be 3 layered structures. Outer layer of fluoro polymer, middle layer of Polyester (PET) based and Inner layer of fluoro polymer or UV resistant polymer. Back sheet with additional layer of Aluminium also will be considered.
- iii. The back sheet should be durable for humid – hot conditions with properties of moisture barrier, elongation retention and UV resistance.

l) **Authorised Testing Laboratories / Centers:**

- i. The PV modules must be tested and approved by one of the IEC authorized test centers. Test certificates can be issued by any of the NABL / BIS Accredited Testing / Calibration Laboratories.

- ii. Test certificates for the system/ components/ items from any of the NABL / BIS Accredited Testing Calibration Laboratories / MNRE approved test centers to be submitted to the Bank.
- iii. The Contractor shall provide the Bill of Materials (BOM) of the module that is submitted for approval along with the datasheets of each component. The component datasheet shall contain all the information to substantiate the compliance for component specifications mentioned above. The Contractor shall also provide complete test reports and certifications for the module proposed as per above. The BOM proposed shall be the subset of Constructional Data Form (CDF)'s of all the test reports.

m) **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 twenty five (25) years from the date of sale to the original 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 processes. If the solar Module(s) fails to conform to this warranty, the manufacturer will replace the solar module(s), at the Owners sole option.

b).**Performance Warranty:**

- i. The manufacturer should warrant the output of Solar Module(s) for at least 90% of its rated power after initial 10 years & 80% of its rated power after 25 years from the completion of trial run at site/date of final commissioning.
- ii. Modules with lower degradation rate less than 0.7% per year will be considered.
- iii. The contractor shall collect the Warranty Certificate for performance of the modules from the manufacturer and submit the same to SBI prior to delivery of the products to the respective sites.
- iv. If, Module(s) fail(s) to exhibit such power output in prescribed time span, the Contractor will bound to either deliver additional PV Module(s) to replace the missing power output with no change in area of site used or replace the PV Module(s) with no extra cost claimed at Owner's sole option.

2. **Solar PV Mounting Structure**

- a. The mounting structure shall have to be designed by the Contractor after spot verification.
- b. The module mounting structures should be made suitable for Sheet Roof & Flat RCC roof.



- c. Structures shall be supplied complete with all members to be compatible for allowing easy installation at the rooftop site.
- d. The structures shall be designed to allow easy replacement of any module.
- e. Each structure will have a provision to adjust its angle of inclination to the horizontal as per the site condition and will be capable of withstanding a wind load of 150 Km/hr after grouting and installation. The vendor has to submit the installation drawings approved by the registered structural engineer that designed structure and grouting method is capable of withstanding a wind pressure of 150 Km/hr.
- f. Few locations/site are of Flat RCC roof, where the suitable Elevated GI Structure to be fabricated to utilize the space beneath the Structure.
- g. The Modules on the elevated structures with GI Sheet roofs & existing GI Sheet roof will be mounted with Anodized Aluminium Channels/structures. The Anodized Aluminium Rails/channels should be fixed with suitable Adhesives to the GI Sheet roof withstanding wind speed of 150Km/hr
- h. Mounting Structure must be designed to withstand all weights of modules and to withstand wind speed of 150km/hr. Anti-theft Nut & Bolts must be used for modules.
- i. For Elevated Structure Hot dip galvanized MS angles & poles to be used adhering to IS standards. The thickness of galvanization should be minimum of 90 microns. All the nuts, bolts are made of good quality Stainless Steel (SS 304). Space must be provided in between rows for proper maintenance and cleaning.

The minimum clearance of the lowest part of the module structure and the developed ground level shall not be less than 600 mm. The structure shall be fixed tilt type to give maximum output from the plant

- j. Material Specification for MS Items for Elevated Structure:

Column	MB200
Rafter	Rectangular Tube 100 x 50 x 4mm
Purlin	Rectangular Tube 80x50x4mm
Base Plate	HR Plate 300x300x10mm

- k. Bidders have to submit detailed designs and Drawings to SBI for acceptance and approval before execution of work.
- l. Vendor shall carry out all the tasks such as cleaning/ scratching/ roughening/ smoothing etc required to prepare the floor for effective bonding with the concrete pedestal of the module mounting structures (MMS). Foundation that is Concrete pedestal for the MMS structures shall be of 300X300X300mm @ ratio 1:2:4 concrete mix as per IS: 456. Two-part epoxy compound (NITO Bond Epoxy Resin Bonding agent) shall be applied between the floor and pedestal surfaces to facilitate effecting bonding.

- m. Contractor to confirm that no damage to existing water proofing of the roof shall be made during the course of installation of the structure on roof top. Any damage to the waterproofing found during the above should be rectified to the existing roof condition at Contractor's cost. All pedestals shall be finished to the existing roof condition to prevent any water seepage later. Contractor shall commence the work only after clearance of drawings by SBI authority
- n. Racks will be laid out in parallel matrices allowing individuals to access the area between the racks for cleaning and other maintenance needs. In between the row of solar panels sufficient gap need to be provided to avoid falling of shadow of one row on the next row. Seismic factors for the site will be considered while making the design of the foundation. Array support structure shall be fabricated using corrosion resistant GI sections electrically compatible with the structural material. Adequate spacing shall be provided between any two modules secured on PV panel for improved wind resistance
- o. Provision for installing the Array Junction Box shall be available on the same frame material and specification as defined for Module mounting structure.
- p. The total load of the structure (when installed with PV modules) on the terrace should be less than 60 kg/m<sup>2</sup>. The array structure shall be grounded properly using maintenance free earthing kit suitable for mounting over building terrace.
- q. **Bidder has to design MMS as per the actual site conditions and loads of roof top. Elevated systems to be installed on any roof, if the obstacles found within the terrace area. Structural integrity and safety is afforded the topmost priority during the design process. The expected life of a solar power plant is 25 years and ensure that structures are designed in a manner to ensure achieving of said milestone**

r) **Cable Trays:**

**Cable trays should be overhead .It should be avoided at ground installation** The perforated cable trays with Tray cover shall be manufactured from good commercial, high grade strength sheet steel having minimum thickness of 1.6mm for Tray and 1mm for Tray Cover. The perforated cable trays shall be hot dip galvanized according to IS-2629, BS729-1971

OR

Equivalent standard suitable for indoor/outdoor use having moderate humidity and air pollution. The zinc coating thickness shall work out by applying a 610 gm of zinc per square meter surface with an approximate thickness of 80 microns

Sr No	Size of Tray Size	Size of Tray Cover	Approx. Quantity
1	250mm X 100mm X 1.6mm	250mm X 15mm X 1mm	As required
2	100mm X 50mm X 1.6mm	100mm X 15mm X 1mm	As required
3	50mm X 25mm X 1.6mm	50mm X 15mm X 1mm	As required

### 3. Junction Box:

A DC Junction/Combiner Box shall be used to combine the DC cables of the solar module arrays with DC fuse protection for the outgoing DC cable(s) to the DC Distribution Box.

- i. The junction boxes are to be provided in the PV array for termination of connecting cables. The Junction Boxes (JBs) shall be made of GRP/FRP/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.
- ii. Suitable markings shall be provided on the busbar for easy identification and the cable ferrules must be fitted at the cable termination points for identification.
- iii. Copper bus bars/terminal blocks housed in the junction box with suitable termination threads conforming to IP 65 standard and IEC62208 Hinged door with EPDM rubber gasket to prevent water entry, Single/ double compression cable glands, Provision of earthings. It should be placed at a height suitable for ease of accessibility.
- iv. Each combiner box/ junction box will have suitable Reverse Blocking Diodes of maximum DC blocking voltage of 1000 V with suitable arrangement for its connecting.
- v. Junction boxes should be equipped with fuses on both positive & negative input to protect the PV module from short circuits.
- vi. The combiner box/ Array junction Box will also have suitable surge protection device to protect the PV modules as well as the other electrical / electronic systems from transients over voltages created due to lightning and to reduce insulation break downs due to lightning.

The SPD's should be tested and approved according to IEC 61643-11 and EN 50539-1:2013-03.

### 4. Solar Array Fuse

- i. The cables from the array strings to the solar grid inverters shall be provided with DC fuse protection. Fuses shall have a voltage rating and current rating as required. The fuse shall have DIN rail mountable fuse holders and shall be housed in thermoplastic IP 65 enclosures with transparent covers.

**Selection of fuses:** It is important to coordinate the power dissipation of fuse-links with the acceptable power dissipation of fuse holders. Rated voltage of fuse-link and fuse holder should be at least 20% higher than open circuit voltage of photovoltaic installation. Typical rated voltage of fuse-links and fuse holders is 1000 V DC. Rated current of fuse-links  $\geq 1.4$  ISC. (ISC = short circuit current of photovoltaic modules), Utilization category g PV (protection against overload and short-circuit), Minimum interrupt rating  $1.35I_n$ , Non fusing current  $1.13 I_n$ .

## 5. DC Distribution Board:

A DC distribution box shall be mounted close to the solar grid inverter. The DC distribution box shall be of the thermo-plastic IP65 DIN-rail mounting type and shall comprise the following components and cable terminations:

Incoming positive and negative DC cables from the DC Combiner Box- DC circuit breaker, 2 pole & DC surge protection device (SPD), class 2 as per IEC 60364-5-53; Outgoing positive and negative DC cables to the solar grid inverter.

## 6. Power Conditioning Units:

### a) **General:**

- i. DCDB output will be fed to Inverter/ Power Conditioning Unit (PCU), grid interactive in nature, which mainly consists of Maximum Power Point Tracker (MPPT), Charge Controller, Inverter, Voltage Stabilizer, Frequency and voltage and distribution panel along with necessary Displays, Indicators and Alarms. It shall provide necessary protections for Grid Synchronization and Data Logging/Monitoring. The Inverters should convert DC power produced by SPV modules in to AC power and must synchronize automatically its AC output to the exact AC Voltage and frequency of **Suitable Capacity**. The bidder have to choose the inverter as string as per the design. PCU should conform IEC 61683, IEC 60068 as per specifications.
- ii. The string inverter shall be installed near to the solar array and hence it shall be suitable for weather proof and shall have IP65 class of protection. Also, a separate hood type arrangement using GI metal sheet to cover top of the string inverter enclosure shall also be provided with necessary mounting arrangements.
- iii. The inverters shall have protection against any sustained fault, lightning discharge in feeder line and earth leakage faults.
- iv. PCU/inverter shall be capable of complete automatic operation including wake-up, synchronization & shutdown.
- v. The combined wattage of all inverters should not be less than rated capacity of power plant.
- vi. The PCU shall be mounted on a suitable reinforced concrete pad inside control room not susceptible to inundation by water. All cable entry to and from the PCU shall be fully sheathed to prevent access of rodents, termites or other insects into the PCU from bottom/top of the PCU in form of a detachable gland plate.
- vii. In case of GRID failure, the PCU shall be re-synchronized with grid after revival of power supply. Vendor to furnish the time taken by PCU to be re- synchronized after restorations of GRID supply same to be indicated in data sheet to be submitted during detail engineering stage.



viii. Typical technical features of String inverter of following ratings is required as mentioned below: Bidder should ensure compatibility of inverter system with SPV modules PV modules Mono-PERC half cut solar panel and above.

r.	Technical parameter	Specification
1	<b>Type</b>	Grid Connected String Inverter
2	<b>Make</b>	Waree/SMA / ABB / SCHNEIDER / Delta/Poly Cab / Refusol/
3.0	<b>Standards:</b>	
3.1	Efficiency Measurement	IEC 61683/ Equivalent BIS Std.
3.2	Environmental testing	IEC 60068-2 (1,2,14,30) / Equivalent BIS Std.
3.3	Interfacing with utility grid EMC	IEC 61727, IEC 61000-6-2
3.4	Islanding Prevention Measurement	IEC 62116
3.5	MPPT	IEC 62093
3.6	Type Test certificate issuing authority (for Sl. No. 3.1 , 3.2,3.3,3.4 and 3.5 )	NABL/ IEC Accredited Testing Laboratories or MNRE approved test centers.
4.0	<b>Input</b>	<b>DC</b>
4.1	Voltage range	Min 250-1000
4.2	MPP voltage range	Min 420-850
4.3	Power Control	MPPT
5.0	<b>Output AC</b>	
5.1	Output voltage and phase	Sine wave 3 Phase 415 V $\pm$ 10% 50Hz AC, minimum 4 wire output RYBN or RYBN+PE
5.2	Reactive power	0.8 lagging to 0.8 leading
5.3	Total Harmonic Distortion (THD)	< 1.8 % at rated power

5.4	Power factor at rated current		0.98-1.00
5.5	Phase Load Imbalance at least 30 %		at least 30 %
5.6	Grid frequency synchronization range		+/- 3 Hz
5.7	Grid frequency tolerance range		+/-2 or more
5.8	Grid voltage tolerance range		+/- 20%
5.9	Standby power consumption	Standby power consumption of Inverter	shall not exceed 20 Watts
6.0	<b>Efficiency</b>	Min 94% at 100% load as per IEC 61683	
7.0	<b>Protection</b>		
7.1		<input type="checkbox"/> Disconnection device	
		<input type="checkbox"/> Reverse polarity protection	
	<b>DC Side</b>	Reverse current to PV array protection overvoltage, under	
	94		
			voltage and over current protection a) Short circuit protection: PV fuse b) Surge protection: SPD type II
7.2	<b>AC Side</b>		1. Short circuit protection 2. Over voltage, under voltage over 3. current protection over and Under Grid frequency protection. 4. Anti-Islanding protection 5. AC surge protection
7.3	Ground fault / Grid Monitoring		Yes
7.4	Over Temperature protection		Yes

8.0		<b>Display:</b>
8.1	Display type	LCD/LED
8.2		Voltage, current, power, line status, grid voltage grid frequency, export power and export energy.
	Display parameter	
9.0	<b>Communication</b>	
9.1	Communication port	<b>Ethernet</b> , RS485, port for web based remote monitoring system and should match with data
0.0		<b>General:</b>
0.1	Operating Temperature	- 20 Deg. C to + 60 De. C
	Humidity	95% non-condensing
0.2	Dimensions	Shall be provided by the Bidder.
0.3	Weight	Shall be provided by the Bidder.
0.4	Cooling	Cooling arrangement (if any) details shall be furnished by the Bidder.
0.5	Ingress protection (IP)	IP 65 or better (Out Door Installation)
0.6		Bidder to mention up to what altitude above sea level inverters will work without de-rating.
	Maximum altitude	
0.7	Noise level	<b>&lt;45Dba</b>
11	Switching devices	IGBT/MOSFET
12	Control	Microprocessor /DSP

- x. DC side of each inverter shall be earthed to distinct earth pit through adequate size conductor as per IS 3043 -1987. The size of conductor/ procedure for earthing for inverters shall be as per the maximum fault current of DC system.
- xi. To allow maintenance of the PV Inverter, means of isolating the PV Inverter from the DC side must be provided by a DC isolator mandated in each photovoltaic power system according to IEC 60364-7-712.
- xii. **Operating Modes:** Operating modes of PCU shall include, but not limited to, the following modes.

**I). Low Power Mode:** The control system shall continuously monitor the output of the solar arrays connected to the inverter until preset value is exceeded & begins to export power provided there is sufficient solar energy and grid voltage and frequency are in specified range.

**II). Active Maximum Power point tracking (MPPT) mode:** When solar radiations increases further, the PCU shall enter Maximum Power Point Tracking (MPPT) mode and adjust the voltage of SPV arrays to maximize solar energy fed into the grid. When the solar power from arrays falls below threshold level, the PCU shall enter into low power mode.

**III) Sleep mode:** Automatic 'sleep' mode shall be provided so that unnecessary losses are minimized at night.

- xii. 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.
- xiii. **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 90 KWP CAPACITY 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.

**xiv. Grid Islanding:**

Anti-islanding (Protection against Islanding of Suitable capacity Grid): The PCU shall have anti islanding protection in conformity to IEEE 1547/UL 1741/ IEC 62116 or equivalent BIS standard.

- i) 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 4pole 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.
  - iii) Inverter shall be tested for islanding protection performance. When the mains power is off, the PCU should also get automatically off so that back-feeding to the grid is not possible.

**xv. Maximum Power Point Tracker (MPPT):**

Maximum power point tracker shall be integrated into the PCU to maximize energy drawn from the Solar PV array. The MPPT should be microprocessor / micro-controller based to minimize power losses. The details of working mechanism of MPPT shall be mentioned.

The efficiency of the Charge controller (MPPT based with data logger) shall not be less than 94% and shall be suitably designed to meet array capacity.

MPPT must conform IEC 62093, IEC 60068 as per specifications.

**xvi. Data Acquisition System / Plant Monitoring:**

- i) Data logger system (Hard ware) and the software for study of effect of various environmental & grid parameters on energy generated by the solar system and various analyses would be required to be provided. The communication interface shall be suitable to be connected to local computer and also remotely via the Web using either a standard modem or a GSM / WIFI modem.
- ii) Remote Monitoring system shall be provided to monitor the Solar Power Generation such that all (i.e. AC & DC) electrical parameters (cumulative & instant) in graphical presentation from string level, next inverter and so on as desired by Bank/ owner
- iii) Monitoring complete systems including hardware and Modem/Router shall facilitate monitoring of the performance of the Inverter /inverters, energy yield, temperature, irradiance level etc through LAN based or GSM based network. PC based inverter monitoring is also required for local monitoring of each system. Some of the salient features of the monitoring system shall be:
  - a) The data acquisition system shall have a real-time clock and data storage capacity for recording data round the clock for min. one year.

b) The monitoring of the Solar system and logging / viewing of system data shall be through a PC with latest software/hardware configuration and service connectivity to be supplied, operation & maintenance/control to be ensured by the bidder.

c) The software package shall be preferably windows based MS Excel compatible.

The data shall be represented in both tabular and graphical form.

d) System shall have provision for remotely viewing the System status on local LAN /INTRANET of bank.

e) The following parameters are accessible via the operating interface display in real time separately for solar power plant:

- AC Voltage.
- AC Output current.
- Output Power
- Power factor.
- DC Input Voltage.
- DC Input Current.
- Time Active.
- Time disabled.
- Time Idle.
- Power produced
- Protective function limits (Viz-AC Over voltage, AC Under voltage, Over frequency, Under frequency ground fault, PV starting voltage, PV stopping voltage)

f) 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.

g) Metering and Instrumentation for display of systems parameters and status indication to be provided.

h) **PV array energy production:**

- a) Digital Energy Meters to log the actual value of AC/ DC voltage, Current & Energy generated by the PV system provided. Energy meter along with CT/PT should be of 0.5 accuracy class shall be provided.

- b) All major parameters available on the digital bus and logging facility for energy auditing shall be available on the display.
- c) The following parameters should be accessible via the operating interface display.
  - a) AC Voltage.
  - b) AC Output current.
  - c) Output Power
  - d) DC Input Voltage.
  - e) DC Input Current.
  - f) Time Active
  - g) Time disabled.
  - h) Time Idle
  - i) Temperatures
  - j) Inverter Status

### **POWER CONSUMPTION:**

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

#### **7) AC Distribution Board (ACDB):**

- i. 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. ACDB shall be installed on roof-top.
- ii. All switches and the circuit breakers, connectors should conform to IEC 60947, part I,II and III/ IS60947 part I, II and III.
- iii. The changeover switches, cabling work should be undertaken by the bidder as part of the project.
- iv. All the Panels 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 and designed for minimum expected ambient temperature of 45degree Celsius, 80 percent humidity and dusty weather.
- v. All indoor panels will have protection of IP54 or better. All outdoor panels will have protection of IP65 or better.
- vi. Should conform to Indian Electricity Act and rules (till last amendment).
- vii. ACDB shall be 3-phase, 50Hz, 415VAC, 1.1kV system voltage, outdoor, with canopy, IP55, neoprene gasket for doors/ frame joints, CRCA sheets 2mm (frame)/ 1.6mm



(door)/ 3mm (removable gland plate bottom side), painting seven tank process, colour RAL 7032, base frame with section 75mm min/ black painted, panel lifting hooks, Al bus bars as per SLD, RYB colour coded heat-shrinkable sleeves for bus bars, SMC/DMC insulator supports, Al earth bus, accessible live parts shrouded with FRP/polycarbonate sheets, MCBs for i/c feeders, 25mm min phase to phase clearance, LED indicators for RYB at o/g, colour coded Cu-cable AC/DC wiring (1.5/2.5 mm<sup>2</sup> as applicable) etc. For the incoming and outgoing power cables, nickel plated brass double compression glands, Al cable lugs, SS304 plain/ spring washers shall be provided.

- viii. Modifications/ addition if any, in existing L T panel and D G set panel of SBI shall be done at site and covered in scope of Bidder. Also required size cable and other equipment between existing panel to solar AC distribution panel is covered in scope of Bidder.
- ix. An AC distribution box shall be mounted close to the solar grid inverter.
- x. The AC distribution box shall be of the thermo plastic IP65 DIN rail mounting type and shall comprise the following components and cable terminations:
  - 1. Incoming 3-core / 5-core (single-phase/three-phase) cable from the solar grid inverter
  - 2. AC circuit breaker, 2-pole / 4-pole
  - 3. AC surge protection device (SPD), class 2 as per IEC 60364-5-53
  - 4. Outgoing cable to the grid interconnection point
- xi. Extra feeders (including two spare feeders) shall be provided to meet the various auxiliary supply requirements at the roof-top such as module washing pumps, data loggers etc.
- xiii. MCCB, MCB shall be L&T/C&S/Siemens/ABB/ Schneider or reputed equivalent subject SBI approval.
- xiv. Vendor shall submit the detailed GA, SLD, BOM, MQP etc of ACDBs for SBI approval during detailed engineering.

8) **Cables & Wirings:**

The Specification of wiring material of PV Power plant shall include but not limited to the following:

Sl.	Item	Description
1.0	<b>DC Cable</b>	From PV module to inverter
1.1	Type	1.1kV grade heavy duty PVC insulated, Double sheathed, UV Protected XLPO stranded copper cables as per IS: 7098 (Part I & II) – 1976 or IS 1554 or IS9537/IEC60227/IS694.



		<b>The voltage drop shall not exceed more than 2% of peak power voltage</b>
1.2	Size	<b>The minimum DC cable size shall be 6.0 mm<sup>2</sup> copper.</b>
1.3	Laying	The cable must be laid through PVC conduit /GI pipe/ cable tray on roof and indoor. In case of using metallic pipe as conduit proper grounding of the conduit must be done.
<b>2.0</b>	<b>AC Cable</b>	From inverter to ACDB and ACDB to distribution panel/LT panel
2.1	Type	1.1 kV grade heavy duty PVC insulated Aluminum armored XLPE stranded cables as per IS: 7098 (Part I & II) – 1976 or IS 1554 or IS9537/IEC60227/IS694. <b>The voltage drop shall not exceed more than 2% of peak power voltage</b> ➤ Outdoor AC cables shall have a UV-stabilized outer sheath.
2.2	Laying	The cable must be laid through PVC conduit /GI pipe/ cable tray on roof and indoor. In case of using metallic pipe as conduit proper grounding of the conduit must be done.

**a) Procedure of cable laying:**

- i. Cable terminations shall be made with suitable cable lugs & sockets etc, crimped properly and cables shall be provided with dry type compression glands wherever they enter junction boxes/ panels/ enclosures at the entry & exit point of the cubicles. The panels bottoms should be properly sealed to prevent entry of snakes/lizard etc. inside the panel. All cables shall be adequately supported. Outside of the terminals / panels / enclosures, shall be protected by conduits. Cables and wire connections shall be soldered, crimp-on type or thimble or bottle type.
- ii. Only terminal cable joints shall be accepted. Cable joint to join two cable ends shall not be accepted.
- iii. All cable/wires/control cable shall be marked with good quality letter and number ferrules of proper sizes so that the cables can be identified easily.
- iv. All fasteners will be made of Stainless steel or Aluminum or UV Protected PVC.
- v. All power, control, communication cables running from buildings shall be routed from one building to another building through underground cable trench (direct burying) as per IS: 1255.
- vi. The DC cables from the SPV module array shall run through a UV stabilised PVC conduit pipe of adequate diameter with a minimum wall thickness of 1.5mm. The conduits shall not run across the path way of the terrace. Flexible corrugated PVC conduits shall not be used.

- vii. Cables and wires used for the interconnection of solar PV modules shall be provided with solar PV connectors (MC4) and couplers.
- viii. 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 6.0 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 to the size of the phase wires. The following colour coding shall be used for cable wires:
  - DC positive: red (the outer PVC sheath can be black with a red line marking)
  - DC negative: black
  - AC single phase: Phase: red; neutral: black
  - AC three phase: Phases: red, yellow, blue; neutral: black
  - Earth wires: green
- ix. Cables and conduits that have to pass through walls or ceilings shall be taken through a PVC pipe sleeve.
- x. Cable conductors shall be terminated with tinned copper end-ferrules to prevent fraying and breaking of individual wire strands. The termination of the DC and AC cables at the Solar Grid Inverter shall be done as per instructions of the manufacturer, which in most cases will include the use of special connectors.
- xi. The total voltage drop on the DC cable segments from the solar PV modules to the solar grid inverter shall not exceed 2.0%. Conductor size of less than 6 sq. mm shall not be accepted.
- xii. Cable/wire connections shall be soldered, crimp-on type or split bolt type. Wire nut connections shall not be used.
- xiii. The wiring must be carried out in pvc precession make conduit only.
- xiv. Cable Routing/ Marking: All cable/wires are to be routed in a GI/PVC cable tray and suitably tagged and marked with proper manner by good quality ferule or by other means so that the cable easily identified use
- xv. The Cable should be so selected that it should be compatible up to the life of the solar PV panels i.e. 25 years.
- xvi. The size of each type of AC cable selected shall be based on minimum voltage drop however; the maximum drop shall be limited to 2 %.

#### **9) LTPDB combiner boxes:**

AC outputs from ACDB installed at the Roof top of building are terminated at a LT power distribution board (LTPDB) which is located in the ground floor of the same building where LT evacuation point is provided. Supply and installation LTPDB is in vendor scope.

- i. LTPDB suitable for 100 KWp Solar power system/comprises of 320A/400A, 4 Pole MCCB and suitable for termination of cable coming from AC Distribution Board. PVC insulated AL armoured cable coming from solar ACDB at incoming end shall be provided in main control room with Out going of 320A, 4 Pole MCCB The panel shall be 3-phase, 50Hz, 415VAC, 1.1kV system voltage, outdoor, with canopy, cubicle design, compartmentalized (Breaker/ control box/ CTPT chamber etc), floor mounted, free standing IP55, neoprene gasket for doors/ frame joints, CRCA sheets 2mm (main frame)/ 1.6mm (door)/ 3mm (removable gland plate bottom side), painting seven tank process, panel illumination lamp, space heater, thermostat etc. CU bus bars as per SLD, RYB colour coded heat-shrinkable sleeves for bus bars, SMC/DMC insulator supports for the incoming and outgoing power cables, nickel plated brass double compression glands, Al cable lugs, SS304 plain/ spring washers shall be provided.
- ii. Vendor shall provide bus bar extension at LT panel if Spare breakers are not available for LT evacuation.
- iii. Digital MFM shall be EM6300 of Schneider along with Indicator lamps shall be L&T/ C&S or reputed equivalent subject to SBI approval
- iv. MCCB: L&T/ C&S/ ABB/ Siemens/ Schneider or reputed equivalent subject to SBI approval
- v. Vendor shall install the LTPDB panels near to Customer LT evacuation point
- vi. Laying and termination of cables from ACDB box to LTPDB box:
  - a. Cables are 1.1kV, Al, XLPE, armoured as per IS: 7098 part-1 shall be in vendor scope of supply and installation for laying between ACDB to LTPDB.
  - b. These cables shall be routed using the same type of GI cable trays/ accessories/ hardware used for 1Cx4 cables up to the ground level outside the buildings.
  - c. All power, control, communication cables running from buildings shall be routed from one building to another building through underground cable trench (direct burying) as per IS:1255.

## 10) NET METERING:

Net Metering: Bi Directional Meter (As per M.P. Gazette notification 14 Nov. 2017 standard for net meter Net meter HT Consumer's premises AMR compatible generation meters & modems, as per provision of guidelines, the procedure and all technical specifications, standards of the solar rooftop system from M.P. Policy for decentralized renewable energy 2016) shall have the provision for measurement for Current, Voltage, frequency, Energy, Power/Load, power factor, maximum demand with RS232 with class 0.5 accuracy.



Net metering shall be provided by the contractor for the captioned sites of SBI. The scope of work for net metering is detailed as below:

- Preparation of necessary documentation and submission of application (Online /offline) to MP Discom (MPCZ/ MP Pachshim Kshetra/ MP Poorv Kshetra) for net metering.
- Obtaining site feasibility report from MP Discom.
- Obtaining net metering approval from MP Discom.
- Contractor shall work with MP Discom to enable SBI's signing of Power Purchase Agreement (PPA).
- Supply & Testing of net meter (Main & Check meter) and related accessories (Cubicle, CTs, PTs, earthing etc.) as per requirements of MP Discom.
- Replacement of existing meter and related accessories (Cubicle, CTs, PTs, earthing etc.) with new metering systems as per requirements of MP Discom.
- CEIG/CEA/ MP Discom inspectorate approval for supply, testing and replacement of new net metering system including preparation and submission of necessary documentation.
- CEIG/CEA/ MP Discom inspectorate approval of Solar Power Plant including preparation and submission of necessary documentation.
- Synchronization / Commissioning approval from CEIG/CEA/ MP Discom.
- Synchronization/Commissioning certificate for the Plant from CEIG/CEA/ MP Discom.

Note:

The contractor shall take up net metering for SBI turnkey basis including any statutory fees, fee towards testing of net meter, CTs, PTs, Cubicle etc. to be paid. Any other item / supply/ activity / approvals/NOCs/fees not specifically defined in the above clause but required for successful completion of net metering with MP Discom as per the latest Net Metering Policy for SBI shall be to the scope of the Contractor. In other case of non-applicability of Net metering, Contractor has to take care of approval of alternative mechanism as per state electricity regulatory norms & latest revisions of state grid code, all the required fees/NOC/other activity adhering to alternative mechanism shall be responsibility of contractor only

## **10) PROTECTIONS**

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

### **i. LIGHTNING PROTECTION:**

The SPV power plants shall be provided with lightning & overvoltage protection. 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 /IS 2309 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. ESE Lightning and surge protection for the SPV plant shall be provided using adequate number of earthing kits but not less than two independent earthing stations. It shall be ensured that all the earth are bonded together to bring them to the same potential. *Earth resistance shall not be more than 5 ohms with earthing Strip of 25x6mm GI.*

- a) Lightning Arrester is composed of one main striking point, emission device, fixing element, and a connection to the down conductor.
- b) The area protected by LA is determined using the early streamer emission test method as per NFC 17 102 Standard and it is preferred to have LA installed on the highest part of the structure.
- c) Lightning arrester is advanced ESE type and provides protection radius of 107m in Level IV.
- d) Our ESE lightning arrester is testable from external tester for internal configuration as well as magnetic field test. Carries 30 years warranty.

Tested as per NFC 17-102 standard for:

- Short circuit test of 115KA
- Advance triggering time of 63 microseconds.
- Temperature withstand test of -50 to +120 degree Centigrade
- Salt mist and humid sulphur test
- CE marking
- Internal test report available for each unique serial numbered rod provided with each lightning rod.

## **ii. SURGE PROTECTION:**

Surge protection shall be provided on both the DC and the AC side of the solar system. The DC surge protection devices (SPDs) shall be installed in the DC distribution box adjacent to the solar grid inverter.

The AC SPDs shall be installed in the AC distribution box adjacent to the solar grid inverter. The SPDs earthing terminal shall be connected to earth through the above mentioned dedicated earthing system. The SPDs shall be of type 2 as per IEC 60364-5-53.

## **iii. EARTHING PROTECTION:**

Body and lightning protection system earthing shall be of provided with maintenance free earthing (MFE) system comprising of 17mm (3M length) dia copper bonded stainless/ nickel steel alloy rods suitably joined together with thread less/compression couplers made of copper alloy including supply of copper rods and all other accessories required for the total erection of the earthing system. The rod shall be driven in earth with augured hole dia of 75-100 mm in ground filled with conductivity/earth enhancement compound.



Earth pit chamber with RCC cover as per standards shall be constructed for each maintenance free earth rod. Earthing conductor of size not less than 25x3mm GI strip on roof/wall mounting for body Earthing system shall be provided with proper clamping arrangement using GI spacer and saddles over a suitable concrete blocks on roof and with necessary fixing materials with a spacing of not less than 600mm. Earth resistance shall not be more than 5 ohms. All metal casing/shielding of the plant shall be thoroughly grounded to ensure safety of the solar power plant

#### EARTHING SPECIFICATIONS:

- Electrode : Material - Cu. Bonded
- Diameter - Ø17 mm.
- Length - 2 m. long
- Earthing Chemical / Enhancement compound: 15- 25 kg.

Minimum four (04) numbers of interconnected earth pit needs to be provided in each location. Minimum required gap shall be provided in between earth pits as per relevant standard. Body earthing shall be provided in inverter, each panel, module mounting structure, kiosk and in any other item as required. Separate dedicated earthing for LA & SPD.

#### 1) **TOOLS, TACKLES AND SPARES**

The Installer shall keep ready stock of tools, tackles and essential spares that will be needed for the day-to-day maintenance of the solar PV system. This shall include but not be limited to, the following:

- I. Screw driver suitable for the junction boxes and combiner boxes.
- II. Screw driver and / or Allen key suitable for the connectors, power distribution blocks, Circuit breaker terminals and surge arrestor terminals.
- III. Spanners / box spanners suitable for the removal of solar PV modules from the solar PV module support structure.
- IV. Solar panel mounting clamps.
- V. Cleaning tools for the cleaning of the solar PV modules.
- VI. Spare fuses

#### 2) **CAUTION SIGNS**

In addition to the standard caution and danger boards or labels as per Indian Electricity Rules, the cable junction box near the solar grid-tie inverter, the building PCC board to which the AC output of the solar PV system is connected shall be provided with a non-corrosive caution label

The size of the caution label shall be minimum 105mm (width) x 20mm (height) with white letters on a red background.

#### 3) **FIRE EXTINGUISHERS:**



The firefighting system for the proposed power plant(s) for fire protection shall be consisting of: Portable fire extinguishers in the control room for fire caused by electrical short circuits. The installation of Fire Extinguishers should confirm to TAC regulations and BIS standards. The suitable fire extinguishers shall be provided in the control room housing as well as near the Roof or site where the PV arrays have been installed. Separate payment will not be made for the provision of fire prevention measures.

**4) DOCUMENTATION TO ACCOMPANY FOR HANDING OVER THE PROJECT (Part-A,B,C)**

**Part A: DOCUMENTATION**

- 1) The complete documentation should be as per IEC 62446 and submitted to Bank.
- 2) One set of operation manuals complete with drawing, parts list (with part codes) circuit diagrams with list ratings of components and list of do's and don'ts for the main equipment as well as the sub-systems should be submitted to Bank.
- 3) One set of maintenance manuals with full information on drawings, circuit diagrams, list and suppliers addresses for bought out parts, troubleshooting charts, programs of built in controllers etc. for the main equipments as well as for the sub-system.
- 4) These manuals should be in the form of hard (printed) copy in English Language as well as in electronic storage form (disc pen drive etc.)
- 5) A certificate for the adequacy of the manuals should be obtained and provided with the manuals. Such certificate must be signed by the QA engineer of the manufacturer.
- 6) The Installer shall supply the following documentation also:
  - a) System description with working principles.
  - b) System single line diagram.
  - c) Solar PV array lay-out.
  - d) Routing diagram of cables and wires.
  - e) Data sheets and user manuals of the solar PV panels and the solar grid-tie inverter.
  - f) A system operation and maintenance manual.
  - g) Name, address, mobile number and email address of the service centre to be contacted in case of failure or complaint.
  - h) Guarantee & Warranty cards of the components supplied with seal and signature of the manufacturer.
  - i) Maintenance Register

**Part B:TEST CERTIFICATES AND REPORTS TO BE FURNISHED**

- a. Test Certificates / Reports from IECQ / NABL accredited laboratory or MNRE approved test centers for relevant IEC / equivalent BIS standard for quoted components shall be furnished.
- b. Type Test Certificates shall be provided for the solar modules and the solar grid inverters to provide evidence of compliance with standards as specified in relevant articles of this Technical Specification.
- c. Bank reserves the right to ask for additional test certificates or (random) tests to establish compliance with the specified standards.

### **Part C: INSTRUCTION AND O& M MANUALS**

Four copies of Instruction and Operation and Maintenance Manual should be furnished. The manual shall be furnished at the time of dispatch of the equipment and shall include the following aspects about:

- a. Precautions during unpacking
- b. Instructions for handling at site.
- c. Erection drawings with written assembly instructions.
- d. Detailed instructions and procedures for the installation, operation and maintenance.
- e. Pre-commissioning tests.
- f. Solar PV system—its components and expected performance.
- g. Clear instructions about mounting of PV module (s)
- h. DO's and DONT's.
- i. Specimen log book.
- j. Principle of Operation of various equipment
- k. Safety and reliability aspects
- l. Metering scheme
- m. string inverter software and controls
- n. Clear instructions on regular maintenance and troubleshooting of solar power plant.
- o. Name and address of the person or service centre to be contacted in case of failure or complaint.
- p. Outline dimension drawings showing relevant cross sectional views, earthing details and constructional features.
- q. Rated voltages, current and all other technical information which may be necessary for correct operation of the SV plant.



- r. Catalogue numbers of all the components which are liable to be replaced during life of the SV plant and all the component parts.
- s. Trouble shooting and diagnostic procedure



### Approved Make of Materials

S. No.	Components/ Make	Specification/ Standards	Warranty
1	<u>Solar Module</u> (Goldie Green/ Panasonic/ Tata Solar/ Waree/ Vikram/ Navisol/ Solar Max/ Nano/UTL Solar/Pixon or as per latest approved ALMM list of MNRE)	<b>PV modules Mono-PERC half cut solar panel</b> (Manufactured in India) to be employed shall be of <b>minimum 144 cell configuration with rated power (Min 540 Wp +)</b> IEC 61215/ IS 14286, IEC 61730 ( part 1 & 2) IEC 62716, IEC 61853-1, IEC- 61701, IEC-62782, IEC 62804, IEC 62892	25 years
2	<u>Solar Grid tied inverter</u> (Schnider/ ABB/ Sungrow/ Delta/ Solis/ powerone) SMA/ Solar age/polycab/ solare/Grow watt/ fronious/ Waree)	IP 65; Transformer less with MPPT, minimum efficiency of 98%/ IEC 61683, IEC 62109-2 and c 62093 or equivalent BIS standards	5 years
3	Mounting structure and GI tray	Hot dip galvanized, 80 microns thick, Design wind speed 150 kmph	25 years
4	Cables DC (Polycab/ V-guard/ Gloster/ Havells/ finolex/RR)	Single Core DC cable, UV stabilised, multi-strand XLPE PVC insulated)	-
	Cable AC (Poly Cab/ V-Guard/ Gloster/ Havells/ RR)	4 Core solid CU conductor, XLPE insulated, FLEXIBLE, PVC inner sheathed, 650/1100 V, cable as per IS IEC 60227/ IS 694, IEC 60502/IS 1552 (pt. I & II) YUV 2PFG 1169	
5	Array Junction Box ( if required)	Polycarbonate IP 65 ( Protection DC fuses, DC isolator and DC SPD)	
6	AC/DC Distribution Board	MDS/ Hager/ L&T	
7	String Combiner Box	Robotina/ Trinity touch/ Hense/ Cape Electric, AKG	
8	LV Switchgear	ABB/L&T/ Schneider/ MDS or equivalent/ IEC 60947 part I, II, III IEC 60947 part I, II, III EN 50521 IEC 62852	

9	Energy Meter	Secure/ L&T or equivalent (As per M.P. Gazette notification 14 Nov. 2017 standard for net meter Net meter HT Consumer's premises AMR compatible generation meters & modems, as per provision of guidelines, the procedure and all technical specifications, standards of the solar rooftop system from M.P. Policy for decentralized renewable energy 2016)	
10	Connectors	MC4/ or Equivalent	
11	Surge Protections (SPD)	MDS, L&T, Hager	
12	ACDB ( if required)	Polycarbonate IP 65 ( protection AC isolator along with phase ( indicators)	
13	Earthing ( Chemical Earthing Kit)	Chemical type 3 mtr ISI mark along with Earthing Chambers as per IS 3043 Ashok or equivalent	
14	Lighting Arrestor	Standard (Copper Type) IEC 62305	
15	Cable Trays	Sharda cable Trays, Bravo Cable Trays, CSR industries, BG shirke	



S. No.	Components	Make
1	Solar Photovoltaic Modules	<b>(Waree /GoldieGreen / Panasonic / TATA Solar/ Vikram/ Navisol/ Solar max/ Nano/UTL solar/Pixon or as per latest approved ALMM list of MNRE)</b>
2	Solar Inverter	<b>(Schnider/ABB/ Sungrow / Delta/ Solis/ Pwerone) SMA/Solar age /Polycab/ solare Grow watt /Fronius /SMA Solar /Delta / Waree</b>
3	Cable	<b>RR/Polycab / Siechem / KEI</b>
4	Cable Tray	<b>Sharada Cable Trays , Bravo Cables Trays, CSR Industries, BG Shirke</b>
5	Chemical Earthing Kit	<b>Ashlok, /Equivalent</b>
6	Energy Meters	<b>Secure/ L&amp;T/ LNG</b>
7	Surge Protection	Conzerve/ Secure
8	Panel meters	Conzerve/ Secure
9	Lightning Arrestor	OBO/ Indelec
10	SS fasteners	Unbrakp/ APL/Viraj/ Raj
11	Components of LT panels	Schneider/ ABB/ Siemens

Note: -

- 1) The contractor should obtain prior approval from SBI/ Consultants before placing order for any specific materials SBI may / delete any of the makes or brands out of the above list.
- 2) All materials should conform to relevant standards and codes of BIS. Materials with I.S.I. mark shall be used duly approved by the SBI Engineer/Architect.
- 3) Any material is found to be not up to the mark, the contractor will have to produce original bills/certificate from the manufacturer or his authorized Distributor for authenticity and genuineness of the material for consideration and as per make approved by the SBI. The same will not be considered for payment.
- 4) Any additional item as per BOQ specifications or as per the instructions of the bank / Consultants. Any of the above items / other items if any will be as approved by the Consultants & Engineer-in-charge.



**A. SCHEDULE OF TECHNICAL DATA TO BE FINISHED BY THE CONTRACTOR**

<b>a</b>	<b>SPV MODULE</b>	
i.	Manufacture's Name & Address	
ii.	Type of Modules with cat. Reference	
iii.	Design of module at standard test condition	
	a) Peak power watt	
	b) Peak power voltage	
	c) Peak power current	
	d) Open circuit voltage	
iv.	No. of SPV Modules proposed branch wise to achieve minimum <b>KWp DC power</b> (i),ii,iii,iv,v,vi	
v.	Short circuit current of PV module (Amp.)	
vi.	Open circuit voltage of PV Module (V)	
vii.	Max. power rating of one PV Module (KWp) (not less than 540 Wp)	
viii.	Photo electrical conversion efficiency of SPV module ( not less than 14% )	
ix.	Fill factor of the SPV module (> 0.70)	
x	Designated life of the SPV modules	
xi.	Overall dimensions (in mm)	
xii.	Weight	
xiii	Frame materials	
xiv.	Reference of Standards / approval, if any	



xv.	Life of SPV Module (Years of Operation)	
<b>b</b>	<b>PV ARRAY CAPACITY</b>	
	Number of Module in series in each array	
	Peak power rating of one array	
	Number of array considered to achieve the specified output	
<b>c</b>	<b>MODULE MOUNTING STRUCTURE</b>	
i)	Type of structure and its materials used in frame and accessories	
ii)	Type of mounting structures (Fixed or any other type)	
iii)	Overall dimensions	
iv)	Type of mounting	
v)	Surface azimuth angle of PV Modules	
vi	Tilt angle (Slope) of PV module	
vii.	Confirm structure & module frame shall be designed at wind speed 150 km/hr.	
<b>d</b>	<b>POWER CONDITIONING UNITS (PCUs)</b>	
i.	Manufacturer's name & address	
ii.	Type of PCU (Centralized or string type)	
iii.	Number of units proposed	
iv.	Rated capacity of each PCU	
v.	Input DC Voltage range	
vi.	Output voltage	

vii.	Frequency	
viii.	Minimum efficiency at full load	
ix.	Location (outdoor/indoor)	
x.	Output wave shape	
xi.	Dimensions in mm	
xii.	IP protection level	
xiii.	Type of cooling required	
xiv	Type of mounting	
xv.	Suitability for specified Ambient Temp. range & Humidity at	
xvi.	Type of Protection provided	
xvii	Over Load Condition	Yes/No
xviii	Short Circuit Protection	Yes/No
xix	Low/High Voltage Protection	Yes/No
xx	Power Electronic Component Protection Yes/No	Yes/No
<b>e.</b>	<b>METERING</b>	
i.	Nos. of meters proposed to be provided	
ii.	Location of meters	
iii.	Manufacturer's name & address	
iv	Confirm compliance with laid down specification	

f	Item	Quantities	To be filled by the contractor
1	SPV Modules	Total Quantities (nos)	
		No. of Arrays	
		Nos of SPV module in each array	
2	Power Conditioning Units (PCUs) (Centralized/ string type)	Type	
		Quantity	
3	DC Junction Boxes		
4	AC Junction Boxes		
5	Other related items viz. control & power cables, cable trays, surge diverters, earthing etc. for the complete work as required & specified	LOT	

**Signature of the Contractor with Seal**

B- WARRANTY CERTIFICATE

Name & Address of the Manufacturer/ supplier	
Name & address of the purchasing Agency	
Date of Ereccion system	
PV Module (a) Make	
(b) Model	
(C) Serial No. (List enclosed)	
(d) Wattage under STC	
(e) Warrantee valid upto	
(a) Make	
(b) Model	
(C) Serial No. (List enclosed)	
(d) Warrantee valid upto	
Designation & Address of the person to be contacted for claiming Warrantee obligations	
Date: Place:	(Signature) Name Designation Name & Address of the Manufacture/ Supplier (Seal)