**Request for Proposal for Solar Photovoltaic Power Plant**

**Request for Proposal**
**Design, Manufacture, Supply, Erection, Testing and Commissioning of Solar Photovoltaic Power Plant with associated Power Evacuation Arrangement on turnkey basis**
**Indian Institute of Astrophysics site Merack Leh-Ladak, Jammu- Kashmir**

**SOLAR PHOTOVOLTAIC POWER GENERATING SYSTEM OF CAPACITY 10 KWp WITH 24 HOURS BATTERY BACKUP**

## 1.0 Introduction

Government of India is laying great emphasis on reducing the country's carbon footprint. In this pursuance, the Hon'ble Prime Minister of India has on 30th June, 2008 released the National Action Plan for Climate Change (NAPCC). One of the NAPCC missions is the *National Solar Mission* and it aims to increase the share of solar energy in India's overall energy mix. Accordingly, Indian Institute of Astrophysics accords high priority to harnessing of solar energy. The energy generated by solar photovoltaic system will be utilized to feed IIA's observatory electrical loads.

## 2.0 Scope

2.1. Supply, installation and commissioning of Solar Photovoltaic Power Plant system of capacity 10 KWp with battery bank of 24 hrs backup.

a.The batteries shall be solar photo voltaic batteries of flooded electrolyte, low maintenance, lead Acid and electrolyte of specific gravity of 1280 shall be used.

b. Batteries of type 2 volts per cell,1800AH at C10 shall be used.

c.The batteries shall be reputed make or equivalent of superior Models/ makes.

d. The Ambient temperature in Leh during winter season may drop down to

(-25) degree centigrade. The battery shall be designed for negative temperature prevailing at site.

e. Battery terminals shall be provided with covers.

f.Charging instructions shall be provided along with the batteries.

g. Suitable carrying handle shall be provided.

2.2. Service the facility as and when required under warranty and should provide guaranteed service either/or under AMC for the entire plant including subsystems for at least 10years.

2.3. The company should be able to provide operational support to IIA Merack site Leh-Ladak Jammu & kashmir as and when required.

2.4. The company should get all the statutory clearances for the operation of the plant from all the concerned agencies. IIA will provide required documents for the same.

## 3.0 Eligibility

3.1. Companies who are or have been channel partners with Ministry of Natural Resources and Environment (Accredited under Rooftop and Small Solar Power Plants Programme"), Government of India, can bid.

3.2. The companies should have the consistent track record of installing and commissioning equal or higher capacity Solar Photovoltaic Power Plants during the last three years.

3.3. The companies should primarily be system integrators. They can also be manufactures of subsystems. However, all the subsystems should meet all the standards as given in subsequent sections.

## 4.0 Reference Standards

All the bidders have to adhere to the Reference Standards as given in Table 4.1

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|---|---|
| IS: 12834:1989 (reaffirmed 2000) | Solar Photovoltaic Energy Systems –Terminology |
| IEC : 61215 Ed 2 or latest | Crystalline silicon terrestrial photovoltaic (PV) modules – Design qualification and type approval |
| IEC: 61730 Pt 1 & 2 | Photovoltaic (PV) module safety qualification-<br>Part 1: Requirements for construction<br>Part 2: Requirements for testing |
| IEC: 61701 | Salt mist corrosion testing of photovoltaic (PV) modules |
| IEC:60904-1(2006) | Photovoltaic Devices- Part-I: Measurement of Photovoltaic current-Voltage Characteristic |
| IS: 9000 | Basic environmental testing procedure for Electronic and electrical items. |
| IEC:60068 | Environmental testing |

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| IEC 61723 Ed1.0 | Safety Guidelines for inverter connected photovoltaic systems mounted on the buildings |
| IEC 60364-7-712 (2002) | Electrical Installations of Buildings<br>Part 7: requirements for special installations or locations<br>Section, 712: Photovoltaic power supply systems. |
| IEC 62446 (2009) | integrated photovoltaic systems-<br>Minimum requirements for system documentation, commissioning tests and inspection |

Note: Latest version of the specification shall be referred to.

Table 4.1 - Reference Standards

## 5.0 System Description

5.1 Solar Photovoltaic (SPV) power systems shall consist of mainly the following: -

i. Solar panels
ii. Module mounting structure
iii. Junction boxes
iv. Inverters
v. Import metering
vi. Cable, safety components and other accessories
vii. Earthing system
viii. Module for remote monitoring
ix. Lightning arrestor

5.2 The PV array converts the light energy of the sun to DC power. The module mounting structure shall be used to hold the module in position. The DC power shall be converted to AC by Inverters to supply AC loads such as computers, lights, astronomical instruments, etc. within the IIA Merack Site premises Leh-Ladak Jammu & Kashmir.

5.3 DC distribution board/ combiner shall be provided in between solar array and Inverter. It shall have DC Disconnector / MCCB of suitable rating for connection and disconnection of array section. Type II Surge Arrestor should be incorporated for surge protection. It shall have meters for measuring the array voltage and array current locally and remotely.

5.4 AC distribution board shall be provided in between Inverter and loads. It shall have an integrated energy meter, voltmeter and ammeter. Class I + II (as per IEC 62305) 100 kA Surge Arrestor should be incorporated for protection against surges.

5.5 Electrical storage batteries shall be required for the backup for 24hrs with full load and accordingly the battery's can provided.

5.6 The system shall comply to IEC 60364-7-712 and 62446.

## 6.0 General Requirements

6.1 Solar generating system to support the computers, lights, astronomical instruments, etc. within the IIA Merack Site Leh.

6.2 Solar panels and array junction boxes shall be installed on shade free roof while the inverter and distribution boards, etc. shall be housed inside the room provided by IIA.

6.3 Statutory approval of local authorities/state electricity distribution company, etc. shall be obtained by the vendor.

6.4 IIA shall provide a shadow free area @ 125 - 150 sq.ft./KWp of solar array.

6.5 Array structure of PV yard and all electrical equipments such as Inverters, panels etc. shall be grounded properly. Towards this end, the contractor will supply and install an adequate number and appropriate size of IS:3043 – 1987 compliant earthling kits; at least one each for AC circuit, DC circuit and lighting protection system.

6.6 Suitable marking shall be provided on the bus for easy identification.

6.7 PV modules may be connected in series up to the maximum allowed operating voltage of the PV modules and the PV inverter, whichever is lower.

6.8 The reverse current of blocking diodes (connected in series) used shall be rated for 2 X VOC STC of the PV string.

6.9 Proper sealing arrangements at the points of cables entering the enclosures/ buildings should be incorporated. Although not mandatory, manufacturers are however encouraged that the cables entering into the outdoor enclosures be sealed with modular EPDM based cable sealing and protection system based on multi-diameter technology.

## 7.0 Technical Requirements

7.1 The DC output from the modules shall be fed to array junction box and the strings are paralleled at sub Main & Main junction boxes. Then Inverter shall convert DC energy produced by the solar array to AC energy. The AC power output of the inverter shall be fed to the AC distribution board (metering panel & isolation panel), which also houses the energy meter.

7.2 The system shall automatically wake-up in the morning and supply power, provided there is sufficient solar energy.

7.3 When the voltage and/or frequency goes out of preset range, the inverter shall be immediately disconnected. The inverter will reconnect after a pre-determined time when the battery is back in the range.

7.4 Array to inverter voltage drop shall be less than 3% at the maximum power output of the array.

7.5 Adequate space and ventilation shall be provided for the inverter.

7.6 For safety reasons, PV inverter system shall be disconnected from the network following a fault or loss of supply on the power network.

7.7 The performance and generation data shall be recorded using a data logger. The monitoring system shall comprise of the following main components:

7.7.1 **Inverter** will log performance data and transmit the same to the data logger. It shall also monitor basic parameters like power generated, etc.

7.7.2 **Data logger** shall gather information and monitor the performance of the inverter. It shall also support measurements from the external sensors. Data Logger shall also monitor the Solar Insolation and Temperature of Array Yard.

7.7.3 **Data logging system/ software** shall enable automatic long-term storage of measured data from PV plant. It shall allow visualization, monitoring, commissioning and service of the installation. The data logger shall be web enabled. It should be possible to access the data logger with any standard web browser like internet explorer, google chrome, etc. and for this purpose, relevant software/ hardware will be supplied by the contractor. In addition to the web portal, it should also be possible to retrieve the data directly from the data logger. The software for access/ visualization of data from data logger should be provided by the supplier free of cost. Necessary executable files, if any, will be required to be given free of cost by the supplier on a CD/ any other storage device.

7.7.4 **Communication interface**
The system should offer RS232/RS485 port and LAN/ WAN interface to facilitate remote monitoring of the system.

**7.8 Scalability of the SPV system**
Scalability of the system will be decided by IIA should on the basis of its electrical load requirements. Hence, seamless integration of additional SPV as and when required should be possible.

**7.9 SPV Module**

7.9.1 Individual Solar PV Module should be of minimum capacity 300/315 Wp conforming to IEC:61215 Ed 2 or latest – Edition II, IEC : 61730 – I:2007, IEC : 61730 – II : 2007, manufactured in a plant certified under ISO 9001 : 2008 and type tested by an accredited national/international testing laboratory. The Solar PV Module should be made from mono/poly crystalline Silicon Solar Cell connected in series. Imported SPV module or cell will not be accepted, unless

MNRE’s policy/ rules permit the same. PV modules must qualify Salt Mist Corrosion Testing as per IEC 61701.

7.9.2 SPV modules of similar output with +5Wp tolerance in single string shall be employed to avoid array mismatch losses.

7.9.3 SPV module shall contain crystalline high power silicon solar cells. The solar cell shall have surface anti-reflective coating to help to absorb more light in all weather conditions.

7.9.4 Photo-electric conversion efficiency of SPV module shall not be less than 14%.

7.9.5 Fill factor of the module shall not be less than 72%.

7.9.6 Each module shall have low iron tempered glass front for strength and superior light transmission. It shall also have tough multilayered polymer back sheet for environmental protection against moisture and provide high voltage electrical insulation. Transmitivity of glass shall not be less than 91%.

7.9.7 Module junction box and terminal block (weather resistant) shall be designed for long life outdoor operation in harsh environment.

7.9.8 Bird spike shall be provided so as to avoid bird sitting on the solar modules at the highest point of the array/module structure.

7.9.9 SPV module shall be highly reliable, light weight and shall have a service life of more than 25 years. SPV modules shall have a limited power loss of not more than 10% of nominal output at the end of 10 years and of not more than 20% of nominal output at the end of 25 years.

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| Type | Crystalline Silicon |
| Origin | Manufactured in India |
| Efficiency | ≥ 15% |
| Fill factor | ≥ 70% |
| Degradation warranty | Panel output ($W_p$) capacity to be ≥90% of design nominal power after 10 years and ≥80% of design nominal power after 25 years. |
| Module frame | Non-corrosive and electrolytically compatible with the mounting structure material |
| Termination box | Thermo-plastic, IP 65, UV resistant |
| Blocking diodes | Schottky type |
| Module minimum rated power | The nominal power of a single PV module shall not be less than 300/315 Wp. The output of any supplied module shall not be less than the rated output and shall not exceed the rated power by more than 5Wp. Each module, therefore, has to be tested and rating displayed. |
| RF Identification tag data (RFID) | Shall be provided inside the module and must be able to withstand environmental conditions and last the lifetime of the solar module.<br><br>a. Name of the manufacturer of PV Module<br>b. Name of the Manufacturer of Solar cells<br>c. Month and year of manufacture (separately for solar cells and module)<br>d. Country of origin (separately for solar cells and module)<br>e. I-V curve for the module<br>f. $W_m$, $I_m$, $V_m$ and FF for the module<br>g. Unique Serial No and Model No of the module<br>h. Date and year of obtaining IEC PV module qualification certificate<br>i. Name of the test lab issuing IEC certificate<br>j. Other relevant information on traceability of solar cells and module as per ISO 9000 standard |
| Power output rating | To be given for standard test conditions (STC). I-V curve of the sample module shall be submitted. |
| Compliance with standards and codes | IEC 61215 / IS 14286<br>IEC 61730 Part 1 and 2 |
| Salt Mist Corrosion Testing | As per IEC 61701 |

Table 7.1 : Specifications on Solar Photovoltaic Modules

### 7.10 Module Mounting Structure:

The array structure shall be so designed that it will occupy minimum space without sacrificing the output from SPV panels. The structure shall be designed to allow easy replacement of any module and shall be in line with the site requirements.

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| Wind velocity withstanding capacity | 150 km / hour |
| Structure material | Hot dip galvanised steel with a minimum galvanisation thickness of 120 microns or aluminium alloy. |
| Bolts, nuts, fasteners, panel mounting clamps | Stainless steel SS 304 (unbrako/TVS) |
| Mounting arrangement for RCC-flat roofs | With removable concrete ballast made of pre-fabricated PCC (1:2:4), M15 |
| Mounting arrangement for metal sheet roofs | Mounting directly on the sheet metal, ensuring stability and wind withstanding capacity, or penetrating the sheet metal and fixing to the substructure, ensuring that the roof remains water proof and ensuring stability and wind withstanding capacity. |
| Mounting arrangement for elevated structures | The elevated structure has to be securely anchored to the supporting surface. Concrete foundations of appropriate<br>weight and depth for elevated structures mounted directly on the ground; Bolted with anchor bolts of appropriate strength for elevated structures mounted on RCC surfaces. |
| Mounting arrangement for ground installations | With removable concrete ballast made of pre-fabricated PCC (1:2:4), M15; assuring enough ground clearance to prevent damage of the module through water, animals and other environmental factors |
| Installation | The structures shall be designed for simple mechanical on-site installation. There shall be no requirement of welding or complex machinery at the installation site. |
| Minimum distance between roof edge and mounting structure | 0.6m |
| Access for panel cleaning and<br>maintenance | All solar panels must be accessible from the top for cleaning and from the bottom for access to the module junction box. |
| Panel tilt angle | North – south orientation with a fixed tilt angle of 11 – 13 degrees (depending on location), south facing to provide maximum efficiency |

Table 7.2 : Mounting Structure Requirements

## 7.11 JUNCTION BOXES:

i. The module junction box (if any) shall be certified as per IEC 61215. Else, they should have the same properties as mentioned for array junction boxes. Array sub-main and main junction boxes, shall have the following properties:

a. They shall be dust, vermin & waterproof and made of Polycarbonate - Glass Fibre Substance (PC-GFS) thermoplastic. The enclosure should be double insulated with protection class II as per IEC 61439-1. Material and the protection class shall be marked on the enclosure.

b. The enclosure shall have a transparent front lid for enabling easy visibility.

c. The enclosures shall have IP 65/IP66 protection in accordance with IEC 60529. Third party conformance certificate is required to be given for IP 65/ IP 66 degree of protection.

d. Minimum requirements for fire protection in the event of internal faults: Glow wire test in accordance with IEC 60 695-2-11 at 9600C for box and $850^0$C for conducting components

e. Burning Behaviour: Base part of Polycarbonate Enclosure shall be UL94-V-0 compliant and Lid part of PC Enclosure shall be UL94-V-2 compliant.

f. The enclosures shall have IK 08 degree of protection for mechanical load.

g. The material used shall be halogen, silicon free conforming to RoHS directive 2002/95/EC.

h. The enclosure shall have a usage temperature rating of $-10^0$C to $55^0$C.

i. The enclosure should be chemically resistant to acid, lye, petrol, mineral oil & partially resistant to benzene.

j. The enclosures shall have a rated insulated voltage of 1000V DC and dielectric strength of 4.65 KV DC.

k. The material of the enclosure shall be UV stabilized.

l. Though not mandatory, manufacturers are encouraged to provide breather glands in the array junction boxes to prevent overheating and explosions. The properties mentioned above should be demonstrated through datasheet of the manufacturer.

ii. SPDs Class II as per IEC 61643-1, shall be used at the terminals of array junction boxes for external surge protection. Internal Surge protection (SPDs) shall consist of three MOV type arrestors connected from + ve and – ve terminal to earth (Via Y arrangement) for higher withstand of the continuous PV-DC voltage during earth fault condition. SPD shall have safe disconnection & short circuit interruption arrangement through integrated DC in-built bypass fuse

(parallel) which should get tripped during failure mode of MOV, extinguishing DC arc safely (created by inbuilt thermal disconnection) in order to protect the installation against fire hazards. Nominal discharge current (In) at 8/20 microseconds shall be minimum 10 KA with maximum discharge current (Imax) of minimum 20KA at 8/20microseconds with visual indication (through mechanical flag) in all modules to monitor the life of SPD. The $I_{scwpv}$ (Short Circuit current withstand capacity of arrester) should be at least 10% more than Nominal output current of the combiner box and AJB. Detailed internal schematic for the above SPDs, compliant to these specifications, should be submitted by the manufacturers.

iii. The junction boxes shall have suitable cable entry points with cable glands of appropriate sizes for both incoming and outgoing cables. Though not mandatory, manufacturers are encouraged to provide suitable cable entry points fitted with MC-4 Connectors.

iv Suitable markings should be provided on the bus bar for easy identification, and cable ferrules shall be fitted at the cable termination points for identification.

v. The Array Junction Box should preferably have maximum 08input and 01 output with SPD and Terminal block.

## 7.12 EARTHING FOR PV ARRAY, BALANCE OF SYSTEM (BOS) AND OTHER COMPONENTS AND LIGHTNING PROTECTION

i. The photovoltaic modules, Balance of system (BOS) and other components of power plant require proper grounding for protection against any serious faults as guided by IEC 60364.

ii. The earthling resistance must not exceed the limits generally in practice for such applications.

iii. The Bidder shall submit the detailed scheme of earthling and grounding.

iv. The contractor will supply and install an adequate number and appropriate size of IS:3043 – 1987 compliant earthling kits;( Preferably plate earthing to get the resistance value between 2 to 10 Ohms) at least one each for AC circuit, DC circuit and lighting protection system.

v. The source of over voltage can be lightning or other atmospheric disturbance. Main aim of over voltage protection is to reduce the overvoltage to a tolerable level before it reaches the PV or other sub-system components. Lightning protection should be provided as per IEC 62305.

vi. Necessary concrete foundation or any other arrangement for holding the lightning conductor in position is to be made after giving due consideration to shadow on PV array, maximum wind speed and maintenance requirement at site in future.

vii. The lightning conductor and structures shall be earthed through flats as per applicable Indian Standards with earth pits. Each lightning conductor

shall be fitted with individual earth pit as per required Standards including accessories, and providing masonry enclosure. Else, a matrix of lightning conductors is to be created which will be required to be connected to an earth.

viii. If necessary, more numbers of lightning conductors may be provided.

ix. The Bidder shall submit the drawings and detailed specifications of the PV array lightning protection equipment.

### 7.13 INVERTERS

Inverters shall supply the DC energy produced by array to DC bus for inverting to AC voltage using its MPPT (Maximum Power Point Tracking) control to extract maximum energy from solar array and produce 415V (+15% and -20%) AC, 3 phase, 50 ± 5% Hz (47.5 to 52.5 Hz). The array output should be well within the input voltage range of the inverter so that
the inverter works in MPPT range for most of the solar insolation range. This should be applicable for the whole life of the solar array and needs to be substantiated through design calculations. Inverter should be able to handle maximum open circuit DC voltage of 1,000V.

The inverter shall be efficient with Insulated Gate Bipolar Transistor IGBT based reliable design. The control system should be of highest reliability preferably based on Digital Signal Processors. The Inverter shall be capable of complete automatic operation, including wake-up, synchronization and shut down.

Inverter shall be able to have option for synchronize independently and automatically/ phase-lock with DG power line frequency to attain synchronization.

10 KWp inverters for the total capacity of SPV (10KWp).

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| Total output power (AC) | To match solar PV plant capacity while achieving optimum system efficiency |
| Input DC voltage range | As required for the grid support inverter DC input. |
| Maximum power point (MPPT) tracking | MPPT controller, inverter and associated control and protection devices, etc. all shall be integrated into the Inverter |
| Number of independent MPPT inputs | 1 or more |
| Operation AC voltage | inverter shall provide 3 phase, 415V |
| Operating Frequency range | 50 Hz (with grid tracking of ±5% i.e. 47.5 to 52.5 Hz) supply on AC side with voltage Third Harmonic Distortion of less than 3% and current Third Harmonic Distortion of less than 3%. |
| Power factor of the inverter | >0.98 at nominal power |
| Built-in Protection | Degree of protection will be minimum IP20 for non-electronics portion where transformer, etc are |

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| | mounted, if any and for the rest of the portion including electronics, it will be IP31 for units of capacities upto 15KWp and IP41 for units of capacities greater than 15KWp. IP 65 for outdoor mounting, IP 54 for indoor mounting.<br><br>Following is the list of protections :<br><br>➢ Over-voltage both at input and output<br>➢ Over-current both at input and output<br>➢ Over/under grid frequency<br>➢ Over temperature<br>➢ Short circuit on AC side<br>➢ Reverse polarity protection<br>➢ Array ground fault protection<br>➢ Protection against lightning induced surges Class II, 10 kA as per IEC 61643-1<br>➢ Protection against surge voltage induced at output due to external source<br>➢ Anti-islanding protection : As per VDE 0126-1-1, IEC 60255.5 /IEC 60255.27 |
| Operating ambient temperature range | $-15^0$C - $+60^0$C |
| Humidity | 0 – 95% Rh |
| Inverter efficiency (Transformer-less design)<br><br>Inverter weighted efficiency (Transformer-less design) | ≥95%<br><br>≥94% |
| Communication interface | RS 485 / RS 232 |
| Environment tests (as per IEC 60068/ IS 9000) | a) Dry Heat Test: $50^0$C±$2^0$C for 16 hours<br>b) Damp Heat Test (Steady state): $40^0$C, 93% RH for 4 days<br>c) Damp Heat Test (Cyclic): $40^0$C, 93% RH for 6 cycles (duration of one cycle shall be 24hrs)<br>d) Cold Test: $0^0$C for 16 hours<br>e) Change of temperature Test: -$10^0$C/-$5^0$C to $50^0$C for 3 cycles (rate of change in temperature shall be $3^0$C per minute) |
| EMI and EMC Requirements | System shall comply the following EMI and EMC requirements:<br>i. Emitted interference as per IEC: 61000-6-4.<br>ii. Interference emitted as per IEC: 61000-6-2. |
| Noise level | Should be less than 65 dBA (nominal) at 1m. |
| Safety compliance | IEC 62109-1, IEC 62109-2 |
| Display type and display parameters | LCD for data display. LCD / LED for status display<br><br>➢ Inverter ON<br>➢ Inverter under voltage/over voltage<br>➢ Inverter over-load |

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| | ➢ Output power (W),<br>➢ Cumulative energy (Wh),<br>➢ DC voltage (V),<br>➢ DC current (A),<br>➢ AC voltage (V),<br>➢ AC frequency (Hz),<br>➢ AC current (A),<br>➢ Cumulative hours of operation (h)<br>➢ Inverter over-temperature<br>➢ Earth Fault |
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Table 7.3 : Specifications of Inverter

**7.14 Cables and Hardware's**

The cables used in module/ array wiring shall be TUV 2Pfg 1169/08.2007 or VDE EPV 01:2008-02 or UL4703 certified. Cables of appropriate size to be used in the rest of the system shall have the following characteristics:

i. Temp. Range –25ºC to +120ºC.
ii. Voltage rating 600/1000V
iii. Excellent resistance to heat, cold, water, oil, abrasion, UV radiation, ozone and weathering
iv. Halogen-free, fire retardant, low smoke, low toxicity.
v. Flame retardant
vi. Flexible, bending radius to suit site requirements.
vii. Fulfils IEC 60332-1 requirements. Accredited lab test report/Manufacturer's test report shall be attached.
viii. Conductor class IEC 60228 class 5. Accredited lab test report/Manufacturer's test report shall be attached.

7.14.1 Cabling on DC side of the system shall be as short as possible to minimize the voltage drop in the wiring.

7.14.2 Components and hardware shall be vandal and theft resistant. All parts shall be corrosion-resistant.

7.14.3 Voltage drop on the DC side from array to the inverter should not be more than 3%. Necessary calculations in this regard shall also be submitted during design approval.

7.14.4 Overload protection may be omitted to PV string and PV array cables when the continuous current-carrying capacity of the cable is equal to or greater than 1.25 times ISC STC at any location. Necessary calculations in this regard shall be submitted during design approval.

7.14.5 Overload protection may be omitted to PV main cable if the continuous current-carrying capacity of the cable is equal to or greater than 1.25 times ISC STC of the PV generator. Necessary calculations in this regard shall be submitted during design approval.

**7.15** The system description, general/technical requirements, etc. are given for general guidance only. The supplier/manufacturer shall submit the detailed design of the complete solar generating system by using their software to optimize the combination of modules considering the specific location, insolation, nature of load, etc.

**7.16 AC Distribution Board (ACDB):**

The ACDB must have the following features:

i. Bus Bar should be minimum 3 times capacity of Solar Power plant.

ii. The Solar Power should be supplied to the bus bar inside the ACDB through a LCD Energy Meter.

iii. The Designated Load should be routed through ACDB and an Energy Meter to register the Load Energy Consumption from Solar power.

iv. ACDB should have Class I + II (as per IEC 62305; IEC 61643 and IEC 60364-5-53), 100 kA Surge Suppression inbuilt for surge protection. Surge protection on AC side (Type 1 + Type 2) shall consist of Pre wired metal encapsulated spark gap based solution for fire safe and fire proof operation at site, consisting of base part and plug in protection modules. Total discharge capacity/Lightning Impulse current (Iimp) at 10/350 µ sec and nominal discharge current (In) at 8/ 20 µ sec shall be minimum 100 KA for three phase power supply system and 50 KA for single phase power supply system. The discharge capability of L-N connected module shall be 25 KA at 10/350 µ sec and 8/20 µ sec. All the L-N & N-E connected arresters shall have built in mechanical health indication. Complete solution shall have voltage protection level (Up) of <= 1.5 KV to protect the sensitive electronics inside the Invertors, having follow current extinguishing and limiting capability up to 25 KA rms (at 255V) without tripping of even small rating 32 AGL/ gG fuse and approved from international independent test labs like KEMA or VDE or UL as per latest IEC 61643-1 or equivalent EN 61643-11 standard. SPDs on the ACDB shall be provided if the same haven’t been provided on the SGI.

**8.0 INSTALLATION & COMMISSIONING:**

The installation and commissioning shall be done by the supplier/manufacturer who is responsible for system performance, direction of installation and structural stability. The supplier shall conduct a detailed site assessment. The PV installer shall obtain data specific to the site, rather than relying on general data. While making foundation design, due consideration shall be given to weight of the module assembly, maximum wind speed at the site, etc.

**9.0 DOCUMENTATION:**

The supplier shall provide easy-to-use illustrated installation and operation manual in English for easy installation and trouble-free usage. Manual shall contain complete system details such as array layout, schematic of the system, working principle, clear instruction on regular maintenance, trouble-shooting of the solar generating system, emergency shutdown procedure, etc.

**9.1 As built drawing to be provided.**

**9.2 SLD to be provided.**

**10.0 AFTER SALES SERVICE:**

The complete details of service centres in India shall be provided along with the offer. All essential materials and manpower shall be placed at the service centres to ensure quick and efficient after sales service. Any spares to be procured may be specified by vendor.