



### महाराष्ट्र ऊर्जा विकास अभिकरण (महाऊर्जा)

सिटी सर्व्हे नं.२४९/अ-१/५५,ई वॉर्ड म्हाडा कॉम्प्लेक्स, नागाळा पार्क, जिल्हा परिषदेजवळ कोल्हापूर-४१६००३  
ई-मेल आयडी [medakolhapur@mahaurja.com](mailto:medakolhapur@mahaurja.com) संकेतस्थळ (website)www.mahaurja.com

#### फेर- दरपत्रक सूचना

सागणेश्वर वन्यजीव अभयारण्य, ता.कडेगाव, जि. सांगली येथे एकूण ०८ कि.वॅ. पारेषण संलग्न व एकूण ०२ कि.वॅ. पारेषण विरहित सौर ऊर्जा प्रकल्प आस्थापित, पुरवठा, आस्थापना, चाचणी, कार्यान्वित करणे व ५ वर्षांच्या हमी कालावधीत सुट्या भागांसह देखभाल व दुरुस्ती करणे (CMC) या कामासाठी सौर विद्युत संच साधनांचे उत्पादक /पुरवठादार/प्रकल्प विकासक यांच्याकडून दरपत्रके मागविण्यात येत आहे.

- दरपत्रके सादर करण्याचा दिनांक व वेळ :- दि. ११/०७/२०२३ सकाळी १०:०० ते १७/०७/२०२३ सांय. ६:०० वाजेपर्यंत.
- दरपत्रके सादर करणेकरीता पत्ता : महाराष्ट्र ऊर्जा विकास अभिकरण (महाऊर्जा), सिटी सर्व्हे नं.२४९/अ-१/५५,ई वॉर्ड म्हाडा कॉम्प्लेक्स, नागाळा पार्क, जिल्हा परिषदेजवळ कोल्हापूर-४१६००३

याअंतर्गत प्राप्त होणाऱ्या दरपत्रकांपैकी एक किंवा सर्व दरपत्रके स्विकारण्याचे अथवा नाकारण्याचे सर्व अधिकार विभागीय महाव्यवस्थापक, महाऊर्जा, विभागीय कार्यालय, कोल्हापूर यांच्याकडे राहतील.

सही/-

विभागीय महाव्यवस्थापक,  
विभागीय कार्यालय, महाऊर्जा, कोल्हापूर

# MAHARASHTRA ENERGY DEVELOPMENT AGENCY, KOLHAPUR

2023/DOK/Technical/Desk -1/Quotation/S-59/

Date: 10/07/2023

## RE- Quotation Call

To,  
(Supplier/Developer/Contractor/Integrator)

**Sub: Supply, Installation, Testing & Commissioning of Total 8 KW Grid Connected Roof Top & 2 KW Off-Grid Roof Top Solar Power Plant, at Sagareshwar Wildlife Forest, Tal.Kadegaon, Dist. Sangli – Invitation to Quote**

With reference to subject matter, we would like to invite your quotes in sealed condition for undertaking the work with given technical specifications and technical standards with following terms and conditions –

• **Details and Dates: -**

			<b>Name of Site</b>	<b>Project Capacity</b>	<b>Project Cost Rs.</b>
1	System details	Grid Connected	Meter No. 01 (Amphitheatre)	05 Kwp	2,91,795/-
			Meter No. 02 (Office)	01 Kwp	75,878/-
			Meter No. 03 (Rest Room)	01 Kwp	72562/-
			Meter No. 04 (Yuvak Ghruh)	01 Kwp	75,878/-
		Off-Grid	Sanctuary Hut -1	01 Kwp	1,36,560/-
			Sanctuary Hut -2	01 Kwp	1,36,560/-
		2	Estimated Cost	7,89,233 /- (Inclusive of all taxes and charges)	
3	Date and time for submission of quotations.	From 11/07/2023; 10:00 Hrs to 17/07/2023 18:00 Hrs			
4	Date and time for opening of quotations.	18/07/2023; 10:00 Hrs			
5	Security Deposit	<b>25000/-</b> ( to be deposited by online mode in favor of Maharashtra Energy Development Agency, Kolhapur)			
6	Address for communication and for quotation opening	Maharashtra Energy Development Agency, Divisional Office Kolhapur SR.No. 249/A-1/55, E Ward, MHADA complex, Nagala Park, Near Zilla Parishad, Kolhapur-416003			
7	Site location	• <b>Sagareshwar Wildlife Forest, Tal.Kadegaon, Dist. Sangli</b>			

# MAHARASHTRA ENERGY DEVELOPMENT AGENCY, KOLHAPUR

## 1. ELIGIBILITY CRITERIA –

The manufacturer/supplier shall be eligible to quote for this work provided fulfilment of following.

1. Shall have a registered firm/company with GST registration within Kolhapur division.
2. Shall provide brief information in prescribed format (enclosed).
3. Shall not be black listed in any govt and/or other organizations.
4. Shall provide documentary proof about having experience of supply, installation and commissioning of minimum 10 KW of SPV Grid Connected Solar Power Plant and 03 kwp Off Grid Solar Power Plant. (Work experience must be of government work).
5. Shall have an annual average turnover of Rs. 20 lakh per year for FY 2020-21 and 2021-22 duly certified by chartered accountant.
6. Shall provide self-attested copy of IT returns for FY 2020-21 and 2021-22 (Assessment year 2021-22 and 2022-23 )
7. Shall have arrangement of providing after sales service in area of installation of systems.

## 2. TERMS AND CONDITIONS –

- 1) Location for installation of Solar Power Plants shall be assigned immediately by the user agency to the selected manufacturer/supplier to get the work done in stipulated time.
- 2) The installation of Solar Power Plant should be done in excellent manner and meet technical standards prescribed by the MEDA.
- 3) As per the technical criteria set by the Ministry of New and Renewable Energy, Govt. of India the solar modules should fulfill the IEC standards and shall be procured from manufacturer providing module with RFID tag.
- 4) The manufacturer/supplier shall provide valid test certificate of inverter from govt. approved test centers.
- 5) The manufacturer/supplier shall provide Solar Modules from the approved Manufacturers which are enlist in MNRE's ALMM list.
- 6) The solar module should be engraved with name of company supplying the same along with installation date etc.
- 7) If the Solar Power Plant does not function as per given standards then the loss incurred shall be borne by the supplier and paid Sagareshwar Wildlife Forest, Tal.Kadegaon, Dist. Sangli.
- 8) If contractor fails to complete the work then Security Deposit will be forfeited and contractor shall be blacklisted.
- 9) Supplier shall give training of system operation to a person duly nominated by user agency and same shall be informed to divisional office Kolhapur.
- 10) The Contractor / Agency should successfully complete the project within timeframe set out by the MEDA. For this purpose, contractor/Supplier shall provide Activity Bar Chart within a week time after issue of Work Order.
- 11) The manufacturer/supplier shall provide the user manual, warranty card to the user agency and copy of same shall be provide to MEDA Kolhapur.**
- 12) The manufacturer/supplier shall visit the site and ensure scope of work before submission of quote against the enquiry. In this context, the manufacturer/supplier should submit the Site Visit Report in given prescribed format along with this quote.
- 13) The work being of limited nature and to seek prompt after sales service the manufacturer/supplier within Kolhapur/Sangli District will be preferred while allotting the work against the invited

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quotes. Required proof in this matter need to be submitted by concerned manufacturer/supplier along with quote.

- 14) The Contractor shall provide the detailed information about Company/firm in attached Format (Contractor's Information sheet)
- 15) **The manufacturer/supplier shall submit their quotations in two different sealed envelopes i.e. First envelop shall contains documents a per the technical eligibility criteria and Second envelop shall contain Financial details (quoted rate).**
- 16) **The manufacturer/supplier should mention the subject on each sealed envelope i.e Technical Envelop and Financial Envelop.**
- 17) **The financial envelop of technically qualified bidders will only be opened.**

### **3. GRID CONNECTIVITY:**

1. Successful Contractor has to process the net meter application during the installation of system & obtain grid connectivity from distribution licensee & ensure its timely commissioning. In this case the successful Contractor has to pay the Applicable fees.
2. Increase in sanctioned load/contract demand and other related requirements shall be completed by user agency in co-ordination with the contractor. In this context the processing fees shall be borne by the contractor and deposit amount for load extension shall be paid by the user agency to MSEDCL along with relevant documents.
3. Successful contractor has to check the requirements of Grid Connectivity for the system and has to complete the grid related work according to MSEDCL/MERC guidelines.
4. Successful contractor has to review & confirm type & capacity of existing CT/PT & transformer for compatibility with type & capacity of proposed Solar Power Generation System. Also, Successful contractor has to arrange and attend inspection by representative of DISCOM. Further all amendments and resolutions regarding the net metering procedure as per MSEDCL/MERC guidelines are applicable and contractor shall follow the same and complete the work accordingly.
5. Since the said Solar Power Project is a Grid - Connected Solar Power Project, the approval of the MSEDCL for its Net Metering should be obtained and the electricity bill of both the meter should not be pending. If there is a delay in the commissioning of the project due to the pending electricity bill, then the MEDA will not be responsible.

### **4. COMPREHENSIVE MAINTENANCE CONTRACT (CMC)**

- i. The complete Solar Power Plants must have warrantee against any manufacturing/ design/ installation defects for a minimum period of 5 years.
- ii. Responsibility of cleaning of SPV panels (once in fortnight) of system shall be the responsibility of the Beneficiary.
- iii. During the CMC period, successful supplier should visit the site quarterly (after each 03 months) and ensure the successful working of Solar Power Plant. Also supplier shall maintain the visit log book at the site. If any problem occurs in working of Solar Power Plant; supplier shall attend the system within 48 hours and rectify the problem immediately.
- iv. In case Contractor fail to provide service during the CMC period, the Performance Bank Guarantee/SD should be forfeited and Contractor shall be blacklisted.

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### 5. **TERMS OF PAYMENT:**

- A. 80% of the total cost will be released after successful installation and commissioning of the system duly certified by Contractor, Officer of MEDA & authorized person of User Agency along with submission of undertaking of Comprehensive Maintenance Contract (CMC) for 5 years from date of commissioning and Insurance policy documents (covering Natural calamity, damage, fire, burglary) effective from date of installation up to five year period.
- B. 20% of the total cost shall be released on receipt of two month successful performance report generated automatically through Remote Monitoring System (RMS) as well as manually which should be duly certified by Officer of MEDA, authorized person of User Agency and submission of performance bank guarantee of 10% amount of project cost from any Nationalized Bank valid for period of 5 years from date of commissioning of project.

### 6. **DEDUCTION:-**

- i. The TDS at the source will be deducted as per the Govt. rule and regulations.
- ii. MEDA will issue necessary certificates of TDS deduction.
- iii. C / 'D' form will not be issued by MEDA.

### 7. **SECURITY DEPOSIT –**

- i. A sum of **25,000** /- shall be deposited by the selected manufacturer/supplier as security deposit by online mode in favor of 'Maharashtra Energy Development Agency, Kolhapur on or before issuing of Work Order.
- ii. If the contractor fails to execute the work in given time or terminates the order prematurely then the security deposit will be forfeited and contractor shall be blacklisted and no excuses will be entertained.
- iii. The security deposit will be returned to the contractor without interest after successful commissioning (i.e. all work is completed as per terms and conditions of work order) of system and receipt of two month successful performance report duly signed by user agency, MEDA official and representative of the contractor.

### 8. **PENALTY –**

- A penalty of 1/2% of the total project cost shall be imposed on the contractor against a delay of one week in project completion subject to a maximum of up to 10% of the total project cost. In case the penalty exceeds 10% of the total project cost, the given order will be canceled & the security deposit will be forfeited and the Contractor/ Supplier shall be blacklisted.

### 9. **TIME FRAME:**

- The successful Bidder will be required to commission the project within 30 Days from the date of issue of work order.

### 10. **EXTENSION :**

- If project not installed or commissioned within the given time frame due to any inevitable reasons then contractor shall seek the time extension for the project at least 07 Days in advance before expiry of project completion period (30 Days) by giving satisfactory reasons for same. However if the time extension is not taken before the project completion period then the penalty clause of work order shall be effective till the request is applied for the extension with MEDA.

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### **11. CHECK LIST OF DOCUMENTS TO BE FURNISHED WITH BELOW QUOTATION –**

- PAN and GST Details.
- Copy of IT Returns.
- Declaration on company letter head.
- Contractors Information Sheet.
- Annual Turnover Certificate.
- Work Experience Details.
- Site Visit Report.( in format )

We look ahead to seek your sealed quotation on or before 17/07/2023 till 18 Hrs.

Thanking you,

Sd/-

Divisional General Manager  
MEDA, Divisional Office, Kolhapur

Encl. :-

1. Contractor Information Sheet.
2. Declaration Format.
3. Annual Turn Over certificate format.
4. Site Survey Form.
5. Technical Specifications of Grid Connected and Off –Grid Solar System.

## MAHARASHTRA ENERGY DEVELOPMENT AGENCY, KOLHAPUR

### CONTRACTOR'S INFORMATION

Sr.No	Particulars	
1	Name of Firm	
2	Details of Mailing Address	
3	Firm Status (PSU/Incorporate/Ltd/Pvt.Ltd/LLP/Partnership/Proprietary )	
4	Name & Designation Of Contact Person	
5	Contact No.	
6	E-mail Address for correspondence	
7	Firm website Address	
8	Firm registration No/ROC Establish Year of firm	
9	PAN No.	
10	GST No.	
11	Turnover (in Rs.) for FY 2020-21 and 2021-22	
12	Skilled manpower	
13	*Experience in SPV Power Pack (On-Grid) in Kwp	
14	*Experience in SPV Power Pack (Off-Grid) in Kwp	

Authorised Sign and Stamp

# MAHARASHTRA ENERGY DEVELOPMENT AGENCY, KOLHAPUR

## DECLARATION

(On company's letter head)

To,

**Divisional General Manager,**

Divisional Office Kolhapur

Maharashtra Energy Development Agency

(A Government of Maharashtra Institution)

Address: C. S. No. 249/A – 1/55, E Ward, Mhada Complex, Nagala Park, Near Zilla Parishad,  
Kolhapur - 416003

Respected Sir/Madam,

1. We have carefully read and understood all the terms and conditions of the quotation and hereby convey our acceptance to the same.
2. The information / documents furnished along with our offer are true and authentic to the best of my knowledge and belief, We are well aware of the fact that furnishing of any false information/ fabricated document would lead to rejection of our quotation at any stage besides liabilities towards prosecution under appropriate law.
3. We have apprised our self fully about the job to be done during the currency of the period of agreement and also acknowledge bearing consequences to of non-performance or deficiencies in the services on our part.
4. We have no objection, if enquiries are made about the work listed by us.
5. We have not been barred or blacklisted by any Government Agency / Department/ PSU or any such competent Government authority, organization where we have worked. Further, if any of the partners/directors of the organization /firm is blacklisted or having any criminal case against them, our quote shall not be considered. At any later point of time, if this information is found to be false, Divisional General Manager, Divisional Office Kolhapur, Maharashtra Energy Development Agency, may terminate the assigned contract immediately.
6. We have not been found guilty by a court of law in India for fraud, dishonesty or moral turpitude.
7. We agree that the decision of Divisional General Manager, MEDA, Divisional Office Kolhapur, in selection of quotation and shall final and binding to us.

For  
(Company Name)

Name of signing authority / Designation / Place / Date



## MAHARASHTRA ENERGY DEVELOPMENT AGENCY, KOLHAPUR

### Annual Turnover

Each Contractor must fill in this form including private/public limited company.

- **Annual Turnover Data for the FY 2020-21,2021-22**
- **Name of Company :**

Year	Rs in Lacs
2020-21	
2021-22	

The information supplied should be the Annual Turnover of the Contractor in terms of the amounts billed to clients for each year for work in progress or completed.

Signature of Applicant

Certified by Applicant's Auditor

(Affix Stamp)

**MAHARASHTRA ENERGY DEVELOPMENT AGENCY, KOLHAPUR**

**SITE VISIT REPORT**

(To be submitted on letterhead of contractor)

Date: \_\_\_\_\_

To,  
The Divisional General Manager,  
Divisional Office Kolhapur,  
Maharashtra Energy Development Agency  
(A Government of Maharashtra Institution)  
Address: C. S. No. 249/A– 1/55, E Ward, Mhada Complex, Nagala Park, Near Zilla  
Parishad, Kolhapur– 416003.

**Sub. :** Site Visit Report for Installation and Commissioning of SPV Grid Connected/Off Grid Roof Top Solar Power Plant at ..... , Sagarshwar Wildlife Forest, Tal.Kadegaon, Dist. Sangli

Ref.: Quotation Call No. ....Date:

Sir,

This has reference to above referred quotation call for Installation and Commissioning of Total 06 Kw. capacity SPV Grid Connected/Off Grid Roof Top Solar Power Plant at..... Sagarshwar Wildlife Forest, Tal.Kadegaon, Dist. Sangli in state of Maharashtra.

I / We hereby declare that we have visited the site.

I / We have made my ourselves acquainted with site conditions, approach to site, requirement of area, availability of water, requirement of quotation conditions etc.

I / We have verified all details required to execute the project.

I / We have no problems in undertaking the project and complete them in the given time period.

Thanking you

Yours faithfully,

(Signature of Contractor)

Name of Contractor -----

Designation -----

Seal:

**Signature of User Agency authorities.**

**Seal:.....**

# MAHARASHTRA ENERGY DEVELOPMENT AGENCY, KOLHAPUR

## TECHNICAL SPECIFICATIONS

### ( Grid Connected SPV Power Plant)

#### 1. DEFINITION :-

A Grid Tied Solar Rooftop Photovoltaic (SPV) power plant consists of SPV array, Module Mounting Structure, Power Conditioning Unit (PCU) consisting of Maximum Power Point Tracker (MPPT), Inverter, and Controls & Protections, interconnect cables, Junction boxes, Distribution boxes and switches. PV Array is mounted on a suitable structure. Grid tied SPV system should be designed with necessary features to supplement the grid power during day time. Components and parts used in the SPV power plants including the PV modules, metallic structures, cables, junction box, switches, PCUs etc., should conform to the BIS or IEC or international specifications, wherever such specifications are available and applicable. Solar PV system shall consist of following equipment's/components.

Solar PV modules consisting of required number of Crystalline PV cells. Grid interactive Power Conditioning Unit with Mounting structures Junction Boxes. Earthing and lightning protections. IR/UV protected PVC Cables, pipes and accessories

#### 2. SOLAR PHOTOVOLTAIC MODULES :-

- a) The PV modules used should be made in India.
- b) The PV modules used must qualify to the latest edition of IEC PV module qualification test or equivalent BIS standards Crystalline Silicon Solar Cell Modules IEC 61215/IS14286. In addition, the modules must conform to IEC 61730 Part-1 - requirements for construction & Part 2 – requirements for testing, for safety qualification or equivalent IS.
- c) For the PV modules to be used in a highly corrosive atmosphere throughout their lifetime, they must qualify to IEC 61701.
- d) The total solar PV array capacity should not be less than assigned **project capacity** and should comprise of solar crystalline modules of minimum 250 Wp and above wattage. Adequate protective devices against surges at the PV module shall be provided. Low voltage drop bypass diodes shall be provided.
- e) PV modules must be tested and approved by one of the IEC authorized test centres.
- f) The module frame shall be made of corrosion resistant materials, preferably having anodized aluminium.
- g) Other general requirement for the PV modules and subsystems shall be the Following:
  - The rated output power of any supplied module shall have tolerance within +/-3%.
  - The peak-power point voltage and the peak-power point current of any supplied module and/or any module string (series connected modules) shall not vary by more than 2 (two) per cent from the respective arithmetic means for all modules and/or for all module strings, as the case may be.
  - The module shall be provided with a junction box with either provision of external screw terminal connection or sealed type and with arrangement for provision of by-pass diode. The box shall have hinged, weather proof lid with captive screws and cable gland entry points or may be of sealed type and IP-65 rated.

#### 3. SOLAR PV MODULES :-

- h) Modules deployed must use a RF identification tag. The following information must be mentioned in the RFID used on each modules. This should be inside the laminate only.
  - a. Name of the manufacture of the PV module
  - b. Name of the manufacture of Solar Cells.
  - c. Month & year of the manufacture (separate for solar cells and modules)
  - d. Country of origin (separately for solar cells and module)

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- e. I-V curve for the module Wattage,  $I_m$ ,  $V_m$  and FF for the module
- f. Unique Serial No and Model No of the module
- g. Date and year of obtaining IEC PV module qualification certificate.
- h. Name of the test lab issuing IEC certificate.
- i. Other relevant information on traceability of solar cells and module as per ISO 6001 and ISO 14001

#### 4. **WARRANTIES :-**

- Material Warranty:
  - i. Material Warranty is defined as: The project developer should warrant the Solar Module(s) to be free from the defects and/or failures specified below for a period not less than five (05) years from the date of sale to the original customer ("Customer")
  - ii. Defects and/or failures due to manufacturing
  - iii. Defects and/or failures due to quality of materials
  - iv. Non conformity to specifications due to faulty manufacturing and/or inspection processes. If the solar Module(s) fails to conform to this warranty, the project developer will repair or replace the solar module(s), at the Owners sole option.
- Performance Warranty:
  - a. The predicted electrical degradation of power generated not exceeding 20% of the minimum rated power over the 25 year period and not more than 10% after ten years period of the full rated original output.

#### 5. **ARRAY STRUCTURE :-**

- i. Hot dip galvanized MS mounting structures having 80 micron thickness may be used for mounting the modules / panels / arrays.
- ii. Each structure should have angle of inclination as per the site conditions to take maximum insolation. However to accommodate more capacity the angle inclination may be reduced until the plant meets the specified performance ratio requirements.
- iii. The Mounting structure shall be so designed to withstand the speed for the wind zone of the location where a PV system is proposed to be installed (wind speed of 150 km/ hour). Suitable fastening arrangement such as grouting and calming should be provided to secure the installation against the specific wind speed.
- iv. The mounting structure steel shall be as per latest IS 2062: 1992 and galvanization of the mounting structure shall be in compliance of latest IS 4759.
- v. Structural material shall be corrosion resistant and electrolytically compatible with the materials used in the module frame, its fasteners, nuts and bolts.
- vi. **Aluminium structures also can be used which can withstand the wind speed of respective wind zone.** Necessary protection towards rusting need to be provided either by coating or anodization.
- vii. The fasteners used should be made up of stainless steel. The structures shall be designed to allow easy replacement of any module. The array structure shall be so designed that it will occupy minimum space without sacrificing the output from the SPV panels.
- viii. Regarding civil structures the Manufacturer/Supplier need to take care of the load bearing capacity of the roof and need arrange suitable structures based on the quality of roof.
- ix. The total load of the structure (when installed with PV modules) on the terrace should be less than 60 kg/m<sup>2</sup>.
- x. The minimum clearance of the structure from the roof level should be 300 mm.

#### 6. **JUNCTION BOXES (JBs) :-**

- i. The junction boxes are to be provided in the PV array for termination of connecting cables. The J. Boxes (JBs) shall be made of GRP / FRP / Powder Coated Aluminium /cast aluminium alloy with full dust, water & vermin proof arrangement. All wires / cables must be terminated through

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- cable lugs. The JB's shall be such that input & output termination can be made through suitable cable glands.
- ii. Copper bus bars / terminal blocks housed in the junction box with suitable termination threads conforming to IP65 standard and IEC 62208 Hinged door with EPDM rubber gasket to prevent water entry. Single / double compression cable glands. Provision of earthing's. It should be placed at 5 feet height or above for ease of accessibility.
  - iii. Each Junction Box shall have High quality Suitable capacity Metal Oxide Varistors (MOVs) / SPDs, suitable Reverse Blocking Diodes. The Junction Boxes shall have suitable arrangement monitoring and disconnection for each of the groups.
  - iv. Suitable markings shall be provided on the bus bar for easy identification and the cable ferrules must be fitted at the cable termination points for identification.
  - v. All fuses shall have DIN rail mountable fuse holders and shall be housed in thermoplastic IP 65 enclosures with transparent covers.

### **7. DC DISTRIBUTION BOARD :-**

- DC Distribution board to receive the DC output from the array field.
- DC DB's shall have sheet from enclosure of dust & vermin proof conform to IP 65 protection. The bus bars are made of copper of desired size. Suitable capacity MCBs/MCCB shall be provided for controlling the DC power output to the PCU along with necessary surge arrestors.

### **8. AC DISTRIBUTION PANEL BOARD :-**

- i) AC Distribution Board (DB) 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.
- j) All switches and the circuit breakers, connectors should conform to IEC 60947, part I, II and III/ IS 60947 part I, II and III.
- k) The changeover switches, cabling work should be undertaken by the Manufacturer/Supplier as part of the project.
- l) All the Panel's shall be metal clad, totally enclosed, rigid, floor mounted, air - insulated, cubical type suitable for operation on three phase / single phase, 415 or 230 volts, 50 Hz
- m) The panels shall be designed for minimum expected ambient temperature of 45 degree Celsius, 80 percent humidity and dusty weather.
- n) All indoor panels will have protection of IP54 or better. All outdoor panels will have protection of IP65 or better.
- o) Should conform to Indian Electricity Act and rules (till last amendment).
- p) 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

### **9. PCU / ARRAY SIZE RATIO :-**

- The combined wattage of all inverters for each SPV power plant should not be less than the assigned project capacity at given location.
- Maximum power point tracker shall be integrated in the PCU/inverter to maximize energy drawn from the array.

### **10. PCU / INVERTER :-**

- q) 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.

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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	230 V /415V, 1/3 Phase, 50 Hz (In case single phase inverters are offered, suitable arrangement for balancing the phases must be made.)
Output frequency	50 Hz
Grid Frequency Synchronization range	+ 3 Hz or more
Ambient temperature considered	-20° C to 50° C
Humidity	95 % Non-condensing
Protection of Enclosure	IP-20(Minimum) for indoor.
	IP-65(Minimum) for outdoor.
Grid Frequency Tolerance range	+ 3 or more
Grid Voltage tolerance	-0.20.15
No-load losses	Less than 1% of rated power
Inverter efficiency(minimum)	>93% (In case of 10 kW or above with in- built galvanic isolation) >97% (In case of 10 KW or above without in-built galvanic isolation)
Inverter efficiency (minimum)	> 60% (In case of less than 10 kW)
THD	< 3%
PF	> 0.9

- a. PCU / inverter shall be capable of complete automatic operation including wake-up, synchronization & shutdown.

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- b. 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.
- c. Built-in meter and data logger to monitor plant performance through external computer shall be provided.
- d. **Anti-islanding** (Protection against Islanding of grid): The PCU shall have anti islanding protection in conformity to IEEE 1547/UL 1741/ IEC 62116 or equivalent BIS standard.
- e. 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.
- f. 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.
- g. The MPPT units environmental testing should qualify IEC 60068-2 (1, 2, 14, 30)/ Equivalent BIS std. The junction boxes/ enclosures should be IP 65 (for outdoor)/ IP 54 (indoor) and as per IEC 529 specifications.
- h. 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.

### **11. INTEGRATION OF PV POWER WITH GRID :-**

The output power from SPV would be fed to the inverters which converts DC produced by SPV array to AC and feeds it into the main electricity grid after synchronization. In case of grid failure, or low or high voltage, solar PV system shall be out of synchronization and shall be disconnected from the grid. In case existing 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.

### **12. REMOTE MONITORING SYSTEM (RMS):**

The contractor shall include the RMS equipment in the system that is capable to store & provide online performance data/parameters comprising AC voltage, AC current, output power, DC voltage, DC current, Time-On, Time-off, Power produced etc. The consolidated monthly RMS report shall automatically get generated in the system & provided by mail to MEDA & user agency.

The RMS portal address, along with user id and password shall be provided by supplier to MEDA and user agency after commissioning of the system.

### **13. 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.

### **14. PROTECTIONS :-**

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

### **15. LIGHTNING PROTECTION :-**

- The SPV power plants shall be provided with lightning & overvoltage protection. The main aim in this protection shall be to reduce the over voltage to a tolerable value before it reaches the PV or other sub system components. The source of over voltage can be lightning, atmosphere disturbances etc The entire space occupying the SPV array shall be suitably protected against Lightning by deploying required number of Lightning Arrestors. Lightning protection should be provided as per IEC 62305 standard. The protection against induced high-voltages shall be

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provided by the use of metal oxide varistors (MOVs) and suitable earthing such that induced transients find an alternate route to earth.

### **16. SURGE PROTECTION :-**

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

### **17. EARTHING PROTECTION :-**

- Each array structure of the PV yard should be grounded/ earthed properly as per IS:3043-1987. In addition the lighting arrester/masts should also be earthed inside the array field. Earth Resistance shall be tested in presence of the representative of Department/MEDA as and when required after earthing by calibrated earth tester. PCU, ACDB and DCDB should also be earthed properly.
- Earth resistance shall not be more than 5 ohms. It shall be ensured that all the earthing points are bonded together to make them at the same potential.

### **18. GRID ISLANDING :-**

- In the event of a power failure on the electric grid, it is required that any independent power-producing inverters attached to the grid turn off in a short

period of time. This prevents the DC-to-AC inverters from continuing to feed power into small sections of the grid, known as "Islands." Powered Islands present a risk to workers who may expect the area to be unpowered, and they may also damage grid-tied equipment. The Rooftop PV system shall be equipped with islanding protection. In addition to disconnection from the grid (due to islanding protection) disconnection due to under and over voltage conditions shall also be provided.

- 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.

### **19. CABLES :-**

- r) Cables of appropriate size to be used in the system shall have the following characteristics:
  - a. Shall meet IEC 60227/IS 694, IEC 60502/IS1554 standards
  - b. Temp. Range: -10°C to +80°C.
  - c. Voltage rating 660/1000V
  - d. Excellent resistance to heat, cold, water, oil, abrasion, UV radiation
  - e. Flexible
  - f. 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%)
  - g. 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.
  - h. 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.
  - i. 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 colour.
  - j. 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.
  - k. Cables and wires used for the interconnection of solar PV modules shall be provided with solar PV connectors (MC4) and couplers.
  - l. All cables and conduit pipes shall be clamped to the rooftop, walls and ceilings with thermo-plastic clamps at intervals not exceeding 50 cm; the minimum DC cable size shall be 4.0 mm<sup>2</sup> copper; the minimum AC cable size shall be 4.0 mm<sup>2</sup> copper. In three phase



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systems, the size of the neutral wire size shall be equal to the size of the phase wires.

- m. 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.
- n. Cable Jacket should also be electron beam cross-linked XLPO, flame retardant, UV resistant and black in colour.
- o. 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.
- p. The ratings given are approximate. Manufacturer/Supplier to indicate size and length as per system design requirement. All the cables required for the plant shall be provided by the Manufacturer/Supplier. Any change in cabling sizes if desired by the Manufacturer/Supplier shall be approved after citing appropriate reasons. (All cable schedules/ layout drawings shall be approved prior to installation.)
- q. Multi Strand, Annealed high conductivity copper conductor PVC type 'A' pressure extruded insulation or XLPE insulation. Overall PVC/XLPE insulation for UV protection 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 /IEC 69947.
- r. The total voltage drop on the cable segments from the solar PV modules to the solar grid inverter shall not exceed 2.0%.
- s. The total voltage drop on the cable segments from the solar grid inverter to the building distribution board shall not exceed 2.0%.
- t. FRLS Cables should be used.

### **20. DANGER BOARDS AND SIGNAGES :-**

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

### **21. DRAWINGS & MANUALS :-**

- Two sets of Engineering, electrical drawings and Installation and O&M manuals are to be supplied.
- Approved ISI and reputed makes for equipment be used.
- For complete electro-mechanical works, Supplier/Manufacturer shall supply complete design, details and drawings for approval to MEDA before progressing with the installation work.

### **22. PLANNING AND DESIGNING:**

- i. The Supplier/Manufacturer holder should carry out Shadow Analysis at the site and accordingly design strings & arrays layout considering optimal usage of space, material and labour. The Supplier/Manufacturer should submit the array layout drawings along with Shadow Analysis Report to MEDA for approval.

### **23. SAFETY MEASURES :-**

The Manufacturer/Supplier holder shall take entire responsibility for electrical safety of the installation(s) including connectivity with the grid and follow all the safety rules & regulations applicable as per Electricity Act, 2003 and CEA guidelines etc.

### **24. DISPLAY BOARD :-**

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- The Manufacturer/Supplier holder has to display a board at the each project site mentioning the following:
  - i) Name of Scheme :
  - ii) Name of Work :
  - iii) Plant Capacity
  - iv) Amount of Work
  - v) Date of commissioning of Plant.
- The size and type of board and display shall be appropriate.

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## TECHNICAL SPECIFICATIONS

(Roof Top Off-Grid SPV Power Plant (01 Kwp Off-grid):

### **1. SOLAR PHOTOVOLTAIC MODULES:-**

- a. The PV modules used should be made in India.
- b. The PV modules used must qualify to the latest edition of IEC PV module qualification test or equivalent BIS standards Crystalline Silicon Solar Cell Modules IEC 61215/IS14286. In addition, the modules must conform to IEC 61730 Part-1 - requirements for construction & Part 2 – requirements for testing, for safety qualification or equivalent IS.
- c. For the PV modules to be used in a highly corrosive atmosphere throughout their lifetime, they must qualify to IEC 61701.
- d. The total solar PV array capacity should not be less than 01 Kwp respectively, should comprise of solar crystalline modules of minimum 250 Wp and above wattage. Adequate protective devices against surges at the PV module shall be provided. Low voltage drop bypass diodes shall be provided.
- e. PV modules must be tested and approved by one of the IEC authorized test centers.
- f. The module frame shall be made of corrosion resistant materials, preferably having anodized aluminum.
- g. Other general requirement for the PV modules and subsystems shall be the Following:
- h. The rated output power of any supplied module shall have tolerance within +/-3%.
- i. The peak-power point voltage and the peak-power point current of any supplied module and/or any module string (series connected modules) shall not vary by more than 2 (two) per cent from the respective arithmetic means for all modules and/or for all module strings, as the case may be.
- j. The module shall be provided with a junction box with either provision of external screw terminal connection or sealed type and with arrangement for provision of by-pass diode. The box shall have hinged, weather proof lid with captive screws and cable gland entry points or may be of sealed type and IP-65 rated

### **2. PV MODULES:**

- a. The PV modules must conform to the latest edition of any of the following / equivalent BIS Standards for PV module design qualification and type approval:
  - Crystalline Silicon Terrestrial PV Modules IEC 61215 / IS14286
- b. In addition, the modules must conform to IEC 61730 Part 1-requirements for construction & Part 2 - requirements for testing, for safety qualification.
- c. Identification and Traceability:

Each PV module must use a RF identification tag (RFID), which must contain the following information:

  - (i) Name of the manufacturer of PV Module
  - (ii) Name of the Manufacturer of Solar cells
  - (iii) Month and year of the manufacture (separately for solar cells and module)
  - (iv) Country of origin (separately for solar cells and module)

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- (v) I-V curve for the module
- (vi) Peak Wattage,  $I_m$ ,  $V_m$  and 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 mandatory placed inside the module laminate

### 3. BATTERY BANK:

- The batteries shall be solar photovoltaic batteries of LiFePO<sub>4</sub> type and made of hard rubber container.
- Storage batteries should conform IEC 61427 / IS 1651 / IS 13369 as per specifications.
- The batteries shall use 12V and battery capacity is to be designed at C/10 rate with end cell cut off voltage of 1.85 V per cell.
- Battery terminal shall be provided with covers.
- Batteries shall be provided with micro porous vent plugs with floats.
- Charging instructions shall be provided along with the batteries.
- Suitable carrying handle shall be provided.
- A suitable battery rack with interconnections & end connector shall be provided to suitably house the batteries in the bank.
- The batteries shall be suitable for recharging by means of solar modules via incremental / open circuit regulators.
- Bidder shall mention the design cycle life of batteries at 80%, 10% and 20% depth of discharge at 27 deg. C.
- The batteries shall be designed for operating in ambient temperature of site .
- The self discharge of batteries shall be less than 3 % per month at 20 deg. C and less than 6% per month at 30 deg. C
- The charge efficiency shall be more than 90% up to 70% state of charge.
- The topping up frequency shall be 12 – 18 months.
- The batteries shall consist of individual cells, which can be carried separately with ease while transporting.
- Offered batteries shall comply to the following:
  - 10 % of DOD: 7200 cycles
  - 50 % of DOD: 3000 cycles
  - 80 % of DOD: 1500 cycles
- The Battery Bank shall be designed to provide Min. 6 Hrs backup. Bidder to provide battery sizing details along with their offer. The distance between two batteries may be kept 6 inches & vice versa.
- There will be one battery bank comprising of capacity 24 V/150 Ah for 01 kWp SPV Power Plant SPV Power Plant. The batteries should be of LiFePO<sub>4</sub> type and shall have long service life. The cells should confirm IEC 61427 / IS 1651 / IS 13369 and as per specification given below shall be provided.
- Battery protection panel

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- The battery protection panel shall be made of CRCA sheet having two incoming and two outgoing terminals. There shall be 2 Nos. HRC fuses of suitable rating with fuse holder/base etc as required. 2 poles MCB/ MCCB can also be used for isolation purpose in stead of fuses, if required.

Container	Polypropylene Co-polymer / hard rubbers with carrying handle.
Cover	Protective cover of polypropylenes against dirt & possible short circuit.
Terminals	Made of lead alloy suitable for bolted connection. The terminals should be greased with petroleum gel.
Electrolyte	Battery grade Sulphuric acid
Self Discharge	Less than 3% per month at 20 degree C
Life expectancy	1500 cycle duty at 27degree C at 80% DOD 3000 cycle duty at 50% DOD
Voltage	12 Volt
Approval	Batteries shall have to be approved by ERTL or CPRI or SEC or any MNRE approved test centres
Service Life	Should perform satisfactory for a minimum period of 5 year under operating conditions as mentioned.

#### 4. BALANCE OF SYSTEM (BoS) ITEMS/ COMPONENTS:

##### Details of Power Conditioning Units:

##### a. General:

As SPV array produce direct current. It is necessary to convert this direct current into alternating current and adjust the voltage levels before powering equipment designed for nominal mains AC supply. 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" OR simply PCU. In addition, the PCU shall also house MPPT (Maximum Power Point Tracker), an interface between Solar PV array & the Inverter, to maximize Solar PV array energy input into the System. PCU should conform IEC 61683, IEC 60068 as per specifications.

PCU refers to combination of charge controller, inverter and AC charger and shall be supplied as integrated unit or separate units.

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Power Conditioning Unit (Solar Charge Controller + Inverter)	
Switching device	MOSFET/IGBT
Type	MPPT based PWM charger to charge battery bank
Input voltage from PV array	90 V DC for 01 kWp unit (The voltage variation shall be as per change in array output)
Protections	<p>Short circuit protection</p> <p>Input under voltage / Deep discharge of battery</p> <p>Input surge voltage protection</p> <p>Over current</p> <p>Battery reverse polarity protection</p> <p>Solar array reverse blocking diode (provided in array junction box)</p> <p>DC rated fuse at input and AC rated fuse at output with suitable contactor/solid-state switches for safe start-up &amp; shutdown of system</p> <p>Load surge current</p> <p>Over temperature</p> <p>Under / Over output voltage</p> <p>Under / Over frequency</p> <p>Automatic / manual isolation at input &amp; output</p> <p>Suitable protection for solid-state switching devices</p>
Dielectric strength	1.1kV between input/output and ground with EMI protections removed
Cooling	Solar natural and Forced air cooling with temperature sensitive fan operation
Ambient operation (max)	50° C
Relative humidity	95% maximum
Assembly & mounting	As per normal industry practice
Finish	Epoxy powder coating
Cable entry	From rear 200mm above ground level
Load test at factory	Minimum 6 hours at full load
Features	<p>Stand-alone and hybrid mode of operation.</p> <p>High quality with high efficiency and reliability</p> <p>Microprocessor based intelligent controller</p> <p>Self monitoring capability.</p> <p>Integral design with MPPT solar charge controller and inverter</p> <p>Highly reliable &amp; efficient solid-state switching devices</p> <p>Rated for continuous operation at full load</p> <p>High over-load capability of 200% surge for 10 seconds</p> <p>Inverter output power factor of 0.8 lag</p> <p>Automatic re-start facility after over load triggered shutdown</p>

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Efficiency	90% at rated load and normal operating conditions 85% (min) at 25% load and nominal input voltage with UPF load
%THD	Sine-wave output with 3% THD at full load UPF and nominal input voltage
Output voltage	230 (+12.5-20%)V AC
Output frequency	50Hz $\pm$ 0.5Hz
%Regulation	5% against input voltage and load variation
Indications	As many as possible with relevance
AC charger input	240 V AC, 50 Hz from AC mains grid
Enclosure	IP 22 (For indoor application)
Weight / Dimension	The details of the inverter will be provided in the specification / user manual
Battery type	LiFePO4 type

### b. 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.

### c. Inverter

- i. Inverters shall be of very high quality having high efficiency and shall be completely compatible with the charge controller and distribution panel.
- ii. Inverter should conform IEC 61683, IEC 60068 as per specifications.
- iii. The inverter shall be designed for continuous, reliable power supply as per specifications. The inverter shall have high conversion efficiency from 25 percent load to the full rated load. The efficiency of the inverter shall be more than 90% at full load and more than 88% at partial load (50%-75%). The supplier shall specify the conversion efficiency in the offer.
- iv. The inverter shall be designed for extreme temperatures.
- v. The Inverter shall have internal protection arrangement against any sustained fault in the feeder.
- vi. The dimension, weight, foundation details etc. of the inverter shall be clearly indicated in the detailed technical specification.
- vii. Each solid-state electronic device shall have to be protected to ensure long life of the inverter as well as smooth functioning of the inverter.
- viii. Supplier shall indicate tripping voltage & start up voltage for the inverters & this should be perfectly matched with the recommendation of battery manufacturers.
- ix. 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

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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.

- x. For the Monitoring of Unit generated provision of Ah meters at input side shall be accomplished with Energy meter and voltmeters at suitable place and included in the technical specification clearly.
- xi. Provision for the Equalizing Charging of battery periodically shall be made and state clearly in the technical details.
- xii. The bidder shall furnish details of proper operation, maintenance and trouble shooting details to MEDA.
- xiii. The inverter will be highly efficient. The inverter should conform IEC 61683 / IEC 60068 and should be based on PWM technology and using IGBT. Inverters would display its own parameters and also the parameters of battery bank connected to the inverter. The inverter's capacity should be minimum 5 KVA for 3 KW SPV power plants. The inverters should be designed to be completely compatible with the charge controllers and distribution panels and are of integrated design.
- xiv. Salient features of the Inverters shall be as follows:

Nominal Capacity	01 KVA minimum (for 01 kWp capacity)
Input / Voltage	150 V DC Nominal (for both SPV Plants) The voltage variation shall be as per change in array output.
Regulation	From minimum to maximum voltage 1%
Output frequency	50 Hz +/- 0.5 Hz
Overload Capacity	200% for 30 Second.
Efficiency	80% at 50% of load and More than 92% at full load 0.8 PF
Short Circuit Protection	Circuit Breaker and Electronics protection against sustained fault.
Low Battery Voltage	Automatic Shut Down
Total Harmonic Distortion	Less than 3%
Over Voltage	Automatic Shut Down
AC over Current/Load	Automatic Shut Down
Protection	Over Voltage both at Input & Output Over Current both at Input & Output Over Frequency Surge voltage inducted at output due to external source.
Protection Degree	IP65
Instrumentation & Indication	Input & Output voltage, Input & Output Current, Frequency, Power output, different status of inverter, kind of fault by audio signal.



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### d. Junction Boxes

The junction boxes shall be dust, vermin and waterproof and made of FRP / Thermo Plastic. The terminals shall be connected to copper bus bar arrangement of proper sizes. The junction boxes shall have suitable cable entry points fitted with cable glands of appropriate sizes for both incoming and outgoing cables. Suitable markings shall be provided on the bus bar for easy identification and cable ferrules shall be fitted at the cable termination points for identification. Each main junction box shall be fitted with appropriate rating blocking diode. The junction boxes shall be of reputed make and should be as per IP 65 (for outdoor), IP 21 (for indoor) & as per IEC 62208.

The junction boxes shall have suitable arrangement for the Following:

Combine groups of modules into independent charging sub-arrays that shall be wired to the controller.

Provide arrangement for disconnection for each of the groups.

Provide a test point for each sub-group for quick fault location.

To provide group array isolation.

The rating of the JB's shall be suitable with adequate safety factor to inter connect the Solar PV array.

### e. Charge Controller Unit:

- The Charge Controller shall be dual input type; however the input is fed from a SPV panel only for battery charging. A selector switch shall be provided for choosing between those modes. The charge controller shall be preferably PWM type employing IGBT switching elements.
- Charge controller should conform IEC 62093 / IEC 60068 as per specification.
- The charging sequence from SPV array or external AC source shall be as follows:
- Salient features of the Charge Controller shall be as follows:
  - Switching elements IGBT
  - Type of Charger: PWM
  - Input :From PV 01 kWp 90V nominal DC from Solar PV array
  - Output Voltage: Suitable for charging 24 V/150Ah for 1 kWp SPV array.
  - Protections : Short Circuit, Deep Discharge, Input Surge Voltage, Over Current (load), Battery Reverse Polarity, Solar array reverse polarity.
  - Indication : String 'ON', Main 'ON', Charging 'ON', 80% Charged, 100% Charged, Charger Overload, Battery On Trickle.
  - Battery disconnected / Fault Battery Reverse Polarity, Low Solar Power, System Fault and Charger over Temperature and Input Over / Under Voltage (for AC).
  - MIMIC Diagram : To indicate power flow and operation of the charge controller/ battery charger; shall have provision for visual indications of existing power input/output through MIMIC diagram.
  - Bidder may design Power Conditioning Unit (PCU), which consists of a solar charge controller & inverter as per design mentioned above. In addition, it should have a Grid Charger.
  - It provides the facility to charge the battery bank through Solar only. The PCU continuously monitors the state of Battery Voltage, Solar Power output and the loads.

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Due to sustained usage of power, when the Battery Voltage falls below a preset level, the PCU will automatically transfer the load to the grid power.

### f. Cables & Wirings:

- a. All cables shall be supplied conforming to IEC 60227/ IS 694 & IEC 60502/ IS 1554. Voltage rating: 1,100V AC, 1,500V DC.
- b. For the DC cabling, Solar Cables, XLPE or XLPO insulated and sheathed, UV stabilised single core flexible copper cables shall be used. Multi-core cables shall not be used.
- c. For the AC cabling, PVC or XLPE insulated and PVC sheathed single or multi-core flexible copper cables shall be used. Outdoor AC cables shall have a UV-stabilised outer sheath.
- d. 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.
- e. Cables and wires used for the interconnection of solar PV modules shall be provided with solar PV connectors (MC4) and couplers.
- f. 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
- g. Cables and conduits that have to pass through walls or ceilings shall be taken through a PVC pipe sleeve.
- h. 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.
- i. All wiring in the control room shall be carried out with minimum four sq. mm. PVC insulated copper conductor in surface/recessed steel conduct in control room & solar hut. All wiring shall be done with an appropriate size Cu conductor as earth wire. All wirings whether it is indoors or outdoors are to be casing capping system. As and when required flexible pipe may be used.
- j. Buried underground cables shall be armoured. Unarmoured buried underground cables shall be enclosed with suitable conduits. Unless, otherwise, specified, all other interconnecting cables shall be armoured.

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- k. Conductor size of cables and wires shall be selected based on efficient design criteria such that the overall electrical energy loss in any section of cable or wire is shall be less than 2% under the designed operating conditions. Conductor size of less than 6 sq. mm shall not be accepted.
- l. Cable/wire connections shall be soldered, crimp-on type or split bolt type. Wire nut connections shall not be used.
- m. All cables shall be adequately supported. Outside of the terminals / panels / enclosures shall be protected by conduits. Cables shall be provided with dry type compression glands wherever they enter junction boxes/panels/enclosures.
- n. The wiring must be carried out in casing capping only.

### **g. Distribution System:**

- Single line diagram of the AC Distribution line shall be attached along with general point wiring diagram of sample room with the Technical details.
- Details of cable used for the distribution and transmission purpose along with their current carrying capacity and make shall be enclosed.
- Supply installation of Energy meter from reputed company. The energy meter shall be tested by State Electricity Board (SEB) and sealed by SEB. Testing certificate shall be submitted.

### **h. Earthing and lightning protection:**

- a. Earthing is essential for the protection of the equipment & manpower. Two main grounds used in the power equipments are:
  - System earth
  - Equipment earth
- b. System earth is earth which is used to ground one leg of the circuit. For example in AC circuits the Neutral is earthed while in DC supply +ve is earthed.
- c. In case of equipment earth all the non-current carrying metal parts are bonded together and connected to earth to prevent shock to the man power & also the protection of the equipment in case of any accidental contact.
- d. To prevent the damage due to lightning the one terminal of the lightning protection arrangement is also earthed. The provision for lightning & surge protection of the SPV power source is required to be made.
- e. In case the SPV Array can not be installed close to the equipment to be powered & a separate earth has been provided for SPV System, it shall be ensured that all the earths are bonded together to prevent the development of potential difference between any two earths.
- f. Earth resistance shall not be more than 1 ohm. It shall be ensured that all the earths are bonded together to make them at the same potential.
- g. The earthing conductor shall be rated for the maximum short circuit current. & shall be 1.56 times the short circuit current. The area of cross-section shall not be less than 1.6 sq mm in any case.

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- h. The array structure of the PV modules shall be grounded properly using adequate numbers of earthing pits. All metal casing/ shielding of the plant shall be thoroughly grounded to ensure safety of the power plant.
- i. The Earthing for array and distribution system & Power plant equipment shall be made with GI pipe, 4.5 m long 10 mm diameter including accessories and providing masonry enclosures with cast iron cover plate having locking arrangement, watering pipe using charcoal or coke and salt as required as per provisions of IS:3043. Necessary provision shall be made for bolted isolating joints of each Earthing pit for periodic checking of earth resistance.
- j. Each array structure of the SPV yard shall be grounded properly. The array structures and the lightning conductors are to be connected to earth through 25 mm X 5mm GI strip.
- k. The inverters and battery charger and all equipment inside the control room and battery room to be connected to earth through 25 mm X 5mm tinned copper strip including supplying of material and soldering. As earth bus is provided inside the control room with 25 mm X 5mm tinned copper strip.
- l. In compliance to Rule 61 of Indian Electricity Rules, 2004 (as amended up to date), all non-current carrying metal parts shall be earthed with two separate and distinct earth continuity conductors to an efficient earth electrode.
- m. Lightning: The SPV Power Plant shall be provided with lightning & over voltage 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.
- n. Metal oxide variastors shall be provided inside the Array Junction Boxes. In addition, suitable MOV's also shall be provided in the Inverter to protect the inverter from over voltage.

### **i. Lightning & Over Voltage Protection System:**

The SPV power plant should be provided with Lightning and over voltage protection. Connected with proper earth pits. The main aim of over voltage protection is to reduce the over voltage to a tolerable level before it reaches the PV or other sub-system components. The source of over voltage can be lightning or other atmospheric disturbance.

The lightning Conductors shall be made of 25 mm diameter 1000 mm long GI spike as per provisions of IS 3070. Necessary concrete foundation for holding the lightning conductor in position to be made after giving due consideration to maximum wind speed and maintenance requirement at site in future. The lightning conductor shall be earthed through 20 mm X 3 mm thick GI flat earth pits/earth bus made with 25 mm X 5 mm GI flats.

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### **5. MAIN FEATURES & OPERATING MODE**

PCU should give preference to the solar power as the first input to load and extra energy produced by solar is used to charge the battery bank. The second preference is given to the battery. In the absence of both solar and battery the power from grid will be fed to the load.

The PCU always gives preference to the solar power and will use Grid power only when the solar power / battery charger is insufficient to meet the load requirement.

### **6. MODULE MOUNTING STRUCTURE**

Hot dip galvanized iron mounting structures may be used for mounting the modules / panels / arrays. These mounting structures must be suitable to mount the SPV modules / panels / arrays on the roof top, on the ground or on the poles / masts, at an angle of tilt with the horizontal in accordance with the latitude of the place of installation.

The Mounting structure shall be so designed to withstand the speed for the wind zone of the location where a PV system is proposed to be installed (wind speed of 150 km/ hour). It may be ensured that the design has been certified by a recognized Lab/ Institution in this regard.

The mounting structure steel shall be as per latest IS 2062: 1992 and galvanization of the mounting structure shall be in compliance of latest IS 4759 with thickness of 80 microns as per IS 5905. All fasteners shall be of Stainless steel - SS 304.

The foundation for Module Mounting structures shall be 1:2:4 PCC Construction. There shall be minimum necessary clearance between ground level and bottom edge of SPV modules.

### **7. ORIENTATION AND TILT OF PV MODULE**

Modules alignment should be due south and tilt angle shall be 12 - 16 degrees with horizontal.

### **8. DC DISTRIBUTION BOARD (DCDB)**

A DCDB shall be provided in between PCU and Solar Array. It shall have MCCB of suitable rating for connection and disconnection of array section. It shall have meters for measuring Array voltage and Array current.

### **9. AC DISTRIBUTION LINE**

The generated electricity from these Power Plants will be utilized for illumination of Streets / Indoor Lighting, Fans, Computers, Internet modem, Printer within allowable practice limit. Necessary electric cable / connection shall be supplied / made by the bidder for illumination of existing streetlights / indoor lights.

### **10. OPERATION MANUAL**

An Operation, Instruction and Maintenance Manual, in English and the local language, should be provided with the Solar PV Power Plant and detail of Wiring and Connection Diagrams will also be provided with the manual.

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### 11. COMPREHENSIVE MAINTENANCE CONTRACT (CMC)

- The complete Solar PV Power Plant must be guaranteed against any manufacturing/ design/ installation defects for a minimum period of 5 years.
- PV modules used in Solar PV Power Plant must be guaranteed for their output peak watt capacity, which should not be less than 90% at the end of 12 years and 80% at the end of 25 years.

### 12. DISPLAY BOARD :-

Providing and fixing board displaying information, such as 'Name of work, Tender cost, Name of Contractor, Work completion and liability period etc', having rectangular shape of 1.20mx0.90m size made out 18gauge(1.25mm) thick mild steel sheet painted with one coat of Zinc chromate stoving primer and two coats of enamel paint on front side and grey stove enamel on back side and border/messages/symbols etc. with approved colour shade paint complete, on M.S.angle of size35x35x3mm frame with properly cross braced M.S. angles ofsize35mmx35mmx3mm duly painted including Two M.S. angle iron posts of size 65mmx65 mmx 6mm, 3.65m long painted with alternate black and white bands of 25 cm width including all fixtures etc. and fixing the boards in 1:4:8 concrete block of size 60 cm x 60 cm x 75cm including, excavation, refilling, transportation, and labor etc complete.

### 13. TEST REPORTS

Test certificates from MNRE approved test centres only will be considered valid.

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