

REGD.

From

RATE CONTRACT

The Director General, Supplies & Disposals, Haryana,  
S.C.O. No. 09 (1<sup>st</sup> & 2<sup>nd</sup> Floors), Sector-16, Panchkula.  
Tel. Nos. 0172-2570121-124.

Fax No. 0172-2570121, E-mail: [supplies@hry.nic.in](mailto:supplies@hry.nic.in)

To

1. M/s Inixy Power Solution Pvt. Ltd.  
Milton Road, Opp. Atlas Mandir Sonipat-131001  
Email:- [inixygroup@gmail.com](mailto:inixygroup@gmail.com)
2. M/s Himalayan Solar Pvt. Ltd.  
Plot No. 237 HSIIDC Industrial Estate,  
Alipur Barwala, Panchkula-134118  
Email:- [clientmanagr@himalayansolar.co.in](mailto:clientmanagr@himalayansolar.co.in)

Memo No :- 33/HR/RC/G-2/2022-23/

Dated Panchkula the:-

Sub:-

Annual Rate Contract for Supply, installation and commissioning of Grid Connected Rooftop Solar Power Plants with battery bank (Category of B-1 to B-7) (Capacity of GCRT:- 1, KWp, 2 KWp, 3 KWp, 4 KWp, 5 KWp, 7.5 KWp, 10 KWp) (with Net Metering Facility) including comprehensive maintenance for a period of 5 years including supply of solar generation & bi-directional meter required by the New & Renewable Energy Department, Haryana & HAREDA (Sr. No. 12).

Dear Sir,

With reference to your Tender No. & dated and this office acceptance letter No. & Dated and your letter No. and Dated given in Schedule "A", on the subject noted above, I have to inform you that your offer has been accepted for the supply of stores to the terms & conditions given in the Schedule "A" and "B".

2. I enclose herewith an agreement form in duplicate and request that the agreement may be executed on a non-judicial stamp paper of Rs.15/- signed and returned to this office within 10 days from the date of issue of this letter. One copy of the agreement will be sent to you duly executed on behalf of Governor of Haryana for your record. You may kindly send power of attorney in favour of the person/persons who is/ are authorized to signed the agreement together with/their specimen signature duly attested by a Magistrate or Oath Commissioner or Resolution of the firm authorizing the persons to sign the documents on behalf of the firm.

3. The Contract shall come into force from the date of its issue and shall remain operative upto i.e. 20-11-2024. Government reserves the right to bring any other party on the rate contract at any subsequent stage during the pendency of this rate contract.

4. The store must confirms to the approved specification as given in Schedule "A" attached, failing which the same shall be rejected at your risk and cost.

5. The inspection of the material will be carried out by the Indenting Officers or their authorized representatives at your premises before dispatch.



6. The supply must be completed within the stipulated delivery period failing which the risk purchase will be affected against you and the excess cost thus incurred will be recovered from you. Delayed supplies shall be accepted under penalty clause of the Schedule "B" unless the delivery period is extended by the competent authority.

7. The Director, Supplies & Disposals, Haryana reserves to himself the right to obtain contracted items of stores when available from any Govt. Deptt./ approved source without prejudice to this contract.

8. Failure to execute agreement/effect supplies within the stipulated period, repeatedly offering supplies liable to rejection or without prior inspection may render your earnest money/security liable to forfeiture, debarring your firm in addition to other remedies as available under the terms of the contracts.

9. All cases, where payments are not made within time, should be referred to this office for taking necessary action against the defaulters.

10. Your attention is particularly invited to the provision of Schedule "B" regarding the compliance with requisitions, preparation and submission of bills and quarterly submission of statement of supplies.

11. **PRICE FALL CLAUSE:-** The price charged for the stores shall not exceed in any way the lowest price at which you quote/ supply the stores of identical description of stores to GeM/State Govt./Central Govt./Institutions/undertaking/ any other person during the delivery period/ currency period of the rate contracts. If at any time during the delivery/ currency period, you reduce the rate, sale price of quoted stores to any person at the price lower than the price chargeable under this supply order/ contract, you are required to inform this office and price payable under the supply order/contract for the stores supplied after the date of coming into force of such reduction of rates shall stand correspondingly reduced to that level. You shall promptly notify the reduction of rates to this office as well as to concerned Indenting Officers/ consignees. You shall also give a certificate on your bills that the rates charged by you are not in any way higher to these quoted to the GeM and other state gov. central gov. Institutions etc. during the corresponding period. The Indenting Officer shall be required to ensure that requisite certificate is given by the concerned firm on the bills before releasing their payments.

12. All disputes will be settled only within the jurisdiction of Head Quarters of the Directorate of Supplies & Disposals, Haryana, Panchkula.

Please acknowledge the receipt of this letter.

Yours faithfully,



Deputy Director, Supplies & Disposals,  
For & On behalf of Governor of Haryana

Endst. No- 33/HR/RC/G-2/2022-23/

Dated:-

A copy of Schedule 'A' showing the prices accepted along with conditions of supply is forwarded to the Director General, New & Renewable Energy Department Haryana & HAREDA, Sector-17, Panchukula for information and necessary action.


1. He may indent for the requirement of the goods included in the Schedule "A" attached direct on the approved contractors under intimation to this office.



2. The security deposited by the firms would be released after two months of the termination of the contract and he is therefore, requested to send the complaints, if any, against the contractors to this office within this limit for settlement, failing which no complaint or claim will be entertained.

3. The Inspection shall be arranged by the Indenting Officer/Consignees or their authorized representatives at destination before releasing the payment of the supplies. The stores should be accepted only after satisfactory inspection and issue of proper inspection note showing the acceptance of the material as per approved specifications.

4. Please report all cases in which contractor fails to effect supply within the delivery period stipulated in the Schedule "A" after the expiry of stipulated delivery period to this office for effecting purchase at the risk and cost of the contractors failing which all responsibility will rest with Indenting Officers/Consignees for not effecting risk purchase within prescribed period.

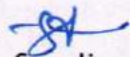
  
Deputy Director, Supplies & Disposals,  
For Director General, Supplies & Disposals, Haryana  
Dated :-

Endst. No- 33/HR/RC/G-2/2022-23/

A copy is forwarded to the following for information & necessary action:-

1. The Deputy Excise & Taxation Commissioner, Sonipat.
2. The Deputy Excise & Taxation Commissioner, Panchkula.

They are requested to ensure that the GST is paid by the firm to government against this rate contract.

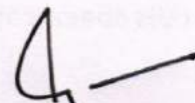
  
Deputy Director, Supplies & Disposals,  
For Director General, Supplies & Disposals, Haryana

Endst. No- 33/HR/RC/G-2/2022-23/ 17898

Dated :- 21-11-2023

A copy is forwarded to the following for information and action:-

1. The Accountant General (Audit), Haryana, Sector-33, Chandigarh.
2. The Controller of Stores, Punjab, Chandigarh.
3. The Controller of Stores, Himachal Pradesh Nigam Vihar, Shimla.
4. The Controller of Stores/Director of Industries and Commerce, J&K, Shrinagar.
5. St. Section O/o DGS&D, Haryana.
6. Programmer O/o DGS&D, Haryana.
7. Departmental Processing Charges branch o/o DGS&D, Haryana

  
Deputy Director, Supplies & Disposals,  
For Director General, Supplies & Disposals, Haryana



## SCHEDULE - "A"

Accepted rates of M/s M/s Inixy Power Solution Pvt. Ltd. Milton Road, Opp. Atlas Mandir Sonipat-131001, MB. NO. 9215092999, Email:- [inixygroup@gmail.com](mailto:inixygroup@gmail.com), offer No. Nil dated 02.09.2022 and your letter dated 13.09.2023, this office acceptance letter No. 17158 dated 18.10.2023 & your letter No. IPS/23/0944 dated 06.11.2023.

Rates quoted in Rs. Per Wp, excluding GST, FOR & Payment and other terms & conditions as per NIT.		
Sr. No.	Name of Items	Negotiated rates received in the HPPC meeting (In Rs.)
1.	Capacity of Grid Connected Rooftop Hybrid Solar Power Plants with Battery Bank):- 01 kWp, Rating of LifePO4 Battery Bank 25.6V (Nominal)/100AH. (Qty. 10 Nos.)	125.96
2	Capacity of Grid Connected Rooftop Hybrid Solar Power Plants with Battery Bank) 02 kWp, Rating of LifePO4 Battery Bank:- 25.6V (Nominal)/150AH (Qty. 100 Nos.)	94.99
3	Capacity of Grid Connected Rooftop Hybrid Solar Power Plants with Battery Bank) :- 03 kWp, Rating of LifePO4 Battery Bank:- 25.6V (Nominal)/200AH. (Qty. 93 Nos.)	87.22
4	Capacity of Grid Connected Rooftop Hybrid Solar Power Plants with Battery Bank):- 04 kWp, Rating of LifePO4 Battery Bank:- 48V (Nominal)/150AH. (Qty. 45 Nos.)	86.24
5	Capacity of Grid Connected Rooftop Hybrid Solar Power Plants with Battery Bank):- 05 kWp, Rating of LifePO4 Battery Bank:- 96V (Nominal)/100AH. (Qty. 40.2 Nos.)	85.26
6	Capacity of Grid Connected Rooftop Hybrid Solar Power Plants with Battery Bank):- 7.5 kWp. Rating of LifePO4 Battery Bank:- 96V (Nominal)/150AH. (Qty. 18 Nos.)	84.28
7	Capacity of Grid Connected Rooftop Hybrid Solar Power Plants with Battery Bank) :- 10 kWp, Rating of LifePO4 Battery Bank:- 96V (Nominal)/200AH. (Qty. 9 Nos.)	79.38

\*Capacity may be interchanged between B-1 to B-7.

(Details specifications as per DNIT & sample submitted by you and approved by the Technical Committee)

### DETAILED TECHNICAL SPECIFICATIONS

(Grid Connected Solar Rooftop Photo Voltaic (SPV) power plant-with bank)

The projects shall be installed and commissioned as per the technical specifications given below.

#### 1. DEFINITION

A Grid Connected Solar Rooftop Photo Voltaic (SPV) power plant consists of SPV array, Module Mounting Structure, Inverter (string or micro)/Power Conditioning Unit (PCU) consisting of Maximum Power Point Tracker (MPPT), and Controls & Protections, interconnect cables and switches. PV Array is mounted on a suitable structure. Grid



connected SPV power plant may be with or without battery and 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, inverters/PCUs, battery 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 equipments/components.
- Solar PV modules consisting of required number of Crystalline PV cells.
- Grid interactive Inverter /Micro Inverter/ Power Conditioning Unit with Remote Monitoring System
- LiFePO<sub>4</sub> Battery bank (for Hybrid System)
- Mounting structures
- Junction Boxes.
- Earthing and lightening protections.
- IR/UV protected PVC Cables, pipes and accessories

2. **SOLAR PHOTOVOLTAIC MODULES:**

- i. Domestically manufactured PV Module with domestically manufactured solar PV cells should be used.
- ii. The PV modules should be made up of crystalline silicon solar cells and must have BIS certificate for IS 14286 & IS 61730 (Part-I, Part II).
- iii. The efficiency of the PV modules should be minimum 16% and fill factor should be more than 70%.
- iv. PV modules must meet the latest specification of MNRE and the models and Manufacturers of PV Modules shall be included in the List of Models and Manufacturers for Solar PV Modules empenelled by MNRE as per its ALMM order (and also valid at the time of supply of meteral) from time to time. The PV modules used must qualify to the latest BIS standards Crystalline Silicon Solar Cell Modules. In addition, the modules must conform to IS 61730 Part-1 - requirements for construction & Part 2 - requirements for testing, for safety qualification or equivalent IS. The Potential Induced Degradation (PID) test for solar modules will be mandatory as per MNRE condtions.
- v. Module shall consists of Solar Cell of minimum 5 Bus Bar technology.
- vi. The total solar PV array capacity should not be less than capacity (kWp) of solar power plant and should comprise of solar crystalline modules of minimum 300 Wp (with 72 cells) and above wattage for the project above 5 kWp and of minimum 250 Wp (with 60 cells) and above wattage for the project upto 5kWp. Module capacity less than minimum of these wattage shall not be accepted.
- vii. Protective devices against surges at the DC side shall be provided. Low voltage drop bypass diodes shall be provided.
- viii. The module frame shall be made of corrosion resistant materials, preferably having anodized aluminum.
- ix. The bidder shall carefully design & accommodate requisite numbers of the modules to achieve the rated power in his bid.
- x. Other general requirement for the PV modules and subsystems shall be the Following:
  - a. The rated output power of any supplied module shall have tolerance of plus 3% or above.
  - b. 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.
  - c. The module shall be provided with a junction box with weather proof lid of sealed type and IP-65 rated.
  - d. I-V curves at STC shall be provided with the module.



- xi. The module should have the following minimum information laminated inside the module.
- Made in India (to be subscribed in words )
  - Company name /logo
  - Model number
  - Serial number
  - Year of make

3. **Warranties:**

a. **Material Warranty:**

- i. Material Warranty is defined as: The manufacturer should warrant the Solar Module(s) to be free from the defects and/or failures for a period of twenty five (25) years from the date of commissioning of the system
- ii. Defects and/or failures due to manufacturing (it should indicate the voltage and rated wattage of the module)
- iii. Defects and/or failures due to quality of materials
- iv. Non conformity to specifications due to faulty manufacturing and/or inspection processes. If the solar Module(s) fails to conform to this warranty, the manufacturer will repair or replace the solar module(s), at the owners sole option.

b. **Performance Warranty:**

- i. The predicted electrical degradation of power generated not exceeding 20% of the minimum rated power over the 25 year period and not more than 10% after ten years period of the full rated original output.

4. **ARRAY STRUCTURE (MODULE MOUNTING STRUCTURE):**

Module mounting structure (MMS) should be of Hot Dipped Galvanised Iron (HDGI), of prescribed Specifications given below, for mounting of SPV modules at site. The panel frame structure should be capable of withstanding a minimum wind speed load of 150 KM per hour, after grouting and installation. MMS should be sturdy & designed to assist SPV Modules to render maximum output. The hardware (fasteners) used for installation of SPV Modules & MMS should be of suitable Stainless Steel (SS 304). Each MMS should be with minimum four legs grouted on pedestals of minimum 300X300X250 mm with anchoring/ chipping & chemical sealing of foundation based on RCC roof. Foundation bolts of stainless /GI steel should be at least 300 mm long.

Its size should be with reference to the specifications of the selected make SPV modules. Anti Theft Nut Bolts of SS (with washers) should be used for mounting modules for better theft proofing.

1. **Hot Dipped Galvanised Iron (HDGI) structure should meet the following minimum specifications:**

Rafter	: 60mmX60mmX3.2mm or 60mmX45mmX15mmX2.6mm
Purlin	: 90mmX45mmX15mmX2.6mm
Vertical Post	: 60mmX60mmX3.2mm or 60mmX45mmX15mmX2.6mm
Base Plate	: 200mmX200mmX8mm
Top Plate	: 176mmX176mmX8mm

2. **Foundation:**

The CC foundation shall have to be designed on the basis of the weight of the structure with module and minimum wind speed of the site, i.e. 150 Km/hour.



Normally, each MMS should be with minimum four legs grouted on pedestals of proper size. However, for sheds CC work will not be required. The structure shall be grouted with fasteners with chemical sealing to withstand the required wind velocity. Angle of inclination shall be between 15° to 30°, however angle of inclination may be changed as per site requirement.

- CC Pillar size shall be: 300mmX300mmX250mm
- For Pillars: Cement: Concrete: Sand Ratio :: 1:2:3
- Screws shall be Grouted in the Slab of roof up to depth of 50 mm, if cemented slab is there.
- Lengths of rafter/Purlin may be changed as per site requirement.

Sufficient numbers of vertical post shall be provided so that the structure may not bent. However, if the system to be installed on the rooftop having tin/ asbestos sheet shed, foundation is not possible, then may be installed in such a way to withstand the prescribed wind velocity.

**5. Specifications For Inverter/Micro Inverter/Power Conditioning Unit (PCU):**

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 "Inverter". In addition, the inverter shall also house MPPT (Maximum Power Point Tracker), an interface between Solar PV array & the Inverter, to the power conditioning unit/inverter should also be DG set interactive, if necessary. Inverter output should be compatible with the grid frequency. Typical technical features of the inverter shall be as follows:

Specifications of Inverter	
Parameters	Detailed Specifications
Switching devices	IGBT
Capacity	The Rated Capacity of the Inverter shall not be less than the solar PV array capacity.
Control	Microprocessor /DSP
Nominal Voltage	230V/415V as the case may be
Voltage range	Single Phase: Shall work from 180 Volts to 270 Volts; Three Phase: Shall work from 180 Volts to 270 Volts per phase
Operating frequency/ range	50 Hz(47to52 Hz)
Grid Frequency Synchronization range	± 3 Hz or more (shall also compatible for Synchronization with DG Set)
Waveform	SineWave
Harmonics	AC side total harmonic current distortion < 5%
Ripple	DCvoltage ripple content shall not be more than1%.



Efficiency	<p>The inverters should be tested as per IEC standards/ as per latest MNRE Specification. The following criteria should be followed :</p> <p>The benchmarking efficiency criteria for the Grid tied (central/string/micro) inverter  At nominal voltage and full load is &gt;95%  For load &gt;25% is &gt;92%.</p> <p>The benchmarking efficiency criteria for Grid Tied PCU of capacity &lt; 5KW: &gt;85% and for capacity ≥ 5KW: ≥90%.</p> <p>No load losses should not be more than 5%.</p>
Losses	<p>Maximum losses in sleep mode: 2W per 5kW  Maximum losses in stand-by mode:10W</p>
Casing protection levels	Degree of protection: Minimum IP-21 and 22 for indoor use and IP-65 certification for outdoor use.
Temperature	Should with stand from-10 to +50 deg. Celsius
Humidity	Should with stand upto 95% (relative humidity)
Operation	Completely automatic including wake up, synchronization (phase-locking)andshutdown
MPPT	Maximum power point tracker shall be integrated in the inverter to maximize energy drawn from the array. MPPT range must be suitable to individual array voltages in power packs.
Protections	<p>Mains Under / Over Voltage</p> <p>Overcurrent</p> <p>Over/Under grid frequency</p> <p>Over temperature</p> <p>Short circuit</p> <p>Lightening</p> <p>Surge voltage induced at output due to external source</p> <p>Anti Islanding (for grid synch. mode)</p> <p>Battery Under Voltage and Over Voltage</p>
System Monitoring Parameters	<p>Inverter/PCU voltage &amp; current</p> <p>Mains Voltage, Current &amp; Frequency</p> <p>PV Voltage, Amps &amp; KWH</p> <p>System Mimic &amp; Faults</p>
Recommended LCD Displayon Front Panel	<p>Accurate displays on the front panel:</p> <p>DC input voltage</p> <p>DC current</p> <p>AC Voltage ( all 3 phases, in case of 3 phase)</p> <p>AC current ( all 3 phases in case of 3 phase)</p> <p>Ambient temperature</p>



	Instantaneous & cumulative output power
	Daily DC energy produced
	Battery Voltage (in case of Hybrid PCU)
Communication interface	RS 485 / RS 232 PCU shall also house MPPT (Maximum Power Point Tracker), an interface between Solar PV array to the power conditioning unit/inverter should also be DG set interactive.
Power Factor	> 0.9
THD	<3%
Test Certificates	The inverters should be tested from the MNRE approved test centres / NABL / BIS / IEC accredited/authorised testing- calibration laboratories. In case of imported power conditioning units, these should be approved by international test houses.

- a. The total capacity of the Inverters/Micro Inverters/PCU shall not be less than the capacity of the Solar Power Plant.
  - b. Inverter/Micro Inverter/PCU shall be capable of complete automatic operation including wake-up, synchronization & shutdown.
  - c. The output of power factor of inverter/ Micro Inverter/PCU is suitable for all voltage ranges or sink of reactive power, inverter should have internal protection arrangement against any sustainable fault in feeder line and against the lightning on feeder.
  - d. Built-in meter and data logger to monitor plant performance through external computer shall be provided (Providing Computer is not part of DNIT & is in the scope of user).
  - e. **Anti-islanding (Protection against Islanding of grid):** The inverter/Micro Inverter/PCU shall have anti islanding protection in conformity to IEEE 1547/UL 1741/ IEC 62116/IS16169 or equivalent BIS standard.
  - f. In Inverter/ Micro Inverter/PCU, there shall be a direct current isolation provided at the output by means of a suitable isolating transformer.
  - g. The 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.
  - h. The inverter should comply with applicable IEC/ equivalent BIS standard for efficiency measurements and environmental tests as per standard codes IS/IEC 61683 and IEC 60068-2 (1,2,14,30)/ Equivalent BIS Std./EN50530,IEC 61727 (all clauses except clause 5.2.2). in case of clause 5.2.2, it should withstand the over/under frequency in the range 47 to 52 Hz.
  - i. 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.
6. **BATTERY BANK (in case of Hybrid system)**  
The battery bank should be Lithium Ferro Phosphate (LiFePO<sub>4</sub>) having given capacity. The other feature of battery should be:-

S.No.	Description	Specification
1.	Battery Type	LiFePO <sub>4</sub>



2.	Working temperature range (both for charging & discharging)	20-60 Deg. C
3.	Minimum capacity of individual Cells	3.2V (Nominal), 20Ah, with 3C cell rating
4.	Type of Cell	Prismatic

Battery should have a certificate of testing as per tender requirement from any MNRE/BIS/NABL/IEC approved laboratory.

The Lithium Ferro Phosphate battery bank needs a very good "Battery Management System (BMS)" to ensure the proper charging and discharging of each cell of battery with proper protection of battery when temperature is reaching beyond battery permissible limits.

**7. INTEGRATION OF PV POWER WITH GRID:**

- i. The output power from SPV would be fed to the inverters/PCU 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. 4 pole isolation of inverter output with respect to the grid connection need to be provided. Solar Generation Meter(s) and bidirectional energy meter, as per HERC Net Metering Regulations should also be installed in the campus/building of beneficiary.
- ii. The solar generation meter and Bi-directional meter along with CT/PT (if required) with Surge Protection Device (SPD) of 0.2S accuracy class is in the scope of bidder. For LT connection the accuracy shall be as per requirement of DISCOMS
- iii. CEA guideline 2013 for interconnecting solar power with Grid shall be followed.
- iv. Certification of Islanding protection in the inverter from the manufacturer of the equipment shall be mandatory. This shall be arranged by the supplier from the manufacturer.
- v. Technical Standards for Interconnection:

S.No.	Parameters	Requirements	Reference
1.	Overall Conditions of Service	Reference to regulations	Conditions for Supply of Electricity of Distribution Licensees
2.	Overall Grid Standards	Reference to regulations	Central Electricity Authority (Grid Standards) Regulations 2010
3.	Equipment	Applicable industry standards	IEC standards/IS
4.	Safety and Supply	Reference to regulations, Chapter III (General Safety Requirements)	Central Electricity Authority (Measures of Safety and Electricity Supply) Regulations, 2010 and subsequent amendments
5.	Meters	Reference to regulations and additional conditions issued by the Commission.	Central Electricity Authority (Installation & Operation of Meters) regulations 2006 and subsequent amendments
6.	Harmonic	Harmonic current injections	IEEE 519 relevant CEA



	Current	from a generating station shall not exceed the limits specified in IEEE 519	(Technical Standards for Connectivity of the distributed generation resource) regulations 2013 and subsequent amendments
7.	Synchronization	Photovoltaic system must be equipped with a grid frequency synchronization device, if the system is using synchronizer inherently built into the inverter than no separate synchronizer is required.	Relevant CEA (Technical Standards for Connectivity of the distributed generation resources) regulations 2013 and subsequent amendments.
8.	Voltage	The voltage-operating window should minimize nuisance tripping and should be under operating range of 80% to 110% of the nominal connected voltage. beyond a clearing time of 2 seconds, the Photovoltaic system must isolate itself from the grid.	
9.	Flicker	Operation of Photovoltaic system shouldn't cause voltage flicker in excess of the limits stated in IEC 61000 or other equivalent Indian standards, if any	
10.	Frequency	When the Distribution system frequency deviates outside the specified conditions (52 Hz on upper side and 47 Hz on lower side up to 0.2 sec), the Photovoltaic system shouldn't energize the grid and should shift to island mode.	
11.	DC Injection	Photovoltaic system should not inject DC power more than 0.5% of full rated output at the interconnection point. or 1% of rated inverter output current into distribution system under any operating conditions	
12.	PowerFactor	While the output of the inverter is greater than 50%, a lagging power factor of greater than 0.9 shall be maintained	
13.	Islanding and	The Photovoltaic system	



	Disconnection	in the event of voltage or frequency variations must island/ disconnect itself within IEC standard on stipulated period	
14.	Overload and Overheat	The inverter should have the facility to automatically switch off in case of overload or overheating and should restart when normal conditions are restored	
15	Cable	For interconnecting Modules, Connecting modules and junction Boxes and junction boxes to inverter, DC copper cable of proper sizes shall be used. To connect inverter with AC panel aluminium cable of proper size shall be used. All the internal cables to be used in the systems shall be included in the cost while 100 mtr. AC aluminium cable of proper size to be used to connect inverter/Micro Inverter/PCU to AC panel shall be included in the cost of the system. If Micro Inverter are used then there is no requirement of DC Cables.	Relevant CEA regulations 2013 and subsequent if any, (Technical Standards for Connectivity of the distributed generation resource)

- a. All switches and the circuit breakers, connectors should conform to IEC 60947, part I, II and III/ IS60947 part I, II and III.
- b. The change-over switches, cabling work should be undertaken by the bidder as part of the project.

**8. JUNCTION BOXES FOR CABLES FROM SOLAR ARRAY:**

The junction boxes shall be made up of FRP (Hensel or equivalent make)/PP/ABS with dust, water and vermin proof. It should be provided with proper locking arrangements.

Series / Array Junction Box (SJB/AJB) (whichever is required): All the arrays of the modules shall be connected to DCCB. AJB shall have terminals of bus-bar arrangement of appropriate size Junction boxes shall have suitable cable entry with suitable glanding arrangement for both input and output cables. Suitable markings on the bus bars shall have to be provided to identify the bus bars etc. Suitable ferrules shall also have to be provided to identify interconnections. Every AJB should have suitable arrangement Reverse Blocking diode of suitable rating. Suitable SPD, suitable Isolation switches to isolate the DC input to Inverter has to be installed in AJB for protection purpose. Thus AJB should have DC isolator for disconnecting the arrays from inverter



input. If in any case diodes, HRC Fuses, SPDs and isolators are installed in the string inverters, then there is need to install these again in AJB. If some of these safety gadgets are not installed in String Inverter it should be installed in AJB. Cable interconnection arrangement shall be within conduit pipe on saddles installed properly. Cable connection should be done in such a manner that fault findings if any, can be identified easily. The cables should be connected in such a manner that clamp meter can be comfortably inserted around the individual cables to measure the data like current, voltage etc. AJB should also be marked as A1, A2, & so on. Wherever conduits are laid on wall/roof or ground, then it should be suitably laid in cable tray or appropriate civil structure which should be at least four inches above roof/ground level.

However, if the inverter/PCU is equipped with inbuilt Junction Box, the cables may be connected directly to the ports provided in the inverter/PCU and no separate Junction Box is required. If Micro Inverter is used, then DCDB and AJB will not be required.

9. **PROTECTION & SAFETY:**

Both AC & DC lines have suitable MCB/MCCB, Contractors, SPD, HRC Fuse etc to allow safe start up and shut down before & after string inverter installed in the system. String inverters should have protections for overload, surge current, high Temperature, over/under voltage and over/under frequency & reverse polarity. The complete operation process & safety instructions should printed on the sticker & suitably pasted on the near inverters.

Inverter should have safety measures to protect inverter from reverse short circuit current due to lightning or line faults of distribution network.

Central/String Inverter or PCU should be suitably placed in covered area on a suitable platform or wall mounted or concrete platform (on rubber mat) with complete safety measure as per norms. The micro inverter (if installed) should be installed near the SPV module and should have protection of water & dust and shall with stand at a temperature of 65 degree Centigrade.

10. **INVERTER/ARRAY SIZE RATIO:**

- The combined wattage of all inverters should not be less than rated capacity of power plant under STC in KW.
- Maximum power point tracker shall be integrated in the inverter to maximize energy drawn from the array

11. **AC COMBINER BOX BOARD (ACCB):**

This shall consist of box shall consists of grid interphase panel of good quality FRP/suitable powder coated metal casing. One Electronic Energy Meter (0.2S Class), ISI make, Single/Three Phase duly tested by DISCOMs (Meter testing Division) with appropriate CT (if required), of good quality shall have to be installed at suitable placed to measure the power generated from SPV Power Plant, as per HERC Net Metering Regulations. Proper rating MCCB & HRC fuse and AC SPDs shall be installed to protect feeders from the short circuit current and surges as per the requirement of the site. Operation AC Isolator Switch of Grid Connectivity should be such that it can be switched ON or OFF without opening the ACCB.

12. **CABLES/WIRE:**



All cables should be of copper as per IS and should be of 650V/1.1 KV grade as per requirement. All connections should be properly made through suitable lug/terminal crimped with use of suitable proper cable glands. The size of cables/wires should be designed considering the line losses, maximum load on line, keeping voltage drop within permissible limit and other related factors. The cable/wire should be of ISI/ISO mark for overhead distribution. For normal configuration the minimum suggested sizes of cables are:

Module to module/AJB	4 sq mm (single core) DC Cable (not required if Micro Inverter are used)
AJBs to MJB/ DCCB/ Inverter/ PCU	<ul style="list-style-type: none"> <li>• Up to capacity of 10 kWp Solar Plant, minimum 4sq mm (Single/Double core) DC Cable, with respect to current ratings of designing</li> <li>• For capacity more than 10 kWp &amp; up to 20 kWp Solar Plant, minimum 6sq mm (Single/Double core) DC Cable, with respect to current ratings of designing</li> <li>• For capacity more than 20 kWp Solar Plant, minimum 10sq mm (Single/Double core) DC Cable, with respect to current ratings of designing.</li> </ul>
Inverter to ACCB/ Distribution board	AC Cable as per design & rating

The size & rating of the cables may vary depending on the design & capacity of SPV Power Plant. However, DC cables are not required if micro inverters are used in the system.

**13. CABLE TRAY:**

All the cables should be laid in appropriate GI cable tray as per the requirement of the site, No cable should be laid directly on ground or wall cable tray should be laid such that there is gap of at least two inches above ground/roof/wall.

**14. DISPLAY BOARD:**

The bidder has to display a board at the project site mentioning the following:

- Plant Name, Capacity, Location, Type of Renewable Energy plant (solar), Date of commissioning, details of tie-up with transmission and distribution companies, Power generation and Export FY wise.
- Financial Assistance details from HAREDA/MNRE/Any other financial institution apart from loan. This information shall not be limited to project site but also be displayed at site offices/head quarter offices of the successful bidder
- The size and type of board and display shall be approved by Engineer-in-charge before site inspection.
- **DANGER BOARDS:** Danger boards should be provided as and where necessary as per IE Act. /IE rules as amended up to date.

**15. MANUAL DISCONNECTION SWITCH:**

It should be provided to isolate the system from Grid which should be outside of ACCB.

**16. AC DISTRIBUTION PANEL BOARD:**



- a. AC Distribution Panel Board (DPB) shall control the AC power from PCU/ inverter, and should have necessary surge arrestors. Interconnection from ACDB to mains at LT Bus bar while in grid tied mode.
- b. All switches and the circuit breakers, connectors should conform to IEC 60947, part I, II and III/ IS60947 part I, II and III.
- c. The changeover switches, cabling work should be undertaken by the bidder as part of the project.
- d. All the Panel's shall be metal clad, totally enclosed, rigid, floor mounted, air - insulated, cubical type suitable for operation on three phase / single phase, 415 or 230 volts, 50 Hz
- e. The panels shall be designed for minimum expected ambient temperature of 45 degree Celsius, 80 percent humidity and dusty weather.
- f. All indoor panels will have protection of IP54 or better. All outdoor panels will have protection of IP65 or better.
- g. Should conform to Indian Electricity Act and rules (till last amendment).
- h. All the 415 AC or 230 volts devices / equipment like bus support insulators, circuit breakers, SPDs, VTs etc., mounted inside the switchgear shall be suitable for continuous operation and satisfactory performance under the following supply conditions.

Variation in supply voltage	+/- 10 %
Variation in supply frequency	+/- 3 Hz

**17. DATA ACQUISITION SYSTEM / PLANT MONITORING (for 10 kWp and above).**

- i. For systems of capacity 10 kWp and above, web based remote monitoring access of which shall also be provided to HAREDA software monitoring system with latest configuration. If needed access to MNRE shall also be provided.
- ii. PV array energy production: Digital Energy Meters to log the actual value of AC/ DC voltage, Current & Energy generated by the PV system provided. Energy meter along with CT/PT should be of 0.2S accuracy class. For Hybrid there shall be provision in built in the PCU to measure generated solar energy as there is no option to install separate solar generation meter.
- iii. String and array DC Voltage, Current and Power, Inverter AC output voltage and current (All 3 phases and lines), AC power (Active, Reactive and Apparent), Power Factor and AC energy (All 3 phases and cumulative) and frequency shall be monitored.
- iv. All instantaneous data shall be shown on the computer screen.
- v. Software shall be provided for USB download and analysis of DC and AC parametric data for individual plant.
- vi. Provision for instantaneous Internet monitoring and download of historical data shall be also incorporated.

**18. PRIORITY FOR POWER CONSUMPTION:**

Regarding the generated power consumption, in case of string inverter, priority need to given for internal consumption first and thereafter any excess power can be exported to grid.

**19. PROTECTIONS**



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

i. **Lightning and Over Voltage Protection:**

The SPV Power Plant shall be provided with lightning and over voltage protection. The principal aim in this protection is to reduce the over voltage to a tolerable value before it reaches the PV or other sub-systems components. The source of over voltage can be lightning or any other atmospheric disturbance. The Lightning Arrestor (LA) is to be made of 1¼" diameter (minimum) and 12 feet long GI spike on the basis of the necessary meteorological data of the location of the projects. Necessary foundation for holding the LA is to be arranged keeping in view the wind speed of the site and flexibility in maintenance in future. Each LA shall have to be earthed through suitable size earth bus with earth pits. The earthing pit shall have to be made as per IS 3043. LA shall be installed to protect the array field, all machines and control panels installed in the control rooms. Number of LA shall vary with the capacity of SPV Power Plant & location. Number of LA should be in such a manner that total layout of solar modules should the effective coverage of LA's.

For systems up to 10 kWp the lightning arrester shall of conventional type and for above 10 kWp systems it should be of Early Streamer Emission (ESE) type.

ii. **Earthing Protection:**

Each array structure of the PV yard shall be grounded properly. In each array every module should be connected to each other with copper wires, lug teathed washers addition the lightning arrester/masts shall also be provided inside the array field. Provision shall be kept for shorting and grounding of the PV array at the time of maintenance work. All metal casing/shielding of the plant shall be thoroughly grounded in accordance with Indian Electricity Act/IE rules as amended up to date. The earthing pit shall be made as per IS: 3043. All the array structures and equipments/control systems shall be compulsorily connected to the earth, separately. Number of earthing shall vary with the capacity of SPV Power Plant & location. G.I. /Copper strips should be used for earthing instead of G.I. wires.

LA should be installed to protect the array field & machines installed in the control rooms. Number of LA shall vary with the capacity of SPV Power Plant & location. Earth resistance shall not be more than 5 ohms.

iii. **Surge Protection:**

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

iv. **Grid Islanding:**

- a. In the event of a power failure on the electric grid, it is required that any independent power-producing inverters attached to the grid turn off in a short period of time. This prevents the DC-to-AC inverters from continuing to feed power into small sections of the grid, known as "islands."

Powered islands present a risk to workers who may expect the area to be unpowered, and they may also damage grid-tied equipment. The RooftopPV system shall be equipped with islanding protection. In addition to disconnection from the grid (due to



islanding protection) disconnection due to under and over voltage conditions shall also be provided.

- b. A manual disconnect 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, if required, by the utility personnel

20. **CONNECTIVITY:**

The user have to take approval/NOC from the Concerned DISCOM for the connectivity, technical feasibility, and synchronization of SPV plant with distribution network and submit the same to HAREDA before commissioning of SPV plant, however the supplier have to extend all technical help to the user for preparing the documents required for getting the above clearance from DISCOMs.

Reverse power relay shall be provided by bidder (if necessary), as per the local DISCOM requirement.

The maximum capacity for interconnection with the grid at a specific voltage level shall be as specified in the Distribution Code/Supply Code and amended from time to time. Following criteria have been suggested for selection of voltage level in the distribution system for ready reference of the solar suppliers.

Plant Capacity	Connecting voltage
Up to 10 kWp	240V-single phase or 415V-three phase as per requirement of electric connection of the consumer
Above 10kWp and up to 50 kWp	415V - three phase

Utilities may have voltage levels other than above, DISCOMS may be consulted before finalization of the voltage level and system shall be designed accordingly.

21. **DRAWINGS & MANUALS:**

- i. One set of Engineering, electrical drawings and Installation and O&M manuals are to be supplied at the time of installation of system. Bidders shall provide complete technical data sheets for each equipment giving details of the specifications along with make/makes in their bid along with basic design of the power plant and power evacuation, synchronization along with protection equipment.
- ii. Approved ISI and reputed makes for equipment be used.

22. **SAFETY MEASURES:**

The bidder 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. All work shall be carried out in accordance with the latest edition of the Indian Electricity Act and rules formed there under and as amended from time to time.



**23. CODES AND STANDARDS**

The quality of equipment supplied shall be controlled to meet the guidelines for engineering design included in the standards and codes listed in the relevant ISI and other standards, such as :

- i. IEEE 928 Recommended Criteria for Terrestrial PV Power Systems.
- ii. IEEE 929 Recommended Practice for Utility Interface of Residential and Intermediate PV Systems.
- iii. IEEE 519 Guide for Harmonic Control and Reactive Compensation of Static Power Controllers.
- iv. National Electrical NEPA 70-(USA) or equivalent national standard.
- v. National Electrical Safety Code ANSI C2- (USA) or equivalent national standard.
- vi. JRC Specification 503 (Version 2.2 March 1991) or JPL Block V standard for PV modules.
- vii. The inverter manufacturer should attach efficiency certificate from Independent Third party Testing laboratory i.e. IEC, TUV, SNL/ERTL & STQC. PCU should confirm to IEC 61683 for efficiency measurements and IEC 60068 2 for environmental testing. MPPT unit should confirm to design qualification IEC 62093.
- viii. IEC 62116 for Anti Islanding
- ix. IEC 62109-1, IEC 62109-2 for safety
- x. IEC 61727 FOR UTILITY INTERF

**TERMS & CONDITIONS**

- 1- **F.O.R.:-** The above rates are F.O.R. destination anywhere in Haryana at supplier's risk.
- 2- **G.S.T. :-** excluding in above rates.
- 3- **Delivery period (includes supply, installation & commissioning)/ Time Schedule, Penalty/Liquidated Damages**
  - a. The time schedule for these systems shall be as under:

Capacity of Solar Power Plant 1	Time period for completing the work which includes inspection, supply, installation and commissioning 2	Date for the pre dispatch/at site inspection of material to be offered by the supplier # 3
1kWp -50 kWp (all Categories)	3 months from the date of work order	Atleast 07 days prior to last date of supply of the system

- i. Although the supplier shall give the date of inspection in the inspection offer which should reach in the office of indenting Department at least 07 days before the date of inspection proposed by the supplier. It shall be the sole responsibility of the supplier to complete the commissioning of systems in the defined time period. Time period is the essence of the contract. GCRT Solar Power plant will be taken as commissioned on the date of start of inverter and ready to synchronize, it will not depend the installation of solar generation meter/Bi-Directional meter by DISCOMs. However, submission of the solar generation meter (with CT, if required)/bi-directional meter along with CT/PT shall be submitted to the DISCOMs for testing and installation.
- ii. After receipt of call for inspection with date for the inspection, the material shall be inspected by the Director, New & Renewable Energy Department/HAREDA/indenting officer or a committee authorized for this purpose. Material shall be dispatched after acceptance of the same by the Inspection Committee, if inspected at premises of the firm; The same shall be installed and commissioned after acceptance by the Inspection Committee, if



inspected at site. However, the supplier may start civil work at any time even before the inspection of material.

- iii. If the proposal for pre-dispatch inspection is received within defined & valid time period in the office of Director, New & Renewable Energy Department/HAREDA/indenting office from the supplier and inspection is not carried out by the New & Renewable Energy Department due to any reasons within 07 days of receipt of such letter/offered date, the time period for supply, installation & commissioning will be extended equivalent to delayed period, from the next day of expiry of these 07 days till the date of actual inspection and no penalty will be imposed for this extended period.
- b. Before placing the work order it will have to ensure that site is clear and feasible in all respect for installation of system/ plant. However, it will be the sole responsibility of the supplier to be satisfied with the site through visit under intimation to PO/APO of the district within 30 days of placing of work order. Request, if any, received from the supplier for any extension on ground of issue of site clearance after above said period will be out rightly rejected.

#### 4. Warranty: -

- i. The Warranty period shall be five (5) years for complete system from the date of commissioning and handing over of the system (or as per latest MNRE, Gol guidelines).The contractor shall rectify defects developed in the system within Warranty period promptly.
- ii. The manufacturer should warrant the Solar Module(s) to be free from the defects and/or failures for a period of twenty five (25) years from the date of commissioning of the system
- iii. 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.

The procedure to rectify the complaint/service to be provided during warrantee period is as follows :

During the warrantee period, the firm shall ensure proper functioning of the systems and complaint, if any, forwarded to the supplier against the system, will have to be attended within 72 hours of forwarding such complaints. If any part is to be procured then the user is to be informed and the systems shall be rectified within 7 days. The procedure to rectify the complaints shall be as under:

- a. The notice through E-mail/hard copy to rectify the complaints shall be issued by the HQ/district officer/User to the supplier with copy to the New & Renewable Energy Department/HAREDA. This shall be followed by two reminders on 3 days intervals each. The district office shall maintain proper record of the complaints.
- b. In case of failure to do so, penalty @ 0.1 % of the system cost per day (subject to max. 10% of the cost) after expiry of 07 days shall be imposed. If the firm does not attend the complaint within the max penalty period then the system may be got repaired/ replaced from the performance security amount. In case whole performance security amount is utilized and complaint/s are still pending then an online / registered notice will be sent to the firm to attend the complaint and if failed to attend the complaint within 7 days then firm may be blacklisted and a legal proceedings may be initiated against the firm for breach the agreement. If maximum penalty has been imposed, then the firm shall deemed to be considered as unfit to participate in all the tenders floated by



New & Renewable Energy Department/HAREDA in future for a period to be decided by competent authority, effective from the date of communication to be conveyed by New & Renewable Energy Department/HAREDA in written and shall be treated as unsatisfactory performer.

- iv. DGS&D/New & Renewable Energy Department/HAREDA/the consignee will have the liberty to get the sample for the item(s) supplied tested from any of the Govt. approved lab. at any time during the installation or warranty period to ascertain the performance of the item(s) as per DNIT specifications. If during the lab test, sample fails then supplier has to repair/ replace the defective systems within 15 days of issue of such notice. If on the request of the supplier more than one samples are drawn for lab test and any one of them fail the lab test, bidder has to replace all the defective system at his own cost.
- v. The Contractor/supplier shall continue to provide spare parts for at least two years after the expiry of warranty period at the users cost. If the contractor fails to continue to supply spare parts and services to users then New & Renewable Energy Department/HAREDA/DGS&D shall take appropriate action against the firm which can be to ban the supplier for participating in future tenders.
- vi. Suryamitra: There is a Programme under MNRE to provide training to ITI Certificate and Diploma holders on operation and maintenance of SPV devices and systems and it is called "Suryamitra Skill Development Programme". The successful contractor(s) will preferably have to engage them in their service centers. They may be engaged by the contractor to provide necessary repairs and maintenance service including installation of the systems during the time of execution.

## 5. Terms and Condition for Payments

The payments shall be made by the indenting department/organisation as per the following terms and conditions:

- a. 70% after installation of the system supported with Joint Commissioning Report (Provisional) signed by Supplier, representative of user organization & P.O. of the concerned district along with bill & photographs of complete system.
- b. 19% payment on submission of Final Joint Commissioning Report (JCR), supported with project completion report, duly signed by the supplier, district PO. However, if the supplier submits the Solar Generation meter (with CT, if required) and Bi-Directional meter (with CT/PT, if required) and there is delay on the part of DISCOMs for installation of Net Meter beyond 15 Days of submission of the meters to DISCOMs or beyond 15 days of installation of system which ever is later, then this payment to the Supplier may be released within next 15 days on the basis of Provisional Joint Commissioning Report & PCR( Status of submission of meters etc. shall be mentioned, if NM is pending for installation at level of user/DISCOMs).
- c. 10% payment to be released @ 2% at the end of each year for 5 years, on submission of satisfactory performance report of the systems duly certified by the concerned district officer and user OR The said amount may be released against the submission of bank guarantee of equal amount valid for five years from commissioning of the plant.
- d. 01% payment after completion of 25 year subject to not having any complaint regarding performance of the solar modules as per performance warranty conditions of MNRE, Gol.
- e. Income Tax shall be deducted at source as per rules.

The Indenting Departments would have option to release payments in RTGS/ Electronics mode also.



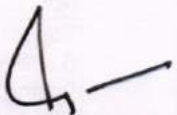
Delay in payments to the suppliers beyond the stipulated credit period indicated in the supply order, unless supported by cogent reasons and approved by a higher authority, will attract penal interest on the defaulting amount @ Rs.25/- per rupees one lakh per day of delay beyond the stipulated credit period. Non provision of adequate budget will be no ground for delay in payments to the supplier.

6. **INSPECTION:-** The inspection of the material will be carried out by the committee constituted by Indenting Department or their authorized representatives at the premises of the supplier before dispatch.

In case, the material offered for inspection by the firm fails to meet the specifications stipulated in NIT/Order/Contract and the samples are rejected by the Inspecting Committee, the Indenting Department will have the right to levy a penalty at 0.1% of the total order value. In case, the material offered for inspection fails during the 2<sup>nd</sup> inspection also, the Indenting Department will have the right to increase the penalty to 0.25% of the total order value. In case, the material offered fails during the 3<sup>rd</sup> and final inspection also, the firm will be liable for penal action including forfeiture of EMD, risk purchase, debarring/ blacklisting in future, and no further opportunity for inspection would be provided to the supplier firm.

(OTHER TERMS & CONDITIONS WILL BE AS PER DNIT AND SCHEDULE-B ATTACHED).

Encls.a/a

  
Deputy Director,  
Supplies & Disposals, Haryana,  
For & On behalf of Governor of Haryana.



## SCHEDULE - "A"

Accepted rates of M/s Himalayan Solar Pvt. Ltd. Plot No. 237 HSIIDC Industrial Estate, Alipur Barwala, Panchkula-134118, Email:- [clientmanagr@himalayansolar.co.in](mailto:clientmanagr@himalayansolar.co.in), offer No. Nil dated 02.09.2022 and your letter dated 13.09.2023, this office acceptance letter No. 17160 dated 18.10.2023 & your letter No. HMS/L-23/747 dated 10.11.2023.

Rates quoted in Rs. Per Wp, excluding GST, FOR & Payment and other terms & conditions as per NIT.		
Sr. No.	Name of Items	Negotiated rates received in the HPPC meeting (In Rs.)
1.	Capacity of Grid Connected Rooftop Hybrid Solar Power Plants with Battery Bank):- 01 kWp, Rating of LifePO4 Battery Bank:- 25.6V (Nominal)/100AH. (Qty. 15 Nos.)	125.96
2	Capacity of Grid Connected Rooftop Hybrid Solar Power Plants with Battery Bank) 02 kWp, Rating of LifePO4 Battery Bank:- 25.6V (Nominal)/150AH (Qty. 150 Nos.)	94.99
3	Capacity of Grid Connected Rooftop Hybrid Solar Power Plants with Battery Bank) :- 03 kWp, Rating of LifePO4 Battery Bank:- 25.6V (Nominal)/200AH. (Qty. 62 Nos.)	87.22
4	Capacity of Grid Connected Rooftop Hybrid Solar Power Plants with Battery Bank):- 04 kWp, Rating of LifePO4 Battery Bank:- 48V (Nominal)/150AH. (Qty. 30 Nos.)	86.24
5	Capacity of Grid Connected Rooftop Hybrid Solar Power Plants with Battery Bank):- 05 kWp, Rating of LifePO4 Battery Bank:- 96V (Nominal)/ 100AH. (Qty. 26.8 Nos.)	85.26
6	Capacity of Grid Connected Rooftop Hybrid Solar Power Plants with Battery Bank):- 7.5 kWp. Rating of LifePO4 Battery Bank:- 96V (Nominal)/150AH. (Qty. 12 Nos.)	84.28
7	Capacity of Grid Connected Rooftop Hybrid Solar Power Plants with Battery Bank) :- 10 kWp, Rating of LifePO4 Battery Bank:- 96V (Nominal)/200AH. (Qty. 6 Nos.)	79.38

\*Capacity may be interchanged between B-1 to B-7.

(Details specifications as per DNIT & sample submitted by you and approved by the Technical Committee)

### DETAILED TECHNICAL SPECIFICATIONS

(Grid Connected Solar Rooftop Photo Voltaic (SPV) power plant-with bank)

The projects shall be installed and commissioned as per the technical specifications given below.

#### 1. DEFINITION

A Grid Connected Solar Rooftop Photo Voltaic (SPV) power plant consists of SPV array, Module Mounting Structure, Inverter (string or micro)/Power Conditioning Unit (PCU) consisting of Maximum Power Point Tracker (MPPT), and Controls & Protections, interconnect cables and switches. PV Array is mounted on a suitable structure. Grid



connected SPV power plant may be with or without battery and 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, inverters/PCUs, battery 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 equipments/components.
  - Solar PV modules consisting of required number of Crystalline PV cells.
  - Grid interactive Inverter /Micro Inverter/ Power Conditioning Unit with Remote Monitoring System
  - LiFePO<sub>4</sub> Battery bank (for Hybrid System)
  - Mounting structures
  - Junction Boxes.
  - Earthing and lightening protections.
  - IR/UV protected PVC Cables, pipes and accessories
2. **SOLAR PHOTOVOLTAIC MODULES:**
- i. Domestically manufactured PV Module with domestically manufactured solar PV cells should be used.
  - ii. The PV modules should be made up of crystalline silicon solar cells and must have BIS certificate for IS 14286 & IS 61730 (Part-I, Part II).
  - iii. The efficiency of the PV modules should be minimum 16% and fill factor should be more than 70%.
  - iv. PV modules must meet the latest specification of MNRE and the models and Manufacturers of PV Modules shall be included in the List of Models and Manufacturers for Solar PV Modules empenelled by MNRE as per its ALMM order (and also valid at the time of supply of meteral) from time to time. The PV modules used must qualify to the latest BIS standards Crystalline Silicon Solar Cell Modules. In addition, the modules must conform to IS 61730 Part-1 - requirements for construction & Part 2 - requirements for testing, for safety qualification or equivalent IS. The Potential Induced Degradation (PID) test for solar modules will be mandatory as per MNRE condtions.
  - v. Module shall consists of Solar Cell of minimum 5 Bus Bar technology.
  - vi. The total solar PV array capacity should not be less than capacity (kWp) of solar power plant and should comprise of solar crystalline modules of minimum 300 Wp (with 72 cells) and above wattage for the project above 5 kWp and of minimum 250 Wp (with 60 cells) and above wattage for the project upto 5kWp. Module capacity less than minimum of these wattage shall not be accepted.
  - vii. Protective devices against surges at the DC side shall be provided. Low voltage drop bypass diodes shall be provided.
  - viii. The module frame shall be made of corrosion resistant materials, preferably having anodized aluminum.
  - ix. The bidder shall carefully design & accommodate requisite numbers of the modules to achieve the rated power in his bid.
  - x. Other general requirement for the PV modules and subsystems shall be the Following:
    - a. The rated output power of any supplied module shall have tolerance of plus 3% or above
    - b. 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
    - c. The module shall be provided with a junction box with weather proof lid of sealed type and IP-65 rated.
    - d. I-V curves at STC shall be provided with the module.



- i. The module should have the following minimum information laminated inside the module.
  - Made in India (to be subscribed in words )
  - Company name /logo
  - Model number
  - Serial number
  - Year of make

**3. Warranties:**

**a. Material Warranty:**

- i. Material Warranty is defined as: The manufacturer should warrant the Solar Module(s) to be free from the defects and/or failures for a period of twenty five (25) years from the date of commissioning of the system
- ii. Defects and/or failures due to manufacturing (it should indicate the voltage and rated wattage of the module)
- iii. Defects and/or failures due to quality of materials
- iv. Non conformity to specifications due to faulty manufacturing and/or inspection processes. If the solar Module(s) fails to conform to this warranty, the manufacturer will repair or replace the solar module(s), at the owners sole option.

**b. Performance Warranty:**

- ii. 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.

**4. ARRAY STRUCTURE (MODULE MOUNTING STRUCTURE):**

Module mounting structure (MMS) should be of Hot Dipped Galvanised Iron (HDGI), of prescribed Specifications given below, for mounting of SPV modules at site. The panel frame structure should be capable of withstanding a minimum wind speed load of 150 KM per hour, after grouting and installation. MMS should be sturdy & designed to assist SPV Modules to render maximum output. The hardware (fasteners) used for installation of SPV Modules & MMS should be of suitable Stainless Steel (SS 304). Each MMS should be with minimum four legs grouted on pedestals of minimum 300X300X250 mm with anchoring/ chipping & chemical sealing of foundation based on RCC roof. Foundation bolts of stainless /GI steel should be at least 300 mm long.

Its size should be with reference to the specifications of the selected make SPV modules. Anti Theft Nut Bolts of SS (with washers) should be used for mounting modules for better theft proofing.

**1. Hot Dipped Galvanised Iron (HDGI) structure should meet the following minimum specifications:**

Rafter	: 60mmX60mmX3.2mm or 60mmX45mmX15mmX2.6mm
Purlin	: 90mmX45mmX15mmX2.6mm
Vertical Post	: 60mmX60mmX3.2mm or 60mmX45mmX15mmX2.6mm
Base Plate	: 200mmX200mmX8mm
Top Plate	: 176mmX176mmX8mm

**2. Foundation:**

The CC foundation shall have to be designed on the basis of the weight of the structure with module and minimum wind speed of the site, i.e. 150 Km/hour.



Normally, each MMS should be with minimum four legs grouted on pedestals of proper size. However, for sheds CC work will not be required. The structure shall be grouted with fasteners with chemical sealing to withstand the required wind velocity. Angle of inclination shall be between 15° to 30°, however angle of inclination may be changed as per site requirement.

- CC Pillar size shall be: 300mmX300mmX250mm
- For Pillars: Cement: Concrete: Sand Ratio :: 1:2:3
- Screws shall be Grouted in the Slab of roof up to depth of 50 mm, if cemented slab is there.
- Lengths of rafter/Purlin may be changed as per site requirement.

Sufficient numbers of vertical post shall be provided so that the structure may not bent. However, if the system to be installed on the rooftop having tin/ asbestos sheet shed, foundation is not possible, then may be installed in such a way to withstand the prescribed wind velocity.

### 3. Specifications For Inverter/Micro Inverter/Power Conditioning Unit (PCU):

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 "Inverter". In addition, the inverter shall also house MPPT (Maximum Power Point Tracker), an interface between Solar PV array & the Inverter, to the power conditioning unit/inverter should also be DG set interactive, if necessary. Inverter output should be compatible with the grid frequency. Typical technical features of the inverter shall be as follows:

Specifications of Inverter	
Parameters	Detailed Specifications
Switching devices	IGBT
Capacity	The Rated Capacity of the Inverter shall not be less than the solar PV array capacity.
Control	Microprocessor /DSP
Nominal Voltage	230V/415V as the case may be
Voltage range	Single Phase: Shall work from 180 Volts to 270 Volts; Three Phase: Shall work from 180 Volts to 270 Volts per phase
Operating frequency/ range	50 Hz(47to52 Hz)
Grid Frequency Synchronization range	± 3 Hz or more (shall also compatible for Synchronization with DG Set)
Waveform	SineWave
Harmonics	AC side total harmonic current distortion < 5%
Ripple	DCvoltage ripple content shall not be more than1%.



Efficiency	The inverters should be tested as per IEC standards/ as per latest MNRE Specification. The following criteria should be followed : The benchmarking efficiency criteria for the Grid tied (central/string/micro) inverter At nominal voltage and full load is >95% For load >25% is >92%. The benchmarking efficiency criteria for Grid Tied PCU of capacity < 5KW: >85% and for capacity ≥ 5KW: ≥90%. No load losses should not be more than 5%.
Losses	Maximum losses in sleep mode: 2W per 5kW Maximum losses in stand-by mode:10W
Casing protection levels	Degree of protection: Minimum IP-21 and 22 for indoor use and IP-65 certification for outdoor use.
Temperature	Should with stand from -10 to +50 deg. Celsius
Humidity	Should with stand upto 95% (relative humidity)
Operation	Completely automatic including wake up, synchronization (phase-locking) and shutdown
MPPT	Maximum power point tracker shall be integrated in the inverter to maximize energy drawn from the array. MPPT range must be suitable to individual array voltages in power packs.
Protections	Mains Under / Over Voltage Overcurrent Over/Under grid frequency Over temperature Short circuit Lightening Surge voltage induced at output due to external source Anti Islanding (for grid synch. mode) Battery Under Voltage and Over Voltage
System Monitoring Parameters	Inverter/PCU voltage & current Mains Voltage, Current & Frequency PV Voltage, Amps & KWH System Mimic & Faults
Recommended LCD Display on Front Panel	Accurate displays on the front panel: DC input voltage DC current AC Voltage ( all 3 phases, in case of 3 phase) AC current ( all 3 phases in case of 3 phase) Ambient temperature Instantaneous & cumulative output power Daily DC energy produced Battery Voltage (in case of Hybrid PCU)



Communication interface	RS 485 / RS 232 PCU shall also house MPPT (Maximum Power Point Tracker), an interface between Solar PV array to the power conditioning unit/inverter should also be DG set interactive.
Power Factor	> 0.9
THD	<3%
Test Certificates	The inverters should be tested from the MNRE approved test centres / NABL / BIS / IEC accredited/authorised testing- calibration laboratories. In case of imported power conditioning units, these should be approved by international test houses.

- a. The total capacity of the Inverters/Micro Inverters/PCU shall not be less than the capacity of the Solar Power Plant.
  - b. Inverter/Micro Inverter/PCU shall be capable of complete automatic operation including wake-up, synchronization & shutdown.
  - c. The output of power factor of inverter/ Micro Inverter/PCU is suitable for all voltage ranges or sink of reactive power, inverter should have internal protection arrangement against any sustainable fault in feeder line and against the lightning on feeder.
  - d. Built-in meter and data logger to monitor plant performance through external computer shall be provided (Providing Computer is not part of DNIT & is in the scope of user).
  - e. **Anti-islanding (Protection against Islanding of grid):** The inverter/Micro Inverter/PCU shall have anti islanding protection in conformity to IEEE 1547/UL 1741/ IEC 62116/IS16169 or equivalent BIS standard.
  - f. In Inverter/ Micro Inverter/PCU, there shall be a direct current isolation provided at the output by means of a suitable isolating transformer.
  - g. The 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.
  - h. The inverter should comply with applicable IEC/ equivalent BIS standard for efficiency measurements and environmental tests as per standard codes IS/IEC 61683 and IEC 60068-2 (1,2,14,30)/ Equivalent BIS Std./EN50530,IEC 61727 (all clauses except clause 5.2.2). in case of clause 5.2.2, it should withstand the over/under frequency in the range 47 to 52 Hz
  - i. 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.
6. **BATTERY BANK (in case of Hybrid system)**  
The battery bank should be Lithium Ferro Phosphate (LiFePO<sub>4</sub>) having given capacity. The other feature of battery should be:-

S.No.	Description	Specification
1.	Battery Type	LiFePO <sub>4</sub>
2.	Working temperature range (both for charging & discharging)	20-60 Deg. C
3.	Minimum capacity of	3.2V (Nominal), 20Ah, with



	individual Cells	3C cell rating
4.	Type of Cell	Prismatic

Battery should have a certificate of testing as per tender requirement from any MNRE/BIS/NABL/IEC approved laboratory.

The Lithium Ferro Phosphate battery bank needs a very good "Battery Management System (BMS)" to ensure the proper charging and discharging of each cell of battery with proper protection of battery when temperature is reaching beyond battery permissible limits.

#### 7. INTEGRATION OF PV POWER WITH GRID:

- i. The output power from SPV would be fed to the inverters/PCU 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. 4 pole isolation of inverter output with respect to the grid connection need to be provided. Solar Generation Meter(s) and bidirectional energy meter, as per HERC Net Metering Regulations should also be installed in the campus/building of beneficiary.
- ii. The solar generation meter and Bi-directional meter along with CT/PT (if required) with Surge Protection Device (SPD) of 0.2S accuracy class is in the scope of bidder. For LT connection the accuracy shall be as per requirement of DISCOMs
- iii. CEA guideline 2013 for interconnecting solar power with Grid shall be followed.
- iv. Certification of Islanding protection in the inverter from the manufacturer of the equipment shall be mandatory. This shall be arranged by the supplier from the manufacturer.
- v. Technical Standards for Interconnection:

S.No.	Parameters	Requirements	Reference
1.	Overall Conditions of Service	Reference to regulations	Conditions for Supply of Electricity of Distribution Licensees
2.	Overall Grid Standards	Reference to regulations	Central Electricity Authority (Grid Standards) Regulations 2010
3.	Equipment	Applicable industry standards	IEC standards/IS
4.	Safety and Supply	Reference to regulations, Chapter III (General Safety Requirements)	Central Electricity Authority (Measures of Safety and Electricity Supply) Regulations, 2010 and subsequent amendments
5.	Meters	Reference to regulations and additional conditions issued by the Commission.	Central Electricity Authority (Installation & Operation of Meters) regulations 2006 and subsequent amendments
6.	Harmonic Current	Harmonic current injections from a generating station shall not exceed the limits specified in	IEEE 519 relevant CEA (Technical Standards for Connectivity of the distributed generation resource) regulations 2013 and



		IEEE 519	subsequent amendments
7.	Synchronization	Photovoltaic system must be equipped with a grid frequency synchronization device, if the system is using synchronizer inherently built into the inverter than no separate synchronizer is required.	Relevant CEA (Technical Standards for Connectivity of the distributed generation resources) regulations 2013 and subsequent amendments.
8.	Voltage	The voltage-operating window should minimize nuisance tripping and should be under operating range of 80% to 110% of the nominal connected voltage. beyond a clearing time of 2 seconds, the Photovoltaic system must isolate itself from the grid.	
9.	Flicker	Operation of Photovoltaic system shouldn't cause voltage flicker in excess of the limits stated in IEC 61000 or other equivalent Indian standards, if any	Relevant CEA regulations 2013 and subsequent if any, (Technical Standards for Connectivity of the distributed generation resource)
10.	Frequency	When the Distribution system frequency deviates outside the specified conditions (52 Hz on upper side and 47 Hz on lower side up to 0.2 sec), the Photovoltaic system shouldn't energize the grid and should shift to island mode.	
11.	DC Injection	Photovoltaic system should not inject DC power more than 0.5% of full rated output at the interconnection point. or 1% of rated inverter output	



		current into distribution system under any operating conditions	
12.	PowerFactor	While the output of the inverter is greater than 50%, a lagging power factor of greater than 0.9 shall be maintained	
13.	Islanding and Disconnection	The Photovoltaic system in the event of voltage or frequency variations must island/ disconnect itself within IEC standard on stipulated period	
14.	Overloadand Overheat	The inverter should have the facility to automatically switch off in case of overload or overheating and should restart when normal conditions are restored	
15	Cable	For interconnecting Modules, Connecting modules and junction Boxes and junction boxes to inverter, DC copper cable of proper sizes shall be used. To connect inverter with AC panel aluminium cable of proper size shall be used. All the internal cables to be used in the systems shall be included in the cost while 100 mtr. AC aluminium cable of proper size to be used to connect inverter/Micro Inverter/PCU to AC panel shall be included in the cost of the system. If Micro Inverter are used then there is no requirement of DC Cables.	Relevant CEA regulations 2013 and subsequent if any, (Technical Standards for Connectivity of the distributed generation resource)



- a. All switches and the circuit breakers, connectors should conform to IEC 60947, part I, II and III/ IS60947 part I, II and III.
- b. The change-over switches, cabling work should be undertaken by the bidder as part of the project.

**8. JUNCTION BOXES FOR CABLES FROM SOLAR ARRAY:**

The junction boxes shall be made up of FRP (Hensel or equivalent make)/PP/ABS with dust, water and vermin proof. It should be provided with proper locking arrangements.

Series / Array Junction Box (SJB/AJB) (whichever is required): All the arrays of the modules shall be connected to DCCB. AJB shall have terminals of bus-bar arrangement of appropriate size Junction boxes shall have suitable cable entry with suitable glanding arrangement for both input and output cables. Suitable markings on the bus bars shall have to be provided to identify the bus bars etc. Suitable ferrules shall also have to be provided to identify interconnections. Every AJB should have suitable arrangement Reverse Blocking diode of suitable rating. Suitable SPD, suitable Isolation switches to isolate the DC input to Inverter has to be installed in AJB for protection purpose. Thus AJB should have DC isolator for disconnecting the arrays from inverter input. If in any case diodes, HRC Fuses, SPDs and isolators are installed in the string inverters, then there is need to install these again in AJB. If some of these safety gadgets are not installed in String Inverter it should be installed in AJB. Cable interconnection arrangement shall be within conduit pipe on saddles installed properly. Cable connection should be done in such a manner that fault findings if any, can be identified easily. The cables should be connected in such a manner that clamp meter can be comfortably inserted around the individual cables to measure the data like current, voltage etc. AJB should also be marked as A1, A2, & so on. Wherever conduits are laid on wall/roof or ground, then it should be suitably laid in cable tray or appropriate civil structure which should be at least four inches above roof/ground level.

However, if the inverter/PCU is equipped with inbuilt Junction Box, the cables may be connected directly to the ports provided in the inverter/PCU and no separate Junction Box is required. If Micro Inverter is used, then DCDB and AJB will not be required.

**9. PROTECTION & SAFETY:**

Both AC & DC lines have suitable MCB/MCCB, Contractors, SPD, HRC Fuse etc to allow safe start up and shut down before & after string inverter installed in the system. String inverters should have protections for overload, surge current, high Temperature, over/under voltage and over/under frequency & reverse polarity. The complete operation process & safety instructions should printed on the sticker & suitably pasted on the near inverters.

Inverter should have safety measures to protect inverter from reverse short circuit current due to lightening or line faults of distribution network.

Central/String Inverter or PCU should be suitably placed in covered area on a suitable platform or wall mounted or concrete platform (on rubber mat) with complete safety



measure as per norms. The micro inverter (if installed) should be installed near the SPV module and should have protection of water & dust and shall with stand at a temperature of 65 degree Centigrade.

**10. INVERTER/ARRAY SIZE RATIO:**

- The combined wattage of all inverters should not be less than rated capacity of power plant under STC in KW.
- Maximum power point tracker shall be integrated in the inverter to maximize energy drawn from the array.

**11. AC COMBINER BOX BOARD (ACCB):**

This shall consist of box shall consists of grid interphase panel of good quality FRP/ suitable powder coated metal casing. One Electronic Energy Meter (0.2S Class), ISI make, Single/Three Phase duly tested by DISCOMs (Meter testing Division) with appropriate CT (if required), of good quality shall have to be installed at suitable placed to measure the power generated from SPV Power Plant, as per HERC Net Metering Regulations. Proper rating MCCB & HRC fuse and AC SPDs shall be installed to protect feeders from the short circuit current and surges as per the requirement of the site. Operation AC Isolator Switch of Grid Connectivity should be such that it can be switched ON or OFF without opening the ACCB.

**12. CABLES/WIRE:**

All cables should be of copper as per IS and should be of 650V/1.1 KV grade as per requirement. All connections should be properly made through suitable lug/terminal crimped with use of suitable proper cable glands. The size of cables/wires should be designed considering the line losses, maximum load on line, keeping voltage drop within permissible limit and other related factors. The cable/wire should be of ISI/ISO mark for overhead distribution. For normal configuration the minimum suggested sizes of cables are:

Module to module/AJB	4 sq mm (single core) DC Cable (not required if Micro Inverter are used)
AJBs to MJB/ DCCB/ Inverter/ PCU	<ul style="list-style-type: none"> <li>• Up to capacity of 10 kWp Solar Plant, minimum 4sq mm (Single/Double core) DC Cable, with respect to current ratings of designing</li> <li>• For capacity more than 10 kWp&amp; up to 20 kWp Solar Plant, minimum 6sq mm (Single/Double core) DC Cable, with respect to current ratings of designing</li> <li>• For capacity more than 20 kWp Solar Plant, minimum 10sq mm (Single/Double core) DC Cable, with respect to current ratings of designing.</li> </ul>
Inverter to ACCB/ Distribution board	AC Cable as per design & rating

The size & rating of the cables may vary depending on the design & capacity of SPV Power Plant. However, DC cables are not required if micro inverters are used in the system.

**13. CABLE TRAY:**



All the cables should be laid in appropriate GI cable tray as per the requirement of the site, No cable should be laid directly on ground or wall cable tray should be laid such that there is gap of at least two inches above ground/roof/wall.

**14. DISPLAY BOARD:**

The bidder has to display a board at the project site mentioning the following:

- Plant Name, Capacity, Location, Type of Renewable Energy plant (solar), Date of commissioning, details of tie-up with transmission and distribution companies, Power generation and Export FY wise.
- Financial Assistance details from HAREDA/MNRE/Any other financial institution apart from loan. This information shall not be limited to project site but also be displayed at site offices/head quarter offices of the successful bidder
- The size and type of board and display shall be approved by Engineer-in-charge before site inspection.
- **DANGER BOARDS:** Danger boards should be provided as and where necessary as per IE Act. /IE rules as amended up to date.

**15. MANUAL DISCONNECTION SWITCH:**

It should be provided to isolate the system from Grid which should be outside of ACCB.

**16. AC DISTRIBUTION PANEL BOARD:**

1. AC Distribution Panel Board (DPB) shall control the AC power from PCU/ inverter, and should have necessary surge arrestors. Interconnection from ACDB to mains at LT Bus bar while in grid tied mode.
2. All switches and the circuit breakers, connectors should conform to IEC 60947, part I, II and III/ IS60947 part I, II and III.
3. The changeover switches, cabling work should be undertaken by the bidder as part of the project.
4. 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
5. The panels shall be designed for minimum expected ambient temperature of 45 degree Celsius, 80 percent humidity and dusty weather.
6. All indoor panels will have protection of IP54 or better. All outdoor panels will have protection of IP65 or better.
7. Should conform to Indian Electricity Act and rules (till last amendment).
8. All the 415 AC or 230 volts devices / equipment like bus support insulators, circuit breakers, SPDs, VTs etc., mounted inside the switchgear shall be suitable for continuous operation and satisfactory performance under the following supply conditions.

Variation in supply voltage	+/- 10 %
Variation in supply frequency	+/- 3 Hz

**17. DATA ACQUISITION SYSTEM / PLANT MONITORING (for 10 kWp and above).**

- i. For systems of capacity 10 kWp and above, web based remote monitoring access of which shall also be provided to HAREDA software monitoring system with latest configuration. If needed access to MNRE shall also be provided.



- ii. PV array energy production: Digital Energy Meters to log the actual value of AC/ DC voltage, Current & Energy generated by the PV system provided. Energy meter along with CT/PT should be of 0.25 accuracy class. For Hybrid there shall be provision in built in the PCU to measure generated solar energy as there is no option to install separate solar generation meter.
- iii. String and array DC Voltage, Current and Power, Inverter AC output voltage and current (All 3 phases and lines), AC power (Active, Reactive and Apparent), Power Factor and AC energy (All 3 phases and cumulative) and frequency shall be monitored.
- iv. All instantaneous data shall be shown on the computer screen.
- v. Software shall be provided for USB download and analysis of DC and AC parametric data for individual plant.
- vi. Provision for instantaneous Internet monitoring and download of historical data shall be also incorporated.

18. **PRIORITY FOR POWER CONSUMPTION:**

Regarding the generated power consumption, in case of string inverter, priority need to given for internal consumption first and thereafter any excess power can be exported to grid.

19. **PROTECTIONS**

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

i. **Lightning and Over Voltage Protection:**

The SPV Power Plant shall be provided with lightning and over voltage protection. The principal aim in this protection is to reduce the over voltage to a tolerable value before it reaches the PV or other sub-systems components. The source of over voltage can be lightning or any other atmospheric disturbance. The Lightning Arrestor (LA) is to be made of 1¼" diameter (minimum) and 12 feet long GI spike on the basis of the necessary meteorological data of the location of the projects. Necessary foundation for holding the LA is to be arranged keeping in view the wind speed of the site and flexibility in maintenance in future. Each LA shall have to be earthed through suitable size earth bus with earth pits. The earthing pit shall have to be made as per IS 3043. LA shall be installed to protect the array field, all machines and control panels installed in the control rooms. Number of LA shall vary with the capacity of SPV Power Plant & location. Number of LA should be in such a manner that total layout of solar modules should the effective coverage of LA's.

For systems up to 10 kWp the lightning arrester shall of conventional type and for above 10 kWp systems it should be of Early Streamer Emission (ESE) type.

ii. **Earthing Protection:**

Each array structure of the PV yard shall be grounded properly. In each array every module should be connected to each other with copper wires, lug teathed washers addition the lightning arrester/masts shall also be provided inside the array field. Provision shall be kept for shorting and grounding of the PV array at the time of maintenance work. All metal casing/shielding of the plant shall be thoroughly grounded in accordance with Indian Electricity Act/IE rules as amended up to date. The earthing



pit shall be made as per IS: 3043. All the array structures and equipments/control systems shall be compulsorily connected to the earth, separately. Number of earthling shall vary with the capacity of SPV Power Plant & location. G.I. /Copper strips should be used for earthling instead of G.I. wires.

LA should be installed to protect the array field & machines installed in the control rooms. Number of LA shall vary with the capacity of SPV Power Plant & location. Earth resistance shall not be more than 5 ohms.

iii. **Surge Protection:**

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

iv. **Grid Islanding:**

a. In the event of a power failure on the electric grid, it is required that any independent power-producing inverters attached to the grid turn off in a short period of time. This prevents the DC-to-AC inverters from continuing to feed power into small sections of the grid, known as "islands."

Powered islands present a risk to workers who may expect the area to be unpowered, and they may also damage grid-tied equipment. The RooftopPV system shall be equipped with islanding protection. In addition to disconnection from the grid (due to islanding protection) disconnection due to under and over voltage conditions shall also be provided.

b. A manual disconnect 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, if required, by the utility personnel

20. **CONNECTIVITY:**

The user have to take approval/NOC from the Concerned DISCOM for the connectivity, technical feasibility, and synchronization of SPV plant with distribution network and submit the same to HAREDA before commissioning of SPV plant, however the supplier have to extend all technical help to the user for preparing the documents required for getting the above clearance from DISCOMs.

Reverse power relay shall be provided by bidder (if necessary), as per the local DISCOM requirement.

The maximum capacity for interconnection with the grid at a specific voltage level shall be as specified in the Distribution Code/Supply Code and amended from time to time. Following criteria have been suggested for selection of voltage level in the distribution system for ready reference of the solar suppliers.

Plant Capacity	Connecting voltage
Up to 10 kWp	240V-single phase or 415V-three phase as per requirement of electric connection of the consumer
Above 10kWp and up to 50 kWp	415V - three phase

Utilities may have voltage levels other than above, DISCOMS may be consulted before finalization of the voltage level and system shall be designed accordingly.



**21. DRAWINGS & MANUALS:**

- i. One set of Engineering, electrical drawings and Installation and O&M manuals are to be supplied at the time of installation of system. Bidders shall provide complete technical data sheets for each equipment giving details of the specifications along with make/makes in their bid along with basic design of the power plant and power evacuation, synchronization along with protection equipment.
- ii. Approved ISI and reputed makes for equipment be used.

**22. SAFETY MEASURES:**

The bidder 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. All work shall be carried out in accordance with the latest edition of the Indian Electricity Act and rules formed there under and as amended from time to time.

**23. CODES AND STANDARDS**

The quality of equipment supplied shall be controlled to meet the guidelines for engineering design included in the standards and codes listed in the relevant ISI and other standards, such as :

- i. IEEE 928 Recommended Criteria for Terrestrial PV Power Systems.
- ii. IEEE 929 Recommended Practice for Utility Interface of Residential and Intermediate PV Systems.
- iii. IEEE 519 Guide for Harmonic Control and Reactive Compensation of Static Power Controllers.
- iv. National Electrical NEPA 70-(USA) or equivalent national standard.
- v. National Electrical Safety Code ANSI C2- (USA) or equivalent national standard.
- vi. JRC Specification 503 (Version 2.2 March 1991) or JPL Block V standard for PV modules.
- vii. The inverter manufacturer should attach efficiency certificate from Independent Third party Testing laboratory i.e. IEC, TUV, SNL/ERTL & STQC. PCU should confirm to IEC 61683 for efficiency measurements and IEC 60068 2 for environmental testing. MPPT unit should confirm to design qualification IEC 62093.
- viii. IEC 62116 for Anti Islanding
- ix. IEC 62109-1, IEC 62109-2 for safety
- x. IEC 61727 FOR UTILITY INTERF

**TERMS & CONDITIONS**

- 1- F.O.R.:- The above rates are F.O.R. destination anywhere in Haryana at supplier's risk.
- 2- G.S.T. :- excluding in above rates.
- 3- Delivery period (includes supply, installation & commissioning)/ Time Schedule, Penalty/Liquidated Damages
  - a. The time schedule for these systems shall be as under:

Capacity of Solar Power Plant 1	Time period for completing the work which includes inspection, supply, installation and commissioning 2	Date for the pre dispatch/at site inspection of material to be offered by the supplier # 3
1kWp -50 kWp (all Categories)	3 months from the date of work order	Atleast 07 days prior to last date of supply of the system



- i. Although the supplier shall give the date of inspection in the inspection offer which should reach in the office of indenting Department at least 07 days before the date of inspection proposed by the supplier. It shall be the sole responsibility of the supplier to complete the commissioning of systems in the defined time period. Time period is the essence of the contract. GCRT Solar Power plant will be taken as commissioned on the date of start of inverter and ready to synchronize, it will not depend the installation of solar generation meter/Bi-Directional meter by DISCOMs. However, submission of the solar generation meter (with CT, if required)/bi-directional meter along with CT/PT shall be submitted to the DISCOMs for testing and installation.
  - ii. After receipt of call for inspection with date for the inspection, the material shall be inspected by the Director, New & Renewable Energy Department/HAREDA/indenting officer or a committee authorized for this purpose. Material shall be dispatched after acceptance of the same by the Inspection Committee, if inspected at premises of the firm; The same shall be installed and commissioned after acceptance by the Inspection Committee, if inspected at site. However, the supplier may start civil work at any time even before the inspection of material.
  - iii. If the proposal for pre-dispatch inspection is received within defined & valid time period in the office of Director, New & Renewable Energy Department/HAREDA/indenting office from the supplier and inspection is not carried out by the New & Renewable Energy Department due to any reasons within 07 days of receipt of such letter/offered date, the time period for supply, installation & commissioning will be extended equivalent to delayed period, from the next day of expiry of these 07 days till the date of actual inspection and no penalty will be imposed for this extended period.
- b. Before placing the work order it will have to ensure that site is clear and feasible in all respect for installation of system/ plant. However, it will be the sole responsibility of the supplier to be satisfied with the site through visit under intimation to PO/APO of the district within 30 days of placing of work order. Request, if any, received from the supplier for any extension on ground of issue of site clearance after above said period will be out rightly rejected.

#### 4. Warranty: -

- i. The Warranty period shall be five (5) years for complete system from the date of commissioning and handing over of the system (or as per latest MNRE, Gol guidelines).The contractor shall rectify defects developed in the system within Warranty period promptly.
- ii. The manufacturer should warrant the Solar Module(s) to be free from the defects and/or failures for a period of twenty five (25) years from the date of commissioning of the system
- iii. 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.

The procedure to rectify the complaint/service to be provided during warrantee period is as follows :

During the warrantee period, the firm shall ensure proper functioning of the systems and complaint, if any, forwarded to the supplier against the system, will have to be attended within 72 hours of forwarding such complaints. If any part is to be procured then the user is to be informed and the systems shall be



rectified within 7 days. The procedure to rectify the complaints shall be as under:

- iv. The notice through E-mail/hard copy to rectify the complaints shall be issued by the HQ/district officer/User to the supplier with copy to the New & Renewable Energy Department/HAREDA. This shall be followed by two reminders on 3 days intervals each. The district office shall maintain proper record of the complaints.
- v. In case of failure to do so, penalty @ 0.1 % of the system cost per day (subject to max. 10% of the cost) after expiry of 07 days shall be imposed. If the firm does not attend the complaint within the max penalty period then the system may be got repaired/ replaced from the performance security amount. In case whole performance security amount is utilized and complaint/s are still pending then an online / registered notice will be sent to the firm to attend the complaint and if failed to attend the complaint within 7 days then firm may be blacklisted and a legal proceedings may be initiated against the firm for breach the agreement. If maximum penalty has been imposed, then the firm shall deemed to be considered as unfit to participate in all the tenders floated by New & Renewable Energy Department/HAREDA in future for a period to be decided by competent authority, effective from the date of communication to be conveyed by New & Renewable Energy Department/HAREDA in written and shall be treated as unsatisfactory performer.
- vi. DGS&D/New & Renewable Energy Department/HAREDA/the consignee will have the liberty to get the sample for the item(s) supplied tested from any of the Govt. approved lab. at any time during the installation or warranty period to ascertain the performance of the item(s) as per DNIT specifications. If during the lab test, sample fails then supplier has to repair/ replace the defective systems within 15 days of issue of such notice. If on the request of the supplier more than one samples are drawn for lab test and any one of them fail the lab test, bidder has to replace all the defective system at his own cost.
- vii. The Contractor/supplier shall continue to provide spare parts for at least two years after the expiry of warranty period at the users cost. If the contractor fails to continue to supply spare parts and services to users then New & Renewable Energy Department/HAREDA/DGS&D shall take appropriate action against the firm which can be to ban the supplier for participating in future tenders.
- viii. Suryamitra: There is a Programme under MNRE to provide training to ITI Certificate and Diploma holders on operation and maintenance of SPV devices and systems and it is called "Suryamitra Skill Development Programme". The successful contractor(s) will preferably have to engage them in their service centers. They may be engaged by the contractor to provide necessary repairs and maintenance service including installation of the systems during the time of execution.

#### 5. Terms and Condition for Payments

The payments shall be made by the indenting department/organisation as per the following terms and conditions:

- i. 70% after installation of the system supported with Joint Commissioning Report (Provisional) signed by Supplier, representative of user organization & P.O. of the concerned district along with bill & photographs of complete system.
- ii. 19% payment on submission of Final Joint Commissioning Report (JCR), supported with project completion report, duly signed by the supplier, district PO. However, if the supplier submits the Solar Generation meter (with CT, if required) and Bi-Directional meter (with CT/PT, if required) and there is delay on the part of DISCOMs for installation of Net Meter beyond 15 Days of submission of the meters to DISCOMs or beyond 15 days of installation of system which ever is later, then this



- payment to the Supplier may be released within next 15 days on the basis of Provisional Joint Commissioning Report & PCR( Status of submission of meters etc. shall be mentioned, if NM is pending for installation at level of user/DISCOMs).
- iii. 10% payment to be released @ 2% at the end of each year for 5 years, on submission of satisfactory performance report of the systems duly certified by the concerned district officer and user OR The said amount may be released against the submission of bank guarantee of equal amount valid for five years from commissioning of the plant.
  - iv. 01% payment after completion of 25 year subject to not having any complaint regarding performance of the solar modules as per performance warranty conditions of MNRE, Gol.
  - v. Income Tax shall be deducted at source as per rules.

**The Indenting Departments would have option to release payments in RTGS/ Electronics mode also.**

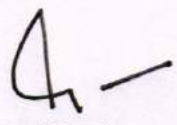
Delay in payments to the suppliers beyond the stipulated credit period indicated in the supply order, unless supported by cogent reasons and approved by a higher authority, will attract penal interest on the defaulting amount @ Rs.25/- per rupees one lakh per day of delay beyond the stipulated credit period. Non provision of adequate budget will be no ground for delay in payments to the supplier.

- 6. INSPECTION:-** The inspection of the material will be carried out by the committee constituted by Indenting Department or their authorized representatives at the premises of the supplier before dispatch.

In case, the material offered for inspection by the firm fails to meet the specifications stipulated in NIT/Order/Contract and the samples are rejected by the Inspecting Committee, the Indenting Department will have the right to levy a penalty at 0.1% of the total order value. In case, the material offered for inspection fails during the 2<sup>nd</sup> inspection also, the Indenting Department will have the right to increase the penalty to 0.25% of the total order value. In case, the material offered fails during the 3<sup>rd</sup> and final inspection also, the firm will be liable for penal action including forfeiture of EMD, risk purchase, debarring/ blacklisting in future, and no further opportunity for inspection would be provided to the supplier firm.

**(OTHER TERMS & CONDITIONS WILL BE AS PER DNIT AND SCHEDULE-B ATTACHED).**

Encls.a/a

  
Deputy Director,  
Supplies & Disposals, Haryana,  
For & On behalf of Governor of Haryana.