8.1	BIS Registration	As per the Solar Photovoltaics, Systems, Devices and Components Goods (Requirements for Compulsory Registration) Order, 2017, Government of India, PV Modules used in the grid connected solar power projects in India shall be registered with BIS and bear the Standard Mark as notified by the Bureau of Indian Standards. Enclose copy of BIS Registration for PV modules
8.2	ALMM Listing	In line with Office Memorandum No. 283/54/2018- Grid Solar ("Approved Models and Manufactures of Solar Photovoltaic Modules Order, 2019), dated 2nd January 2019 and subsequent amendments thereto issued by MNRE, Govt of India, the bidder shall comply with the relevant clause(s) on supply of PV modules.
9	Module Safety Class	Safety Class - II
10	BILL OF MATERIALS	
10.1	Solar cells	**Type : Mono Crystalline solar cells** Pl. indicate **Cell Source :** **Size of Cells :** **Half cell or full cell configuration:** **Cell efficiency :** **No. of busbars** **Enclose a copy of Solar cell data sheet with electrical parameters.**
10.2	EVA	Fast cure type, UV resistant, Gel content > 70 %.
10.3	Glass	High transmission (> 90 %), low iron, toughened glass with minimum thickness of 3.2 mm and bending less than 0.3%.
10.4	Back Sheet	The back sheet used in the crystalline silicon based modules shall be of 3 layered structure. The thickness of back sheet should be of minimum 300 microns with water vapour transmission rate less than 2.0 g/ m^2/day (38°C at 90% RH). The Back sheet can be fluoro polymer based or of any other well proven technology. The backsheet shall have globally benchmarked durability properties on Moisture barrier, Tensile Strength (Machine Direction & Transverse Direction), Elongation retention and UV stability and shall be able to withstand system voltage of 1500 V.
10.5	PV Module Frame	Corrosion resistant, anodized Aluminum. The anodizing thickness shall be 15 microns or better.
10.6	Junction box	IP67 grade with 3 nos. of bypass diodes, UV resistant & weather-proof

		Junction box shall have two 4 sq mm UV resistant cables of minimum 1.2 metre length and plug-in connectors (male and female). JB shall be in compliance with IEC 60670 and class II insulation. **Cables shall be of solar grade and shall conform to specification EN 50618.**
10.7	Adhesive for framing, junction-box fixing and potting	As per manufacturer's IEC test report
10.8	RFID	Each PV module deployed must use a Radio Frequency identification (RFID) tag for traceability. RFID shall either be placed inside the laminate or behind name plate sticker or behind bar code label pasted on the back glass of PV module and must be able to withstand harsh environmental conditions during the module lifetime. RFID tag shall contain the following information: a. Name of module manufacturer with country of origin b. Month & year of manufacture of modules c. Name of cell manufacturer with country of origin d. Month & year of manufacture of cells e. IV curve f. Wattage, I_{max}, V_{max}, V_{oc}, I_{sc}, & fill factor g. Module model number h. Unique serial number i. Date of obtaining IEC qualification certificates j. Name of test lab issuing IEC certificates k. Other relevant information etc. on traceability of solar cells and module as per IOS 9000 series
10.9	Nameplate	Each module shall be provided with a name plate label (sticker) containing the following information: a. Name of module manufacturer b. Module model number c. Serial number d. Polarity Terminal Leads e. Safety Class f. Application Class g. Overall Dimension (W x L x D) h. Weight in Kg i. P_{max}, V_{oc}, I_{sc}, I_{max} & V_{max} j. System Voltage

		k. Relevant standards and certifying lab name l. Date of obtaining IEC qualification certificates m. Warnings, if any n. Other relevant information, etc Nameplate shall be clearly visible and shall not be hidden by equipment wiring. It shall be durable for the entire life of panel.
10.10	BOM as per CDF of IEC Certificate	Solar cells and module materials shall be used as per approved CDF as per IEC Certificate. **Enclose copy of approved CDF as per IEC Certificate.**
10.11	RFID Reader	One number RFID reader (gun type) has to be supplied free of cost by the bidder which has to be compatible to read the module I-V data from the RFID Tag & download the data to Computer. All necessary associated Software, Cables and accessories are to be provided free of cost along with the RFID reader.
10.12	.PAN File	Third Party verified .PAN file for each module wattage offered shall be provided for carrying out PVSYS calculations at our end.
10.13	Mounting hole Pitch	**Pl. provide mounting hole pitch details.** **Horizontal :** **Vertical :** **Mounting hole size :**
10.14	Earthing holes	Earthing holes to be provided on both the shorter arms/ longer arms of PV module frames.
10.15	I-V curves and temperature coefficiencts	The bidder shall provide the sample solar PV module electrical characteristics including current-voltage (I-V) performance curves and temperature coefficients of power, voltage and current. **Enclose Sample I-V performance curve of for highest wattage of modules offered.** **Temperature coefficient of Power (Pmax) :** **Temperature coefficient of Voltage (Voc) :** **Temperature coefficient of Current (Isc) :**

2) QUALITY ASSURANCE

Module Quality Plan, Data Sheet and GTP shall be subject to customer's approval. Each lot of modules shall be subject to Pre Shipment Inspection (PSI) by BHEL and BHEL customer or any third party.

Quality plan will include the following:

I. Incoming Quality Checks on bought out item
II. In-process Quality Checks
III. Sample tests on final product by the customer

3) WARRANTY

Product Warranty shall be for 10 years and Performance Warranty shall be for 25 years.

Solar PV modules used in solar power plants/ systems must be warranted for the product Workmanship for a period of minimum 10 years. Further, they shall also be warranted for their output peak watt capacity, for which module degradation should not be more than 0.75% / year till the end of 25 years from the completion of the trial run. Modules that do not meet the above criteria shall be replaced free of cost at BHEL's/customer's sole discretion.

4) BANK GUARANTEE FOR POWER OUTPUT WARRANTY

The Successful Bidder shall submit a Bank Guarantee for 10% of the contract value through BHEL consortium bank and shall be valid for a period of Ten (10) years and 90 days. The minimum validity of the Bank guarantee shall be Two (2) years and shall be renewed by the bidder of their own subsequently every Two (2) years prior to thirty (30) days of its expiry. In case the PV module fails to provide power output as per its performance warranty, and if the bidder fails to rectify, replace or repair the PV module, then BHEL shall carry out the necessary rectification, repair or replacement at its own discretion at the risk and cost of the supplier. The cost of such rectification, repair or replacement shall be encashed from the Bank Guarantee against PV Module Warranty. The same shall be replenished by the supplier within thirty (30) days, failing which the entire Bank Guarantee amount shall be encashed and all pending payment shall be withheld by BHEL till such amount is replenished by the supplier. In another instance, if the supplier becomes bankrupt or insolvent, then BHEL shall immediately encash the entire amount of the Bank Guarantee against PV Module Warranty.

5) PACKING & IDENTIFICATION OF PV MODULE

The modules shall be packed in seaworthy carton boxes made from triple-strength corrugated cardboard and resting on a wooden or plywood base. The PV modules packed in a carton box shall be of same power rating band only (390 Wp/ 395 Wp / 400 Wp...). Carton box and Pallets shall be adequately designed to prevent damage or deterioration during transportation to site in remote road conditions, handling and storage in site till the time of its installation. The carton box should display the manufacturer's name, number of modules, type, serial numbers, module wattage etc. Modules found damaged at the time of opening of the cartons in the project site shall be replaced free of cost by the module manufacturer.

6) GENERAL CONDITIONS

a) PV Modules shall be manufactured at the vendor's works only.

b. Manufacturing clearance shall be given only after approval of Data Sheet, Bill of Material, manufacturing quality plan, Pre-Shipment inspection plan by BHEL's customer.

7) MODULE RATINGS OFFERED

Pl. fill the table as below for the module wattage ratings offered.
Module Type (model No):

Module Wattage rating	Quantity in MWp	% of total quantity

Note : One vendor can offer maximum of 4 Power ratings.

8) BENEFITS FOR HIGHER WATTAGE RATED PV MODULES

Vendors offering higher wattage PV modules will get the benefit in their prices offered in terms of negative loading while comparing cost to BHEL. The negative loading factor will be -2,50,00,000 per each 5 W increase in the PV module nominal power rating above 390 Wp, offered by the bidder.

If a mix of module ratings are offered, negative loading will be given for respective ratings of PV modules in the pro rata basis.

A typical sample calculation is shown below:

Assume Bidder A and B offers PV modules configurations as below,

	390 Wp	430 Wp	435 Wp	440 Wp
Bidder A	100%			
Bidder B		10%	80%	10%

Loading factor calculation: Bidder A

Module Wattage rating	Loading factor (X)	Percentage of Supply (Y=Offered quanity in MWp /750)	Effective Loading factor (L = X x Y)
390 Wp	Nil	100%	0
		Total	**0**

Loading factor calculation: Bidder B

Module Wattage rating	Loading factor (X)	Percentage of Supply (Y=Offered quanity in MWp /750)	Effective Loading factor (L = X x Y)
390 Wp	Nil		
395 Wp	-2,50,00,000		