4.2.27	Voltage Ride Through	The PCU shall remain connected to the grid during temporary dip or rise in grid voltage as per the LVRT requirements of CEA Technical Standards for Connectivity to the Grid Regulations. The PCU shall also be able to inject reactive power during the period of voltage dip.
4.2.28	Active power regulation	The PCU shall be able to limit the active power exported to the grid based on the set point provided through PCU front control panel. The PCU shall also be able to automatically the limit the active power after an increase in grid frequency above a pre-set value. The ramp rate shall be adjustable during operation and start-up after fault. The applicability of the requirement shall be as per CEA regulation and compliance.
4.2.29	Reactive power control	The PCU shall be able to inject /absorb reactive power to/ from the grid based on the set point provided through PCU front control panel. The same shall be performed automatically with adjustable ramp rate based on dynamic changes in grid voltage or reactive power reference. Night time VAR compensation as per CEA regulation and compliance is required.
4.2.30	Enclosure	Suitable for Outdoor duty and IP class as per Cl. 1.1.
4.2.31	Compatibility to Power Plant Controller (PPC)	PCU shall have the necessary provisions (including any additional hardware/software required) for connection to a Power Plant Controller which shall be able to monitor and control the PCU remotely (both digital and analog PCU parameters)

4.3 Protection systems

4.3.1	Protection systems for current, voltage, temperature, surges, ground faults, fan failure etc. Fault indication shall be communicated to SCADA system	AC & DC over current
4.3.2		AC & DC short circuit
4.3.3		DC reverse polarity
4.3.4		Over temperature protection: Heat sink, Cabinet
4.3.5		Synchronization loss
4.3.6		Anti-islanding protection
4.3.7		EMI and RFI
4.3.8		Grid monitoring Protection against any sustained fault (lightning effect etc) in grid / feeder line.
4.3.9		Ground fault protection
4.3.10		Power regulation in the event of thermal overloading

4.3.11		SPD-based overvoltage protection on both DC and AC sides. SPD shall consist of MOV type arrestors. It shall have thermal disconnectors to interrupt surge current arising from internal / external faults. Type-II surge protective device (SPD) conforming to IEC 61643- 11/12, shall be connected between positive/ negative bus and earth.
4.3.12		Fan failure – Alarm contact shall be provided for air flow loss / rise of temperature of cooling fan

4.4 DC, AC side load break disconnecting switch / breaker provisions

4.4.1	DC side	Load Break Switch Disconnector required on DC side (if fuses are used on each DC input). **(To be read in conjunction with clause 4.8.2)** DC current shall be communicated to SCADA. (ALL SMB CURRENT SHALL BE MEASURED & DISPLAYED INDEPENDENTLY)
4.4.2	AC side	(a) ACBs / disconnecting switch* shall be provided on the AC output side. *In case vendor is proposing isolation mechanism other than breaker, the scope of supporting BHEL in proving the statutory compliances e.g., CEIG/CEA shall be with vendor. (b) Remote operating and controlling facility for PCU from SCADA Panel in Main Control Room shall be provided.
		(b) Surge protection device (3P) with suitable rating shall be provided at the input of the ACB/ disconnecting switch.
		(c) Indication for grid side supply ON / OFF status shall be available on the Door Interface.
		(d) Interconnection between the ACB/switch Panel and PCU supply/provision of cables / busbars as applicable shall be in the scope of the vendor.

4.5 Front panel display and control

4.5.1	Front panel screen (LCD display, etc) with browsing / navigation provisions to 1) select display parameters	Instantaneous DC power input DC input voltage DC Current of each SMB (ALL SMB CURRENT SHALL BE MEASURED & DISPLAYED INDEPENDENTLY) Total DC Current

4.5.2	2) provide settings for various parameters	Instantaneous active AC power output Instantaneous reactive AC power output AC voltage (all the 3 phases and line) AC current (all the 3 phases and line) Frequency Power Factor Energy (kWh) produced during entire day Total Energy (kWh) produced during its life
4.5.3		Faults
4.5.4		Other event logs
4.5.5		Other features as may be necessary for supervisory control and operation of the PCUs shall be provided.

4.6 Data logging, storage, retrieval, downloading, uploading

4.6.1	Provision of built-in systems for data logging, storage, retrieval, downloading, uploading etc.	Date-cum-time stamped logging of DC and AC side parameters (current, voltage, frequency, phase, power factor, power, export energy etc), faults and other events.
4.6.2		Data storage with retrieval features.
4.6.3		Provision of all necessary built-in systems, ports etc for downloading the data into a PC / Laptop etc that will be required for reporting, data analysis and trouble-shooting purposes.
4.6.4		Provision of all necessary built-in systems, ports etc for uploading of software etc that will be required for replacing, revising, upgrading the system.

4.7 Provisions for SCADA interface

4.7.1	SCADA interface requirement	Solar PV power plant will have an integrated SCADA, which is within BHEL scope, whereby all the PCUs will be integrated with other data systems such as solar array string monitoring, weather monitoring, HT side transformers / breakers monitoring, etc. Accordingly, PCU shall have necessary communication protocol and output ports to facilitate SCADA interface as per Clause 4.7.2. SCADA shall be OPC server based.
4.7.2	Communication protocol	Dedicated MODBUS TCP/IP on Ethernet Interface for networking with SCADA.

4.7.4	Parameters for SCADA	All DC and AC parameters (current, voltage, frequency, phase, power factor, power, export energy etc), grid data, temperature, faults, other event logs, date/time logs etc from each PCU will be required at SCADA control desk. PCU shall provide for this requirement. (ALL SMB CURRENT SHALL BE MEASURED & DISPLAYED INDEPENDENTLY)
4.7.5	Remote monitoring features	PCU shall have features to facilitate remote monitoring via telephone modem or mini web server.

4.8 DC Inputs and termination details.

Vendor shall supply the PCU with the termination features on DC side as tabulated below. Detailed drawings of termination arrangements with bus bar particulars such as positions, dimensions, hole sizes, spacing between holes, support to bus bar, etc shall be submitted for BHEL approval.

4.8.1	DC input terminals	**Each SMB output: ~500 kW** **Total no. of DC inputs shall be designed to be suitable for** **a) SMB kW mentioned above (which includes 50% DC Overload) + 1 no. spare input** **b) Vendor to indicate the no. of DC inputs provided for each rating of PCU to meet the requirement as per (a) above in offer.**
4.8.2	Fuses / DC Circuit Breaker on DC input side	Fuse current rating **500A (min)** shall be provided on each positive and negative DC input terminal. Fuse rating shall be finalized during detailed engineering. Alternately, DC circuit breaker in each input can also be provided as per vendor's design.
4.8.3	Max DC input current rating of PCU	Vendor shall indicate the rating. In addition, max rating of each individual DC input shall be indicated
4.8.4	DC cable entry into panel	Bottom entry. Cable supply is within BHEL scope. 1Cx400 sq-mm Aluminium (indicative size), multi-strand, Al, Armoured, XLPE insulation, PVC sheath cable will be used for each DC input. Exact size shall be provided during detailed engg. DC termination shall be suitable for the above cable.
4.8.5	Gland plates	Drilled Gland plates shall be provided with holes to accommodate the cable glands.
4.8.6	Cable glands	Nickel plated brass, double compression type cable

		glands of reputed make (Make: Comet or any other reputed make) shall be provided by the vendor. To enable right selection of glands, final cable O.D will be provided by BHEL at the time of manufacturing. Approval of make and type/size shall be taken from BHEL before procurement of glands. Part no. and qty shall be indicated in the BOM. PCUs shall be supplied with all the glands fixed on the gland plates.
4.8.7	Cable lugs, plain washers, spring washers, bolts and nuts	Similarly, cable lugs, bolts, nuts & plain washers, Zinc coated spring washers shall be provided by the vendor. Make for lugs: Dowells or any other reputed make with CE/VDE/UL/CSA/BIS. Approval of make and type/size shall be taken from BHEL before procurement of lugs. Part no. and qty shall be indicated in the BOM. PCUs shall be supplied with all these items fixed on the bus bars at their respective positions. DC Cables in BHEL scope shall be Aluminium type. Suitable cable lugs in PCU vendor scope shall be based on the type of busbars being used in PCU : a) If Aluminium busbars used, aluminium lugs to be provided. c) If copper busbars used, Cu-Al Bi-metallic lugs or Aluminium Lugs with Bi-metallic strips/washers to be provided.
4.8.8	Bus bar design	Tinned Copper or Aluminium Busbars shall be provided.
4.8.9	In case of separate DC termination panel	(a) General arrangement showing views and details of termination panel, with cable entry particulars, shall be submitted as part of technical bid. (b) Interconnecting the add-on DC termination panel with the main panel, including supply of cables for this purpose, shall be within the scope of vendor.
4.8.10	DC Side Negative Grounding	DC side negative grounding system shall be provided for the PCU. The same shall be indicated in the GA/SLD/Schematics and BOM.

4.9 AC Output and termination details**.**

Vendor shall supply the PCU with the termination requirements on AC side as tabulated below. General arrangement showing views of termination shall be submitted as part of technical bid. Detailed drawings of termination arrangements with bus bar particulars such as positions, dimensions, hole sizes, spacing between holes, support to bus bar, etc shall be submitted within seven days after receipt of purchase order for BHEL approval.

4.9.1	Number of AC outputs	Three phases: R, Y, B terminals
4.9.2	AC cable entry into panel	Top/ Bottom entry. Cable supply is within BHEL scope. For each phase, up to 1Cx630 sq.mm aluminium, multi-strand, armoured, XLPE insulation, PVC sheath cable will be used. Final cable selected, cable O.D and no. of runs of cable shall be informed to vendor during detailed engineering for selecting suitable cable lugs, glands and termination. In the offer, vendor to indicate for each type of PCU being offered, the maximum no. of inputs along with cable size which can be accommodated. If the PCU design being offered is for top entry of cables, cable ladder, necessary hardware etc shall be in vendor's scope.
4.9.3	Gland plates	Drilled Gland plates shall be provided with holes to accommodate the cable glands.
4.9.4	Cable glands	Nickel plated brass, double compression type cable glands of reputed make (Make: Comet or any other reputed make) shall be provided by the vendor. Approval of make and type shall be taken from BHEL before procurement of glands. PCUs shall be supplied with all glands fixed on the gland plates.
4.9.5	Cable lugs, plain washers, spring washers, bolts and nuts	Similarly, cable lugs, bolts, nuts & plain washers, Zinc coated spring washers shall be provided by the vendor. AC Cables in BHEL scope shall be Aluminium type. Suitable cable lugs in PCU vendor scope shall be based on the type of busbars being used in PCU: a) If Copper busbars used, Cu-Al Bi-metallic lugs or Aluminium Lugs with Bi-metallic strips/washers to be provided b) If Aluminium busbars used, Aluminium lugs to be provided. Make for lugs: Dowells or any other reputed make with CE/VDE/UL/CSA/BIS.

		Approval of make and type shall be taken from BHEL before procurement of these items. Part no. and qty shall be indicated in the BOM. PCUs shall be supplied with all these items fixed on the bus bars at their respective positions.
4.9.6	Bus bar design	Tinned Copper or Aluminium busbars shall be provided.
4.9.7	Aux. Transformer taping	Vendor should give provision for tapping Axillary transformer from AC SIDE BUS BAR xxxv/415 volt (where xxx is the PCU AC nominal voltage output).

4.10 Panel related parameters

4.10.1	Structure sheets	Doors and frames - Type of enclosure and size/thickness details of the doors and frames shall be indicated by vendor Gland plate: Minimum 3mm thk min sheet steel or 4 mm thk non-magnetic material
4.10.2	Bus bars	Busbars shall be of appropriate size to match current rating, based on vertical / horizontal layouts and bus bar orientations. Insulation sleeves (PVC etc.) shall be used wherever necessary. Bus bars (both AC and DC) shall be suitably colour coded.
4.10.3	Fixing of PCU	PCU shall be suitable for fixing on the cable trench channels by the means of tack welding.
4.10.4	Earthing terminals as per relevant standards	Earthing terminals shall be provided using tinned copper / aluminium bars of suitable cross section. Terminals shall be brought out to facilitate external connections.
4.10.5	Insulation clearances	AC side: Phase to Phase / neutral: As per relevant standards DC side: As per relevant standards.
4.10.9	Painting	Epoxy based powder coating. Powder coating shall meet the requirement of IS 13871 Paint shade shall be informed during detailed engineering.
4.10.10	Overall dimensions	Width x Depth x Height in mm shall be indicated in the offer.
4.10.11	Weight	Panel weight shall be indicated in the offer.
4.10.12	Air Flow Requirement (m3/hr)	To be indicated by vendor for each PCU. - HVAC calculations shall be provided by vendor during detailed engg including CFD analysis for ventilation.

5.0 Testing and inspection

5.1 Routine tests, as per relevant standards (IEC etc), shall be carried out on the PCUs and shall be witnessed by BHEL & Customer/ Customer authorized third party inspection agency). Vendor shall submit Manufacturing Quality Plan (MQP) and detailed Test Procedure along with drawings for formal approval by customer prior to inspection.

Routine tests shall be carried out by vendor on all the PCUs as per customer approved MQP. Following are the minimum tests to be conducted but not limited to:

(a) HV and IR tests on 100% PCUs.

(b) Functional tests

(c) Load testing of inverter on 1No. PCU:

- Verification of inverter performance in its stand alone operational mode with a defined power (up to 100% rated full load power) and DC input voltage (up to max value). All parameters: DC voltage, current, power, grid voltage / current of R,Y,B lines, line frequency, ac output power, ac output energy, power factor, line current, efficiency, THD, etc. to be measured at 25%, 50%, 75% and 100% of the rated nominal power and checked against specified acceptance norms.

(d) Heat Run Test at rated full load on 1 no. panel

(e) Protection tests (by direct method or simulation method)

- Verification of automatic disconnecting and reconnecting of Inverter to the grid, based on rise and fall of heat sink and cabinet temperature with reference to set points.
- DC Reverse Polarity protection test
- DC Ground Fault
- AC and DC Overvoltage
- Abnormal voltage and frequency

Test reports shall be submitted prior to dispatch of the system to the site.

6.0 Documents to be submitted after receipt of purchase order

6.1	Following documents shall be submitted for approval within seven days from date of purchase order. 1. GTP/Datasheet 2. General Arrangement of PCU and other auxiliary equipment, lighting, HVAC details etc., 3. BOM for complete PCU including all major components of PCU, AC and DC Combiner Panels 4. Type test reports 5. Spares List 6. Manufacturing Quality Plan (MQP) Vendor shall proceed with Manufacturing only after final approval of all the listed documents.

7.0 Documents to be submitted along with consignment

7.1	Following documents shall be submitted at the time of dispatch: a. Test reports on individual PCUs b. Technical manual with system specifications, installation guidelines, commissioning guidelines, schematic drawings, circuit board overlays, system set points, calibration settings, hardware settings, cable schedule, general arrangement drawings, panel details. c. Operation and Maintenance manual including final as Built and tested drawings and datasheet, test reports, catalogs of individual components, schematic drgs shall be provided (segregated section wise) in both hard copy and soft copy. d. PC/laptop interfacing software, if required

Vendor Bid Form

RFQ/NIT/Enquiry no.	**RAJBOS0074**
Description	**Supply and Installation & Commissioning (I&C) of PCU for Rewa ultra Mega solar project, Neemuch**

Sr. No	DESCRIPTION	VENDOR TO FILL THE DETAILS
		RESPONSE
1	VENDOR NAME	
2	OFFICE ADDRESS	
3	WORKS ADDRESS (1,2 etc if any)	
4	Order to be Placed on, Details	
5	CONTACT PERSON	
6	TELE, MOBILE NO	
7	FIRM MAIL IDs	
8	GST NO, scanned copy (mandatory document).**To be attached under "Commercial documents,certificates and forms" packet cover**	
9	PAN NO, scanned copy(mandatory document)**.To be attached under "Commercial documents,certificates and forms" packet cover**	
10	BANK AND BRANCH NAME	
11	BANK ACCOUNT NO	
12	MSE VENDOR / NON MSE VENDOR	
13	Vendor to submit the MSE documents as per ITB/GCC/SCC along with UAM no/Udyam Registration . In case of non-submission, vendor will be treated at par with non-MSE vendors (Mandatory document).**To be attached under "Commercial documents,certificates and forms" packet cover**	
14	ORIGIN OF DISPATCH	
15	QUOTATION REFERENCE	
16	QUOTATION DATE	
17	Preference to make in India order2017 dated 16.09.2020.Submit certificate as per Self Declaration for Local content .**To be attached under "Commercial documents,certificates and forms" packet cover**	
18	Declaration required under Rule 144(xi) of General FinancialRules, 2017 amendment dt 23.07.2020 issued by Ministry of Finance, Govt. of India.Refer Annexure-X for Restrictions under Rule 144(Xi) of General Financial Rules,2017 amendment dt:23.07.2020. **The Bidder shall mandatorily submit Declaration as per format enclosed as part of tender.** **To be attached under "Commercial documents,certificates and forms" packet cover**	
19	The bidder declares that they will not enter into any illegal or undisclosed agreement or understanding, whether formal or informal with other bidder(s).This applies in particular to prices,specifications,certifications,subsidiary contracts,submission or non-submission of bids or any other actions to restrict competitiveness or to introduce cartelization in the bidding process. In case, the Bidder is found having indulged in above activities, suitable action shall be taken by BHEL as per extant policies/guidelines.	

UNPRICED BID

RFQ/NIT/Enquiry No.				RAJBOS0074				
Description	Supply and Installation and Commissioning (I&C) of Centralized 1500V PCUs (2MW & above) for Rewa ultra mega solar project, Neemuch,Madhya Pradesh							
Sl. No	Description	Qty	Unit	WHETHER QUOTED OR NOT **[YES/NO]**	HSN/SAC CODE	GST INDICATED **[IGST or (CGST+SGST)]**	GST %	CURRENCY
1	Supply of PCU as per spec PS-439-1366 + Freight	500	MW					INR
2	I&C of PCU as per PS-439-1366	500	MW					INR