Bharat Heavy Electricals Ltd.,

(A Government of India undertaking)

Solar Business Division

Prof CNR Rao Circle, Opp. IISC, Malleswaram, Bangalore-560012, India

E-TENDER

Quotations are invited under two-part bid system (open tender) for Pre-Bid Tie Up for Supply and Installation & Commissioning of Centralized 1500V PCUs (2MW & above) for 500MW Rewa Ultra Mega Solar Limited (RUMSL) Solar Parks, Neemuch in Madhya Pradesh through e-procurement route.

The Tender shall be procured through e-procurement route. Kindly refer Website **https://eprocurebhel.co.in/nicgep/app/** for details.

RFQ NO and date	RAJBOS0074 dated 01.06.2021 (E-tender)
RFQ due date & time	11.06.2021 up to 13.00 hrs (IST)
Date, Time & Venue of Part-I Bid Opening	11.06.2021 after 13.30 hrs (IST) (E-tender) – Website - **https://eprocurebhel.co.in/nicgep/app/**
Date, Time & Venue of Price Bid opening	Will be intimated later for technically accepted vendors
Address for Communication & Contact Person in BHEL	Mr. Rajesh S (09845634534)/ Mr. Vivek Yadav (09449039232), Email: s.rajesh@bhel.in vivekyadav@bhel.in **Engineering Department**: Mr. PVV RAVI KISHORE (7676492191) BHEL SBD, Malleswaram, opp IISC Bangalore-560 012. INDIA

Note:

1) This is not a Global Tender. Latest GOI guidelines w.r.t Make in India, MSEs, Local Suppliers, Contracts valued less than Rs.200 Crore shall be applicable to this tender.
2) Any bidder from a country which shares a land border with India will be eligible to bid in this tender only if the bidder is registered with the Competent Authority
3) Any Deviations from or additions to the "General Conditions of Contract" or "Special Conditions of Contract" require BHEL's express written consent. The General Terms of Business or Sale of the Bidder shall not apply to this tender.

PRE- QUALIFICATION CRITERIA

1. Vendor shall be an Original Equipment Manufacturer (OEM). Vendor shall submit the product catalogue as an evidence.

2. Vendor should have supplied minimum 500 MW cumulative capacity of central inverters/ PCUs for PV power plants in the last 4 years from the date of technical bid opening. Vendor shall submit PO copies along with the dispatch documents or completion certificate or commissioning certificate from developer or EPC Company as an evidence.

3. Vendor should have commissioned minimum 25 MW cumulative capacity of 1500 V central inverters/ PCUs in PV power plants. Vendor shall submit commissioning certificate or performance certificate from developer or EPC Company as an evidence.

4. Vendor should have a service center in India. Vendor shall submit the details of service center as an evidence.

QUANTITY DISTRIBUTION

Total quantity of 500MW to be shared among 02(two) vendors.

L1:170MW+160MW=330MW

L2:170MW

L2 will get to supply 170MW if he accepts the L1 price. If L2 doesn't accept L1 price, then the same offer will be made to L3,L4,L5 and so on. If none of the vendors accept the L1 price, BHEL reserves the right to order the full quantity on L1 vendor or retender the balance quantity.

बी एच ई एल BHEL	**PURCHASE SPECIFICATION FOR OUTDOOR GRID-CONNECTED POWER CONDITIONING UNITS**	**PS 439-1366** **REV. No. 00** **PAGE 1 OF 17**

Technical specification

for

Supply, installation and commissioning of

Outdoor grid interactive Power Conditioning Units (CENTRAL INVERTER)

***Approved:* PRACHI RAO V**

Prepared	*Checked*	*Date*
PVV RAVI KISHORE V Digitally signed by PVV RAVI KISHORE VUYYURU DN: c=IN, o=BHARAT HEAVY ELECTRICALS LIMITED, ou=BHEL, ELECTRONICS DIVISION, postalCode=560026, st=Karnataka, 2.5.4.20=888553f35c67761b63b1db3a963409e59ac00db05fae8fc66f0bac722e824418, cn=PVV RAVI KISHORE VUYYURU Date: 2021.03.28 13:53:12 +05'30'	S Ashok Digitally signed by ASHOK SUNDARESAN DN: c=IN, o=BHARAT HEAVY ELECTRICALS LIMITED, ou=BHEL, ELECTRONICS DIVISION, postalCode=560026, st=Karnataka, 2.5.4.20=5b4284ceebd291c0fb0ae1e717a742dac1d6b86d22756719c15237cc2c1d4716, serialNumber=79205cb92fc6b88bec93832bd6973ca18a43930dc9edebf0dd3e9ec6f4df3cae, cn=ASHOK SUNDARESAN Date: 2021.03.28 15:03:15 +05'30'	28/03/2021

INTRODUCTION:

This technical specification provides details of supply of Outdoor for 3-phase Grid-connected Power Conditioning Units (PCU)/ Central inverter. The scope also includes commissioning of the supplied units at the project site for synchronizing the generated ac power with LV side of a transformer that connects to 33kV grid on HV side.

1.0 Scope of supply

SL No	Item Description	Quantity
1.1	Supply of: Outdoor PCU (Central inverter) Outdoor PCU/ Central inverter shall have minimum IP54 and suitable for outdoor installation. DC Voltage Rating: 1500V Minimum power rating of each PCU block: 2 MW Each block may comprise of single/multiple inverters connected at the PCU output to give the rated output. The name plate rating shall be the output rating at 50^{o}C. **PCUs quantity required is for 1x160 MW and 2x170 MW PV power plant blocks totaling to 500MW.** Tentatively a) 160MW – 1 no., PV power plant will be having 7 sub pooling blocks of 22 to 25 MW. b) 170MW -2 nos., PV power plants will be having 7 sub pooling blocks of 22 to 25 MW. Vendor to indicate the rating of PCUs and the quantity being supplied for each 160MW and 170 MW in their offer block wise.	500 MW
1.2	**Supply of Spares** for power conditioning units. List of items with quantity is as follows: 1) Control Cards for PCU Quantity = 1 set of each type 2) Fuses Quantity = 1 set of each type and rating 3) Surge Protection Device Quantity = 1 set of each type and rating 4) MCCBs, MCBs Quantity = 1 set of each type and rating 5) AC Contactor, DC Contactor, Air Circuit Breaker – 1 no each	3 sets (1set for each block)

	6) Dust filters – 25% of total quantity **Notes:** (a) **1 SET comprises of the total quantity for each type of PCU being offered for each block. Therefore, if same rating of PCUs are supplied for each block supply, then total spare quantity shall be 1 set for each block supply. If 2 ratings of PCUs are used for each Block, then the total spare quantity shall be 2 sets for block.** **(b) The above spare quantities are for contingency purposes over and above the warranty requirements.** **(c) Item-wise BOQ and break-up prices shall be provided in the offer.** (d) **Control cards of one PCU refers to all the electronics cards used in the PCU including main microprocessor cards, protection cards, I/O cards, gate driver cards and any other PCB used in the PCU not specifically indicated above.**	
1.3	**Commissioning of PCUs along with Training at site.** BHEL scope of activities at site for installation and commissioning: (1) Movement and positioning of outdoor PCU panels at the earmarked position on the outdoor RCC platform. (2) Crimping the incoming (DC side) and outgoing (AC side) cables (BHEL supply) using the cable lugs provided by the vendor. (3) Connecting at the respective termination ends of the panels using the cable glands and fastening hardware (nuts, bolts, washers etc) provided by the vendor. Vendor scope of activities at site for commissioning: (1) All the electrical checks that are required to confirm that solar DC parameters (current, voltage) are available at the DC input side of PCUs. (2) Service engineers shall be present at site during installation of PCUs, commissioning of solar power plant, providing all necessary guidance and support to achieve successful synchronization of PCU output with grid and also to trouble-shoot / resolve the technical problems associated with PCU. Commissioning / Service Engineer shall be from OEM. (3) Guidance and support to BHEL team, at the time of installation and commissioning of SCADA, in respect of connection of communication cables to PCUs and technical problems related to receiving data signals at SCADA station from PCUs. (4) Training: Vendor shall provide training at site to BHEL and customer's engineers during commissioning. Training shall cover various technical aspects such as functional/ operational features, trouble-shooting procedures, maintenance schedules, requirements, safety, emergency precautions etc. Both the theory and practical (hands on) training shall be covered.	500 MW

	Note: Supply and installation of integrated SCADA system for the overall power plant is within BHEL scope. The lump-sum price shall include all the costs that will be incurred by the vendor towards commissioning including travel, boarding, lodging and any other contingency expenses.	

2.0 Warranty

Vendor shall provide **comprehensive warranty** for 60 months from date of commissioning or 66 months from date of supply, whichever is earlier. Vendor shall enclose, along with technical bid, the complete scope, terms and conditions of the warranty. Warranty shall cover all items including consumables like fuses, SPDs, dust filters etc.,

During the warranty period, whenever a technical problem is encountered with the PCU, BHEL will report the same to the vendor. Vendor shall resolve the problem within two days from the date of reporting, including any visit of their service representative as required, within this duration for repair/replacement of failed items and re-commissioning of the PCU. Warranty support also includes software upgradations, as required and statutory compliances.

3.0 Technical Documents to be submitted along with offer

1. Vendor shall provide nil deviation letter as a confirmation to BHEL specification.

In case of any clarifications needed in this specification, the same needs to be communicated in writing at least five days earlier to the technical bid opening date.

2. Product datasheet of the offered PCU model(s).
3. Overall General Arrangement of PCU including DC and AC Combiner Panels.
4. Itemized list of spares offered (with quantity) and without prices as per Cl. 1.2.
5. List of type tests /IEC certifications available along with test certificates complying with Cl.4.12 of this specification. Supporting test reports shall be provided by vendor during detailed engineering.

4.0 Technical specification of Power Conditioning Units

4.1 Basic requirements (PCU type, Standards, Technology, Interconnections, Interfaces etc)

#	Parameter	BHEL specification
4.1.1	PCU type	Grid-interactive. PCU components shall be designed accordingly to remain connected to the grid as per Central Electricity Authority Technical (standards for connectivity to the grid) regulation 2007 with all latest amendments. **Low power mode:** The control system that continuously monitors the output of the

		solar PV plant until pre-set value is exceeded and begins to export power provided there is sufficient solar energy and the grid voltage and frequency are in the specified range. Further, the inverter shall be capable of operation under reduced power mode and shall not trip when the PV array output voltage is below MPPT range under high temperature conditions. **Active MPPT mode (high power mode):** When solar radiation increases further, PCU shall enter maximum power point tracking (MPPT) mode and adjust the voltage of the SPV array to maximize solar energy fed into the grid. When the solar radiation falls below threshold level, the PCU shall enter lower power mode. **Sleep mode:** Automatic 'sleep' mode shall be provided so that unnecessary losses are minimized at night. Vendor shall provide threshold DC voltage level / power level of the PCU as to when it shall enter into the sleep mode and back to low power mode and MPPT mode during detailed engineering for BHEL/customer approval. **Low Voltage mode:** The Inverter shall be capable of operating under reduced power mode and shall not trip when the PV array output is below MPPT range under high temperature conditions**.**
4.1.2	Compliance with standards	

Sl.	Standard	Description
1	IEC 61683	Photovoltaic systems - Power conditioners – Procedure for measuring efficiency
2	EN 50530	Overall Efficiency of Photovoltaic Inverters
3	IEC 62109-1 & 2	Safety of power converters for use in photovoltaic power systems
4	IS 16221, Part 1 and 2 -2016	Safety of Power Converters for Photovoltaic system
5	IEC 61000-6-2	Electromagnetic compatibility (EMC) - Part 6-2: Generic standards-Immunity Standard for industrial environments
6	IEC 61000-6-4	Electromagnetic compatibility (EMC) - Part 6-4: Generic standards- Emission standard for

				industrial environments
		7	IEC 62116/ IEEE 1547/IEEE 519 / UL 1741 / Equivalent EN/ BIS standard	Utility-interconnected photovoltaic inverters – Test procedure of islanding prevention measures, Anti Islanding
		8	IEC 61727	Characteristics of the Utility Interface.
		9	IEC 60068-2-1,2, 14, 30, 68*:2020	Environmental testing
		10	IEC 62093	Balance-of-system components for photovoltaic systems - Design qualification natural environments
		11	IEC 62894: 2014: /EN 50524	Data Sheet and Name Plate for Photovoltaic Inverters
		12	Grid Connectivity - CEA Technical Standards for Connectivity to the Grid Regulations 2007 with latest amendment and latest CERC / Regulations and Grid Codes - including LVRT requirement (CEA resolution on Petition No. 420/MP/2014 Dt. 05.01.2016).	
		13	BIS Certification: As applicable for Central Inverters and as per latest BIS norms	
	*Self-certification is acceptable for IEC 60068-2-68:2020. # Inverter manufacturer to ensure that bought-out items comply to this standard. Responsibility of all bought -out items installed in the inverters and their technical standard compliance are on inverter manufacturer to ensure compliance The Power Conditioners deployed in the power plants must have valid test certificates for their certification as per above specified IEC / UL/ BIS standards by ILAC accredited laboratories or one of the NABL Accredited Certification Centers in India All the type test certificates as per the standards mentioned above shall be submitted for approval.			
4.1.3	Corrosion Zone: Moderate zone.	PCU design shall be suitable for working in this environment.		
4.1.4	Maximum Power Point Tracking (MPPT)	MPPT shall be integrated in the power conditioning unit to maximize energy drawn from the solar PV array. The MPPT should be microprocessor based to minimize power losses. The details of working mechanism of MPPT shall be submitted during the detailed engineering. The operating voltage range of PCU and the MPPT shall be large enough such that it satisfactorily operates for PV modules exposed to the maximum ambient temperature of 50 deg C. The MPPT unit shall confirm to IEC 62093 for design		

		qualification.
4.1.5	AC-DC conversion	3-phase Inverter stack
4.1.6	Built-in support systems	PCU shall be provided with protection circuits, monitoring circuits, data logging & storage system, provisions to download data to PC/Laptop, MODBUS communication outputs for SCADA interface etc as per Cl. 4.7 of this specification.
4.1.7	Heat exchangers	Vendor shall submit HVAC calculations during detailed engineering.
4.1.8	DC input and AC output terminations	Input and output terminations together with cable glands, lugs, hardware shall be provided to match the connections using BHEL cables as specified under related clauses of this specification. Terminals should be shrouded.
4.1.9	Environment protection	All PCB cards shall be provided with suitable coating (epoxy etc) for protection.

4.2 Technical parameters

#	**Technical parameter**	**BHEL specification**
4.2.1	Output power rating	As per Cl. 1.1. Vendor to specify ratings being offered.
4.2.2	AC grid connection	3-phase
4.2.3	Output frequency	50 Hz
4.2.4	Nominal output voltage	Value to be indicated by vendor
4.2.5	Maximum DC input voltage (Max open circuit PV voltage)	Minimum1500 V DC
4.2.6	MPPT Range of control system	Range to be indicated by vendor.
4.2.7	DC side peak power	Vendor shall confirm that PCU is suitable for overloading of DC input power. Vendor to indicate the value in %. Minimum requirement is 50%
4.2.8	Max DC operating current	Value to be indicated by vendor.
4.2.9	Max AC output current	Value to be indicated by vendor corresponding to the rated output power of the PCU.

4.2.10	Power factor	Designed operation close to unity PF. Adjustable window 0.85 lead to 0.85 lag
4.2.11	Ambient temperature	0 to 50 deg C.
4.2.12	Relative Humidity	Up to 95% non-condensing
4.2.13	Protection class	As per Cl. 1.1
4.2.14	Grid Frequency tolerance	+/- 3 Hz
4.2.15	Grid Voltage tolerance	- 10% and +10% (Minimum)
4.2.17	AC output THDi limits	Less than 3% at rated power
4.2.18	Maximum noise level	Value to be indicated by vendor
4.2.19	DC injection (as % of nominal load current)	DC injection shall be limited to 0.5% of the rated current of the inverter
4.2.20	Flicker	Shall be as per IEC 61000/IEEE 519
4.2.21	Set point pre-selection for active power and VAR control	PCU shall be provided with all necessary features that will enable set point selection through SCADA. For this PCU vendor shall furnish the Modbus mapping for the set points or suggest the possible method for selecting VAR control. Operator shall be able to limit the total power (Active and Reactive) injected in the grid through remote/manual intervention as and when required in view of grid security.
4.2.22	Re-synchronization time	In case of grid failure, the PCU shall be re-synchronized with grid after revival of power supply. Vendor shall indicate the time taken by PCU to be re-synchronized after restoration of grid supply.
4.2.23	European efficiency	≥ 98%, measured as per IEC 61683 standard for measuring efficiency
4.2.24	Peak Efficiency	Inverter No Load / Full Load Loss Calculation must be submitted by the bidder during detailed engineering.
4.2.25	PCU availability	The up-time of Inverters should be of minimum 99% in a year, in case of failing to achieve this due to failure of any component of inverter the vendor shall either replace the inverter or the component at their own cost
4.2.26	No load loss	No load loss shall be < 1% of rated power and maximum loss in sleep mode shall be less than 0.05%.