

		Power Supply : 230/440V AC	
5	Table Top Inductions	Top Size : 16" X 18" X 4.5" Frame Material: S/S 304, with complete power electronics, adjustable temperature range, power knob , over heat control with induction on/ off/ trip/ overheat indicators etc Power Supply : 230/440V AC	3.5 kW
6	Induction Vessels Kadhai/Pateelas, Flat Bottom stock pots	Capacity: 10 ltrs to 30 ltrs Material : SS 430 food grade stainless steel with strong bottom, with handles and lids	

3.0 General Notes

- All cooking pot/ vessel material should be food grade compatible stainless steel.
- Kitchen layout should be such as to facilitate easy movement and ensure safety of the person working and handling the equipment
- The bidder shall submit Manufacturer's test certificate / Test results prior to supply of material for NTPC acceptance.

4.0 Quantities and Ratings

Following quantity to be provided for induction cooking system

Description	UOM	Qty
Induction Cook Top (7 kW)	No	4
Induction Roti Tawa (7 kW)	No	3
Induction Dosa Tawa (7 kW)	No	2
Induction Roti Puffer (7 kW)	No	2
Induction Idli Steamer (7 kW)	No	2
Table Top Induction (3.5 kW)	No	2
Induction Vessels : Patelas/ Stock Pot/ Flat Bottom Kadhai (10 ltrs to 30 Ltrs)	No	14

5.0 Civil and Electrical Works

All the civil and electrical works required for installation and commissioning of the induction cooking system at various canteens of NETRA is in the bidder scope. Bidder shall submit the kitchen layout clearing showing the ventilation equipment and Electrical power points, drains, working area etc for NTPC approval.

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D. GENERAL SYSTEMS

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D -1 WEATHER MONITORING STATION

1.0 General

As a part of weather monitoring station, Bidder shall provide following measuring instruments with all necessary software & hardware required to integrate with SCADA so as to enable availability of data from meteorological instrument in SCADA. Each instrument shall be supplied with necessary cables, transmitters and accessories (Trackers, Mounting and base stand etc.) provided by OEM of the sensors only.

Aux. power required by instruments and data logger (If supplied) shall be from UPS only. Data logger shall have provision to receive redundant power supply.

All the instruments to be supplied shall have valid calibration certificate.

Single sensor for measuring combination of Wind Speed, Wind Direction, Relative humidity and Rainfall is also acceptable however offered sensor shall meet the specification as mentioned in following sections.

2.0 SOLAR RADIATION SENSORS

Contractor shall provide Solar Radiation Sensors as per specification given in following section. Contractor has the option to provide these sensors on separate base or on a single base (radiation monitoring station) with tracker, shadow ring and transmitter etc provided by the OEM. Calibration certificate with calibration traceability to World Radiation Reference (WRR) or World Radiation Centre (WRC) shall be furnished along with solar radiation sensors. Bidder shall provide Instrument manual in hard and soft form.

2.1 Pyranometer

Bidder shall provide minimum **03 (Three) numbers** of Secondary Standard Pyranometer as per ISO 9060 **for measuring incident solar radiation as for following**

- Global Horizontal Irradiance (GHI) - 1 Nos
- Global Inclined Irradiance (GII) -1 Nos
- Diffuse Horizontal Irradiance (DHI) - 1 Nos

Technical Requirement of Pyranometer

Sl.No	Details	Values
1.	Principle	Thermopile
2.	Spectral Response.	310 to 2800 nm
3.	Sensitivity	Min 7 micro-volt/w/m ²
4.	Time response (95%):	Max 15 s
5.	Non linearity:	±0.5%
6.	Temperature Response:	±2%
7.	Tilt error:	< ±0.5%.
8.	Zero offset thermal radiation:	±7 w/m ²
9.	Zero offset temperature change	±2 w/m ²

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10.	Operating temperature range:	0 deg to +80 deg.
11.	Uncertainty (95% confidence Level)	Hourly- Max-3%, Daily- Max-2%
12.	Non stability	Max $\pm 0.8\%$
13.	Response Time(95% of final value)	<5 sec

Shadow ring/ball for measuring DHI shall require no regular adjustment of tracker and shadow ring/ball. Pyranometer shall be shaded throughout the day and shall be exposed to diffuse solar radiation only to provide DHI value without any calculation.

All the Pyranometer have to be mounted at single location at shadow free area. The GII Pyranometer has to be at the same inclination as the angular tilt of module mounting structure.

Bidder shall provide 1 (One) no. Battery powered portable handheld data logger supplied by the OEM of the offered Pyranometer.

3.0 TEMPERATURE SENSORS

3.1 Ambient Air Temperature Sensor (Qty -1 no.)

Sl.No	Details	Values
1.	Principle	RTD (Platinum) Resistance proportional to temperature
2.	Range	0-50 °C
3.	Accuracy	± 0.2 °C
4.	Operating Temperature	0 to 50 °C
5.	Radiation Shield	Non-aspirated Radiation Shield

3.2 Indoor Air Temperature Sensor (Qty – 2 no. at each Inverter room)

Sl.No	Details	Values
1.	Principle	RTD (Platinum) Resistance proportional to temperature
2.	Range	0-70 °C
3.	Accuracy	± 0.2 °C
4.	Operating Temperature and calibration	0 to 70 °C

3.3 Module Temperature Sensor (Qty – 1 no. per 500 kW)

Sl.No	Details	Values
1.	Principle	RTD (Platinum) Resistance proportional to temperature
2.	Range	0-100 °C
3.	Accuracy	± 0.2 °C
4.	Operating Temperature	0 to 100 °C

Module temperature sensor shall be fixed on the back of module surface with adhesive or tape without using any mechanical fastener.

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4.0 Wind Sensor (Qty- 1 no)

Sl.No	Details	Values
1.	Principle	Frequency proportional to wind speed/Ultrasonic Sensor
2.	Velocity range	0-60 m/ sec
3.	Threshold	0.3 m/s
4.	Operating Temperature	0 to 50 deg C
5.	Accuracy	3% (upto 35 m/s), 5% (Above 35 m/s) RMS

4.1 Wind Direction Sensor (Qty- 1no)

Sl.No	Details	Values
1.	Principle	Potentiometric type sensor (Resistance proportional to Wind direction) /Ultrasonic Sensor
2.	Range	0-360 deg
3.	Accuracy	±5 deg
4.	Operating Temperature	0 to 50 deg C

5.0 RELATIVE HUMIDITY (%) (Qty- 1no)

Sl.No	Details	Values
1.	Range	0-100 %
2.	Accuracy	±3%
3.	Resolution	1%
4.	Operating Temperature	0 to 50 deg C

6.0 CALIBRATION

All the measuring instruments to be supplied shall have valid and traceable calibration certificate.

7.0 DATA LOGGER

Weather Monitoring system shall be provided with standalone Data logger suitable for outdoor application with IP65 Protection and industrial grade hardware suitable for operating temperature up to 55 Deg. C. Data logger shall be calibrated and proven in field for at least one year in outdoor environment. Data logger shall have following minimum features:

Processor	32 bits
Time synchronization	With Built in GPS Clock or with Solar SCADA GPC Clock
Wireless communication	GSM/GPRS Modem
Data storage	SD card, Min 2GB for storage of raw and processed data locally at resolution of 1 Second for retrieval whenever required. Data to be stored shall be in unencrypted CSV or equivalent format.
Display	LCD display for easy maintenance and debugging for site engineer

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Scan resolution	1 Sec
Analog to Digital Converter (ADC)	16 Bit, Sampling -10 Hz (Min)
I/P Channel	As required with 20 % spare of each type of channel

8.0 METEOROLOGICAL STATION

Sensors shall be installed at suitable height for which Mast/Structure for the sensor shall be provided by the bidder. Proper fencing shall be provided around meteorological station where the Pyranometer, Wind, Ambient Temp. Sensor, Data logger etc. are installed.

D-2 FIRE FIGHTING AND ALARM SYSTEM

1.0 GENERAL

The SPV +BESS plant shall be equipped with suitable fire protection & firefighting systems for protection of entire equipment, transformer yard, BESS area , CMCS as per CEIG requirements.

Bidder shall comply with recommendation of Tariff Advisory Committee for incurring minimal premium for insurance. The installation shall meet all applicable statutory requirements, safety regulations in terms of fire protection.

2.0 The firefighting system for the proposed power plant for fire protection shall consist of:

- a) Sand buckets
- b) Portable fire extinguishers

The above shall be provided as per the relevant standard and relevant guidelines of safety and fire. The tested portable fire extinguishers shall be type test and test reports should be submitted to NTPC by the bidder.

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D-3 MODULE CLEANING SYSTEM

Bidder shall propose solar modules cleaning system made of either dry cleaning system or cleaning with water through pipe network, or a combination.

For water based module cleaning system, bidder has to ensure and provide all the arrangement for water cleaning system.

1.0 Solar Module Washing Systems with Fresh Water:

- 1.2 Bidder shall provide permanent arrangement for module washing in the SPV Plant. This shall include installing storage tank with pump and motor at strategic points with the plant layout and laying network of HDPE pipe conforming to IS 4984 and other relevant codes. The module washing shall be complete in all respect and the details shall conform to the relevant IS codes. The complete scheme shall be subject to approval of the owner including inputs points, design and drawings for the system. Opening from the HDPE pipe with manual isolating valves should be provided at regular intervals. The opening pipes for fixing the movable/Hose pipes for spraying water on module shall be made of GI pipe. Bidder shall install flow meter at pump discharge/ main header for measurement of water consumption.
- 1.3 Design of solar PV module cleaning system shall be designed such that complete solar plant can be cleaned with fresh water as per the requirement (min twice in a month). Module cleaning system piping network shall be close looped pipe network configuration consists of Main pipe, sub-main and branches in the main plot. In array layout, if solar blocks is separated from main plot due to natural topology of the land, Module cleaning system piping network may be design for dead end/tree pipe network configuration. Cut-off valves shall be provided at suitable junction points so that the repair works may be conducted at a particular area without disturbing the whole area. The water tapping for the cleaning system will be from the existing line and the tapping point will be decided during detail engineering.
- 1.4 Bidder shall provide the piping and the instrumentation diagram (P&ID) of water washing arrangement including the physical sequence of branches, reducers, valves, pressure gauge, cleaning points with location of pump(s) and water storage tanks and submit for approval during detailed engineering.
- 1.5 Maximum length of hose pipe shall be 100 meters from tapping point.
- 1.6 The entire water washing system shall be tested for minimum 0.5 N/mm² or double the maximum working pressure, whichever is greater.

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D-4 TRIAL OPERATION, FUNCTIONAL TEST AND PERFORMANCE GUARANTEE TEST

1.0 Trial Operation

The plant will be subject to trial run after completion of erection and commissioning wherein SPV+BESS plant shall perform trouble-free operation for cumulative 72 hours at min 90% load during which functionality of all plant components shall be demonstrated. During Trial run, Bidder should successfully demonstrate all the control and operating function of the system along with load and source prioritization as per technical specification. .

After successful completion of trial run and acceptance by NTPC, SPV Plant shall be deemed to be successfully erected & fully commissioned.

Bidder shall prepare a defect list during trial run and shall attend all those defects and necessary modifications and/or replacements. Any interruption on account of the system will restart the trial run counting.

The plant will be declared successfully commissioned only after successful operation during trial run period.

2.0 Functional Test

- a. Functional Tests shall be carried out after successful completion of uninterrupted 'Trial Operation' for 72 hours at min. 90% plant capacity.
- b. The parameter to be monitored during functional test shall be mutually agreed upon during detail engineering
- c. Functional Tests duration shall be for 24 continuous hours at full plant capacity.
- d. There shall be no monetary penalty in case Functional Test parameters are not met. However, the Bidder shall carry out all necessary modifications and/or replacements in the equipments, to make the equipment/system comply with the Functional Test parameters at no extra cost to the Owner and re-conduct Functional Tests with Owner's consent.

3.0 Performance Guarantee Test

The final acceptance test as to prove the Performance Guarantee shall be conducted by the Contractor in presence of NTPC. The PG test shall be conducted on the basis of PG test procedure to be submitted by the contractor and approved by NTPC. This test shall be binding on all the parties of the Contract to determine compliance of the equipment with the functional guarantee. Any special equipment, instrumentation tools and tackles and manpower, required for the successful completion of the Performance Guarantee Test shall be provided by the Contractor free of cost. Performance Guarantee Test of BESS shall be carried out after successful completion of Trial operation and Functional test.

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PG Test shall be carried out to 1 MW / 1 MWh BESS capacity while simultaneously meeting the requirement of technical specification.

MW and MWh Capacity (MWhC) Testing:

In order to demonstrate the required MW & MWh Capacity (MWhC) of BESS at the point of interconnection to the grid (PCC), this test shall be conducted as per mutually discussed procedure.

In case measured MW/MWhC is lower than the required value, bidder to take necessary corrective action to make the required MW/MWhC without any cost to NTPC. In such case the PG test shall be repeated.

PG Test Acceptance Conditions:

- a. Liquidated damage for deviation in performance shall be computed as per following formula:
 - $\text{Deviation in performance} = (\text{Tested MW and MWh capacity of Battery System} - \text{Declared capacity of Battery System}) / \text{Guaranteed capacity of Battery System}$
 - $\text{Liquidated damage} = (\text{Contract Value}) \times (\text{Deviation in performance})$
- b. There shall be no incentive / reward in case of positive performance deviation i.e. when capacity of Battery System during PG Test is greater than the declared capacity.
- c. In case it is found that the equipment/system has failed to meet the guarantees, Bidder shall carry out all necessary modifications and/or replacements to make the equipment/system comply with the guaranteed requirements at no extra cost to the Owner and re-conduct the performance guarantee test(s) with Owner's consent.
- d. Bidder's aggregate liability to pay Liquidated Damages (LD) for failure to attain the performance guarantee shall not exceed five percent (5 %) of the Contract Price.
- e. Owner will accept the equipment/system after levying liquidated damages only if the deviation is less than 5% of the declared value. If the deviation is greater than 5% of the declared value, Bidder shall carry out all necessary modifications and/or replacements to make the equipment/system meet the declared requirements at no extra cost to the Owner and re-conduct the performance guarantee test(s) with Owner's consent.
- f. Declared capacity of the Battery should not be less than the plant capacity (1 MW / 1 MWh) of this project.
- g. Bidder shall provide any correction curves if applicable during PG test procedure approval.

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E. CIVIL WORKS

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