# Bharat Heavy Electricals Ltd.,

(A Government of India undertaking)

**Electronics Division**

PB No.2606, Mysore Road, Bangalore-560026, India

Quotations are invited under two part bid system for Supply,I&C and O&M of Module washing system for NTPC 100MW RAMAGUNDAM FLOATING SOLAR PV PROJECT through e-procurement route.

Kindly refer Website https://eprocurebhel.co.in/nicgep/app/ for details.

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| RFQ NO and date | BKC0000068 dated 25.05.2021. (E-tender) |
| RFQ due date & time | 10th JUNE 2021 up to 13.00 hrs (IST) |
| Date, Time & Venue of Part-I Bid Opening | 10.06.2021 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 | Engineering Department:<br>Mr. Vijay Choudary (9415041583)<br>Purchase Department:<br>Mr. Chandan BK (9739252560)<br>BHEL Solar Business Division,<br>Malleswaram, opp IISC,<br>Bangalore-560 026. INDIA<br>Email: chandanbk@bhel.in<br>Vijayk.choudhary@bhel.in |

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.

# Consolidated Bill of Material

**Item: PV Module Washing System**

**Project: FSPV NTPC Ramagundam 100 MW**

| S.No. | Material Code | Items And Description | Unit | Quantity |
|---|---|---|---|---|
| 1* | | Design and Supply of all the module washing system parts as per the approved BOM | Set | 1 |
| 2 | | I & C of complete PV module cleaning system as per technical specifications | AU | 1 |
| 3 | | O&M of Module Washing System (1 AU= 1 Month) | AU | 3 |
| * | **This item shall be breaked up after approval of design, layout and BOM.** | | | |


ವಿಜಯ್ ಕುಮಾರ್ ಚೌಧರಿ, ಉಪ ವ್ಯವಸ್ಥಾಪಕರು/ಎಸ್.ಸಿ. & ಪಿ.ವಿ.-ಎಂಜಿ.
विजय कुमार चौधरी, उप प्रबंधक/एस.सी. एवं पी.वी.- इंजी.
VIJAY KUMAR CHOUDHARY, DY. MANAGER/SC & PV-ENGG.
BHEL-EDN, MYSORE ROAD, BENGALURU-560026

## PRE QUALIFICATION CRITERIA

1. **Technical Assessment:**

Bidder should have experience of having successfully completed similar works during the last 5 years from tender of tender opening:

Similar works means bidders should have carried out supply, installation and Testing of PV-Module Washing systems for Solar plants of Minimum 20MW capacity. These systems should essentially involve the following activities:

a.) Laying of Pipe line along with accessories.
b.) Installation of Pump station.
c.) Pressure testing of the entire system.

**Or**

Bidder should have executed BOS/ O&M works for Solar PV Plants of Minimum 50MW capacity involving both Supply and I&C.

As evidence to this, copy of such purchase/work orders and their performance report/completion certificate as a proof for successful execution of the order is to be submitted for either of the two criteria.

Note: Work/order completion has to be in the last 5 years from date of tender opening–Work Order /Purchase order placement date can be earlier than that.

2. **Financial Assessment:**

Average annual financial turn over during the last 3 years, ending 31st March of the previous financial year, should be Rs 46 Lakhs. CA Certificate for average turnover to be submitted.

BHEL reserves the right to verify the documents submitted by the contractor. During verification, if it is found fake/forged/manipulated, suitable penal action shall be taken against bidder as per extent guidelines of BHEL for suspension of business dealing.

Suspension of business dealings with Suppliers/Contractors shall be dealt as per the guidelines available on BHEL website www.bhel.com.

In case the Tenderers not fulfilling the above conditions, the offer is liable for rejection.

# Technical Specification for Design, supply and I&C of Module Washing System for 100 MW (AC) Floating Solar Photovoltaic Grid-connected Power plant for NTPC Ramagundam (Telangana)

| Revision details :R 00 | Prepared<br>VKC | Approved<br>PM | Date<br>14.05.2021 |
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## 1.0. INTRODUCTION:

Bharat Heavy Electricals Limited (BHEL), Electronics Division, Bangalore is setting up a 100MW (AC) Floating solar photovoltaic (SPV) power plant for NTPC at Ramagundam (Telangana). This specification defines the scope of the vendor for Design, Supply and I&C for the Module Washing system (MWS) for the Entire Solar Plant.

Dust and Dirt particles accumulate on the surface of the PV-Module and this can reduce the optimal performance of the Solar Modules and hence Periodic washing of PV Modules is mandatory for the optimum performance of the Solar Plant. Periodic Washing of PV-Modules is carried by O&M Contractor of the Plant.

Specific details of this Project:

The 100MW FSPV Project is divided into 40 discrete Array Blocks of 2.5MW-AC each. These 40 Arrays are spread on approx. 630 acres of the raw water reservoir area of the thermal plant. Each 2.5MW-AC Array has approx. 11200 PV Modules. Of the 40 blocks, 32 Array Blocks are made of M/s Prabh Dayal make of HDPE Floats and balance 8 Array blocks are made of M/s Adtech make. The shape of Array blocks of both makes are different and details of these Blocks are attached as Annexures. Each 2.5MW Floating Array has a corresponding floating equipment platform placed at an approx. distance of 10mts from the Array. Detail of the complete layout is attached in the Annexure.

The module cleaning system to be designed for each 2.5MW Network. Similar system to be used for all 40 nos. of blocks. The auxillary power requirement for the cleaning system to be informed by the vendor. All Module cleaning BOQ items supplied shall be compliant to the corrosion category of the site and complaint to floating environment.
Corrosion category of this Site: Category IV

## 2.0. BRIEF SCOPE OF VENDOR (ILLUSTRATIVE NOT EXHAUSTIVE):

2.1. Design an effective Module Washing system for 100 MW FSPV Plant in line with tentative layout.

2.2. Supply of all the module washing system parts as per the approved BOM.

2.2.1. Floating submersible pumping station of suitable capacity with IP 65 rated control panel for drawing water from reservoir for each 2.5 MW (AC) Floater block.

2.2.2. Piping from Pumping station to PV module floater blocks as per tentative Layout

2.2.3 Supply of suitable nonmetallic clamping arrangements wherever required.

2.2.7 Supply of all types of valves, flow meter, NRV, gauges clamps etc. suitable for module cleaning system as per design.

2.2.8 Supply of Hose pipes up to 50 Meters (or as suitable) for all blocks- Minimum 100 Nos.

2.3. I&C for the module washing system

2.4. O&M of Module Washing System for 3 Months after commissioning of MWS.

## 3.0. BHEL SCOPE:

3.1. Periodic Washing of PV-Modules after 3 months of O&M period

3.2. Supply of water from NTPC reservoir

3.3. Unloading and Storage of Material

3.4. Security of Material

**4.0. ANNEXURE TO THIS DOCUMENT:**

4.1. Tentative Overall layout of 100 MW FSPV Plant is being provided for indication of blocks, position of Inverter station. (Autocad format of this layout can be asked by dropping an email on vijayk.choudhary@bhel.in mentioning tender enquiry no.).

4.2. Water test report to be attached.

4.3. Typical floater pattern of Sample 2.5 MW block.

4.4. Typical Floater drawings of M/s Prabh Dayal and M/s Adtech make.

**5.0. DETAILED SCOPE OF VENDOR:**

5.1. The vendor shall design and install an effective module washing system as per the tentative Module washing system layout for FSPV Plant. Minor changes in tentative layout done as per design requirement, if any can be accommodated during detailed engineering. Design and layout drawings shall be submitted for these arrangements to BHEL/End Customer for approval.

5.2. The vendor to supply and install a floating submersible pump station at each 2.5 MW block for drawing water from Reservoir. The submersible pump of suitable capacity as per design shall be installed to pump water from reservoir to pipelines. The calculation for selecting pump capacity i.e. HP, Head, pressure, discharge etc. shall be submitted for approval. All type of losses and suitable factor of safety shall be considered for the calculation. Generally, an existing PV Module floater of M/s Prabh Dayal and M/s Adtech make to be used made for placement of submersible pump in reservoir at array location. The control panel of the pump may be placed on Inverter platform in case space is available otherwise it has also to be installed at floating pontoons only. Suitable Clamping arrangement shall be designed and provided for installation of pump.

5.3. Vendor to supply and pipe laying with best optimized network of HDPE pipe conforming to IS 4984 and other relevant codes.

5.4. 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/SS/Brass.

5.5. System shall also include valves (NRV, valve, Ball valve, Gate valve, PRV, scour valve etc.), Water hammer arrester(s) or ARV, pressure gauge, Digital flow meter, bends/ joints/ couplers, tap assemblies (at delivery points), jet nozzles, GI Nipple, Branded hose pipes etc.

5.6. Vendor shall install flow meter for measurement of water consumption. Water level Sensor shall be provided for automatic stopping of water pumping. Pressure gauge shall be installed at every pump end. P.R.V, A.R.V, pressure gauge, flow meter etc. as per the planning & design.

5.7. Module washing procedure and pressure requirement at discharge point shall be as per the recommendation of PV module manufacturer. However, discharge pressure at outlet shall be 2-4 bar.

5.8. Supply, laying and termination of electrical cables shall be in vendor scope. Cables from inverter/Control rooms to the pumps/motors shall be laid underwater/overwater by suitable method as per suitability of site conditions.

## 6.0. GENERAL REQUIREMENTS FOR DESIGN OF MODULE WASHING SYSTEM

6.1. Flow rate:

a. Capacity of pump and suitable head for each network to clean the solar module as per design.

b. Pump suction velocity considered 0.5 m/s to 1.0 m/s and discharge velocity considered in the range of 1.0 m/s - 1.5 m/s.

c. Minimum 3 tapping/washing point shall be functional at same time.

6.2. Pressure:

Minimum pressure of water jet required to clean the solar module 2 Bar.

6.3. Factor of safety:

Appropriate factor of safety to be considered in the design of Module washing. (For soundness piping network, Losses, rating of pump, electrical cabling etc.)

6.4. Piping Network:

a. Module cleaning system piping network shall be **closed looped pipe network** configuration consists of Main pipe, sub-main and branches. Module cleaning system piping network may be design for dead end/tree pipe network configuration. Minimum 3 tapping /washing point shall be functional at same time.

b. HDPE pipes shall run along/over floaters with suitable tapping points at appropriate locations. The ears of floaters used for PV Module/cable routing/walkway arrangement may be utilized for these HDPE pipes, wherever available. Suitable and robust clamping arrangement shall be designed and provided for laying of HDPE pipe though existing floaters. Where ever Floaters are not available, suitable size of floaters along with clamping arrangements shall be provided by bidder. Calculations of load shall be provided for approval.

c. Where existing floaters are used, it is ensured that minimum load shall be exerted on these floaters due to pipeline. Calculations of load shall be provided for approval.

d. Maximum length of hose pipe shall be 50 Meters (or as suitable) from tapping point for easy use. Suitable no. of tapping valves to be provided as per layout.

6.5. Instrumentation:

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) to BHEL/End Customer for approval during detailed engineering. The drawings shall be submitted in Auto CAD format.

The design calculation for selection of pumps, pipes, valves etc. shall be submitted for approval. Supply of Module washing System to be as the approved BOM only. Vendor to submit the detailed BOM after design approval by BHEL/End Customer. The GTP/test certificates of all the supply items have to be submitted to BHEL for approval and supply of items to be as per approved make only.

**7.0. I & C OF THE MODULE WASHING SYSTEM**

7.1. Vendor to construct pumping station with suitable canopy to protect the equipment if necessary as per the design.

7.2. Vendor to submit the procedure for pipe laying methodology to BHEL for approval.

7.3. After laying and jointing, testing of main pipe, service pipe and fitting shall be checked by charging with water. The test pressure shall be minimum 0.5 N/mm2 or double the maximum working pressure whichever is greater. The pressure shall be applied by means of a manually operated test pump, or, in the case of long mains or mains of a large diameter, by a power-driven test pump, provided the pump is not left unattended.

7.4. The O&M methodology of the Module washing system has to be shown to BHEL Site Representative.

7.5. Demonstration of the Module washing system: Vendor has to install the entire Module washing system layout and demonstrate the working of the entire system to the satisfaction of the BHEL Engineer.

7.6. Vendor shall organize for the following: Required tools and tackles for digging trenches and laying piping.

7.7. Safety: The vendor shall employ all safety related equipment such as safety ladder, safety harness, scaffolds, and PPE's for workmen for working at site.

7.8. Statutory obligation:

Vendor is required to meet all the statutory obligations with regard to workers employed by him for the contract. The Contractor shall provide and employ on Site in the installation of the Facilities such skilled, semiskilled and unskilled labor as is necessary for proper and timely execution of the Contract. The Contractor is encouraged to use local labor that has the necessary skills.

Unless otherwise provided in the Contract, the Contractor shall be responsible for the recruitment, transportation, accommodation, sanitation, first aid facility and catering of all labor, local or expatriate, required for the execution of the Contract and for all payments in connection therewith.

The Contractor shall be responsible for obtaining all necessary permit(s) from the appropriate authorities for the entry of all labour and personnel to be employed by contractor on the Site including that of his sub-contractors.

The Contractor shall at all times during the progress of the Contract use its best endeavors to prevent any unlawful, riotous or disorderly conduct or behavior by or amongst its employees and the labour of its Subcontractors.

The Contractor shall, in all dealings with its labour and the labour of its Subcontractors currently employed on or connected with the Contract, pay due regard to all recognized festivals, official holidays, religious or other customs and all local laws and regulations pertaining to the employment of labor.

**8.0. O&M OF THE MODULE WASHING SYSTEM**

8.1. Bidder has to do O & M of the commissioned MWS for a period of 3 months after successful commissioning of the MWS.

8.2. In O & M period, bidder has to depute personnel for cleaning of PV module as defined in specifications.

8.3. The spares for maintenance, if needed shall be provided by the bidder only at their own cost.

8.4. The MWS shall be handed over to BHEL regular O & M contractor with proper training of O & M methodology to their personnel.

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