Operation and Maintenance for 05 Years of 600 KWp roof top solar photo voltaic Plant at OF, Kanpur

IMPORTANT NOTE:

"BIDDERS ARE REQUESTED TO VISIT ALL THE SITES IN PERSON AND THEN SUBMIT THEIR BEST OFFER. ANY TYPE OF DENIAL /OBJECTION WILL NOT BE ENTERTAINED AFTER FINALIZATION OF ORDER."

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1. Site Details:

OFB Kanpur 600 KWp roof top solar was installed by BHEL CFP Rudrapur against the order. Total 17 Building in OFB Kanpur premises where solar panel installed. Detail of building and its capacity is as listed below on tentative basis:-

SL. No.	BUILDING	CAPACITY	STRING	NO. OF STRING	PANELS		INVERTER			No. of earthing	Dimenstion of building	MCCB RATING (Amp)	ISOLATION TRF(Amp)
							50KWp	30KWp	20Kwp				
1	DISPENSARY	51	17	6	102	30.6	1	0	0			100	50
2	MAIN GATE		17	4	68	20.4							
3	BUILDING 1	102	17	20	340	102	2	0	0			160	100
4	CANTEEN	61.2	17	12	204	61.2	0	2	0			125	60
5	11/6.6KV BUILDING	51	17	3	30	9	1	0	0			100	50
6	11KV TR ROOM		17	3	40	12							
7	11 KV HT ROOM		17	3	39	11.7							
8	33KV BUILDING		17	3	61	18.3							
9	CTR BUILDING	78.6	17 18 19	10 3 2	262	78.6	1	1	0			125	80
10	BUILDING S/S 45	48.9	17	10	163	48.9	1	0	0			100	50
11	MSB	30.6	17	6	102	30.6	0	1	0	3	3	80	30
12	ACCOUT BUILDING	51	17	10	170	51	1	0	0			100	50
13	COOLING PLANT BUILDING	22.2	18	4	74	22.2	0	0	1			40	20
14	BUILDING NO 50 S/S	30.6	17	6	102	30.6	0	1	0			80	30
15	NEW SUB STATION	20.4	17	4	68	20.4	0	0	1			40	20
16	NEW PINAKA SHOP	40.8	18 16	4 4	136	40.8	0	0	2			80	50
17	DOUBLE STORY BUILDING	15.3	17	4	51	15.3	0	0	1			40	20
		603.6	256	98	2012		7	5	5			1170	610

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Annexure-I

Scope of Operation and Maintenance for period of 5 Years:

1. Man power deployment and its scope.

a) 2 Manpower permanent deployment at OFB for cleaning of all panel's within the span of 15 days' time period. Cleaning of PV Modules to be carried out by water from the nearest tap available.

b) Any flexible water pipe and accessories required for cleaning will be in scope of bidder.

c) For periodic check of PV modules, Power Conditioning Unit and other LT Panels, Junction Boxes etc and carry out periodical maintenance of PV Modules and all other equipment as given in service manual shall be carried out once in 3 Months with one experienced engineer/supervisor, one ITI electrician and a helper.

d) Any PV Modules, coming under shadow of tree nearby, due to its growth, needs to be trimmed/branches cut to make it free from shadow. This is a continuous monitoring & action process, which should continue till O&M contract in line to get maximum output from each PV Modules.

e) During the O&M Period if any faulty items like string inverter, PV Modules, DC Cable, AC Cable, ACDB & DCDB and other items should be replace by vendor without any additional cost. New/repaired items will be provided by BHEL.

f) Bidder shall deploy suitable maintenance personal, technical manpower to clean modules and other equipment at site. During break down additional

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technically qualified manpower as necessary to be mobilized to put the plant in minimum down time.

g) Bidder may be responsible to change the angle of solar module as per customer/BHEL Requirement periodically.

h) All visit by bidder's personnel will have to match the timing of our customer premises for completion of work assigned.

i) Working at height (on roof) shall call for extra protection of safety belt/guide rope/ladder/scaffolding etc. which may be complied during execution.

j) Any malfunctioning/breakdown/safety issue/ non generation issues has to be reported to BHEL, Rudrapur immediately through email/ letters.

k) BHEL will supply new/repaired items against the breakdown/malfunctioned items and bidder has to replace the same without any extra cost.

l) Successful bidder should deploy competent technicians to read/ retrieve data from inverter/SCDA system and work responsibly on electrical equipment's/DC Equipment's.

m) Successful bidder has to coordinate with OEM's of PV Module inverter, transformer etc. for registering complains & resolving issues.

n) Monthly & Quarterly reports has to be submitted with customer signature to CFP, Rudrapur. Gate pass of employee of bidder may be attached with quarterly reports.

o) Target CUF-13.5% needs to be achieved without any penalty from end customer.

p) Care shall be taken to prevent corrosion of outdoor equipment/structure. Any corroded item/ part to be replaced as necessary or cleaned for rusted re-painted.

q) Earthing resistance of earthing system shall be measured and recorded every month. If the measured value of earth resistance is more than 5 Ohms, suitable corrective action is to be taken to bring down time.

r) A proper maintenance register for various equipment is to be kept & maintained at site by vendor to record periodic preventive/break down maintenance work carried out.

s) Vendor shall attend breakdown jobs immediately on receiving intimation over phone or through other means of communication within 72 hours of complaint raise by BHEL/Customer.

t) All tools and tackles required for maintenance contract shall be arranged and maintained at site.

u) If any equipment damage due to negligence of vendor personal then same is to be made good by way of repair/ replacement free of cost.

v) OFB will provide electricity, water and compressed air at one point free of cost. All other required material/ machinery/spares/equipment/consumable are to be arranged by vendor.

w) Vendor's personnel shall comply with all safety & security regulation of OFB at site to avoid any accident to his personnel/ OFB's personnel.

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x) All necessary gate passes has to be obtained by your representative in consultation with BHEL Representative.

y) Vendors shall comply with provisions of all relevant acts of central or state Government.

z) Vendor must comply, Employee provident fund, Minimum wages Act 1948, Employee State Insurance Act 1948, Worker Compensation Act-1932, Indian Electricity Act-2003, and all other statutory rules & regulations are applicable.

2. Payment Terms:

Sl. No.	Detail of Mile Stone	Bill to be claimed on monthly basis.
1	Vendor Invoice supported by Customer signed O&M reports and RA Bill formats (all required in original/digital signed). Copy of statuary documents like EPF, ESI, Etc. deposit challan, wages sheet and bank statement for salary payment to be certified by vendor.	Quarterly invoice Value = Basic work order value/20 Months

3. **Delivery Term:** O&M Work to start at site within 7 (Seven) days after placement of PO. Mobilization of manpower along with requisite tool and tackle list to be submitted at BHEL CFP Rudrapur.

4. Quarterly payments can be made by submission of Customer signed monthly AMC reports, proof for attendance register verified by preferably customer/BHEL Representative, statutory payments EPF, ESIC, Bonus, Online Salary transaction to be submitted along with Invoice.

5. The deployed manpower has to ensure the solar plants operates all 60 months in 5years to their peak and generate installed capacity & synchronize the solar power to OFB grid. Ensure that no performance penalty will be imposed by OFB as per the terms & conditions schedule of fiscal aspects or tender document.

6. The successful bidder shall be responsible for all the required activities for successful operation and maintenance of the Rooftop Solar PV system for a period of 5 years from the date of mobilization at site.

7. Supply of all spares **as per spare list in Annexure III**.

8. All the testing instruments required for Testing, Commissioning and O&M for the healthy operation of the Plant shall be maintained by the Bidder. The testing equipment must be calibrated once in a year from NABL accredited labs and the certificate of calibration must be kept for reference as required.

9. ***If negligence/ mal-operation on part of the Bidder's operator results in failure of equipment, such equipment should be repaired/replaced by the Bidder free of cost.***

10. Online Performance Monitoring, controlling, troubleshooting, maintaining of logs & records. A maintenance record register is to be maintained by the operator with effect from starting of O&M period to record the daily generation, regular maintenance work carried out as well as any preventive and breakdown maintenance along with the date of maintenance, reasons for the breakdown, duration of the breakdown, steps taken to attend the breakdown, etc.

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11. For any issues related to operation & maintenance, a dedicated/toll-free number shall be made available to the BHEL/Customer to **resolve within 72 hours**. Also, an email ID shall be provided by the bidder as optional contact for recording of complains and other official communications. If not attended within such stipulated time, a complaint may be raised by BHEL/OBF , pursuant to which, a penalty of Rs. **25 per kw / day** or more shall be imposed. If the outage of the plant is more than 30 days continuously, then the **50% CPBG amount shall be encashed** by BHEL and If the outage is exceeding more than 60 days than **complete CPBG amount shall be encashed** by BHEL. This will be applicable till 5 years of O&M as per the scope of the NIT.
12. If any jobs covered in O&M Scope as per NIT are not carried out by the contractor/Bidders during the O&M period, the Engineer-In-Charge shall take appropriate action as deemed fit. BHEL/Customer reserves the right to make surprise checks/inspection visits at its own or through authorized representative to verify the O&M activities being carried out by the Bidder. Failure to adhere to above guidelines will result in penal action including debarring from participation in next tender.
13. The Operation & Maintenance of Solar Photovoltaic Power Plant would include wear, tear, overhauling, machine breakdown, smooth operation of plant for a period of 5 years.
14. The contractor shall supply ***01 set of maintenance tools as per Annexure III*** to the primary customer and ***01 set of maintenance tools as per Annexure III*** shall be kept at site for day to day maintenance purpose at no extra cost. 01 set supplied to the primary customer shall be kept at the place identified by the user.
15. Contractor/Bidder will have to take custody of BHEL supplied items at site. If any item to be repair during the O&M Period, i.e. Cables, Modules etc.

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Annexure-II

OPERATION AND MAINTENANCE GUIDELINES OF GRID CONNECTED PV PLANTS

For the optimal operation of a PV plant, maintenance must be carried out on a regular basis. All the components should be kept clean. It should be ensured that all the components are fastened well at their due place.

Maintenance guidelines for various components viz. solar panels, inverter, wiring etc. are discussed below:

1. SOLAR PANELS:

Although the cleaning frequency for the panels will vary from site to site depending on soiling, it is recommended that:

- Any bird droppings or spots should be cleaned regularly. Use soft water and a soft sponge or cloth for cleaning.
- Do not use detergent or any abrasive material for panel cleaning. Iso-propyl alcohol may be used to remove oil or grease stains.
- Do not spray water on the panel if the panel glass is cracked or the back side is perforated.
- Wipe water from module as soon as possible.
- Use proper safety belts while cleaning modules at inclined roofs etc.
- The modules should not be cleaned when they are excessively hot. Early morning or Late evening is particularly good time for module cleaning.
- Ensure that the module terminal connections are not exposed while cleaning; this poses a risk of electric shock.
- Never use panels for any unintended use, e. g. drying clothes, chips etc. Ensure that monkeys or other animals do not damage the panels.
- Periodic check for tightness of all nuts and bolts (Specially for mounting nuts and bolts of Panels and structure)
- Removable for any shadow falling on Solar PV Panel like that cutting of tree branch etc.

2. CABLES AND CONNECTION BOXES:

- Check the connections for corrosion and tightness.
- Check the connection box to make sure that the wires are tight, and the water seals are not damaged.
- There should be no vermin inside the box.
- Check the cable insulating sheath for cracks, breaks or burns. If the insulation is damaged, replace the wire.

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- Make sure that the wire is clamped properly regularly and that it should not rub against any sharp edges or corners.
- If some wire needs to be changed, make sure it is of proper rating and type.

3. INVERTER:

- Remove any excess dust in heat sinks and ventilations. This should only be done with a dry cloth or brush.
- Check functionality of fans regularly and clean the fans when needed.
- Check that vermin have not infested the inverter. Typical signs of this include spider webs on ventilation grills or wasps' nests in heat sinks.
- Check functionality, e.g. automatic disconnection upon loss of grid power supply, at least once a month.
- Verify the state of DC/AC surge arrestors, cable connections, and circuit breakers.

4. SHUTTING DOWN THE SYSTEM:

- Disconnect system from all power sources in accordance with instructions for all other components used in the system.
- Completely cover system modules with an opaque material to prevent electricity from being generated while disconnecting conductors.
- To the extent possible, system shutdown will not be done during day time or peak generation.

5. Submission of O & M Report (OMR)

- The successful bidder shall submit the monthly O&M report mandatorily to BHEL as per the format enclosed at annexure-IV. Non-submission of the report shall be considered as —breach of contract and shall attract punitive actions as per the relevant provisions of the contract including

Note: ***A site register at all sites shall be maintained by the bidder in which all O&M activities shall be noted and shall be signed by the primary customer.***

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INSPECTION AND MAINTENANCE SCHEDULE:

Component	Activity	Description	Interval	By
PV Module	Cleaning	Clean any bird droppings / dark Spots on module	Regularly	User/ Technician
	Cleaning	Clean PV Modules with plain water or mild dish wash detergent. Do not used brushes, any types of solvent, abrasives, harsh detergent	15 days' time interval	User/ Technician
	Inspection for plants > 100 kWp	Use infrared camera to inspect for hot spots , by pass diode failure.	Bi- Annually	User/ Technician
PV Array	Inspection	Check the PV Modules and racks for any damage, note down location & Serial No. Of damaged modules	Quarterly	User/ Technician
	Inspection	Determine if any new objects such as vegetation growth are causing shading of the array and remove them if possible	Quarterly	User/ Technician
	Vermin Removal	Remove bird nest or vermin from array or rack area	Annual	User/ Technician
Junction Boxes	Inspection	Inspect electrical boxes for corrosion or intrusion of water / insects	Bi- Annually	Electrician
		Seal boxes if required	Bi- Annually	Electrician
		Check position of switches and breakers	Bi- Annually	Electrician
		Checks operation of all protection devices	Bi- Annually	Electrician
Wiring	Inspection	Inspect cabling for signs of cracks, defects, loose connections, overheating ,short or open circuit and ground faults	Bi- Annually	Electrician
Inverter	Inspection	Observed instantaneous operational indicators on the face plate of the inverter to ensure that the amount of power being generated is typical of conditions.	Monthly	Electrician

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		Inspect inverter housing or shelter for physical maintenance if requires.	Monthly	Electrician
	Service	Clean or replace any air filters	As needed	Electrician
Instruments	Validation	Spot check monitoring instruments (Pyranometer etc) with standard instruments to ensure that they are operational and within specifications	Bi- Annually	PV Specialist
Isolation Transformer	Inspection	Inspect transformer, temperature gauges , breaker, meter , connections	Bi- Annually	Electrician
Tracker (if present)	Inspection	Inspect gears, gears boxes, bearing as required	Bi- Annually	Technician
	Service	Lubricate tracker mounting bearings, gear box as requires	Bi- Annually	Technician
Plant	Monitoring	Daily operation & performance monitoring	Daily	Site In-charge
	Data logger and weather monitoring	Check wiring and other equipment's	Monthly or as required	Electrician
Spare Parts	Management	Manage inventory of spare parts	As needed	Site In-charge
Log Book	Documentation	Document all O&M activities in the log book available to all service personnel.	Continuous	Site In-charge

Note: ***A site register at all sites shall be maintained by the bidder in which all O&M activities shall be noted and shall be signed by the primary customer.***

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Annexure III

SPARE AND MAINTENANCE TOOLS

Spare List:

1. **MCCB: (Minimum inventory to be maintained all the time during the maintenance period)**

Sl. No.	MCCB Rating	Qty.	Make
1	4P 25 Amp	03	ABB/L&T/Schnider
2	4P 50 Amp	03	ABB/L&T/Schnider
3	4P 100 Amp	03	ABB/L&T/Schnider
4	4P 125 Amp	03	ABB/L&T/Schnider
5	4P 250 Amp	01	ABB/L&T/Schnider

2. **MC4 Connectors:** 50 Nos.
3. **SPD Type II –** 05 Nos.
4. Fuses, Cable glands and lugs of suitable sizes, nuts and bolts of suitable sizes.
5. For other items other than mentioned here, please check **Clause no. 1.3, Chapter 15** of General conditions of the contract

Maintenance Tools:

1. Screw driver set suitable for the junction box, combiner box etc.
2. Allen Key set suitable for the junction box, combiner box etc.
3. Multi meter and clamp-meter for day to day maintenance and routine check of the electrical equipment.
4. Infrared camera to check hot spots.

Note:

1. *The successful bidder shall supply & keep ready stock of tools, tackles and essential spares that will be needed for the day-to-day maintenance of the solar PV system. Above minimum set of spares shall be maintained in the plant itself for the entire period of warranty and Operation & Maintenance which upon its use shall be replenished to maintain above quantity.*
2. *Bidder shall provide calibration certificate of all tools within 30 days from the date of Work order.*
3. *Bidder shall renew the calibration certificate before the expiry date of current certificate and submit the same to BHEL.*

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Annexure IV

Monthly O & M Report
(Part A)

Month and year:
Name of the bidder:
NIT/PO ref no.:
Project Capacity:
Name & Address of the site:

Component	Activity	Description	Date	Name & Signature	Remarks
PV Module	Cleaning	Immediately clean any bird droppings / dark Spots on module			
	Cleaning	Clean PV Modules with plain water or mild dish wash detergent. Do not used brushes, any types of solvent, abrasives, harsh detergent			
	Inspection for plants > 100 kWp	Use infrared camera to inspect for hot spots , by pass diode failure.			
PV Array	Inspection	Check the PV Modules and racks for any damage, note down location & Serial No. Of damaged modules			
	Inspection	Determine if any new objects such as vegetation growth are causing shading of the array and remove if any			
	Vermin Removal	Remove bird nest or vermin from array or rack area			
Junction Boxes	Inspection	Inspect electrical boxes for corrosion or intrusion of water / insects			
		Check position of switches and breakers			
		Checks status of all protection devices			

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Wiring	Inspection	Inspect cabling for signs of cracks, defects, loose connections, overheating ,short or open circuit and ground faults			
		Observe instantaneous operational indicators on the faceplate			
Inverter	Inspection	Inspect inverter housing or shelter for physical maintenance if requires.			
	Service	Clean or replace any air filters			
Instruments	Validation	Verify monitoring instruments (Pyranometer etc) with standard instruments to ensure that they are operational within tolerance limits			
Isolation Transformer	Inspection	Inspect transformer, temperature gauges , breaker, meter , connections			
Tracker (if present)	Inspection	Inspect gears, gears boxes, bearing as required			
	Service	Lubricate tracker mounting bearings, gear box as requires			
Plant	Monitoring	Daily operation & performance monitoring			
	Data logger and weather monitoring	Check wiring and other equipments			
Spare Parts	Management	Manage inventory of spare parts			
Log Book	Documentation	Document all O&M activities in the log book available to all service personnel.			

- Provide details of any replacement of systems/components, damages, plant/inverter shut down (planned/forced), breakdown, etc under remarks.

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- ***Daily register* is to be maintained by the bidder at each location**. The same may be inspected by BHEL/OFB or its authorized representative at any time 5 years of O&M period. The Register will have the information about the daily generation, Inverter downtime if any, grid outages.

(Part B)

Sl.No.	Date	Generation kWh	Grid outage (hh:mm)	Inverter down period (hh:mm)	Remarks
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					
31					

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Total generation for the month in kWh:
Cumulative generation since commissioning in kWh:
CUF for month in %:
Cumulative CUF since start of O&M in %:

Date:

Signature of the Authorized
signatory of the Bidder

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Annexure-V

ACCIDENT REPORT:

(The form must be filled in so as to contain the maximum details)

1. Name of the Victim:
2. Designation:
3. Age:
4. Place of duty:
5. Date and time of accident:
6. Exact place of accident:
7. Measure and extent of injuries:
8. Approximate time for which the victim cannot attend to his duties:
9. Person in direct charge of the work at the time of the accident

   Name: Designation:
10. Brief but complete account of the causes/ circumstances surrounding the accident:
11. Was the accident due to anybody's fault?
12. If so, the name and the designation of the person(s) at fault with the full account of the negligence, fault etc.
13. Is the accident directly attributable to:

i) the workman having been at the time thereof under the influence of drink or damage drugs or

ii) the wilful disobedience of the workman to an order expressly framed for the purpose of accruing the safety or workman, or

iii) the wilful removal or disregard by the workman of any safety guard or otherwise which he know to have been provided for the purpose of securing the safety of workman

14. Name and designation of the persons who were present on the spot at the time of the accident and who can give important evidence.

Name Designation

Name Designation

15. Was the victim given any first aid? Yes/No Time
16. Did any Medical Officer attend? Yes/No Time

If yes (name of the Medical Officer):

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17. Was the victim sent to hospital?

(with the time of admission may be indicated)

18. How can recurrence of such an accident be avoided in future?

Signature of official directly in-charge
at the time of the accident

Signature of Officer-on-Charge

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