3.0 BRIEF SCOPE OF WORK:

The scope of work includes operation and maintenance of 25 MW Floating solar power plant for 36 months' period. The scope includes O & M for entire plant covers the floating solar array on Reservoir, Main Control Room (CMCS), Inverter platform cum Transformer yards, 33KV power cables laid from Inverter stations along the reservoir and terminated at Simhadri TPP switchyard and final termination at Panel room of NTPC close to switch yard. The scope includes O & M for all floating system, electrical, civil and mechanical installations. The brief scope of works is listed below:

3.1 Ensuring successful operation of SPV Plant for optimum energy generation.

3.2 Ensuring Breakdown maintenance, Preventive maintenance overhauls, arranging visit of O&M experts (when required) to maximize the availability of the solar plant.

3.3 Daily work of the operators involves logging the voltage, current, power factor, power and energy output of the SPV plant, temperature, logging down individual array output data once a day.

3.4 Monitoring and controlling, troubleshooting, maintaining of records, registers.

3.5 The operator shall record monthly energy output of each array and transformer and reports shall be prepared on performance of SPV plant.

3.6 Submission of periodical reports to the owner on the energy generation & operating conditions of the SPV plant. Further forwarding of the Operation/generation reports to the Statutory authority in designated format and routine on behalf of the owner as required through SCADA and communication system.

3.7 Ensuring Safety and protection of the plant by deputing sufficient security personnel to cover the CMCS, 5 nos. Inverter room cum switchyards and the overall perimeter fencing of the dead water reservoir which contains the floating solar plant.

3.8 Maintain and carry out inventory management of all type of maintenance spares, consumables and fixing / application of the same. In order to meet the emergency requirements, contractor, with the permission of Employer can utilize the mandatory spares being supplied under the contract to customer NTPC with due notice. However, the used spares shall be identified well in advance by the contractor and informed to BHEL within reasonable time to enable its replenishing from OEMs. Also vendor shall follow up with OEMs for such spare items of matching quantity and quality and rating on behalf of BHEL to ensure timely receipt, storage and safe keeping of the replenished or replaced spare items.

3.9 Cleaning of the plant including floating solar array and Inverter cum transformer yards on regular basis and as and when required.

3.10 Cleaning of drains, cable trenches, box culverts etc.

3.11 Module washing as per as per approved schedule.

3.12 The contractor shall at his own expense provide all amenities to his workmen as per applicable laws and rules.

3.13 The Contractor shall ensure that all safety measures are taken at the site to avoid accidents to his employees or his Co-contractor's employees

3.14 The Contractor shall immediately report the accidents, if any, to the Engineer in charge & to all the concerned authorities as per prevailing laws of the state.

3.15 In order to ensure longevity, safety of the core equipment and optimum performance of the system the contractor should use only genuine spares of high-quality standards wherever his supplied are involved.

3.16 Deployment of Plant in Charge, adequate number of technical support staff and other supporting personnel and sufficient security personnel during the O&M period. All O&M electrical personnel shall possess NTPC (CISF issued) Gate pass for entry to Switchyard work area, Panel room.

3.17 The Contractor shall arrange for a vehicle throughout the tenure of the O&M contract for daily movement of the O&M staff along with BHEL personnel from reservoir area to Switchyard area and around the bund roads for necessary checks. The vehicle shall be a car/jeep with all requisite valid fitness and registration documents, permits, licensed driver and compulsorily have the NTPC-CISF Gate permit for entry to switchyard and NTPC EMD and other offices inside the Thermal plant.

3.18 At the time handing over of the plant by the contractor to NTPC through BHEL, the contractor shall handover equipment and spares in healthy condition.

4.0 DETAILED OPERATIONS AND MAINTENANCE SCOPE:

4.1 DATE OF COMMENCEMENT:

Date of commencement (Zero date) for O & M shall be the 10 days from the date of Purchase Order OR date of handover by joint Minutes of Meeting date made at site whichever is later. Date shall be decided by BHEL, considering the site requirements.

4.2 O & M PERSONNEL REQUIREMENT:

Contractor shall deploy following minimum personnel:

4.2.1 Technical / administrative / office personnel:

I. One (1) Engineer (B. Tech in Electrical Engg.) with 33 kV Power station/switchyard working experience to be appointed who will be the overall O & M in-charge of the plant. Engineer shall have minimum 3 years of experience in operation of 33 KV or higher electrical substation and SCADA operation. The in-charge shall have competence to handle technical and operational / problems with overall responsibility for running complete plant operations. Necessary credential shall be submitted along with technical bid.

II. Minimum 2 (two) technicians (with Diploma in Electrical with 3 years of experience) and Minimum 4 (Four) electricians with field experience in solar plant to be deployed. They should have necessary skills in operating electrical / electronic / mechanical equipment, taking measurements, data logging / maintaining registers, preparation of reports in computer.

III. The Plant shall be staffed in three 8 hour shifts. One electrician shall be available as per roster for the night shifts.

Note: At least one among the technical personnel shall essentially be a certified / licensed person for HT operations (33KV minimum) with valid licence for the state of A.P. This is a mandatory requirement.

IV. One person for regular house-keeping (cleaning / mopping etc.)

V. Required man-power (Minimum 12 Nos.) for washing of SPV modules fitted on floater – Solar array consists of total 109800 number of PV modules distributed in 10 blocks. Each block consists of typically 10980 numbers of PV modules. Each PV modules must be cleaned at least twice in a month by using water and Wiper. Use of wiper/mop is must. Cleaning of modules shall be carried out block wise. Cleaning of floater and pathways also need to be attended as and when required.

VI. One persons for grass cutting at transformer yard, switchyard, and for clearing vegetation which may foul with Ropes and wires of the floater system from the bund area.

VII. One scuba diver at site for any type of works under water shall be made available as and when required. The scuba diver should have requisite diving permit and experience. Approved diving equipment and apparatus required shall be available during diving works.

VIII. Minimum two Persons required for maintenance of Floater Island. Periodic maintenance shall be carried out for checking the floater condition, sign of crack/ damage, tightening of mooring ropes and any other maintenance needed to maintain healthiness of floating island as per OEM's O & M Manual. This includes replacement of faulty PV Modules, floaters used for PV modules.

IX. Other Manpower requirement as per the scope of work given shall be arranged by contractor as per requirement.

The manpower requirement mentioned above is minimum required and indicative only. Contractor shall depute additional manpower for attending the O & M activities as and when required basis. Contractor need to furnish attendance of persons deployed for the purpose of HR and statutory documentation purpose like payment of wages, insurance, provident fund etc.

4.2.2 **Security personnel:**

Minimum Twelve (12) security guards (all unarmed) to be deployed in three shifts with competence to handle tough situations and safeguard the plant from miscreants. Shift wise deputation of Security staff will be as per decision of BHEL site in-charge during O & M. Security shall deployed round the clock and 365 days a year. Considering the large area to be patrolled around the floating solar array inside the reservoir premises, the security personnel shall undertake regular Beat duty on motorbikes for area patrolling to provide quick response in case of any theft/incidents. Security shall be trained in firefighting also.

In case, any of the above O & M personnel is on leave, reliever shall be arranged by the Contractor so that there is no effect on O & M activity.

4.2.3 O & M personnel shall be provided with Life jackets, raincoats, toolsets, earthing rods, safety gloves, safety goggles, gumboots, helmets, face masks and all other personal protective

equipment (PPE) that will be relevant to ensure human safety while working in the reservoir.

4.2.4 COVID protocol shall be strictly followed by all O&M and security personnel employed by the vendor.

4.2.5 Names, qualification, work responsibility of personnel shall be listed on a display board within control room.

4.2.6 Attendance register shall be maintained.

4.2.7 Contractor shall ensure statutory requirements such as ESI, PF and labour license for their O & M personnel posted at site.

4.2.8 BHEL shall have right to disallow any O & M employee, if found unfit to perform. BHEL instructions issued in writing shall be binding on Contractor who shall replace the person.

4.2.9 O & M personnel at site shall conform to general regulations in force at site and to any special instructions from local administration/NTPC /BHEL.

4.2.10 O & M personnel at site shall be deemed to be aware of damages and risks incidental to conditions of the reservoir and works from time to time and BHEL shall not be responsible for any injury to personnel arising there from.

4.2.11 Training to O & M personnel:

It is the absolute responsibility of Contractor to ensure imparting of necessary training to their O & M personnel to get them acquainted with the operations of various electrical and mechanical equipment of the power plant and maintain Safety practices and protocol at all work places.

4.2.12 Availability of O & M personnel at power plant:

Contractor shall ensure that operating staff are present in the power plant round the clock. Contractor shall ensure that certain minimum operating staffs are present at the power plant even on festivals, public holidays and any other unique occasions so that the plant is run under competent supervision on all days.

4.2.13 Security guards shall be available at the power plant on round the clock basis and on all the days. In case of any break in duty of security guard(s), replacement with alternate guard(s) shall be ensured during the break time.

4.2.14 O & M personnel shall, strictly, not use any part of the power plant for their personal / residential purposes. Their presence at the plant shall, strictly, be meant only for the purpose of operation and maintenance of plant.

4.2.15 In case of Maintenance activity / failure or damage/accident / replacement activity/ repair required for equipment as Solar modules, VCB, CT and PT, Auxiliary, Main transformers, Battery bank / charger etc, all site related activities e.g. unloading, erection, installation, charging, co-ordination with agencies involved, etc., shall be in O & M contractor's scope. Arrangement of JCB/ crane / hydra / additional labour hiring / Ladder, etc., for O & M works will be in the scope of the Contractor. Supply of replacement material will be in BHEL scope except for tool kits and Measuring instruments. Tool kits and Measuring instruments will be supplied by BHEL at start of O & M (as listed in clause 4.7) and shall be maintained by O & M contractor. On damage of tools

or instruments, replacement items shall be by O & M contractor.

4.2.16 Safety gadgets, first aid box items will be supplied and maintained by O & M contractor for all personnel.

4.2.17 Contractor shall designate one of the technicians as safety supervisor for supervising safety of various O&M Activities. Contractor shall prepare Job Safety Assessment for the works involved and train O & M staff accordingly.

4.3 O&M ACTIVITIES – WEEKLY BASIS:

4.3.1 Removal of garbage from solar array in pond, switchyard, roads, drains, pathways, sand buckets; logging in registers with signatures of operating persons and in-charge.

4.3.2 Monitoring and logging of fire extinguisher levels / pressures as per BHEL formats.

4.4 O&M ACTIVITIES – MONTHLY BASIS:

4.4.1 Inspection of fire extinguishers (weight, pressure indication, physical status etc) followed by refilling actions, if necessary, based on indications. Report to be submitted as per BHEL approved recording formats.

4.4.2 Earth resistance measurements (individual and in grid) for solar array structures, control room equipment, transformer yard equipment, lightning arrestors (ESE): measured values shall be recorded in registers and reported to BHEL as per BHEL approved recording formats.

4.4.3 Submission of values / status of plant parameters and events for the corresponding month, as below, as per BHEL approved formats:

a. Daily values of solar array strings (SCB parameters)
b. Daily values of weather parameters (solar energy, wind speed, ambient temperature)
c. Daily energy generation
d. Events (with date, time) of faults / tripping / breakdown of equipment
e. Events (with date, time) of grid outage
f. Events (with date, time) of equipment damages, accidents and thefts
g. Activities of module cleaning

4.4.4 Monthly reports shall be submitted to BHEL for all the above data.

4.4.5 Energy generation / meter reading report to be prepared and submitted to the concerned department of NTPC. Signatures from BHEL's customer and substation representatives shall be obtained wherever required.

4.4.6 Co-ordination with STU/SLDC/other statutory organizations as per the requirement on behalf of Employer for Joint Metering Report (JMR), furnishing generations schedules as per requirement, revising schedules as necessary and complying with grid requirements. The arrangement to transmit data required by the Load Dispatch Centre (LDC) as per extant regulatory requirement from Solar plant to NLDC/RLDC/SLDC shall be in O & M Contractor's scope. Activities as per

SLDC pertaining to routine capture of Automatic Meter Reading (AMR), telemetry data and procedures for telemetry shall be undertaken by the contractor as per schedule.

4.5 O&M ACTIVITIES – QUARTERLY BASIS:

4.5.1 Cleaning of PCUs, VCB panels, ACBD, IRDB, FCBC, battery banks etc. to remove accumulated dust at plant and substation end.

4.5.2 Monitoring and status review, followed by rectification / calibration / replenishment / replacement actions as necessary and applicable for following:

(a) Spare items of all electrical equipment

(b) First aid box items - medicines and accessories

(c) Safety gadgets

(d) Tool kits and measuring instruments

(e) Yard lights

(f) Pumps, starters

(g) Control room appliances: air conditioners, lights, fans, exhaust fans, switch boards etc.

Note: Except for tool kits and Measuring instruments, consumable and minor spares, all other items required for replacement during O & M period will be supplied by BHEL except wherever specified otherwise. Tool kits and Measuring instruments will be maintained by O & M contractor. On failure/damage of tools or instruments, replacement items will be supplied by O & M contractor. Safety gadgets, First aid box items will be supplied and maintained by O & M contractor.

4.5.3 Following measuring instruments will be supplied by BHEL at start of O & M at site:

1	Insulation tester	Reputed make	1 No
4	Digital multi-meter	Reputed make	2 No
5	Clamp meter DC & AC	Reputed make	2 No

On failure/damage of tools or instruments, replacement items will be supplied by O & M contractor.

Note: Any other tools or instruments required for purpose of O & M, replacement of PV modules from floating pontoon etc., will be supplied and maintained by O & M contractor. Any tools required for the efficient running and maintenance of PV module cleaning system shall be provided by the vendor. This shall include tools to replace submersible pump-motors, repair pressurized water pipe lines and supply cable connections.
The vendor shall assemble and supply light weight step ladder frames for accessing the second and third row of PV modules for purpose of maintenance such as replacement, cables reconnection, earthing etc. Two nos. of ladder frames shall be supplied for each Block of 2.5 MW i.e. 20 nos. in total. Same shall be made of aluminium, FRP or pre-galvanized light weight sections. It shall be capable of providing support for the O&M technician over the floaters and without damaging any PV modules or floaters. Vendor shall obtain prior approval of BHEL before supply of these ladders.
However, the floaters and assembly parts if any required to be supplied as replacements shall be made available by BHEL from the Floater OEM.

4.5.4 Pest control (rats, snakes etc.) – sprays, chemicals, medicines etc. to be applied wherever

required.

4.5.5 Submission of quarterly report on above activities to BHEL.

4.5.6 Cleaning of water storage tanks

4.6 O & M ACTIVITIES – YEARLY BASIS:

4.6.1 BDV and PPM and GA measurements for oil samples from all the transformers and submission of report to BHEL.

4.6.2 Calibration of Weather Monitoring Station equipment whenever falls due

4.6.3 Filtration of oil to be arranged, if required, based on BDV measurement report. Machinery/ Testing Equipment, DG set, Oil sample bottles (of aluminium material) as per requirement will be arranged by O & M contractor. Tightness of cables, earthing and hardware, replacement of gasket, silica gel breather, paint touch-up, arresting oil leakages and oil top-up of all transformers (33KV and aux transformers) and other related electrical works. Material for replacement of silica gel and gaskets will be supplied by BHEL.

4.6.4 Testing and calibration of VCBs, relays, CTs, PTs, LA etc

4.6.5 Cleaning of sewerage lines, septic tanks (if found necessary)

4.6.6 Painting of switchyard and transformer yards gate and fencing, earthing chambers, other steel structures within control room and transformer yard if required based on conditions of rusting etc.

4.6.7 Checking tightness of hardware in solar array structures, floaters and tightening wherever required.

4.6.8 Checking tightness of power cable terminations in SPV modules (MC4), SCBs, electrical panels of control room, Inverter room, Transformer yards

4.6.9 Hot-spot detection of Solar panels by using thermal imaging camera to be carried out as per schedule and report shall be submitted indicating PV modules number wise.

4.7 O & M ACTIVITIES –ONCE IN 3 YEARS

Painting of Main Control room building and inverter room buildings using weather proof cement based acrylic emulsion paint (Exterior grade) for outside and oil bound distemper paint for inside the building.

4.8 O & M ACTIVITIES - AS AND WHEN REQUIRED:

4.8.1 Contractor shall do the periodic maintenance of all equipment's in order to maintain higher performance ratio (PR) and generation target as mentioned in plant performance warranty.

4.8.2 Regular checking by 'Walk Down' checks to internal condition of equipment such as- Module, SCB, Array Junction Box, WMS, all type of Cables, Electrical connection, Earth Strips, Conduit, Communication system etc.

4.8.3 Module Hotspot detection as per O & M schedule of OEM.

4.8.4 Schedule Junction box servicing as per O & M schedule of OEM.

4.8.5 Schedule Inverter servicing as per O & M schedule of OEM.

4.8.6 Schedule Check of Cabling connections

4.8.7 Schedule Checking of Earthing Protection

4.8.8 Schedule Checking of Lightening Protection

4.8.9 Maintenance of the anchoring arrangements, mooring arrangements etc. where schedule of checking, maintenance etc shall be done as per OEM maintenance Manual.

4.8.10 Cleaning of the vegetation from water surfaces of monthly basis from Module and HDPE Pontoons, Mooring ropes.

4.8.11 Monthly cleaning of the surface drains, road etc. at transformer yard, MCR in and around and switchyard area.

4.8.12 Monitoring and operation of plant electrical equipment as and when required:

4.8.13 VCB on/off: local operations from outdoor HT panel and remote operations

4.8.14 Settings of numerical relays in HT panels: review and revision in consultation with BHEL.

4.8.15 ACB on/off operations on LT side.

4.8.16 PCU operations: emergency close, LCD displays (selection of settings, monitoring the DC/AC/event/fault status parameters), operation of duct fans.

4.8.17 Battery and battery charger operations.

4.8.18 Coordinating and liasoning on behalf of BHEL for obtaining renewal of statutory licenses, clearances and approvals from state or Central agencies and or departments.

4.8.19 Maintenance of all electrical/mechanical/civil installations with urgent action plans and implementation, when the items are found non-working / damaged. The same shall be reported to BHEL within 12 hours from time of observation.

4.8.20 All the equipment required for O & M for the healthy operation of the Plant must be calibrated, time to time, from the NABL accredited labs and the certificate of calibration must be provided prior to its deployment.

4.8.21 Reporting, on an immediate basis (within max 2 hours) of functional problems / damages in BHEL supplied items to facilitate repair / replacement by BHEL. Further, Contractor shall correspond / coordinate with respective equipment Contractors / service centers, on behalf of BHEL, for getting the service engineers to the site. Later, coordinating with the service engineers during their visit to site, and assisting them in the trouble shooting process until the problem is resolved. Contractor shall report to BHEL (within max 2 hours) immediately after the problem is resolved.

4.8.22 Contractor shall keep updating the spares inventory at the site every time there is consumption of spare items towards replacement. In case of shortage of spares, the same shall be reported

on an urgent basis (with max 2 hours) to BHEL.

4.8.23 Coordinating with authorities upon failures at Upstream O & M contractor, sub-station bay, grid failures, line problems etc and implementing the needful steps to restore the plant to normal operation.

4.8.24 The charges for the broadband internet, telephone and data charges, if any, of the SPV plant during the entire period will be in scope of the Contractor

4.8.25 Theft incidents: immediate reporting to BHEL, filing FIRs with police stations on behalf of BHEL, coordination for site inspection by insurance companies and clearance of insurance claims, logging of events (date, time) and maintaining records for entire plant.

4.8.26 Accidents: immediate reporting to BHEL, coordinating with hospitals, logging of events (data, time) and maintaining records.

4.8.27 Grass cutting – Sufficient number of Grass cutting machines, quantity as required, will be supplied and maintained at site by O & M contractor for grass cutting activity. Arrangement for electrical supply or fuel, as applicable, will be made by O & M contractor. Contractor shall attend grass cutting activity on continuous basis or when the grass start growing. Plant area shall be maintained free of grass and vegetation growth at Switch yards and for clearing the mooring ropes and wires attaching the floating system to the piles and anchors.

4.9 O & M OF FLOATING PLATFORMS BLOCK:

O & M of floating platform blocks shall be as per schedule of Floater OEM's attached with tender enquiry. The suitable no. of manpower is arranged by the contractor as per requirement.

4.10 DRONE INSPECTION WITH THERMAL IMAGING OF FLOATING SOLAR PLANT AS PART OF O&M:

a. Thermography of PV panels in the reservoir shall be carried out using RPA/UAV/drone mounted thermal/IR camera having minimum resolution of 640 x 512. The brief scope of bidder includes
b. Identification of low performing strings.
c. Identification of reasons of low performance like hot spots on the cells/panels, diode failures, cracked cells or glass cracks, loose contacts and wiring faults, penetration of moisture and/or dirt, failed or disconnected modules, junction box heating or any other.
d. Identification of hot spots in other equipment like SCBs, Y connectors, DC cables, Switchyard.
e. Preparation and submission of detailed report covering physical panel location of each anomaly, summary of defect types and number of defects indicating the priority which arrays need immediate attention etc. The report should be provided in soft (pdf, images in jpeg) as well as hardcopy.
f. Recommendation on root cause of the problems.

g. Frequency of drone survey for thermography shall be weekly per block during the PG test period of the plant for period of three to four months and thereafter shall be monthly once per block during the regular O&M period. Experienced operator shall be made available for operating and conducting the regular Drone survey of the system as above till end of the O&M period. Procurement, Maintaining and upkeep of the Drone with accessories such as Thermal Camera, software and hardware for obtaining and analysing the survey inputs for O&M purpose shall be under scope of the O&M vendor. Necessary approvals shall be obtained from Owner (NTPC) for movement of the drone over the reservoir.

4.11 SCHEDULE OF REPORTS:

Sl. No.	Description	Frequency (At least)
(1)	Previous day Plant wise Insolation vs Generation vs Schedule Generation and next day schedule	Daily
(2)	Net Meter sent out generation of the PV plant and for total power station.	
(3)	Performance Ratio & Plant Utilisation Factor	
(4)	Details Maintenance Schedule program	
(5)	Main incident recorded	
(6)	Actual generation Vs Guaranteed	Monthly / Quarterly / Bi-Annual / Yearly
(7)	Actual Performance Ratio vs Guaranteed	
(8)	O & M preventive and corrective maintenance services during the current month and expected for the following month.	
(9)	Main incidents recorded, incidents handling and resolution times.	
(10)	Analysis of all performance data of the plants to ensure optimal performance and detect any areas for improvement.	

Note: All site daily reports should be sent in pdf form and Excel sheet form and not as photos.

4.12 SERVICE SCHEDULE:

Maintenance register/log book must be maintained at site. Vendor shall provide the Services activities described below at the frequency indicated in table:

Sl. No.	Description	Frequency (At least)
	PREVENTIVE MAINTENANCE	
1	For monitoring of plant performance by walking between module rows for random checking of Floater/modules / cables / SCBs both at SCADA and Physically. (Including Drone survey as per schedule for PG test period and regular O&M period for finding faulty strings and modules)	Daily
2	Random inspection of output of Floater/modules / strings at SCADA.	
3	Checking that all inverters are producing generation as per expected generation values and Checking for received alarm and failure warnings(if any)	
4	Array inspection: Walk through each row of the PV array and check the PV modules for any damage. Report any damage to rack and damaged	

Sl. No.	Description	Frequency (At least)
	modules for warranty replacement. Note location and serial number of questionable modules.	
5	Washing of all panels with water with no chemicals in a method approved by the Purchaser.	Twice in a Month
6	Remove any sprouting seeds or vegetation, bird nests, leaves or debris, etc. from Solar panel, Modules, SCB, walkways etc. It is to be ensured that above debris shall not be discharged into the reservoir.	Monthly
7	Floater and MMS integrity	Monthly
8	Inspect electrical boxes for corrosion or intrusion of water or insects. Seal boxes if required.	Half yearly
9	Exercise operation of all protection devices.	Half yearly
10	HT Switchgear cleaning and tightness of Bus, Contact resistance, IR etc.	Yearly
11	HT Switchgear: Preventive maintenance of VCB, CT, PT, Relays etc with IR, Primary injection, secondary injection, Contact resistance, Closing and opening time, Interlock checking etc.	
12	SWITCHYARD: Checking, cleaning, tightness. thermo-graphic of CT, PT, VCB, CR panel, LA, Isolators etc. at Switchyard.	Every three month Yearly
13	Oil filled Transformer: Oil level, Wdg temp, Oil temp reading.	Daily
	Transformer Oil: BDV and PPM and DGA as required	Yearly
14	UPS and UPS Battery: Cleaning and voltage as per OEM schedule.	Twice in a month
15	Grounding inspection : Continuity and Earth resistance test (below 1 ohm) system grounding for a) Electrical all earthing at Control room & Switchyard, b) Electronic earthing at Control room, c) Array earthing.	Half yearly
16	Inspect cabling for signs of cracks, defects, pulling out of connections; overheating, arcing, short or open circuits, and ground faults.	Monthly
17	LT panels: ACDB, DCDB, Aux. DB, Utility DB and other LT panels	Half yearly
18	Inverter inspection: Observe instantaneous operational indicators on the faceplate of the inverter to ensure that the amount of power being generated is typical of the conditions. Compare current readings with diagnostic benchmark. Inspect inverter housing or shelter for physical maintenance required if present.	According to OEM's O&M schedule.
19	String inspection: Test open-circuit voltage of series strings of modules.	According to OEM's O&M schedule.
20	220V/110V DC battery sets : Specific gravity, level of electrolyte, Per cell voltage as per OEM standard.	Weekly
21	220V/110V DC Battery Charger Sets : Cleaning, operation and interlock, Changeover from Float to Boost and Boost to Float etc. as per OEM standard.	Yearly
22	Corrosion inspection: Check all hardware for signs of corrosion, and remove rust and re-paint if necessary.	Half yearly
23	Mounting system inspection: Inspect ballasted, non-penetrating mounting system for abnormal movement	Half yearly
24	Mooring arrangements checking and taking preventive action	Monthly

Sl. No.	Description	Frequency (At least)
25	Cleaning of the vegetation from water surfaces (If anything comes over the plant that has be cleaned for smooth O & M activity and sustained generation.)	Monthly
26	Cleaning of Surface drains, road (In and around MCR, Transformer yard) and switchyard area	Monthly
27	Visual inspection and correction of Solar Facility for loose electrical connections and ground connections.	Half yearly
28	Infrared scans on all combiner and re-combiner boxes; tighten connections to manufacturer's torque specification; report broken terminal blocks. (Employ Drone survey with thermal scanner as per schedule)	According to OEM O & M schedule.
29	Clean inverter cabinet air vents.	Half yearly
30	Clean and change inverter air filters, if present, per manufacturer's warranty requirements.	Half yearly
31	Clean/remove dust from inverter heat sinks per manufacturer's warranty requirements.	Half yearly
32	Check torque marks and re-tightening appropriate wiring connections to design specification torque force per manufacturer's guidelines.	Half yearly
33	Perform infrared scan of 100% of modules for two types of circuitry connections: cells on the front and junction boxes on the back. (Employ Drone survey with thermal scanner as per schedule)	According to OEM O & M schedule.
34	Document details of preventive maintenance work, such as condition observations, work performed, meter readings, thermal images, and system testing results.	Monthly
35	Vendor will make available a 24x7x365 Technical Support	Ongoing

5.0 GENERAL CONDITIONS APPLICABLE DURING O & M:

O & M contractor shall ensure that technically qualified people shall be provided employment during O & M.

1	Vendor shall make their own arrangements for necessary food, drinking water and accommodation for their labour and employees posted at the site. Similarly, food and drinking water required at the site, during the operations, shall also be in scope of vendor.
2	Vendor shall organize all necessary steps to meet statutory requirements such as labour license, PF, ESI etc and also ensure compliance with relevant acts such as minimum wages act, income tax act, employee insurance act etc for their labour deployed at site.
3	Vendor shall maintain updated labour register, with name, age, qualification, salary, attendance details etc. at the site.
4	Vendor shall use danger boards, wherever required, to ensure safety of the persons.
5	Vendor shall adhere to all necessary safety norms such as use of lifejackets, floating devices, helmet, goggles, hand gloves, gumboots, aprons, safety harnesses etc. It is the ultimate responsibility of the vendor in all respect to prevent accidents at the site and safeguard their labour from accidents.
6	Vendor shall, at the completion of every work, clear off the debris, which resulted out of the work. In case of excavation work such as cable trench etc, vendor shall finish the land neatly with necessary leveling, rolling etc.

7	Vendor shall carry out the work without causing inconvenience to other contract groups at the site. In case of conflicts with other groups, vendor shall ensure that the matter is resolved at once amicably so that the progress of work is not affected.
8	Any damages on the building, structures etc. attributable to the acts of labour / employees of vendor shall be rectified and made good by the vendor at their own cost.
9	No child labour shall be employed for execution of the present contract.
10	Vendor shall submit periodic status report, on daily as well as weekly consolidated basis, to BHEL on the progress of the contract.
11	General Guidelines Any civil or electrical work which is not mentioned or included in this tender document but necessary for functional requirements of the plant shall be carried out by vendor. All work shall be carried out in accordance with the latest edition of the Indian Electricity Act and rules formed thereunder and as amended from time to time.
12	The Contractor shall comply with the provision of all relevant Acts of Central or State Governments including payment of Wages Act 1936, Minimum Wages Act 1948, Employer's Liability Act 1938, Workmen's Compensation Act 1923, Industrial Dispute Act 1947, Maturity Benefit Act 1961, Employees State Insurance Act 1948, Contract Labor (Regulations & Abolishment) Act 1970 or any modification thereof or any other law relating whereto and rules made there under from time to time.'
13	BHEL shall have right to disallow any O&M employee, if found unfit to perform. BHEL instructions issued in writing shall be binding on vendor who shall replace the person.
14	

6.0 HANDING OVER OF THE PLANT:

6.1 At the end of the contract period, the contractor shall hand over the plant and equipment back to the owner (NTPC) jointly with BHEL in completely safe and healthy condition and without any pending defect.

6.2 The items supplied by NTPC/BHEL on returnable basis, such as spares parts (from mandatory spares or through procurement), consumables, tools and plants, documents etc. shall be returned back to NTPC/BHEL. Else suitable recoveries shall be made from the Contractor's bills.

6.3 After O&M period, BHEL may at its discretion decide to extend the existing O&M contract on mutually acceptable terms & conditions.

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ENCLOSURES TO TECHNICAL SPECIFICATION PS-439-1371 REV. 00 (TENDER PURPOSE ONLY)

1	Tentative AC single line diagram of overall Solar PV power plant
2	Tentative floating SPV plant layout on dead water reservoir
3	Tentative layout of main control room
4	Tentative route of underground transmission line and switchyard
5	O & M Manual of Floating Platforms-Purushottam Profile
6	O & M Manual of Floating Platforms-Quant Solar Profile