~~F = Average Index Number for wholesale price for the group of `Fuel, Power, Light & Lubricants' as published by the Economic Adviser, Ministry of Industry, Govt. of India for the period to which the escalation/de-escalation relates.~~

~~Fo = Index number of wholesale price for the group, Fuel, Power, light & lubricants as published by the Economic Adviser, Ministry of Industry, Govt. of India prevalent on the last date of receipt of bids (inclusive of Price Part) or revised price bids whichever is later.~~

2.4 **While calculating the value of "W" the following may be noted** : The cost on which the escalation will be payable shall be reckoned as 85 % of the cost of work as per the bills to which escalation relates, and from this amount the value of materials supplied or services rendered at the prescribed charges under the relevant provisions of the contract, and proposed to be recovered in the particular bill, shall be deducted before the amount of compensation for escalation or de-escalation is worked out. In the case of materials brought to site for which any secured advance is included in the bill, the full value of such materials as assessed by the Engineer-in-Charge (and not the reduced amount for which secured advance has been paid) shall be included in the cost of work done for operation of this clause. Similarly, when such materials are incorporated in the work and the secured advance is deducted from the bill, the full assessed value of the materials originally considered for operation of this clause should be deducted from the cost of the work shown in the bill, running or final. Further the cost of work shall not include any work for which payment is made at prevailing market rates.

2.5 In the event the price of materials and/ or wages of labour required for execution of the work decreases, there shall be downward adjustment of the cost of work so that such price of materials and/or wages of labour shall be deductible from the cost of work under this contract and in this regard the formulae herein before stated under this clause shall mutatis/mutandis apply. No such adjustment for the increase / decrease in material price and/ or wages of labour before mentioned would be made in case of contracts in which the stipulated period of completion of the work is six (6) months or less.

2.6 **Application of Price Variation Clause during extended period of Contracts.**

The Price Variation Clause as stated above will be applied for extended time frame of a contract by following the principle stated as under:

i) Normally, if and when it is understood that a contract is not going to be completed within the scheduled time period, the contract is kept operative by extending the time of completion provisionally. During this provisional extended period the operation of the Price Variation Clause will remain suspended.

ii) If and when it is decided at the end of the successful completion of the work that the delay was due to causes not attributable to the contractor, then the Price Variation Clause will be revived and applied as if the scheduled date of completion has been shifted to the approved extended date.

iii) If it is decided at the end of successful completion of the work that the delay was due to the fault of the contractor then the Price Variation Clause will not be revived for the purpose of escalation but shall be revived and applied for the purpose of de-escalation and no further payment will be made to the contractor

on account of any escalation during this period but recovery shall be made for de-escalation, if any. Additionally, the Clause related to Compensation for delay will be applied.

iv) If it is decided at the end of successful completion of work, the delay was partly due to the fault of the contractor and partly due to the fault of the employer and thereby Liquidated Damages (LD)/compensation due to delay is imposed then price variation clause for the purpose of escalation shall not be revived for this extended period, but shall be revived and applied for the purpose of de-escalation.

No payment will be made by applying "FROZEN INDICES "under any circumstances.

~~**Table – 1**~~

~~Value of A, B & C in the escalation formula in the additional terms & conditions for Civil Works:~~

~~**Sl. No.**~~	~~**Particulars**~~	~~**A% (Labour Component)**~~	~~**B% (Material Component)**~~	~~**C% (POL Component)**~~	~~**Remarks**~~
~~1~~	~~For building works~~	~~25~~	~~75~~	~~Nil~~	
~~2~~	~~For Road works~~	~~15~~	~~80~~	~~05~~	
~~3~~	~~For external sewerage, External water supply, and external electrification~~	~~10~~	~~90~~	~~Nil~~	
~~4~~	~~For external water supply, external sanitary and external electrification (through labour rate contract)~~	~~75~~	~~25~~	~~Nil~~	
~~5~~	~~For steel structural works~~	~~15~~	~~85~~	~~Nil~~	
~~6~~	~~For steel structural works with Deptt. free supply of rolled steel sections (through labour rate contract)~~	~~75~~	~~25~~	~~Nil~~	
~~7~~	~~For Coal Handling Plant Civil Works~~	~~25~~	~~75~~	~~Nil~~	
~~8~~	~~For under ground civil works such as Incline Drivage, Shaft Sinking etc.~~	~~35~~	~~65~~	~~Nil.~~	
~~9~~	~~For only labour oriented works of maintenance nature.~~	~~100~~	~~Nil~~	~~Nil~~	

~~For all other works not listed above, the component of labour, material and POL of the total cost of work shall be as specifically indicated in the tender document.~~

SPECIAL TERMS AND CONDITIONS:

SCOPE OF OPERATION & MAINTENANCE:

A. Manpower:

1. The contractor has to engage One Engineer having Diploma / B.Tech / M.Tech with 1 to 5 years of expertise to supervise the O&M of Solar Power Plant and all-round maintenance including Break-down maintenance, Preventive Maintenance, Condition Based Maintenance and Periodic Maintenance for a period of 2 years.

2. The contractor has to engage Two Engineer having ITI or Diploma with 1 to 5 years of expertise in O&M of Solar Power Plant for a period of 2 years.

3. The contractor has to engage Two Helper for cutting of grass in the vicinity of Solar Power Plant and removing of debris, Cleaning of 6720 Solar Modules once a week and up-keeping of Control Rooms, Inverter Rooms for a period of 2 years.

B. Operation and Maintenance of Solar Plant:

The sole responsibility of the contractor is to ensure guaranteed 98% plant availability subject to grid availability with (guaranteed) 75% Performer Ration (PR) with 0.7% yearly degraded value and (guaranteed) 13 to 15 % Capacity Utilization Factor (CUF) yearly.

- **General Scope – for O&M Service:**

a. Contractor Shall maintain different registers such as Attendance Register, Spare & Consumable Consumption (Inventory) Register, Grass Cutting Register, Cleaning Register (with raining frequency & water consumption), Breakdown Register(Plant & Equipment), Solar Maintenance Register, Earth-pit Resistance Maintenance Register, Transformer Oil Sampling Register, Installed Apparatus & Replacement Register. The records may be available in both offline and online for submission to Electrical Inspector.
b. Plant MIS : Plant MIS Report to be furnished on Daily, Monthly, Quarterly & Annually basis as specified, mainly containing Net generation, Aux Consumption, Radiation Data, Losses at Each Level, Soiling Loss, Temp. Loss, Mismatch Loss, Inverter Loss, Transformer Loss, DC & AC Cable Loss etc (As per availability) in Mutually agreed format. The requisite data has to be communicated to Dispatch Centre in specified format daily with a copy to General Manager/HOD (E&M).
c. Analysis for repeated failures and low generation along with corrective action.
d. Scheduling and monitoring of preventive maintenance for each equipment solar plant as prescheduled.
e. Support in Warranty & Insurance management.
f. Preventive maintenance with standard checklist and procedures based on guidelines of OEM for different equipment in the solar plant.
g. Thermography imaging of PV Modules and Electrical Circuit on sample basis annually and analysis. Corrective/Preventive action as and when required.

❖ **Scope of O&M Service:**

S. N.	Plant Component	Tasks	Frequency
1	PV modules	Inspection to see if there are any cracks or hotspots ddeveloping on the modules.	Continuous basis so as to cover up all in a month
		Physical inspection of the module's junction boxes for any damage.	Continuous basis so as to cover up all in a month
		Water jets are sprayed on the solar modules and they are cleaned with a mop and grass cutting in and around peripheral area as specified elsewhere in NIT	Thirty Six times of cyclic cleaning and 3 times grass cutting as per instructions of Engineer in charge
		Check for any shadows on the panels	Everyday
		Check for any bird droppings	Everyday
		Thermo graphic inspection of the Modules (Scanner will be provided departmentally)	Once a year
2	Module support structure: posts, substructure frames and mounting systems	The system shall be periodically inspected to verify the integrity of all the support structures;	Every 6 months
		Checking of module clamps through sampling for Tightness	Every 6 months
		Sample check for the tightness of nut and bolts of the structure	Every 3 Months
		Checking of module mounting structures for any rusting or sharp edges.	Every 3 Months
3	DC cable and wiring	Checking through sampling for the connectors and string cable for any physical damage;	Every 3 Months
		Check on the connection points of combiner boxes if connectors are intact properly	Every 3 Months
		Check all the MC4 connectors for any melting/overheating etc.	Every 3 Months
		Checking the open-circuit voltage (Voc) of String replace the low VOC module.	Yearly
		Perform I-V curve test to check on the performance of the system (Actual cost of the test will be borne by MCL)	The same shall be done on the advice of MCL
		Perform Insulation resistance test of the DC cables from combiner boxes to inverter to check the healthiness of the cables	Once a year OR IN BREAKDOWN TIME
4	Combiner box	Ensuring termination points are tightened properly	Every 6 Months
		Checking all the cables to ensure it is maintained in good condition.	Every 6 Months
		Checking of fuses	Every Months
		Visual inspection of the combiner box for any damage	Every Months
		Check for the working of communication board	Every Months
		Check the DC switch for its smooth functioning	Every 6 Months
		Check for the status of surge protection device	Every Months
		Check for the closing of the door of combiner box	Every 6 Months
		Check if all holes are closed with sealant	Every 3 Months
		Check all the cable glands are properly sealed	Every 3 Months
		Check for any short circuit or burning inside SMB	Monthly
		inspection of the support structure for rust and any physical damage	Every 3 Months
		Cleaning of the combiner box	Every 3 Months
		Check ampere of all the strings either through SCADA or physically.	Every Week in physically and every day in SCADA and making comparisons statement.

5	Meteorological station: station structure, power and control wiring. Irradiance, temperature, humidity sensors	Cleaning the pyranometer and silicon sensor	WEEKLY
		Checking the tilt angle (if applicable)	Every Month
		Checking bubble position on the pyranometer (if made available)	Every 3 Months
		Check for any other abnormalities	Every Month
		Check the physical condition of the support Structure	Every 3 Months
		Calibration of pyranometer and silicon sensor(Actual cost for calibrations will be borne by MCL.	This will be done on advice of MCL)
6	Inverter: inverters, cabinet, doors and seals (Scheduled maintenance in accordance with manufacturer's recommendation)	Checking the inverter to see if the LCD display is intact and checking for warnings/errors;	Every month
		Check inverter bottom fasteners tightness;	Every 3 months
		Ensure that the heat sink at the rear of the inverter is not covered (e.g. by insectsor dirt);	Every 3 months
		Checking warning labels and stickers;	Every 3 months
		Cleaning of inverter (if necessary);	Every months
		Checking the surge arrestor physical condition.	Every months
		Check the inverter for any physical damage	Every months
		Clean the filters of the inverters	Every months
		Check AC and DC voltage of the inverter	Every 3 months
		Check DC fuse for it's working	Every 3 months
		Check AC and DC breaker for it's working	Every 6 months
		Check for the presence of any insect/pest/reptile inside the inverter	Every month
		Check for the health of GFDI/EFC	Every month
		Check all components inside the inverters for any damage	Every month
		Check for any fire/hot spot inside the inverter	Every month
		Check inverters fan for its working	Every 3 months
		Check DC power supply for its operation	Every 3 months
		Tightness of AC/DC cables.	Every 6 Months
		Check all the doors for its proper opening and closing	Every 6 Months
		Check the connectivity between SCADA and inverter	Every 6 Months
		Clean the contacts of the PV load-break switch. Clean by cycling the switch to on and off positions ten times. The PV load-break switch is located at the bottom of the inverter.	Once a year
		Check for any type of corrosion inside the inverter	Once a year
7	Grounding system (Earthing & Lightning System)	Check for the continuity between Earthing strip/structure and Earthing pit; & Lightning System	Every 6 Months
		Check & Maintain the earth pit resistance of entire plant.	Every 6 Months
		Check tightness of all the fasteners in Earthing pit	Every 6 Months
		Check all the earth pits for any physical damage	Monthly
8	AC cable and wiring	Inspection of the wires to ensure there is no damage due to environmental conditions.	Every 6 months
		Check AC cable terminations (Lugs) for physical damage	Every 6 months
		Check AC cable terminations (Lugs) for any heating with temperature gun	Every 6 months
		Perform Insulation resistance test of the AC Cables for the entire plant to check the healthiness of the cable	Every 6 months & during BD maintenance.
9	SCADA Monitoring system: power and control wiring, monitoring panels, internal structural and support components, power supply, interface, logic and controller devices, monitoring devices	Ensuring the data logger and battery are intact.	Every 3 months
		Check all the physical connections inside the cabinet for tightness	Every 3 months
		Check the monitoring cabinet for any physical Damage	Every 3 months
		Check the operation of SMPS	Every 3 months
1	HT & LT Panels(Scheduled	Check panel for any physical damage	Every 3 months
		Check cable terminations for any abnormality	Every 6 months

0	maintenance in accordance with manufacturer's recommendation)	Check all the connections for tightness	Every 3 months
		Check all the connections of control wiring	Every 3 months
		Check the breaker for its functioning by rack in and rack out	Every 3 months
		Maintenance of the VCB	ONCE IN YEAR
		Check operation of protection relays	ONCE IN TWO YEAR
		Check the operation of relay mechanism	ONCE IN TWO YEAR
		Check any sign of moisture in bus bar and circuit	ONCE IN YEAR
		Check all the cable gland if it's properly sealed	ONCE IN YEAR
		Check the MFM for its functioning and it's wiring	ONCE IN YEAR
		Cleaning of panel with dry cloth or blower	ONCE IN YEAR
		Check all the indicators for their working	ONCE IN YEAR
		Check all the auxiliary supply AC/DC	ONCE IN YEAR
		Check volt and Amp meter for their operation	Every months
1 1	Battery Bank & Battery Charger	Check batteries physical condition	Every 6 months
		Check the tightness of battery cell connection	Every 6 months
		Clean the surface and connection of battery cell using dry cloth	Every 6 months
		Apply petroleum jelly on battery cell termination to avoid terminal corrosion	Every 6 months
		Check voltage of the battery bank	Every 6 months
		Check for the operation of battery charger	Every 6 months
		Check for the tightness of all the terminations	Every 6 months
		Check all the indicators and meters for their operation	Every 6 months
		Check for the operation of MCB and DC switch	Every 6 months

❖ Corrective and Condition Based Maintenance:

S. No.	Plant Component	Activity	Tasks
1	All	Technical Support	Provide 24x7x365 information support on activities, performance and incidents in the plant
2	PV modules	Replace modules failing performance test and infrared scan after showing cracks in glazing, discoloration of metallic contacts, delamination, or signs of water	Furnish detailed report with all relevant details of damage and recommended resolution steps. Supply of Modules will be under scope of MCL
		Repair cracking of PV module back sheet	Provide Warranty Claim support and carry out execution in consultation with Owner and Module manufacturer
		Repair or replace damage to module frame	
		Repair junction box	
3	Module support structure: posts, substructure frames and mounting systems	Replace foundation element	Excavate and replace failed foundation element
		Replace rack parts	Repair or replace rack parts damaged by corrosion or physical damage
4	DC cable and wiring	Replace connectors between modules	Replace MC4 Connectors between modules
		Ground Faults	Locate & Replace ground fault
		Wiring Repairs	Locate underground DC wiring as part of repairs to faults
			Carefully dig to expose fault and repair wire
5	Combiner box	Replace MC connector lead to combiner box	Replace MC connector lead to

			combiner box
		Replace combiner box fuses	Replace failed fuses in combiner box
		Replace damaged combiner box	Replace combiner box if available in spares
			Mobilize SCB supplier support for replacement
6	Inverter: inverters, cabinet, doors and seals	Start/stop inverter (reboot to clear unknown error)	Execute restart and carry out RCA with inverter supplier
		Replace inverter fan motor through OEM and spares will be provided by MCL.	Mobilize Inverter support team to resolve the issue
		Replace inverter data acquisition card/board; diagnose with fault code through OEM and spares will be provided by MCL.	Resolve with remote assistance if spares are present
			Replace inverter control card (PWM signal, voltage, phase, frequency, shut-down); diagnose with fault code
			Replace IGBT driver card/board; diagnose with fault code
			Replace maximum power-point tracker card/board; diagnose with fault code
			Replace AC fuse in inverter
			Replace AC contactor in inverter
			Replace IGBT matrix in inverter
			Replace 24VDC power supply for inverter controls
			Replace DC contactor in inverter
			Replace GFI components in inverter
			Replace capacitors in inverter
			Replace inductors (coils) in inverter
			Replace fuses internal to inverter
			Replace inverter relay/switch
			Replace overvoltage surge suppressors for inverter
			RE-install inverter control software
			Manual reset of arc-fault trip
			Replace inverter
			Re-tap Transformer
7	Grounding system	Correct discontinuity in system	Correct discontinuity in system
		Re-charge earth pits	Re-charge earth pits
8	AC cable and wiring	Damaged AC wiring and spares will be provided by MCL.	Locate and repair underground AC wiring
		Line-to-line Faults	Locate and Repair Line-to-line faults
		Damaged AC wiring conduit and fittings	Replace broken/crushed AC wiring conduit and fittings
9	Monitoring system	Loss of internet connectivity	Provide bridge internet connectivity, if mobile networks are active
			Resolve through ISP services
		Loss of equipment connectivity and spares will be provided by MCL.	Locate and repair source of connectivity issue
		Incorrect data / Configuration	Resolve through SCADA provider

		issue	
		Loss of power	Replace/Repair power Source
10	Transformer	Transformer protection device	Checking of protection device of transformer.
		Oil level checking.	Oil level checking every 6 months.
		Checking of both HT and LT side of transformer.	Checking annually of both HT and LT side of transformer
		Breather	Quaterly Breather checking.
		Oil leakage	Checking of oil leakage with BDV value in every 6 month.
		Oil testing with extra cost.	DGA testing of Transformer oil in every 6 month.
11	HT & LT Panels	Replace protective Devices and additional cost shall be borne by MCL.	Replace protective devices

C. Cleaning of Solar PV Modules:

1. The work should be completed within 365 Days i.e Thirty Six times of cyclic cleaning and 3 times grass cutting as per instructions of Engineer in charge which shall be reckoned from within 10 days of issue of work order/LOA.

2. The tenderer(s) will deploy sufficient number and size of equipments/machineries/vehicles and the technical/ Labour/ supervisory personnel if required for execution of the work.

3. Cleaning of PV modules will be allowed from 5:00 A.M to 9:00 A.M and from 4:00 P.M to 8:00 P.M. However, the timing may be varied by Engineer-in-charge (EIC) depending upon the seasonal change.

4. Cleaning of the modules will be done strictly as per the instruction of the engineer-in-charge or his representative. The cleaning of the module & Grass cutting shall be done under the supervision of EIC or his representative.

5. Water for cleaning of Solar Panels will be provided by MCL through tanks and piping system available at Solar Power Plant.

6. Cleaning of 6720 Solar PV modules must be done within 7 days. However the time duration of the cycle of cleaning will be decided by engineer-in-charge depending on the weather conditions.

7. The Following details are to be maintained daily by the contractor in a day to day work register and should be signed by EIC or his representative:

S. N.	Cycle number	Date	Starting Table No.	Ending Table No	Total No. Table cleaned	Sign of contractor or his representative	Sign of EIC or his representative	Remarks

D. Cutting of Grass and Removal of the Rubbish:

1. Plant layout has been annexed at Annexure XIV. The total Plant Area has been segregated into 3 blocks i.e Block A, Block B & Block C.

2. Cleaning of Grass and Removal of the Rubbish as per NIT in Block A & Block B including hillock should be limited to Area enclosed by fencing excluding area shown in Green colour markings in Annexure XIV.
3. Cleaning of Grass and Removal of the Rubbish should be done entirely in Block C.
4. Tree dressing and removal debris from the site is also in the scope of the contractor.
5. Any Physical Damage to Solar PV panels due to improper cleaning or during grass cutting or cleaning of rubbish will be the responsibility of the contractor and corresponding financial loss due to above damage will be recovered from Security deposit. The damage will be recorded in the day to day work register.
6. Up-keeping including Pest Control of vicinity of Solar Power Plant including Control Rooms, Inverter Rooms, Metering Rooms.

E. Additional Safety measures to be taken by the Contractor:

(i) Gearing, Transmission, Electric wiring and other dangerous parts of hoisting appliances shall be provided with efficient safeguard. Hoisting appliances should be provided with such means as will reduce to minimum risk of accident independent of the load. Adequate precautions should be taken to reduce to the minimum risk of any part of suspended load becoming accidently displaced.

When workers employed on electrical installations which are already energized insulating mats wearing apparel, such as Gloves, sleeves and boots as may be necessary should be provided, the workers should not wear any ring, watch & carry key or other materials which are good conductors of electricity.

(ii) To ensure effective enforcement of the rules regulations relating to safety precaution the arrangements made by the contractor shall be open to inspection by the labour Officer, Engineer-in-charge of the department or their representatives.

(iii) Notwithstanding to above clause from (i) & (ii) there is nothing in these to exempt contractor from the operations of any Act or Rule in force in Republic of India.

F. List of Spare to be provided for each year:

SL.NO	MATERIALS	UOM	Quantity
1	Distilled water	Ltr.	100
2	Solar PV-Fuses	Nos.	40
3	Insulation Tap	Nos.	40
4	Silica gel (aux)	Kg	1
5	MC4 Connector Pair	Pair	100
6	Solar PV cable 1C6sqmm	Mtr.	500
7	Cable TIE,292 MM	Nos.	1000
8	Bentonite powder	Kg	50

G. General Terms & Conditions:

1. G.M /HOD (E&M), MCL HQ or his authorized representative shall be the Engineer–in-Charge for execution of this contract.

2. The payment shall be made as per clause No.9.0 under the head Measurement and Payments of General Terms and Conditions of Tender Document. The bills shall be submitted to the Engineer– in–charge for processing of payment.

3. The contractor has to maintain an Attendance register for the daily deployment of labour and it should be made available for verification as and when required by the Engineer-In-charge (EIC) or his authorized representative.

4. In case of less deployment of manpower on any particular day, a deduction will be made at the rate of prevailing minimum wages of respective category of manpower from the running on account of bill(s) of contractor.

5. The contractor has to ensure the regular updation of maintenance record in all shifts. Each electrical works/repairs shall be entered in the said register & get it signed by users & shift in charge/ electrician in respective shifts.

6. Contractor has to supply materials as per quantity mentioned in NIT as and when required as per the instructions of Engineer-In-charge (EIC) or his authorized representative. The supplied items are to be of ISI marked, reputed make and must have satisfactory performance which will be decided by EIC. A list of brands and makes of quoted items are to be submitted before execution of the contract and the addition and deletion can only be done after getting directions/intimations from EIC based on performance of the supplied item.

7. A store /room will be provided to contractor at Solar Plant. The contractor shall ensure the availability of adequate number of items at assigned store along with the issue register as per instructions of EIC or his authorized representative.

8. The material/ items are to be issued to EIC or persons authorized by EIC of E&M Department as and when required basis from 08:00 A.M to 11:00 A.M on daily basis. The issuance is duly recorded in issue register with authentication of the EIC or his authorized representative(s) and Contractor or his representative.

9. If contractor fails to supply/ issue the items within 24 hrs of the intimation of Engineer-In-charge or his authorized representative to the contractor or supervisor, the Company can buy the same from any local store/market by any means and the corresponding actual purchase bill plus 10% of such bill as handling charges shall be deducted from AMC bills.

   Note: Requirement shall be intimated in any e-media such as e-mail, fax, Whatsapp, SMS etc.

10. Contractor shall submit the contact details of the Supervisor such as name, address, e-mail id, phone number and Whatsapp number before execution of the agreement.

11. No claim for extra payment other than the contracted amount will be considered.

12.

(a) The contractor shall be liable for the implementation of the provision of contract of labour registration and abolition acts and rules thereof, payment of wages act/ rules. Minimum wages act and the rules thereof and any other legislation which are obligatory for the contractor towards his employees during the currency of the contract.

(b) That the Contractor shall provide full medical treatment/ compensation to his staff and labour in case of accident on duty including poisons reptiles & insect bites. The company shall have no responsibility whatsoever of /towards staff/ labour deployed by the contractor. The contractor should ensure that his service crew observes all the safety norms while working.

13. THAT in no manner the COMPANY is liable to the CONTRACTOR or any member of his staff or any other person or to Government or other bodies for injuries or death caused as a result of accidents either within or outside the working areas in the course of work. The CONTRACTOR shall be responsible for such contingencies and make good