

**ESTABLISHMENT OF FRAME AGREEMENT FOR the provision of
Maintenance, Operation and Monitoring Service of Solar plant in Zaatari Camp, Jordan**

Background:

UNHCR, in partnership with the Government of Jordan, have established the largest solar power plant in Zaatari refugee camp. The plant is meeting the electricity needs for around 76,000 individuals in all shelters in the camp.

The 12.9 MW Zaatari solar plant is producing on average, about 23,000 MWh of clean energy per year and supplying shelters with electricity for about 14.5 hours per day. The Zaatari solar project uses 37,380 Canadian solar modules with a capacity of 320Wp/325Wp/330Wp each and 10 Ingeteam inverters of 1108 kW ac capacity (Ingecon Sun 1110 TL). Each inverter is connected to a different number of strings, which have either 183 or 186 or 189 modules each. There are 20 PV modules connected in series in each string and 18 to 21 strings are connected to one combiner box. 10 to 9 combiner boxes are being connected to one inverter and 2 inverters are connected to 1 transformer. A total of 1,869 strings are used in the PV plant.

The purpose of the Operation and Maintenance (O&M) Management Plan for the Zaatari Solar Power Plant is to:

- 1) Maintain and operate the plant and its equipment;
- 2) Ensure safe and optimal operation of the facility - safety through security guards' presence on site 24/7 and optimal operation through cleaning, preventive and corrective maintenance;
- 3) Monitor plant status; analyze incidents and production;
- 4) Develop and carryout preventive maintenance activities;
- 5) Carryout corrective and breakdown maintenance.

As a general principle, the O&M management activities seek to guarantee and maximize the availability and the performance of the solar plant thereby extending its useful lifetime.

The awarded vendor shall guarantee at least 97% of the Available Energy* the Vendor should extract the yearly amount of energy generated from GPMPV Solar portal (Online Portal logs the daily generation for the plant) and PV Syst. Original Report.

*Available Energy: The energy to be produced from the Solar Plant as presented in the web portal/ Scada system excluding design faults, sudden and planned electricity grid outages in addition to limitation on power factor. The vendor shall be responsible for any non-design faults leads (after the hand-over period) to reduction in the generated energy and the vendor will reimburse UNHCR.

The expected degradation of the efficiency for the solar panels is not the responsibility of the Vendor and it will not be part of the performance guarantee.

Scope of Work:

Provision of all O&M services needed in so as to guarantee at least 97% of the design capacity but not limited to operation and maintenance (corrective, preventative, breakdown and predictive) of all equipment of the plant, including electrical infrastructure, water statutory inspections (Flood mitigation measures) and testing, staff, vehicles, tools, spare parts (including modules, inverters, mounting structures, transformers and high voltage protection equipment), consumable products, security, overhaul, specialist repair services, etc. needed to perform the services. Minimum aspects are as follows:

Note: The following aspects shall in no way be considered exhaustive nor limited, the Vendor is responsible to carry out the operation and maintenance of the Zaatari Solar PV plant with highest state-of-the-art standards and best international practices.

Annex A - RFP/HCR/JOR/2020/06 - Terms of Reference (TOR)

1) Routine Cleaning Schedule and Procedures The vendor shall submit a full and detailed proposal showing the methodology, equipment, staffing and machinery

- Monthly one (1) dry cleaning using IBVs when the robots are not working or need maintenance.
- One-time wet cleaning in Summer Season (To be determined and decided by UNHCR Electrical Engineer) each year within the contract period.

2) Ensure safety, security and optimal operation of the facility:

- Security 24/7 and remote monitoring through existing CCTV systems which contains twenty-three (23) cameras installed in all sites.
- safety through security guards present on site 24/7 in addition to monitoring through existing cameras and CCTV system, and optimal operation through cleaning, preventive and corrective maintenance

3) Monitoring and Reporting The vendor shall submit a full and detailed proposal showing what will be inspected, inspection & reporting forms to be used, methodology or standard, equipment, staffing and machinery:

- **Daily inspection:**

- To be conducted by Technician or higher position.
- **Frequency:** Twice a day (at 9:00 AM and at 6:00 PM).
- **PCS Skid and Inverter:** Making sure no dirt/soil build around the skid, no abnormal noises or smells, inverter is operating normal, no inverter alarms are on, Skid is clean and free of debris, all labels and warning in place, all cabinet doors locked.
- **PCS Transformers:** Checking the Transformer's temperature, Transformer oil level, Transformer's pressure, making sure no unusual noise or oil leakage occur, pressure relief seated, making sure cooling fins are clean, no loose connections and valves, no gas leakage and all instruments are functioning.
- **Block:** Making sure no general drainage or erosion problems occur, block is clean and free of debris, checking the visual module, table, and wire damage, making sure the combiner box is in a good condition, combiner box doors secured, no excess vegetation, no excess module soiling, no damage to racking system.
- **Site General:** Making sure no excess vegetation, all control and junction boxes are secured, security cameras are functional (if applicable), Perimeter fence (If applicable), Doors and gates closed and locked (upon exit).
- **Solar Panels:** checking for cracks, hot spots, tilt angle etc.
- **Structure :** checking the Alignment, Corrosion, Rust etc.
- **DC and AC Cables:** All related tests such as continuity, insulation, etc. (if needed).

- **Weekly inspection:**

- To be conducted by Engineer or higher position.
- Frequency: Twice per week.
- **PCS Skid and Inverter:** Making sure no dirt/soil build around the skid, no abnormal noises or smells, Inverter is operating normal, no inverter alarms are on, Skid is clean and free of debris, all labels and warning in place, all cabinet doors locked
- **PCS Transformers:** Checking the Transformer's temperature, Transformer oil level, Transformer's pressure, making sure no unusual noise, no oil leakage occurs, Pressure relief seated, making sure Cooling fins are clean, No loose connections and valves, No gas leakage, All instruments functioning.
- **Block:** Making sure no general drainage or erosion problems occur, Block is clean and free of debris, checking the Visual module, table, and wire damage, making sure the Combiner box in good condition, Combiner box doors secured No excess vegetation, no excess module soiling, no damage to racking system

Annex A - RFP/HCR/JOR/2020/06 - Terms of Reference (TOR)

- **Site General:** Making sure no excess vegetation, all control and junction boxes are secured, Security cameras are functional (if applicable), Perimeter fence (If applicable), Doors and gates closed and locked (upon exit).
- **Solar Panels:** checking for Cracks, Hot spots, Angle etc.
- **Structure :** Checking the Alignement, Corrosion, Rust etc.
- **DC and AC Cables:** All related tests such as continuity, insulation, etc. if needed.

4) Proposal for all needed preventive maintenance and tests: The vendor shall submit a full and detailed proposal showing what will be inspected, inspection and reporting forms, methodology or standard(s), equipment, staffing and machinery.

Preventive Maintenance shall include periodic visits to the Solar Plant, with the replacement of consumable materials and the correction of those systems whose failure has been statistically predicted, and of those for which requirements for personnel and materials have been projected.

The preventive maintenance activities shall include:

- Visual inspection.
- Confirmation of the electrical protective devices.
- Confirmation of the integrity and performance of the solar modules.
- Confirmation of the condition of the supporting structures and of their foundation structures.
- Confirmation of the mechanical condition of the cables and terminals, plates, junctions, connections, and cleaning (including the grounding cables, and tightening terminals).
- Confirmation of the condition of the electrical equipment, e.g., operation of the inverters and controls, Combiner boxes, Smart Logger, Inverter Station, transformer etc.
- Maintenance of switchgears within the LV Panel and at interconnection point.
- Maintenance of the safeguard/monitoring, communications, and safety/security systems.
- Management of the vegetation, grass as needs or as required by local site conditions, to prevent shading of the panels, minimize fire risk, keep access to equipment open.
- Cleaning and maintenance of the weather stations.
- Recording of the maintenance operations in a maintenance logbook.
- Maintenance of fences.
- Thermograph analysis of inverters, combiner boxes and relevant equipment.
- The following table shows the O&M services for solar projects should be:

Components	Service Frequency	Preventive Maintenance
Check grounding impedance of each loop of the substructure	Every 6 Months	Modules and Substructures
Check hotspot heating on the modules by IR thermography		
Check the cable holders' condition (fixings, connections, galvanization)		
Check the cables position at the electric panel input (humidity risk)		
Check the module connections and the electric cables DC and their circuit connections		
Visual Check the modules condition (cells, glass, etc.)		
Visually check the identification plates or RFID	Every 3 months	
Visually check if there is an unexpected shading caused by growing plants or other obstacles in the PV plant		
Check the auto-cleaning robot	Every Month	

Annex A - RFP/HCR/JOR/2020/06 - Terms of Reference (TOR)

Visual inspection of the panel's safety connection	Weekly	
Visually check the module glass condition (module fixing and fastenings)	Weekly	
Remove weeds on the site especially around the panels to allow proper operation	Every 6 Months	Civil works
Visual inspection of the manhole covers / earth pits if any		
Visually check and check the mesh tension of the surrounding		
Check the mesh of the fence (if any)	Every 6 Months	Civil works
Visually check and check the resistance and stability of the fence stakes		
Check all gates (condition / corrosion / closure)		
Visually check the site ground and the structure (degradations, etc.)		
Check the slopes (if any)		
Check the soil erosion		
Check of cracks and sweeping away in the ground surface		
Check of cracks and sweeping away in the Granular paved Interior roads (if any)		
Functional test of firefighting system (if any)		
Improvement and repair of the drainage on site (if any)		
Confirm the accuracy of the as-built documentation		
Check the metallic structure of the meteorological station (corrosion and fixing)	Every month	
Visual check of Inverters container, main substation building, (and all related to inverter and SWG).		
Visual check of C-channel holding the Inverters and Structural stability of main substation building		
Check fuses and surge protection systems conditions	Every 3 Months	Electrical boxes
Check that all the structures are properly grounded		
Check the box has no sign of an abnormal heating		
Check the box is clean inside, otherwise clean it up		
Check the box sealing		
Check the connections and the electric cables DC and them circuit connections		
Check the electrical connection tightening		
Check the ventilation work properly; check the operation temperature under a closed cap and if overheated make sure that the ventilation is not blocked by any chance		
Checking the DC Switch-Disconnected		
Tighten terminal boards and tie-point blocks showing hot spots		
Visually check the junction box and its fasteners	Every 2 Months	Electrical boxes
Visually check the junction box signage (electrical hazard stickers, single-line diagrams and cabinet codification)		

Annex A - RFP/HCR/JOR/2020/06 - Terms of Reference (TOR)

Visually check the fuse terminal boards		
Visually check the electrical cabinets (terminal boards, connections, sealing, fixing, etc.)		
Check the electrical connection tightening	Every 3 Months	Inverters
Check the ventilation work properly; check the operation temperature under a closed cap and if overheated make sure that the ventilation is not blocked by any chance		
Internal cleaning		
Check all the switchgear devices inside the panel	Every 6 Months	Solar LV Panel
Check and control protections relays		
Check the switchgear trip history		
Check whether there is effective cooling system maintained in the LV Room		
Visual inspection of the apparent connection status	Every 2 Months	
Ensure that the MCC Panel ACB rating is locked and sealed permanently and the seal is not broken		
Check whether the Panel doors are secured		
Observation noises, possible loose connections		
Check the import export details of electricity		
Check and control protections (threshold and time-lag)	Every Year	Main Switchgear Panel / Solar LV Panel
Check the electrical connections of HT bars, busbars and clean the auxiliary terminals		
Check the tightness of busbar		
Controlling the operation of control devices like relays and controllers, interface protection device etc.		
Monitor and verify the coverage (thresholds and timers)		
Verify and monitor the connection to the ground and its		
Check the room temperature and the proper condition of the mechanical equipment room	Every 3 Months	
Visually check the electrical cabinets (terminal boards, connections, sealing, fixing, etc.)		
Check that safety equipment has valid certification	Every 6 Months	
Check the electrical connection tightening		
Check whether the cooling system equipped in the Switchgear room is effective and no additional heat is affecting the		
Clean Air condition Filters		
Clean up all the elements (including ventilation units), remove dust or pollution residues		
Cleaning the Switch Cabinet from the Outside		
Tighten terminal boards and tie-point blocks showing hot spots		
Visual examination of leakage from prefabricated building		
Check the plug-in terminals (if present)		

Annex A - RFP/HCR/JOR/2020/06 - Terms of Reference (TOR)

Check that safety equipment is in place and in good working order (insulating stick, gloves, extinguisher, etc.)	Every 2 Months	
Clean the room		
Isolation measures between phases and between phases and earth	Every Year	Applicable to Inverters, Combiner boxes and SWG Room
A visual inspection of low voltage cabinets	Every 6 Months	
A visual inspection of low voltage cables		
Visual inspection of the low voltage side		
Checking for Error Messages and Warnings	Every 6 Months	Applicable to Inverters, Combiner Boxes and SWG Room
Checking Screw Connections		
Checking Seals on Doors		
Checking the Ventilations		
Checking the Fuses/Disconnecting Blades		
Checking the Interior of the Connection Cabinet for Soiling		
Checking the Screw Connections of the Power Cabling		
Checking the Surge Arrester		
Checking the Switch Cabinet Surface		
Final testing service	Every 6 Months	Applicable to Combiner Boxes, Inverter, SWG Room and Security Equipment
Perform functional tests mechanical and electrical		
Removal of control devices, interlocks, mechanical and electrical order		
Testing of mechanical and electrical operation after return to service		
Tightening torque wrench		
Visually inspect the insulation, insulators and cable ends (no traces of scent, hot spots, corrosion)		
Check locks		
Check the condition of wiring		
Check the electrical connections of busbars and clean the auxiliary terminals		
Check the earthing connection and its continuity		
Clean the equipment		
Tighten the electrical connections and clean the terminal block		
Check the electrical connection sealing (IR thermography to be implemented systematically)	Every 3 Months	
Checking the Safety Notices		
Check that the single-line and interlocking diagram is present	Monthly	
Control operation position indicators, measures, protection relays, auxiliary cabinets		
No indications of defects outstanding		

Annex A - RFP/HCR/JOR/2020/06 - Terms of Reference (TOR)

Search for characteristic symptoms of degradation / abnormal material (burning smell, noise and vibration, traces of leaks or condensation)		
Control operation position indicators, measures, protection relays, auxiliary BT boxes, indicators of the presence voltage capacitive dividers, counter maneuvers		
Check correct operation of the DGPT	Every Year	Transformers
Check and control protections (threshold and time-lag)		
Check that there are no oil traces	Every Year	
Follow the safety instructions in the prevention sheet entitled "Work on transformer"		
Checking oil levels and fill as needed		
Control of the temperature control on the top of the tank	Weekly	
External visual inspection of the entire tank to control state		
Observation noises, possible seepage		
Visual inspection of the apparent connection status		
Dismantle the measuring equipment and send it back to the manufacturer in order to check the calibration	Every Year	Sensors
Calibration of the pyranometer	Every 6 Months	
Check the plug-in terminals (if present)		
Check the detectors and sensors fixings (inclination and orientation ...)		
Check the metallic structure of the meteorological station / Junction Box (corrosion and fixing)	Every 2 Months	
Clean up the elements of the central unit and the monitoring screens		
Visually check the connections of the components of the central monitoring unit		
Check the controlling front panels and the measuring and monitoring devices	Every 2 Months	
Clean up and check the ambient temperature sensors and the detectors		
Clean up and check the anemometer		
Visually check the electronic units (modem, wiring, etc.)		
Visually check the LEDs work properly and replace them if needed		
Visual Check of the sensor for measuring radiation	Monthly	
Visual Check of the sensor for measuring the temperature of the environment		
Visual Check of the sensor for measuring the temperature of the panel		
Visual Check of the sensor for measuring the wind		
Clean up and check the irradiance sensors		

Annex A - RFP/HCR/JOR/2020/06 - Terms of Reference (TOR)

Write down a report of the power plant performance	Monthly	SCADA / Monitoring
Write down a report of the power plant performance and the maintenance jobs carried out		
Analyze the comparing data on couples (U, I) on the strings on sample strings	Weekly	
Analyze the electricity output and the performance ratio		
Analyze the equipment and alarms availability		
Analyze the inverters efficiency		
Analyze the meteorological data		
Check that the meteorological station data are fully displayed		
Keep the maintenance logbook up to date		
Check the automation works properly and that the electric meter data are fully displayed (if possible – meter is within in the IEC part of the room)	Daily	
Check that the inverters data are fully displayed		
Check that the junction box data are fully displayed		
Check the Internet connection		
Check the system alerts to the central communications		
Test alarms and alerts history if such alarms and/or alerts exist		
Renew the extinguishers and check fire detection via an approved subcontractor or the manufacturer	Every 4 Years	Safety
Check alarm limits according to instructions, note the drift and adjust thresholds as needed to adjust	Every 3 Years	
Check the site bears the proper signage and that it is in good condition (speed limits, emergency exits, etc.)	Every Year	
Visual inspection the electrical connections, emergency		
Check the activation of over-temperature systems (alarms and fans)	Every 6 Months	
Visual inspection of the security manhole if any	Every 6 Months	Security
Check physical state of metallic structures and posts		
Check grounding of the camera's poles if available		
Check inside / outside of security cabinets: Humidity, soiling, etc....		
Check cleaning of cameras	Every 6 Months	
Visual check the fence, sensor detection system and cameras are not damaged	Every 3 Months	
Intervening to assist the full maintenance of equipment	Every 3 Years	Applicable to all Facilities and Equipment (when applicable)
All labeling and signs	Every Year	
Check that the equipment is correctly locked		
Preventive maintenance accordance to the requirements of the manufacturer		
Check the equipment fixing		
Remove dust and clean up the equipment		

Annex A - RFP/HCR/JOR/2020/06 - Terms of Reference (TOR)

Removing Corrosion if any		
Visual inspection ground connections		
Updating of all maintenance manual on site if required		
Verify that the installation is in compliance with applicable codes and standards		
Identify situations where rodents, birds, or bees are nesting on or within array components	Every 3 Months	Applicable to all Facilities and Equipment (when applicable)
Meeting to update and feedback on of the preventive maintenance measures	Every 3 Months	
Identify whether the birds are roosting upon or the shadows upon or defecating upon the solar modules which would block light rays	Every 2 Months	
Identify any loss of components by theft	Monthly	

As part of the preventive maintenance activities and reporting, the vendor shall report within the monthly report in details all the information related to planned and unplanned solar plant outages whatever the cause is (Grid related reasons, Governmental regulations etc)

- 4) **Proposal for all needed corrective maintenance:** The vendor shall submit a full and detailed proposal showing the inspection components, inspection and reporting forms, methodology, equipment, staffing and machinery.
 The maintenance shall include but not limited electrical protective devices, solar modules, cleaning robots, CCTV, security system, monitoring system, servers, structures and of their foundation structures, cables terminals, plates, junctions, connections, inverters and controls, Combiner boxes, Smart Logger, Inverter Station, transformer, switchgears, weather stations, site drainage system.

Operation and Maintenance Plan - Submitting all reports and documents:

As part of their technical offer, all vendors shall provide a proposal and forms of the Daily/Weekly and Monthly Check Lists, Performance Reports, Damaged Parts, Cleaning Robots, O&M PV Plant, PV Plant Drawings, Corrective, Breakdown and Preventive Maintenance Reports, Unplanned outages/downtime, Performance Reports, Warranty Equipment, Installation Manuals, O&M Manual Equipment, Performance Analysis, Graphics and Visualizations, Executive Summary and Assessment, Spare Parts Stock, Health, Safety and Security Alerts. The Vendor shall also submit two separate tables/documents as per the below:

Document Needed	Type of Document	Comments
Dry Cleaning Schedule and Agenda	Proposal	<i>Please include type of materials and tools to be used</i>
Wet Cleaning Schedule	Proposal	<i>Please include type of materials and tools to be used</i>
Security Company Details	Details	<i>Comments (As part of their financial Bid, bidder must indicate the price per post including three shifts).</i>
Preventive Maintenance Schedule	Report	<i>Please include safety, methodology and activities intended, on quarter basis per year</i>
Tests Form	Report	<i>Please include types of tests, Standard, Optimum Readings, methodology and activities intended</i>
PV performance Form	Report	<i>Please include generation on monthly and accumulatively, and include consumption extracted from electricity bills.</i>

Annex A - RFP/HCR/JOR/2020/06 - Terms of Reference (TOR)

Unplanned outages/downtime form		
---------------------------------	--	--

1- Proposal of Health, Safety and Security:

The Vendor shall submit all the safety measures will be taken through the O/M for the site and list of the tools and equipment.

IMPORTANT NOTES:

- The Vendor shall provide evidence from certification entity such as TUV, UL, DNV, ISO (*“or equivalent”*) about the ability to conduct the tests listed below; or evidence (such as Certification entity or Equipment Supplier) that the Vendor’s staff can perform the tests and that they are certified from the equipment supplier on their ability to conduct the tests listed below:

Tan Delta, Winding resistance and Short Circuit Impedance (Capacity Test), MV cable: Very Low Frequency test, Polarity Test, Voltage Tests, All PV String Tests, AC Low Voltage Tests and IV Curve Test.

- The Vendor shall guarantee 97% of the Available Energy generated or at least 97% of the estimated production which is 21,000. This guarantee will apply unless the Contractor proves that it has fully and satisfactorily performed the services under the Contract and that a failure to meet this target results solely from a cause beyond the Contractor’s reasonable control. Failure to obtain repair or replacement of equipment under a manufacturer’s warranty will not be considered a cause beyond the Contractor’s reasonable control.
- UNHCR will held a monthly meeting with the awarded vendor to monitor the generation, and any loss of energy will be recorded with all causes, solutions and responsibility.
- The vendor is obliged to offer warranty for all activities and works which include but not limited to: Warranty of Goods (at least 7 years), Execution of Works (at least 1 year), Warranty of Equipment (at least 1 year), Energy Generation Availability Warranty (99%).

Additional Notes:

- 1- UNHCR owns a spare for most of the key elements in the system. In case of shortage of spare parts, the vendor shall procure additional spare parts to be quoted as per the lists below. The installation cost for these additional items should be included under the offered costs for maintenance.
- 2- All labor costs should be included in the prices of the maintenance cost.
- 3- If any equipment was damaged due to inadequate maintenance or poor security measures, the Vendor shall be responsible for replacing and/or repairing them at their own expense.
- 4- The Vendor shall detail all personnel requirements, security measures, scheduled equipment replacement, maintenance schedules and operational for each year.
- 5- The Vendor is encouraged to employ Syrian Refugee Labor in the operation and maintenance of the plant.
- 6- The vendor will be held responsible and will reimburse damages to persons or property resulting from breach of the contract.

Environmental Considerations:

- 1- All packaging and wastes associated with the installations shall be carefully disposed of in accordance with the laws in Jordan (Article Number 6 – Environment Protection Law)

Annex A - RFP/HCR/JOR/2020/06 - Terms of Reference (TOR)

<https://www.ammanchamber.org.jo/Uploaded/PRFiles/%d9%82%d8%a7%d9%86%d9%88%d9%86%20%d8%ad%d9%85%d8%a7%d9%8a%d9%87%20%d8%a7%d9%84%d8%a8%d9%8a%d8%a6%d9%87.pdf> (English version of the full text is available in Annex A1 attached)

- 2- The Vendor shall be responsible for ensuring the waste materials, packaging, and any other items associated with these installations, do not get blown or otherwise distributed around the site. They shall also be careful not to create excessive dust or debris in any area. Any costs incurred in cleaning wastes or debris generated by Vendor shall be charged to the Vendor.
- 3- The Vendor shall be responsible for repairing and or replacing anything which has been damaged by the Vendor within the site. They shall also be responsible for the cleaning of any debris, wastes or other items created during these works.

List of Estimated Spare Parts to be sourced by the Vendor for the next three (3) Years:

ITEM	QTY	Specifications
PV solar panels 320Wp/325Wp/330W	300 Pcs	ISO 9001:2015 / Quality management system ISO 14001:2015 / Standards for environmental management system OHSAS 18001:2007 / International standards for occupational health and safety IEC 61215 / IEC 61730: VDE / CE / MCS UL 1703 / IEC 61215 performance: CEC listed (US) UL 1703: CSA / IEC 61701 ED2: VDE / IEC 62716: VDE IEC60068-2-68: SGS 5400 Pa snow load, 2400 Pa wind load Up to IEC1500 VDC system voltage, saving on BoS cost Fire Class A and Type 3 / Type 13 certified according to IEC 61730-2 / MST 23 and UL 1703
Central Inverter any related component inside	1 Pc	1,034.3 - 1,325.7 kWp 580 - 820 V 2,000 A 5 up to 12 (up to 15 if the combiner box is not integrated) 63 A / 1,000 V to 630 A / 1,000 V fuses (optional) Connection to copper bars 1 MPPT Type II surge arresters (type I+II optional) Motorized DC load break disconnect Up to 15 pairs of DC fuses (optional) / Reverse polarity / Insulation failure monitoring / Anti-islanding protection / Emergency pushbutton 1,108.5 kVA / 1,019.8 kVA 400 V IT System -4 °F to +149 °F NEMA 3R (NEMA 3 with the sand trap kit) Air forced with temperature control (230 V phase+ neutral power supply) UL1741, FCC Part 15, IEEE C37.90.1, IEEE C37.90.2, CSA22.2 No107 IEC 62116, UL1741, IEEE1547, IEEE1547.1, NEC CODE, Electric Rule 21: 2015, CSA22.2 No107
Power phase and IGPT for the inverter	10 Pcs	With capacitor, FFLC6-3575 – A, 4200 micro F, 820 Vdc, 350 Arms Maxi.

Annex A - RFP/HCR/JOR/2020/06 - Terms of Reference (TOR)

DC Combiner box	20 Pcs	<p>Ith-400A, S604002ED0, DC 21B-1000 Vdc-400, Uimp 12kV, Ui 1500 Vdc. IEC 60947-3. switching device combination is a string combiner box for up to 22 or 20 photovoltaic strings. The positive pole of the solar strings is connected to the UK 10,3-HESI 1000V fuse modular terminal blocks and the negative pole of the solar strings is connected to the STU 35/4x10 BU feed-through terminal blocks or as well to UK 10,3-HESI 1000V fuse modular terminal blocks. The output cables are connected to the UKH 150 and UKH 150 BU high-current terminal blocks or to the load break switch.</p> <p>Properties</p> <ul style="list-style-type: none"> – Degree of protection: IP65 – Housing: polycarbonate – Connection of up to 22 solar strings – UK 10.3 HESI 1000V fuse modular terminal blocks
Main breaker 400 A	10 Pcs	<p>3pole / 440 V / 6KV / 400 A / Icu=36KA, IEC 60947-2 JIS C8201-2-1</p>
Branch breaker 250 A	20 Pcs	<p>3pole / 440 V / 6KV / 250 A/ Icu=36KA, IEC 60947-2 JIS C8201-2-1</p>
Single breaker 10 A	20 Pcs	10 A
Combiner box fuses 15 A	200 Pcs	PV / 1000V dc / 15A
Modular surge arrester IPRF1	10 Pcs	<p>230/400 V (+/- 10%) AC 50 HZ -50 KA Standards: EN61643-11 : 2012, IEC 61643-11 : 2011</p>
160-400A adjustable breaker	5 pcs	<p>440V / 8KV IEC/EN 60947-2</p>
Weather station SOLAR ENERGY MEASUREMENT SYSTEM FOR PHOTOVOLTAIC SOLAR POWER PLANTS	1 Pc	<p>Real-time monitoring of all the main or critical plant parameters. This will provide the possibility of a quick identification of failed components or abnormal operation conditions of the plant. • An efficient remote alarm management procedure by means of urgent transmission of SMS alert messages to cellular phones and e-mails to central computers, in order to minimize the troubleshooting efforts and to prevent damages in key plant components. • On-line and Off-line analysis of the plant efficiency, in order to know the overall performance of the photovoltaic installation. Pyranometer. All pyranometers meet ISO 9060:1990 standards Adjustable Solar Irradiance Sensor for Global or Plane-of-Array monitoring Can support a second Thermopile Pyranometer for comprehensive irradiance monitoring 1 or 2 x Back-of-PV Panel Temp Sensor(s) Ambient Air Temperature Sensor Modbus RTU Communication Ethernet Modbus TCP option available SunSpec Certified</p>
Monitoring screen	1 Pc	LED A++ 32"
HD-TVI Analog Camera	10 Pcs	IP Bullet camera, 2.8 to 12mm motorized lens,

Annex A - RFP/HCR/JOR/2020/06 - Terms of Reference (TOR)

		IR Range up to 40m 720 p Dual Power IP 66
Monitoring Camera	5 Pcs	IP Bullet camera, 3MPX, 8 to 32mm motorized lens, WDR, 80m. Resolution: 2048*1536 Face detection EIS ROI
DVR	1 Pc	HD-TVI Hybrid 8/16 Channel Recorder up to 4/8 IP cameras real time recording up to 4/8 TB
NVR	1 Pc	16/32/64 channel H.265 NVR 2U real time recording up to 48 TB
Power supply	2 Pcs	Universal 12VDC, 3.5A
Server / DVR Wall Mount Cabinet	2 Pcs	Single Section Installations of EN 50173-1, EN 50174-1 and2, ISO/IEC 11801, ANSI/TIA/EIA-568-C Comply with mounting dimensions to IEC 297-3 and DIN - 41494 for all equipment • IP 20 Material: • SPCC cold rolled steel • Mounting profiles - 1.2mm • Other elements - 1.0mm • Door - Tempered glass
6mm DC cables	500 m length	TUV Certified tinned copper according to IEC 60228 Insulation special polyolefin Alternating rated voltage Uo/U 600/1K V cable according to EN 50395 cable according to EN 50395: 2 min, -40 – 40 degrees cables comply with European directive 2002/95/CE, ROHS certificate on request according to EN 60216-2, estimated lifetime 30 years LCIE certificate
4mm DC cables	600 m length	TUV Certified tinned copper according to IEC 60228 Insulation special polyolefin Alternating rated voltage Uo/U 600/1K V cable according to EN 50395 cable according to EN 50395: 2 min, -40 – 40 degrees cables comply with European directive 2002/95/CE, ROHS certificate on request according to EN 60216-2, estimated lifetime 30 years LCIE certificate
Aluminum Cables 1*240	300 m length	Al/XLPE/PVC Armored PVC Insulated Cables 600/1000 V according BS 6346 and IEC 60502-1 IEC 60502-1

Annex A - RFP/HCR/JOR/2020/06 - Terms of Reference (TOR)

		<p>Conductor: Annealed Copper or Aluminum Conductor according to IEC 60228 Insulation: PVC type TI 1 according to BS 6346 or Type PVC/A according to IEC 60502-1 Bedding: Extruded Black PVC Armoring: Aluminum Wires for Single Core and Mild Galvanized Steel for Multi Cores Sheathing: PVC type TM 1 according to BS 6346 or Type ST 1 according to IEC 60502-1.</p>
Copper rod (1.2 m)	5 Pcs	<p>Copper purity is 99.95% Tensile strength over 600N/mm² Lifetime minimum 28 years Rod Diameter 17.2MM</p>
Light units	20 Pcs	70 W LED
Cable tie clips 10cm	400 Pcs	UV-resistant cable ties Compatible with DC Cables above
Cable tie 30cm	400 Pcs	UV-resistant cable ties Compatible with DC Cables above
MC4 outlet	500 Pcs	Compatible with DC Cables above
Inverter manager	1 Pc	Compatible with the inverter specs above
Switch for inverter manager Westermo	2 Pcs	Data Communications 8 RJ45 port DIN Rail Mount Unmanaged Ethernet Switch, 10 Mbit/s, 100 Mbit/s
Galvanized paint (Grey)	4 Kilo	<p>Gray Color VOLUME SOLIDS (ASTM D2697) 46 ± 2% SPECIFIC GRAVITY 1.50 ± 0.05 THEORETICAL SPREADING RANGE 11.5 – 9.2 M²/LTR RECOMMENDED DFT RANGE (DRY FILM THICKNESS) 40 – 50 Microns/Coat RECOMMENDED WFT RANGE (WET FILM THICKNESS) 88 – 110 Microns/Coat FLASH POINT 38°C</p>
3X4mm cable CU /PVC	300 m length	CU/XLPE/SWA/PVC
2X2.5mm cable CU /PVC	300 m length	CU/XLPE/SWA/PVC
Cat6 cable	300 m length	<p>Solid UTP Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 7e, Flame-retardant acc. to IEC 60332-1-2, Smoke density acc. to IEC 61034</p>
Fiber optic cable	300 m length	4 Core 9/125
PVC Pipes 50 Inch (3 m) PVC Pipes 32 Inch (3 m) PVC Pipes 25 Inch (3 m)	10 Pcs 10 Pcs 10 Pcs (3-meter length each Piece)	UV-resistant cable conduit
Steel Structure	200 Set per KW	Galvanized Ground Mount PV Mounting System
Enclosures	4 Pcs	<p>POLYESTER REINFORCED WITH FIBERGLASS, IP65, WITH CANOPY H: 1000MM W: 750MM D: 320MM TIN PLATED COPPER BUS BARS, 30x5 MM, 3PHASE AND EARTH.</p>
Three-phase transformer	1 Pc	<p>IEC 60076, cooling ONAN, power 2050 KVA, Frequency 50 Hz, connection Dyn11, primary side insulation level Un 36/LI 170/AC 70, secondary side insulation Un 3.6/LI 20/AC 10, Impedance 5.81 Primary voltage 34KV to 31 KV, secondary voltage 400 V.</p>

Annex A - RFP/HCR/JOR/2020/06 - Terms of Reference (TOR)

<p>Switch Gear or any related component inside such as (Vacuum Circuit Breaker, Busbars, Enclosures, Insulation Cables, Lugs etc.)</p>	<p>1 Pc</p>	<p>36 KV / 1250 Amp / 25 KA 1s-3s / peak 65 KA/ 70/80 KV insulation/ IP 3X / Vacuum Circuit Breaker / -25 – 40 C degree/ IEC 62271-200 (IAC class) / IEEE Std C37.20.7 (1D-S class). IEC 62271-200 (IEC 62271-102). IEC 61243-5) IEC 62271-1 Common specifications for high voltage switchgear and control gear standards. IEC 62271-200 Alternating current metal-enclosed switchgear and control gear for rated voltages above 1 kV and up to and including 52 kV. IEC 62271-103 Switches for rated voltages above 1 kV up to and including 52 kV. IEC 62271-102 Alternating current disconnectors and earthing switches. IEC 62271-105 High voltage alternating current switch-fuse combinations. IEC 62271-100 High voltage alternating current circuit-breakers. IEEE / ANSI IEEE C37.74 IEEE Standard Requirements for Subsurface, Vault, and Pad-Mounted Load-Interrupter Switchgear and Fused Load-Interrupter Switchgear for Alternating Current Systems Up to 38 kV IEEE C37.20.3 IEEE Standard for Metal-Enclosed Interrupter Switchgear IEEE 1247 Standard for Interrupter Switches for Alternating Current, Rated Above 1000 Volts IEEE C37.123 IEEE Guide to Specifications for Gas-Insulated, Electric Power Substation Equipment IEEE Std C37.20.4 IEEE Standard for Indoor AC Switches (1 kV-38 kV) for Use in Metal-Enclosed Switchgear IEEE C37.04 IEEE Standard Rating Structure for AC High-Voltage Circuit Breakers IEEE C37.06 AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis- Preferred Ratings and Related Required Capabilities IEEE Std C37.09 IEEE Standard Test Procedure for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis IEEE Std C37.20.7 IEEE Guide for Testing Medium-Voltage Metal-Enclosed Switchgear for Internal Arcing Faults</p>
<p>Switch Gear or any related component inside such as (Vacuum Circuit Breaker, Busbars, Enclosures, Insulation Cables, Lugs etc.)</p>	<p>1 Pc</p>	<p>36 KV / 1250, Ud: 70 KV, Up, 170KV, fr: 50 Hz, circuit breaker Ir: 630 A, Ik/Ip: 25/65 KA. Type : cpg. Standards: IEC-62271-200 IEC-62271-102 IEC 62271-100</p>
<p>Switch Gear or any related component inside such as (Vacuum Circuit Breaker,</p>	<p>1 Pc</p>	<p>36 KV / 1250, Ud: 70 KV, Up, 170KV, fr: 50 Hz, circuit breaker Ir: 630 A, Ik/Ip: 25/65 KA.</p>

Annex A - RFP/HCR/JOR/2020/06 - Terms of Reference (TOR)

Busbars, Enclosures, Insulation Cables, Lugs etc.)		Type: cpg Standards: IEC-62271-200 IEC-62271-102 IEC-62271-103 IEC-62271-105
MV Cables	100 m length	18/30 KV, HES 1 X 150 mm ² AL C2XLPE/CWS/AWA/PVC BK IEC 60502-2
First aid	3 boxes	<p>an up to date first-aid manual</p> <p>a list of emergency phone numbers</p> <p>sterile gauze pads of different sizes</p> <p>adhesive tape</p> <p>adhesive bandages (Band-Aids) in several sizes</p> <p>elastic bandage</p> <p>a splint</p> <p>antiseptic wipes</p> <p>soap</p> <p>antibiotic ointment</p> <p>antiseptic solution (like hydrogen peroxide)</p> <p>Hydrocortisone cream (1%)</p> <p>acetaminophen and ibuprofen</p> <p>extra prescription medicines (if the family is going on vacation)</p> <p>tweezers</p> <p>sharp scissors</p> <p>safety pins</p> <p>disposable instant cold packs</p> <p>calamine lotion</p> <p>alcohol wipes or ethyl alcohol</p> <p>thermometer</p> <p>tooth preservation kit</p> <p>plastic non-latex gloves (at least 2 pairs)</p> <p>flashlight and extra batteries</p> <p>a blanket</p> <p>mouthpiece for giving CPR (you can get one from your local Red Cross)</p>
Fence	100 m Length	<p>Galvanized 2.7 meters height Chain link fence consisting of 5.5cmX5.5cmX3.65 mm, with a 2-inch diameter and 2.8mm thickness and 3.5 m total high steel galvanized pipes every 2 m ,3m above the ground. 80cm steel angle 40x40x4mm bended forward at angle 45 degrees for the Outside fence with 3 line of barbed wire to be fixed on the top. 1 line of razor wire 1-meter diameter to be fixed between the fence. Supplying and installing a main 5x10cm H bridge 3 m total height supported with two steel pipes 2" diameter and 2.8mm thickness for each H bridge for corners. Supply and install 4 lines horizontal wires 2.9mm diameter fixing, fittings, and 50X50X50 cm minimum square concrete bases for the supports. Price must include constructing a tie foundation of 20 cm depth (10 cm above ground and 10 cm underground) * 15 cm width all along the fence (outside and inside) including all civil works, wood works, excavation and restoring the original surface.</p> <p>IF the length of the fence exceeds 25 m, we have to provide two diagonal pipes to support in the middle. (This will be for every 25</p>

Annex A - RFP/HCR/JOR/2020/06 - Terms of Reference (TOR)

		m),(all bracing pipes will be welded),Concrete Foundation Spec,50cm x 50cmx50cm hole filled with concrete mix with stones. Providing and casting a normal concrete (cement: fine aggregate :coarse aggregate ratio 1:3:6) with minimum breaking load not less than 15 MPa after 28 days , concrete curing at least of the 3 day period and all to the complete job, supply and install Welded steel bar 40cm length 8mm diameter at the bottom of Galvanized Pipe 20 cm.
Double Swing Gates	2 Gates	Supply materials, equipment and labor for manufacturing swing vehicle gate, 5-meter width and 2.5-meter height. Covering material is galvanized chain link fence consisting of 5.5cmX5.5cmX3.65 mm. Price must include installing three 8 cm strong heavy duty welded with H bridge (5x10 cm) (welding overlap between door frame and H- bridge 16mm). A rubber wheel should be installed for each part. Provide and install two crossing pipes for each side of the door. Price must include installing concrete footings 50 x 50 x 60 cm with steel support and two downward sliding locks of 12mm diameter.

Kit Parts for inverters (INGECON SUN PowerMax B400 DCAC)

Qty	Items
10	control converter Unit PCB INGECON SUN TL B400
10	power supply board PCB INGECON SUN TLB
10	contactor supply system PCB INGECON SUN TL B
10	power phase
10	intercooler
10	impedance measurement
10	heat resistor
10	Fan electronic board
10	ABB main contactor
10	Eaton main contactor
10	Drive contactor
10	power phase Ventilation sys
10	Inductance Ventilation set
10	fans monitoring PWBLCK INGECON SUN TL B
10	Harmonics filter 1000vdc
10	relay 16A
10	V panel measurement INGECON SUN TL B
10	Optical fiber synchronization
10	bus discharge system
10	panel measuring breaking system
10	common mode filter INGECON SUN TL B
10	matrix display for three-phase inverters with RS485
10	relay 8A
10	safety limit switch 600V
10	thermal magnetic breaker 0.1A to 0.5A

Annex A - RFP/HCR/JOR/2020/06 - Terms of Reference (TOR)

10	thermal magnetic breaker 63A
10	AC circuit breaker kit ABB 100kA
10	AC circuit breaker kit Eaton 100kA
10	SET motorized switch-breaker 4P 2000A 1000Vdc
10	DC surge arrester Type II
10	SET emergency stop button
Kit parts MV switchgear SIEMENS 8DJH36	
Qty	Items
5	CB shunt tripping coil
5	SP SIE 8DJH 36 CB closing coil
5	SP SIE 8DJH 36 spring charging motor
5	SP SIE 8DJH 36 auxiliary contacts box
5	SP SIE 8DJH 36 CB spring charged limit switch
5	SP SIE 8DJH 36 varistor for CB control circuit
5	SP SIE 8DJH 36 anti-pumping relay for CB
5	SP SIE 8DJH 36 CB mechanical operation counter
5	SP SIE 8DJH 36 1ph CT ratio 100A/1A 2VA 5P10
5	SP SIE 8DJH 36 cable CT (earth fault CT) (size 50/1A)
5	MV relay type THYTRONIC NA016
5	SP SIE 8DJH 36 Assembly phoenix standard terminals
5	SP SIE 8DJH 36 set of one of each auxiliary relay
5	SP SIE 8DJH 36 set of one of each mcb used
5	SP SIE 8DJH 36 set of one of each selector switch and electronic push button used
5	SP SIE 8DJH 36 plug-in indicator for voltage presede
5	SP SIE 8DJH 36 1kg grease for CB mechanism
5	SP SIE 8DJH 36 vaseline tube for electric contacts
5	set of touch-up paint
5	set cable terminations
5	1kg varnish
Additional spare parts	
Qty.	Items.
10	patch card F.O.
10	CM-1000-IVN expansion 1000V for the insulation monitoring relay
10	CM-IWN.5 insulation monitoring 1000 micro Farad
10	E 92/32 Switch E 90 2P 32A
10	indicator lights with LEDs - yellow
10	relay HC4 CR-M230AC4-230 VAC
10	standard sockets for relay HC4

Annex A - RFP/HCR/JOR/2020/06 - Terms of Reference (TOR)

10	interface relays CR-M230AC4
10	CR-P230AC2 ALIMENT.230VAC
10	CR-PSS STANDARD SOCKET(CR-P)
10	S204-D32 Miniature circuit breaker 4P Icn=6KA
10	S201 NaL-C16 Miniature circuit Breaker 1P+N Icn=4.5KA
10	residual current circuit breaker 1P+N DS201 L C10 A30
10	S201NaL- C6 miniature circuit breaker 1P+N Icn=4.5KA
10	residual current circuit breaker 1P+N DS201 L C16 A300
10	switch SD202/25 switch disconnecter 2P,25A
10	S202L-C6 miniature CIRCUIT Breaker 2P Icn=4,5KA
10	ABB POWER SUPPLY CP-D24/2.5
10	DC Power supply 24V 1.3A
10	Modular sockets Italian dual standard
10	2-phase busbars, 58 pin distance 17.6 10sqmm
10	end caps PS-END
10	INGECON SUN communication - Ethernet card by display
10	fiber optic patch panel 24port (multi-mode)
10	Filter unit 204*204 mm
10	fan filter 204*204mm 130m ³ /h
10	class II modular multi-pole SPD AC 275V 40KA 3+1 poles
10	distributor 4P 100A
10	industrial switch Moxa EDS-208A (8 port)
10	fiber optic- ethernet converter MOXA EDS-405A-MM-SC
10	ethernet remote I/O with 2-port Ethernet switch and 6 RTDs
10	ethernet remote I/O with 2-port ethernet switch, 8DIs and 8DIOs
10	patch card ethernet cat 5e FTP m.1
10	cylindrical fuse, operational class Gg 10*38 2A
10	Thermostat 1NO 250V 10A
10	fuse holder assembly 1500V 450A NH3L 1P-rear negative from 5 to7 PWBLCK
10	fuse holder assembly 1500V 450A NH3L 1P-front positive from 5 to7 PWBLCK
10	Axial fan IP55 filter + grill 320m 230V 50/60Hz
10	SP integrated safety detector production relay for MV transformers
10	fire detection control panel (4 zone)
10	battery power reserve 12V 7.2A
10	conventional smoke detector
10	conventional temperature detector
10	high profile adapter
10	communication infrastructure-UPS Monitoring
10	METEO SENSOR - ambient temperature sensor PT100 type (SCAT CP1B4X) box IP65
10	LVT Fusible 25A Am DIN000 690VAC
10	Air Filter 620*497 B series
10	LV transformer 15kva 50/60Hz Dyn11 400/400V at 55C ambient temp.

List of Spare parts already available on site by UNHCR of which the awarded contractor may use (bidders are not required to quote for these items):

No.	Item	Quantity
1	Control converter Unit PCB INGECON SUN TL B400	4
2	Power supply board PCB INGECON SUN TLB	2
3	Contactora supply system PCB INGECON SUN TL B	1
4	Ingeteam Intercooler	10
5	POWER PHASE INGECON SUN TL B400	32
6	Impedance measurement	1
7	Heat resistor	1
8	Fan electronic board	2
9	ABB main contactor	2
10	Eaton main contactor	2
11	Drive contactor	2
12	Power phase Ventilation sys	1
13	Inductance Ventilation set	1
14	Fans monitoring PWBLCK INGECON SUN TL B	1
15	Harmonics filter 1000vdc	1
16	Relay 16A	4
17	Vpanel measurement INGECON SUN TL B	1
18	Optical fiber synchronization	1
19	Bus discharge system	1
20	Panel measuring breaking system	1
21	Common mode filter INGECON SUN TL B	1
22	Matrix display for three-phase inverters with RS485	1
23	Relay 8A	4
24	Safety limit switch 600V	1
25	Thermal magnetic breaker 0.1A to 0.5A	4
26	Thermal magnetic breaker 63A	1
27	AC circuit breaker kit ABB 100kA	2
28	AC circuit breaker kit Eaton 100kA	2
29	SET motorized switch-breaker 4P 2000A 1000Vdc	1
30	DC surge arrester Type II	2
31	SET emergency stop button	2
32	Canadian Solar Module 320/325/330 W	372 ea.
33	Combiner BOX	3 boxes
34	Ethernet Lugs	52
35	Gland for Combiner Box	10
36	MC4 Connectors	139 Pair

Annex A - RFP/HCR/JOR/2020/06 - Terms of Reference (TOR)

37	Solar 6mm2 Cable	200 m
38	15 Amp DC fuses	>500 ea.
39	240mm2 DC cable	450 m
40	150mm2 MV voltage	180 m