

Annex A – Terms of Reference (TOR)

ESTABLISHMENT OF FRAME AGREEMENT FOR THE PROVISION OF Maintenance, Operation and Monitoring Services of the Zaatari Solar Plant – Jordan

1. Background

UNHCR, in partnership with the Government of Jordan, has established a 12.9 MWp solar power plant in Zaatari refugee camp to meet electricity needs for approximately 76,000 individuals. The plant produces about 23,000 MWh of clean energy per year using 37,380 Canadian Solar modules (320/325/330 Wp) and ten (10) Ingeteam central inverters (Ingecon Sun 1110 TL, ~1.1 MVA). Strings of 20 modules are combined via combiner boxes (18–21 strings per box), with 9–10 boxes per inverter and two inverters per transformer (total of 1,869 strings).

2. Purpose of the O&M Management Plan

- Maintain and operate the plant and its equipment.
- Ensure safe and optimal operation through 24/7 site security and robust preventive/corrective maintenance.
- Continuously monitor plant status and energy production.
- Analyze incidents, identify root causes, and implement mitigation measures.
- Plan and execute predictive and preventive maintenance activities.
- Perform corrective and breakdown maintenance as required.
- Proactively recommend solutions, upgrades, and optimizations when needed.

3. Scope of Work

3.1 Routine PV Module Cleaning

Bidder shall submit a detailed cleaning methodology including schedule, staffing, robots/tools, brush types (with datasheets/certificates), and water-use controls. The baseline program consists of 16 dry-cleaning cycles per year (robotic preferred; use IBVs only when robots unavailable) scheduled in agreement with UNHCR, and up to four (4) wet cleanings per year as directed by UNHCR. Wet cleaning shall observe water efficiency (< 1 m³/100 kWp).

3.2 Monitoring and Reporting

Contractor shall monitor operations continuously and provide daily, weekly, monthly, and annual reports using agreed templates. Daily monitoring by an engineer and inspections by technicians shall cover inverters, transformers, blocks and combiner boxes, site general conditions, modules, structures, and DC/AC cabling. Monthly reports summarize works performed, events, KPIs and PR.

3.3 Corrective Maintenance

Submit a corrective maintenance plan covering fault diagnostics, root-cause analysis, test lists, tools/instruments, staffing, spare parts, and mitigation to avoid fault recurrence. Scope includes all plant equipment and systems (modules, inverters and cleaning robots, CCTV/security, SCADA/servers, structures and foundations, cables and terminations, combiner boxes, smart loggers, inverter stations, transformers, switchgear, weather stations, drainage, etc.).

3.4 Performance Guarantees

- Availability Guarantee: $\geq 98\%$ at inverter level.
- Performance Ratio (PR) guarantee compliant with IEC 61724; use GPMPV portal and PVSyst for annual energy assessment.
- Provide calculation methodology, corrections, exclusions, and an availability responsibility matrix.

3.5 Health, Safety, Security and Environment (HSSE)

- Provide comprehensive HSSE plan (procedures, staffing, PPE, LOTO, permits, risk assessments).
- Ensure 24/7 on-site security guard service and remote CCTV monitoring throughout the contract period.
- Comply with applicable national regulations and camp SOPs.

3.6 Company Profile and Qualifications

- Valid company registration with purposes including design, supply, installation, O&M and testing of renewable energy systems.
- Valid EMRC Class “A” license authorizing solar maintenance works.
- Minimum five (5) years of experience in solar PV design/installation/O&M.
- At least three (3) projects ≥ 5 MWp within the past eight (8) years (completed or underway) with ≥ 3 client references.
- Experience with central inverters is an asset.

3.7 Team Qualifications and Minimum Staffing

- Project Manager: ≥ 10 years' experience (≥ 5 years in PV construction /commissioning/O&M).
- O&M Site Engineer: ≥ 5 years recent PV O&M experience; dedicated on-site during working days (08:00–16:00).
- Technicians: 4 qualified technicians with ≥ 10 years relevant PV/O&M experience.
- Emergency response: immediate 24/7 response; initiate corrective actions within 4 hours.

3.8 Preventive Maintenance Plan & Tests

Provide a detailed PM plan, test standards, tools (with calibration), optimum readings, forms and checklists. PM includes visual inspections; verification of protective devices; module integrity and performance; structures and foundations; cable/terminal condition and cleaning; inverter/combiner/logger/transformer operation; switchgear at plant and interconnection; monitoring/communications and security systems; vegetation management; weather station cleaning; thermography; UPS checks; fiber optics; SCADA/monitoring; and logbook maintenance.

Summary of preventive maintenance frequencies (indicative; to be detailed in the Contractor's PM plan):

Component/Area	Frequency	Activities (examples)
Modules & Substructures	Monthly / Quarterly / Semiannual	Visual inspection; IR thermography; torque checks; shading control; grounding impedance; bolt tightening; cleaning robot upkeep.
Civil Works & Site	Bi-monthly / Quarterly	Weeds removal; fence & gates condition and stability; drainage & erosion; roads/cracks; manholes/earth pits.
Electrical Boxes & DC Cables	Quarterly / Semiannual	Grounding continuity; signs of heating; enclosure sealing & cleanliness; connection tightening; DC switch-disconnector tests; earthing values.
Inverters	Daily / Weekly / Monthly	Alarms & readings; cooling & filters; sensors validation; doors/hinges/gaskets; torque checks; UPSs; portals monitoring; housekeeping.
LV Panels	Semiannual / Annual	Protection relays; ACs & lighting; enclosure security; noise/loose connections.

Main Switchgear (MV/LV)	Quarterly / Semiannual / Annual	Busbar connections & torque; protection devices; grounding continuity; room temperature; housekeeping; AC filters.
Security Equipment	Quarterly / Semiannual	CCTV, sensors, cabinets, surge protection, thermography (incl. 5% module sampling).
Transformers	Weekly / Monthly / Annual	Oil level & leaks; temperature/pressure; protection relays; external inspection; torque checks; noise observations.
Sensors & Weather Station	Monthly / Bi-monthly / Annual	Clean/inspect irradiance & temperature sensors; validate instruments at certified lab annually.
SCADA / Monitoring	Daily / Weekly / Monthly	Data availability; KPI/PR analysis; alarms; communications; maintain logbook; internet link.
Safety	Semiannual / Annual	Fire extinguishers renewal; fire detection checks; signage; emergency lighting; over-temperature systems.
Plant Spares & Inventory	Monthly	Stock check; loss/damage reports; repair & return processing; labelling & documentation updates (biennial).

4. Documents to be Submitted with the Technical Offer

- Dry cleaning plan and report templates (methodology, staffing, tools and brush datasheets/certificates).
- Wet cleaning plan and report templates (as above; water efficiency $\leq 1 \text{ m}^3/100 \text{ kWp}$).
- Preventive maintenance plan and sample weekly/monthly reports (tests, standards, tools, optimum readings).

- HSSE plan (including 24/7 security approach; price per post to be reflected in Annex B).
- Corrective maintenance plan and sample reports (RCA, tests, mitigation).
- Proposed list of tests and report templates (where applicable).
- PR Guarantee document and monthly report template (calculation methods, corrections, exclusions, responsibility matrix) as per IEC 61724 and NREL TP-7A40-73822.
- List of certified tools, machinery and equipment (specifications and quantities).
- Team list and CVs for all staff proposed for the project.
- Daily/weekly/monthly inspection checklists and reporting templates.
- Inventory monthly report template; loss and damage report templates.
- Company profile, organization chart/management structure, proof of past projects (contracts/POs), Class “A” EMRC license, valid registration, and reference letters (UN/NGO experience preferred).

5. Important Notes

- Provide evidence (from certification bodies or equipment suppliers) of staff competency to perform key tests (e.g., Tan Delta, winding resistance, short-circuit impedance, VLF MV cable tests, polarity, AC LV tests, PV string tests, IV curves).
- Assign a dedicated site engineer (≥5 years) and four qualified technicians; ensure 24/7 emergency response and action within 4 hours.
- Obtain INGETEAM inverter OEM certifications for relevant staff within two months of contract start; arrange two OEM site visits annually (pre-summer and pre-winter) at Contractor’s cost; coordinate regularly with OEMs.
- Maintain manufacturers’ warranty conditions for all system components and keep documentation up to date.
- Service prices shall be all-inclusive and covered within the monthly O&M fee.
- UNHCR pre-owned spare parts installation is included within the maintenance scope at no extra charge; when shortages occur, Contractor shall procure from the priced spare parts list and include installation in unit prices.
- Maintain minimum stock levels on site considering consumption and lead/clearance times; avoid inverter blackouts due to spares shortage or delays.
- Coordinate repair-and-return processes with manufacturers and UNHCR Supply (shipping, customs, transport, storage, installation).
- Contractor bears costs of replacing/repairing equipment damaged due to inadequate maintenance or poor security.
- Detail personnel plan, security measures, equipment replacement and maintenance schedules by year; hold monthly update meetings with UNHCR and copy UNHCR on all manufacturer technical communications.
- Encouraged to employ Syrian refugee labor per government regulations and camp SOPs.
- Mandatory site visit prior to offer submission.

6. Environmental Considerations

- Dispose of packaging and waste per Jordanian law (Environment Protection Law – Article 6).
- Prevent dispersion of waste and excessive dust; Contractor pays any cleanup costs caused by its activities.
- Repair/replace any items damaged by Contractor and clear debris generated during works.

Note on performance thresholds: The Contractor shall guarantee a minimum Performance Ratio (PR) of 98% and Availability $\geq 98\%$ at inverter level, calculated and reported as per IEC 61724 and the methodology defined in this TOR.