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Guideline for Solar PV Technical Proposals

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1. SCOPE OF WORK

The beneficiary is responsible for selecting a qualified PV company to conduct a facility energy assessment and develop a technical proposal covering the scope of work described in this section. The scope of work consists of Design, Supply, Installation, Testing, Commissioning and Handover of a complete solar photovoltaic (PV) system including Operation and Maintenance and Training to ensure safe, efficient and reliable operation.

The technical proposal shall include at a minimum the following:

- a) PV modules
- b) PV mounting structure
- c) Solar inverter
- d) Battery energy storage system (optional)
- e) Battery inverter / charger (optional)
- f) Fuel save controller
- g) Monitoring system / Data logger
- h) Weather station / Sensors
- i) Earthing system / Lightning Protection (if required)
- j) AC/DC electrical components (panels, cables/wires and accessories)
- k) Civil works (if required)

General Requirements:

- a) The beneficiary should provide a complete system proposal prepared by the selected qualified PV company. The proposal will be reviewed and assessed technically by IM energy expert.
- b) The proposal should include at a minimum the following:
 - i. Current annual energy consumption (in kWh) and energy cost (in USD).
 - ii. Typical energy consumption profile of the facility during working and non-working days, also during winter and summer periods (if applicable).
 - iii. PV system simulation report including the estimated annual energy savings and performance ratio of system (taking into consideration the facility consumption profile).
 - iv. Schematic diagram of the proposed system.
 - v. Detailed Bill of Quantities (BOQ).
 - vi. Technical Datasheets for all proposed equipment.
- c) The PV company in charge of delivering the full scope of work should meet all the qualification criteria listed in Appendix 1.
- d) Approval of equipment brands will be subject to USAID restrictions.
- e) The beneficiary or the PV supplier company are responsible for any required permits related to the PV system installation.
- f) The proposal should include an annual Operation and Maintenance (O&M) contract which covers the full duration of the financing lease agreement (5 years for standard financing, or 3 years for early settlement at end of year 3).
- g) Training shall be provided to facility team covering at a minimum PV system operation, preventive maintenance and troubleshooting.
- h) PV system main equipment shall have minimum 5-years product warranty (refer to Technical Requirements in Section 2).
- i) PV system shall be insured by the beneficiary either through a standalone insurance policy or added to the current whole facility insurance policy.

2. TECHNICAL REQUIREMENTS

The proposed system should meet the minimum equipment requirements listed in sections 2.1 to 2.8 below.

2.1 Photovoltaic (PV) Modules

Minimum specifications for PV modules:

- Tier-1 solar PV modules
- Mono-crystalline (144 cells)
- Module efficiency: $\geq 21\%$ at Standard Test Conditions (STC)
- Positive power tolerance
- Product warranty: ≥ 12 years
- Performance warranty: 25-year linear power output $> 80\%$

PV modules reference standards/certificates:

NL EN 61215: 2016 IEC 61215	Terrestrial photovoltaic (PV) modules – Design qualification and type approval
NL EN 61730-1: 2016 IEC 61730-1	Photovoltaic (PV) module safety qualification - Part 1: Requirements for construction
NL EN 61730-2: 2016 IEC 61730-2	Photovoltaic (PV) module safety qualification - Part 2: Requirements for testing
IEC 61701	Photovoltaic (PV) modules - Salt mist corrosion testing
IEC 62716	Photovoltaic (PV) modules - Ammonia corrosion testing
IEC TS 62804	Photovoltaic (PV) modules - Test methods for the detection of potential-induced degradation
IEC 60364-4-41	Low-voltage electrical installations – Part 4-41: Protection for safety – Protection against electric shock

2.2 Solar Inverter

Minimum specifications for solar inverters:

- On-grid (string or central inverter) with multiple independent Maximum Power Point Tracking inputs (MPPT)
- Total harmonics distortion (THD): $\leq 3\%$ (harmonic current)
- Maximum Efficiency: $\geq 98.5\%$ ($\geq 98.0\%$ European efficiency)
- Product warranty: ≥ 5 years

Solar inverter reference standards/certificates:

NL EN 62109-1: 2016 IEC 62109-1	Safety of power converters for use in photovoltaic power systems - Part 1: General requirements
NL EN 62109-2: 2016 IEC 62109-2	Safety of power converters for use in photovoltaic power systems - Part 2: Particular requirements for inverters
NL EN 62116: 2016 IEC 62116	Utility-interconnected photovoltaic inverters - Test procedure of islanding prevention measures
IEC 61000-3 (2, 4)	Electromagnetic compatibility (EMC) - Part 3: Limits (harmonic currents)
IEC 61000-3 (5, 11)	Electromagnetic compatibility (EMC) - Part 3: Limits (voltage fluctuations and flicker)

2.3 Battery Energy Storage System (BESS)

Minimum specifications for battery energy storage system:

- Type: Lithium iron phosphate LFP (Grade A cells) containerized or installed in standalone cabinets
- Cycle Life: $\geq 5,000$ cycles at 80% Depth of Discharge (DoD)
- Include battery management system (BMS) for monitoring and control
- Product warranty: ≥ 5 years

Minimum functions of the battery management system (BMS):

- Monitoring parameters of batteries (SOC, temperature, cycles, voltage, charge/discharge currents)
- Compatible communication with battery inverters and charge controllers
- Control and balance individual cells
- Protection against over-charging, over-temperature and over-loading

Battery energy storage system (BESS) reference standards/certificates:

NL EN 61427-1: 2017 IEC 61427-1	Secondary cells and batteries for renewable energy storage - General requirements and methods of test - Part 1: Photovoltaic off-grid application
NL EN 61427-2: 2017 IEC 61427-2	Secondary cells and batteries for renewable energy storage - General requirements and methods of test - Part 2: On-grid applications

2.4 Battery Inverter / Charger

Minimum specifications for battery inverter / charger:

- Maximum Efficiency: $\geq 98.0\%$
- Total harmonics distortion (THD): $\leq 3\%$ (harmonic current)
- Product warranty: ≥ 5 years

Battery inverter / charger reference standards/certificates:

NL EN 62109-2: 2016 IEC 62109-2	Safety of power converters for use in photovoltaic power systems - Part 2: Particular requirements for inverters
IEC 62477	Safety requirements for power electronic converter systems and equipment
IEC 61000-3 (2, 4)	Electromagnetic compatibility (EMC) - Part 3: Limits (harmonic currents)
IEC 61000-3 (5, 11)	Electromagnetic compatibility (EMC) - Part 3: Limits (voltage fluctuations and flicker)

2.5 Battery Charge Controller

Minimum specifications for battery charge controller:

- Multiple independent Maximum Power Point Tracking inputs (MPPT)
- Maximum Efficiency: $\geq 98.0\%$
- Product warranty: ≥ 5 years

Battery charge controller reference standards/certificates:

NL EN 62509: 2016 IEC 62509	Battery charge controllers for photovoltaic systems - Performance and functioning
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2.6 Fuel Save Controller

Minimum specifications for battery energy storage system:

- Compatible communication with inverters, BESS, Genset control unit, energy meters, etc.
- Product warranty: ≥ 2 years

Minimum functions of the fuel save controller:

- Maintain diesel generator minimum loading
- Prevent back-feeding into the generator (reverse power protection)
- Power management (control active and reactive power from inverters)
- Ensure sufficient spinning reserve
- Grid export control (feed-in control)

2.7 Monitoring System / Data Logger

Minimum specifications for monitoring system/data logger:

- Compatible communication with inverters, solar charger controllers, BESS, energy meters, etc.
- Include sensor inputs for at least: solar irradiance, module temperature and ambient temperature
- Monitoring: Local (onboard screen or PC connection) and remote monitoring (internet)
- Data storage capacity: ≥ 2 years at 10 min intervals (onboard memory and remote)
- Product warranty: ≥ 2 years

2.8 Mounting Structure

The PV mounting structures shall be sourced from a manufacturer specialized in solar mounting structures. Custom mounting structures shall be designed, verified and approved by a registered structural or civil engineer. The mounting structures should either be of foundation-mount or ballasted-mount types, designed in line with NL 137:2020.

All the mounting structure materials shall be corrosion-resistant (anodized aluminum or hot-dip galvanized steel). The warranty on the mounting structure shall be for at least 10 years.

3. APPENDIX 1: PV Company Qualification Criteria

The companies must comply with the below criteria in order to be qualified for the SoLR& Renewable Energy Fund:

- 1) The company must submit an official proof of the company's registration number (السجل التجاري);
- 2) - The company must submit its registration number at the Ministry of Finance (الرقم المالي);
- 3) The company must submit a detailed company profile showing its main field of expertise and previous experiences;
- 4) The company must have at least one electrical engineer registered at the Order of Engineers and Architects in Beirut or Tripoli (either as a shareholder/ owner or as an employee);
- 5) The electrical engineer must have at least 5 years of proven experience in the field of solar photovoltaic systems;
- 6) The company must have a valid working contract with a civil engineer registered at the Order of Engineers and Architects in Beirut or Tripoli;
- 7) The civil engineer must have at least 5 years of proven experience;
- 8) The company must have at least one electrical or mechanical technician as a full-time employee;
- 9) In addition to his/her main technical school certificate, the technician must have at least one training certificate on solar photovoltaic systems issued by a reputable institution;
- 10) The company must submit a signed letter mentioning that the products used by the company are fully compliant with the standards issued by Libnor, Lebanon's national standards institution, and no importation of goods produced using forced labor in China, especially the Xinjiang Uyghur Autonomous Region;
- 11) The company must prove that it has participated in the latest version of the Solar PV Market Report of Lebanon;
- 12) The company must submit its list of reference for the last three years (2020-2022);
- 13) The company must have installed at least one solar photovoltaic system with a capacity of more than 150 kWp;
- 14) Throughout its lifetime, the company must have installed solar photovoltaic systems with a cumulative total capacity exceeding 700 kWp and provided O&M contracts and monitoring data to their beneficiaries.