Terms of Reference

Scope of Work for Design, Construction and Installation of Solar PV system

International organization for migration IOM required to a hybrid solar PV - diesel generator system that will be integrated with existing generators on site to provide 24/7 electricity. The system will have a 291kWp solar array mounted on the rooftops of the main office building, guesthouse buildings and existing carports. The proposed system will have a 962kWh battery bank, which will provide 0.6 days of autonomy. They system shall include separate feeders for critical and lifesaving functions, guaranteeing power to priority equipment in the event diesel fuel shortages or generator failures. We also require construction/installation of climate controlled equipment room for the battery bank to ensure the long life of batteries.

1.01 Scope of Work

1. Contractor shall provide all labor, materials, tools, equipment's, transportation; hoisting, rigging, insurance, etc. for all work herein specified and or required to complete the project to the IOM representative (Technical Officer) satisfaction.
2. All work shall be in accordance with Uniform Building Code, National, and South Sudanese Local Codes.
3. All work under this contract shall be guaranteed for a period of 5 year after completion, as determined by IOM representative (technical officer)
4. The contractor shall submit shop drawings for the IOM technical officer review and record drawings for all work provided under this contract for his use.

1.01.1 Basic Principles to Follow When Designing a Quality PV System

1. Ensure the roof area or other installation site is capable of handling the desired system size.
2. Specify sunlight and weather resistant materials for all outdoor equipment.
3. Locate the array to minimize shading from foliage, vent pipes, and adjacent structures.
4. Design the system in compliance with all applicable building and electrical codes.
5. Design the system with a minimum of electrical losses due to wiring, fuses, switches, and inverters.

6. Ensure the design meets local utility interconnection requirements.

1.01.2 Basic Steps to Follow When Installing a PV System

1. Ensure the roof area or other installation site is capable of handling the desired system size.
2. If roof mounted, verify that the roof is capable of handling additional weight of PV system.
3. Properly seal any roof penetrations with roofing industry approved sealing methods.
4. Install equipment according to manufacturer's specifications, using installation requirements and Procedures from the manufacturers' specifications.
5. Properly ground the system parts to reduce the threat of shock hazards and induced surges.
6. Check for proper PV system operation by following the checkout procedures on the PV System Installation Checklist.
7. Ensure the design meets local utility interconnection requirements
8. Have final inspections completed by the Authority and the utility (if required).

1.02. General Recommendations

The following is a list of general recommendations to help the contractor and installer choose the right materials, equipment, and installation methods that will help ensure that the system will provide many years of reliable service these recommendations can be used to evaluate pre-engineered system designs and compare system features from one supplier to another.

1.02.1. Materials recommendations

•Solar mono-crystalline M60-250Wp PV modules
• Materials used outdoors should be sunlight/UV resistant
• Urethane sealants should be used for all non-flashed roof penetrations.
• Materials should be designed to withstand the temperatures to which they are exposed.
• Dissimilar metals (such as steel and aluminum) should be isolated from one another using non-conductive shims, washers, or other methods.
• Aluminum should not be placed in direct contact with concrete materials.
• Only high quality fasteners should be used (stainless steel is preferred).

• Structural members should be either:
a. corrosion resistant aluminum, 6061 or 6063o hot dip galvanized steel per ASTM A 123
b. coated or painted steel (only in low corrosive environments such as deserts)
c. stainless steel (particularly for hot and rainy environments)

1.02.2. Equipment recommendations and installation methods
• All electrical equipment should be listed for the voltage and current ratings necessary for the application.
• PV modules should be listed to UL 1703 and warranted for a minimum of 5 years (20-25 year warranties are available).
• Inverters should be listed to UL 1741 and warranted for a minimum of 5 years.
• All exposed cables or conduits should be sunlight resistant.
• All required overcurrent protection should be included in the system and should be accessible for maintenance
• All electrical terminations should be fully tightened, secured, and strain relieved as appropriate.
• All mounting equipment should be installed according to manufacturers' specifications
• All roof penetrations should be sealed with an acceptable sealing method that does not adversely impact the roof warranty
• Integral roofing products should be properly rated (e.g., class A roofing materials)
• All cables, conduit, exposed conductors and electrical boxes should be secured and supported according to code requirements.
• PV Array should be free of shade between 9:00 a.m. and 4:30 p.m. This requirement includes even Small obstructions such as vent pipes and chimneys. A small amount of shade can have a disproportionately high impact on system performance.

1.02.3. Vendor needs to carry out a site visit for the verification of required details and assessment of installation methods and structural rigidness (to avoid over stressed areas) of roof or slab for the PV panels. It is also required to check the spacing for electrical connections, metering and monitoring equipment's.

1.02.4. The proposed system, accessories and all the installation work should be in compliance of NFPA 70. NEC 2011. ARTICLE 690.

1.02.6. Typical System Components:

PV Array: A PV Array is made up of PV modules, which are environmentally-sealed collections of PV Cells—the devices that convert sunlight to electricity. This PV-array is typically around 2700 square meter in area for ease of handling on roofs. This allows some assembly and wiring functions to be done on the ground if called for by the installation instructions.

Balance of system equipment (BOS): BOS includes mounting systems and wiring systems used to integrate the solar modules into the structural and electrical systems of the office/guest house. The wiring systems include disconnects for the dc and ac sides of the inverter, ground-fault protection, and overcurrent protection for the solar modules. Most systems include a combiner board of some kind since most modules require fusing for each module source circuit. Some inverters include this fusing and combining function within the inverter enclosure.

Dc-Ac inverter: This is the device that takes the dc power from the PV array and converts it into standard ac power used by the IOM office and guest house appliances.

Metering: This includes meters to provide indication of system performance. Some meters can indicate home energy usage. Other components: utility switch (depending on local utility).