

Annex - A (SCOPE OF WORK)

Supply and Installation of 1000 Units of Solar System for the Host Community and Refugees in Kharaz Camp, Lahj, Yemen

PART 1 - GENERAL

1.1 THE REQUIREMENT

- A. The WORK to be performed under this Contract shall consist of furnishing materials, tools, equipment, supplies, and manufactured articles, and furnishing all labor, transportation, and services, power, water, and essential communications, and performing all work or other operations required for the fulfillment of the Contract in strict accordance with the Contract Documents.
- B. **The WORK shall be complete, and all work, materials, and services not expressly indicated or called for in the Contract Documents which may be necessary for the complete of the WORK in good faith shall be provided by the CONTRACTOR as though originally so indicated, at no increase in cost to the EMPLOYER.**
- C. If there are contradictions between the Contracts Documents, the CONTRACTOR will ask to the EMPLOYER to choose between the possibilities and the CONTRACTOR shall provide all work, materials and services which may be necessary for the complete and proper construction of the WORK in good faith according to the choice of the EMPLOYER.
- D. The estimated work duration and completion is 4 (Four) Months.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of this Contract is to provide components of the solar system as per bill of quantities, specification and drawings attached in this ITB, the contract includes delivery of the materials to Kharaz camp in Lahj governorate, Yemen, and installation in the designated houses/shelters as per identified by UNHCR, the work includes preparation of the work in the sites and supply a good quality of solar system components according to the specification and drawings of this contract.
The contractor is committed during his implementation stage to act to do complementary works in addition to the above works, which includes the following works:
 - 1. **Site Works:** The contractor shall prepare the works at the sites (refugee Shelters and host community houses), including installation of solar panel and the suitable locations as per available space within the shelters/ houses, including the electrical wiring particularly in the host community houses. The work is including but not limited; Manpower, materials, Equipment and all necessary to complete the works as instructed by the Employer's Engineer.
 - 2. **Materials:** The contractor must give samples of the solar system components to get the approval of the EMPLOYER before supplying and install any equipments. If the contractors cannot offer materials with the agreed specifications as per technical proposal of the bidder.

- B.** The supplier will do manufacturing for the steel bases of the solar panels according to what is known in Yemen of tendencies, which range between (10-15) degree, and as well as for the battery racks in accordance of the quantities in the bill of quantities. The supplier will deliver all required quantities to Kharaz camp in Lahj governorate, Yemen identified by UNHCR, the supplier will transport the solar system units to the refugee's shelters and host community houses and will do installation for all items, the supplier must do site visit to Kharaz camp (if needed) to assess the works required.

C. Quantity:

1. Full solar system components, **1000 units**, 800 units for Refugee shelter (12°46'05.6"N 44°01'34.6"E) and 200 units for the host community houses (12°46'04.2"N 44°02'17.1"E), the system components consist of (solar panels, solar inverter, Solar Battery with Racks, AC and DC cabling, LED Lights, Ceiling fan and switches) see more specification below.

UNHCR reserves the right to increase or decrease the quantities (number of solar system units mentioned above)

1.3 CONTRACT METHOD

The WORKs hereunder will be implemented under a unit price contract comprised of both unit price items and lump sum items.

1.4 WORK BY OTHERS

Interference with Work on Utilities: The CONTRACTOR shall cooperate fully with all utility forces of the EMPLOYER, forces of other public or private agencies or other contractors or companies.

1.5

Progress Meetings:

1. The CONTRACTOR shall schedule and hold regular on-Site progress meetings at least weekly and at other times as requested by EMPLOYER or as required by progress of the WORK and will give a weekly report compared to the plan schedule. The CONTRACTOR, EMPLOYER, and all Contractors, Companies and Subcontractors active on the Site shall attend each meeting. CONTRACTOR may at its discretion request attendance by representatives of its Suppliers, Manufacturers, and other Subcontractors.
2. The EMPLOYER will preside at the progress meetings and will arrange for keeping and distributing the minutes. The purpose of the meetings is to review the progress of the WORK, maintain coordination of efforts, discuss changes in scheduling, and resolve other problems that may develop. During each meeting, the CONTRACTOR shall present any issues that may impact its progress with a view to resolve these issues expeditiously.

**Specifications for Supply and Installation of 1000 Units of Solar System for
the Host Community and Refugees in Kharaz Camp, Lahj, Yemen:**

Solar System Components for Refugee Shelters:

1. Solar PV Module

- a) panels (200) W with PV Steel structure.
- b) should be comprising of either mono-crystalline or polycrystalline.
- c) The module type must conform with CE and IEC 61215, IEC 61730, IEC 61701, or equivalent standards.
- d) Module conversion efficiency should be equal to or greater than 20 % under STC.
- e) The PV module shall perform satisfactorily in temperature between – 40 C to +85 C.
- f) The rated output power of any supplied module shall have tolerance of 0-5 W.
- g) The module shall be provided with a junction box with IP67.
- h) The supplied module DC voltage should be not less than 1000 VDC.
- i) The product warranty should be at least 10 years.
- j) The price include galvanized Iron base (thickness not less than 4mm) composed of steel angle frame dimensions manufactured by welding, the dimension of the frame should be compatible with the size of one panel, the price including painted two coats using anti-corrosion paint and two coats by the required color, the panels must be fixed on steel frame by anchor and bolt on the roof of shelters, taking in the account that the base is in the required inclination, the base should consist of 4 galvanized legs connect the front legs to the back legs by galvanized angle section all this to easy installation of these bases.

2. Solar Inverter

Solar inverter 1000 W Single Phase, Pure Sine wave, 230 V, 50 Hz, 12v DC including all accessories required: with MPPT- Charge Controller, efficiency not less than 92 % @50 VDC -250 VDC input voltage, 12V DC output voltage.

- a) The inverter shall produce pure sine wave form with provision for battery charger, and it can be configured individually or in parallel.
- b) Output frequency shall be 50 Hz.
- c) Total Harmonic Distortion shall be less than 3%.
- d) Designed for indoor enclosure IP 20.
- e) Maximum efficiency should be not less than 90 % at full load.
- f) To be certified to meet at least CE and UL marking and complaint with IEC 62109.
- g) The device should be integrated with LED indicators or LCD display.
- h) It shall allow adjustment of battery voltage and charging current.
- i) The device shall allow connection to grid and/or backup generator(s).
- j) The charging function of the inverter/charger shall include battery charging functionality; and the inverter shall be wired in ways that make use of the inverter's battery charging functionality if the installation includes either mains power or a diesel generator.
- k) Protections required: AC overload and load short circuit, overvoltage, overheating and battery reverse polarity.
- l) Product warranty shall be 2 years.

3. Solar Battery with Racks

- a) Battery bank voltage shall be 12 volts.
- b) Batteries shall be Gel type 150Ah, 12V, the rating shall be calculated @ 10 Hr discharge rate.
- c) Battery cyclic life shall be at least 2500 cycles at 50% depth of discharge (DOD).
- d) Reliable performance at high operating temperatures of up to 50° C.

- e) Wires connected to batteries shall utilize appropriately sized and rated lugs or terminals and proper hardware; battery shall be installed in a secured, well-ventilated powerhouse.
- f) The operating temperature for the battery shall be -20°C to +55 °C.
- g) Test certificates/reports must be provided as proof of battery life.
- h) The manufacturing date must not exceed 10 months from the contract date.
- i) Product warranty shall be 2 years; warranty certificates shall be provided by the manufacturer.
- j) The price including rack to put the battery on, made of galvanized Iron (thickness not less than 3mm), the dimension of the frame should be compatible with the size of one battery, the price including painted two coats using anti-corrosion paint and two coats by the required colour, the battery must be fixed on steel frame.

4. DC Cabling

- a) DC Cabling 2x (1C*10 sqr.mm) (Red& Black) PV to inverter, battery.
- b) 1KV, Flexible stranded copper per EN 60228, TUV certified. Insulation: Halogen-free, thermoset polyolefin. Jacket: low smoke non-halogenated, flame retardant, oil, abrasion, chemical and sunlight resistant meeting UL 44, UL 854.
- c) All cables shall be marked properly according to approved design so that cable can be easily traced and identified.
- d) PV array to battery circuit(s) to be sized for maximum 3% voltage drop at rated array power (Imp).
- e) Cable ends connections are to be made through suitable lugs or terminals, crimped properly & with use of cable glands.
- f) this item is including the cables and cable trays.
- g) Cable Tray: - 1mm thickness, Perforated type Galvanized steel cable trays, cable tray covers, clamping bolts and other cable tray accessories such as coupler plates, bends, tees, reducers, vertical elbows in manufactured accordance with ASTM A653 SS, Grade 33, coating designation G90.

5. AC Cabling

- a) AC Cabling stranded type, TUV certified, double insulation material 1kV XPLE/PVC/CU
- b) All cables shall be marked properly according to approved design so that cable can be easily traced and identified.
- c) All outdoor exposed wiring to be protected from UV radiation and physical damage, all cabling above ground should be suitably mounted inside cable trays with proper covers.
- d) XLPE insulated and PVC sheathed single or multi core flexible copper cables meeting IEC 60227 and IEC 60502.
- e) Cable ends connections are to be made through suitable lugs or terminals, crimped properly & with use of cable glands.
- f) 2C*10sqr.mm include remove tiles and excavation trench as per site condition.

6. LED, Lights

- a) LED light (20 W), and lamp holder.
- b) Mount type: Surface Mount; - Color: White.
- c) Lamp luminous efficacy: not less than 100 lm/W; - Housing: Metal.
- d) Input Voltage and frequency: 220-240V, 50 Hz; - Working Lifetime (Hour): at least 15,000 h.
- e) Certification: All related certificates shall be provided such CE, RoHS.
- f) Warranty: at least two years.

7. Ceiling fan:

Solar powered motorized 30-inch ceiling fan of 40 Watt.

8. Light switch, socket outlets, of good quality.

Solar System Components for Host Community Houses:

1. Solar PV Module

- a) Solar panels (250) W with PV Steel structure.
- b) Should be comprising of either mono-crystalline or polycrystalline.
- c) The module type must conform with CE and IEC 61215, IEC 61730, IEC 61701, or equivalent standards.
- d) Module conversion efficiency should be equal to or greater than 20 % under STC.
- e) The PV module shall perform satisfactorily in temperature between – 40 C to +85 C.
- f) The rated output power of any supplied module shall have tolerance of 0-5 W.
- g) The module shall be provided with a junction box with IP67.
- h) The supplied module DC voltage should be not less than 1000 VDC.
- i) The product warranty should be at least 10 years.
- j) The price include galvanized Iron base (thickness not less than 4mm) composed of steel angle frame dimensions manufactured by welding, the dimension of the frame should be compatible with the size of one panel, the price including painted two coats using anti-corrosion paint and two coats by the required color, the panels must be fixed on steel frame by anchor and bolt on the roof of shelters, taking in the account that the base is in the required inclination, the base should consist of 4 galvanized legs connect the front legs to the back legs by galvanized angle section all this to easy installation of these bases

2. Solar Inverter

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- a) The inverter shall produce pure sine wave form with provision for battery charger, and it can be configured individually or in parallel.
- b) Output frequency shall be 50 Hz.
- c) Total Harmonic Distortion shall be less than 3%.
- d) Designed for indoor enclosure IP 20.
- e) Maximum efficiency should be not less than 90 % at full load.
- f) To be certified to meet at least CE and UL marking and complaint with IEC 62109.
- g) The device should be integrated with LED indicators or LCD display.
- h) It shall allow adjustment of battery voltage and charging current.
- i) The device shall allow connection to grid and/or backup generator(s).
- j) The charging function of the inverter/charger shall include battery charging functionality; and the inverter shall be wired in ways that make use of the inverter's battery charging functionality if the installation includes either mains power or a diesel generator.
- k) Protections required: AC overload and load short circuit, overvoltage, overheating and battery reverse polarity.
- l) Product warranty shall be 2 years.

3. Solar Battery with Racks

- a) Battery bank voltage shall be 12 volts.
- b) Batteries shall be Gel type 200Ah, 12V, the rating shall be calculated @ 10 Hr discharge rate.
- c) Battery cyclic life shall be at least 2500 cycles at 50% depth of discharge (DOD).
- d) Reliable performance at high operating temperatures of up to 50° C.
- e) Wires connected to batteries shall utilize appropriately sized and rated lugs or terminals and proper hardware; battery shall be installed in a secured, well-ventilated powerhouse.
- f) The operating temperature for the battery shall be -20°C to +55 °C.
- g) Test certificates/reports must be provided as proof of battery life.
- h) The manufacturing date must not exceed 10 months from the contract date.
- i) Product warranty shall be 2 years; warranty certificates shall be provided by the manufacturer.

- j) The price including rack to put the battery on, made of galvanized Iron (thickness not less than 3mm), the dimension of the frame should be compatible with the size of one battery, the price including painted two coats using anti-corrosion paint and two coats by the required color, the battery must be fixed on steel frame.

4. DC Combiner Box (DCCB)

2 inputs, 1 output DC Combiner Box.

- a) The DCCB to be provided for termination of connecting cables. The DCJB shall be made of metal or UV resistant material and suitable for outdoor installation, IP65,
- b) All wires/cables must be terminated through cable lugs.
- c) DC output circuit: In accordance with the rating not less than 100A, 1000 VDC breaker.
- d) DC fuse rating for each string:1000V, 20 A.
- e) Built in surge protection device.
- f) Product warranty shall be 2 years.

5. DC Breakers Box

DC breakers box including 2X100 A for batteries DC+1x125A breaker and all the required accessories.

6. DC Cabling

- a) 1KV, Flexible stranded copper per EN 60228, TUV certified. Insulation: Halogen-free, thermoset polyolefin. Jacket: low smoke non-halogenated, flame retardant, oil, abrasion, chemical and sunlight resistant meeting UL 44, UL 854.
- b) All cables shall be marked properly according to approved design so that cable can be easily traced and identified.
- c) PV array to battery circuit(s) to be sized for maximum 3% voltage drop at rated array power (Imp);
- d) Cable ends connections are to be made through suitable lugs or terminals, crimped properly & with use of cable glands.
- e) this item is including the cables and cable trays.
- f) Cable Tray: - 1mm thickness, Perforated type Galvanized steel cable trays, cable tray covers, clamping bolts and other cable tray accessories such as coupler plates, bends, tees, reducers, vertical elbows in manufactured accordance with ASTM A653 SS, Grade 33, coating designation G90.
- g) 2x (1C*6 sqr.mm) (Red& Black) Connection from PV series to Combiner Box
- h) 2x (1C*10 sqr.mm) (Red& Black) from Combiner box to Hybrid Solar Inverter

7. AC Cabling

- a) Stranded type, TUV certified, double insulation material 1kV XPLE/PVC/CU
- b) All cables shall be marked properly according to approved design so that cable can be easily traced and identified.
- c) All outdoor exposed wiring to be protected from UV radiation and physical damage, all cabling above ground should be suitably mounted inside cable trays with proper covers.
- d) XLPE insulated and PVC sheathed single or multi core flexible copper cables meeting IEC 60227 and IEC 60502.
- e) Cable ends connections are to be made through suitable lugs or terminals, crimped properly & with use of cable glands.
- f) 2C*10sqr.mm include remove tiles and excavation trench if needed as per site condition.

8. AC Breaker box AC Circuit breaker RCCB 63 A single phase 2 line.

1. Transporting of the Solar system units from the warehouse of the supplier to the designated houses/shelters in Kharaz camp, Scope of work of the project, the work will include all equipment required for transferring the solar units.
2. The supplier is fully responsible for the installation of the solar system units and will take enough and high degree of safety measures when he transports the solar system units to the designated houses/shelters and will do inspection for the sites where the solar systems will be installed before the delivering of the units and make sure about readiness of the sites to receive the units.
3. Safety of handling the system units will be under the responsibility of the supplier therefore, the solar systems will install in the host community houses and refugee shelter according to the design of each house/ shelter, the contractor should know the nature of the houses/shelter and roofs particularly be ready for the solar panels installation.
4. Suppliers applying for the tender must submit catalogues of the system components within the technical offer showing all technical specifications according to the required technical specifications. If they are selected, a sample of the system must be provided for examination by the UNHCR technical unit, the supplier should prepare and install a sample of the solar system with the two models in his warehouse for UN inspection and the supplier should prepare all the need devices for inspection process.