



TECHNICAL STATEMENT OF WORK (TSOW)

SOLAR LIGHTING FOR AL-HOL CAMP PERIMETER PROJECT

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1. INTRODUCTION

The solar lightening system is divided into two separate parts: The Solar Panel and the Lighting Device that includes all the remaining parts within one unit (i.e., Battery, LED arrays, and Controller).

Panel, LED and supporting structure designed to withstand site climatic, environmental, and meteorological conditions: yearly average and seasonal extremes, particularly solar radiance, availability of sunlight, relative humidity up to 95%, wind speeds up to 120 km/h, ambient temperature from -20°C to +65°C, high levels of dust, ultraviolet radiation, insects, etc.

2. THE SOLAR PANEL

I. Minimum Technical Specifications:

- i. The Solar Panel is completed with brackets for the proposed panel and corresponding supporting structures:
- ii. Cell: Mono-crystalline silicon cells with a junction box including protection diodes cable and MC4 connection terminals for external use, the bidder must submit a 10-year manufacture warranty, a 12-year 90% performance guarantee, and an 80% performance guarantee in the 25 year and cover materials and manufacturing faults for 10 years.
- iii. Panel capacity must be between 250-270 Watt sufficient to fully charge the battery in five (5) hours solar brightness maximum.
- iv. Module efficiency > 17%.
- v. All structures to be made of corrosion-resistant materials. The same applies to all bolts, nuts, and fasteners.
- vi. The panel's frame must be made of weatherproof galvanized aluminium.
- vii. Minimum IP rating of product: IP65
- viii. The solar panel must be installed on an adjustable base separated from the LED arrays direction (brackets for the proposed solar panel); Bracket's design and specification must be provided.
- ix. The solar panel life span must be no less than 25 years.
- x. The panel size shall be as small as possible while covering all the technical specifications
Vendors proposing smaller panels will be preferred.

II. Minimum requirement:

The catalogues required for solar panel as below at least:

- | | |
|-------------------------------|--|
| ▪ Cell type | ▪ (I, V) and (P,V) curve |
| ▪ Solar Panel dimensions | ▪ Module efficiency |
| ▪ Solar Panel weight | ▪ Parameters must be for STC (standard test conditions): Vmax, Imax, Isc, Voc, Vmp, Imp and Pmax). |
| ▪ Operating temperature range | ▪ Load max |
| ▪ Fill Factor | ▪ Temperature coefficient |

TECHNICAL STATEMENT OF WORK (TSOW)
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III. Technical Data Sheet and Manuals:

Each module must have a technical data sheet including the following:

- Name, monogram or manufacturer's mark, module reference number, serial number and lifespan
- Module dimensions and weight.
- Operating Temperature.
- Module's efficiency.
- Fill Factor.
- The following parameters must be for STC (standard test conditions): Vmax, Imax, Isc, Voc and Pmax).
- (I,V) curve.
- (P,V) curve.
- Vmp.

The bidder must provide the specifications and catalogues of the installed panels in English and Arabic languages. Detailed and clear installation, operations and maintenance manuals Arabic and English must be provided with each delivered product.

3. THE LIGHTING DEVICE

The lighting device includes the LED arrays, Battery, Controller and Accessories. The Weight of the Lighting Device should not exceed 25 Kg.

3.1. LED ARRAYS

I. Minimum Technical Specifications:

- Must be manufactured according to international standards.
- LED Technology - multichip technology
- Minimum capacity **60W.**
- Minimum luminous flux **9,600 lumens** at least.
- Daylight color temperature: 6,000 K \pm 500 K.
- Min. LED beam angle 120° at least.
- Min. LED life **50,000 hrs.**
- Min. lighting efficiency **160 lumens/watt** at least.
- The outer casing of the device must be aluminium.
- Aluminum heat exchanger (aluminium cooling plates).
- The device must be subject to dismantling and reinstallation.
- Operating temperature: -20° to +60° C.
- IP: 65.
- CRI >70
- Optical sensitization should be either by a sensor or controller.
- Operation time: All nights even in rainy, cloudy, foggy, high-humidity days.
- Operation period: min. 12 hrs daily - 100% bright lighting for first 6 hours, and 50% bright lighting for the next 6 hrs.

TECHNICAL STATEMENT OF WORK (TSOW)
SOLAR LIGHTING FOR AL-HOL CAMP PERIMETER PROJECT



II. Minimum requirement:

The bidder must provide technical specifications and catalogues. The catalogues of the LED arrays must include the following information at least:

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|------------------------|--|
| ▪ LED Technology | ▪ Color temperature |
| ▪ The LED arrays power | ▪ LED lifespan |
| ▪ Inlet's volt | ▪ IP rate |
| ▪ Lighting efficiency | ▪ Operating temperature range |
| ▪ Luminous flux | ▪ Aluminium heat exchanger (aluminium cooling plates). |
| ▪ CRI | |

2.2. BATTERY

I. Minimum Technical Specifications:

- i. Battery type: **LiFePo4 Lithium-Iron Phosphate**.
- ii. Battery capacity: **1080 Wh** at least operate the required load for the operation period.
- iii. Life cycle at 50% Deep of discharge (DOD) min. **5000 cycles** at 25
- iv. The battery's voltage and capacity must be stable during night operation time.
- v. Battery operating temperature (charging/discharging, not storage temp.) from -20°C to +65°C
- vi. All parameters should be clear on the battery's body
- vii. Charging and discharging curves are required
- viii. The battery life should be not less than 8 years, and it is warranty must be at least 5 years
- ix. Batteries' production date should be maximum three months earlier before from the purchase order issue date.

II. Minimum requirement:

The catalogues of the battery must include the following information at least:

- | | |
|------------------------|-------------------------------|
| ▪ Battery type | ▪ Operation temperature range |
| ▪ Charging current | ▪ Charge and discharge curve |
| ▪ Discharge current | ▪ DoD @ 50% |
| ▪ The battery capacity | ▪ Battery volt |

2.3. CONTROLLER (REGULATOR- CHARGER)

I. Minimum Technical Specifications:

- i. Minimum lifespan of the charge controller should be 10 years and the warranty period should be at least 5 years.
- ii. Programmable inverted charger: the charge controller shall enable the hourly power consumption of lighting to be controlled and programmed, so that it can be regulated during the night-time (e.g. from dusk: 3h at 100 per cent, 2h at 50 per cent etc.) and with automated intelligence to cope with reduced sunlight capture or low battery charge.
- iii. Controller to be **MPPT** according to the conditions at the site

TECHNICAL STATEMENT OF WORK (TSOW)

SOLAR LIGHTING FOR AL-HOL CAMP PERIMETER PROJECT



- iv. The following minimum protection functions should be available; overcharge, over-discharge, overcurrent and overvoltage, short circuit, polarity inversion and short circuit of the LED lamp. The risk of reverse polarity connections must also be precluded mechanically through the choice of plug technology and size.
- v. Controller must stop discharging when the power level reaches 15% of the battery capacity.
- vi. Operating temperature: -20°C to +65°C.
- vii. Must be remotely controllable by remote control - every fifty (50) lighting devices should have at least one (1) remote control

II. Technical Data Sheet and Manuals:

Each Charge controller must be delivered with a technical data sheet including the following information:

- | | |
|--|---|
| ▪ Name, monogram or manufacturer's name and mark | ▪ Self-consumption data |
| ▪ Nodule reference number | ▪ Weight, charging strategy |
| ▪ Serial number | ▪ Warranty |
| ▪ Rated capacity | ▪ Maximum power current and maximum system voltage. |