



**UNITED NATIONS DEVELOPMENT PROGRAMME**

**PAL10- 000116664 - Supporting transitions to solar energy in education and improving energy efficiency in three schools in efficiency in refugee camps .**

**ITB-PAL-0000143263: Supporting transitions to solar energy in education and improving energy efficiency in three schools in the Gaza Strip**

## **Technical Specification**

## **General Requirements**

### **Office Facilities**

At proposed location, to be agreed upon with the municipality, temporary site offices will be established by the Contractor at his own cost, to the sole use of the Engineer's and his staff.

The office will not be part of the project and shall not disturb the construction of the project. The Contractor is responsible to keep and maintain the office and office facilities; also he is responsible to keep the office as well as his temporary buildings clean during the entire period of construction.

The Contractor should remove all temporary buildings and the connecting facilities on his own expense after the completion of the project.

The site offices should have windows, floors, doors, electric lighting, telecommunication system, A/C units or system, current clean water, and connected to a suitable sewage hygienic disposal system.

The contractor shall provide the office with Tea-boy, to work under the instructions of both the owner and the consultant. Salaries, allowances and expenses of the Tea-Boy of all kinds will be made by the contractor, and shall be included in his prices.

(In the absence of the tea-boy for any reason, the contractor should substitute him by another one through the whole period of such absence).

### **The offices shall consist of the following:**

- Site Engineers office with WC 2x 20 m2.
- Meeting Room 20 m2.
- Buffet 9 m2.

### **The following furniture and equipment shall be provided by the contract at his own costs to the satisfactory of the Engineer or his Representative:**

- Desk with two locking drawers and chair for Supervision Staff 2
- Sitting Chairs 6
- Non-plastic Meeting Table with chairs (at least for 8 persons) Complete Set
- Steel Filing Cabinet 4
- Telephone line 1
- Fax machine 1
- Internet Line (Min. Speed 16Mb)
- Photocopier machine (A4/A3) 1
- HP ProBook Laptop according to the following: 4
- Processor: Core I7 10th Gen
- RAM: 16 G Byte
- Hard disk: 1T SSD
- HP Desk Jet Printer (A4/A3) 1
- Dry Fire Extinguisher (5 kg) 3
- Digital Camera 1

- Kitchen utilities 1
- Refrigerator 1
- Water, Café and tea service sets 1
- Supply of stationary required during the whole period of construction 1

Necessary watchman during day and night shall also be provided by the Contractor at his own expense.

# GENERAL SPECIFICATION FOR SOLAR COMPONENTS

## 1- Photovoltaic cells

- PV module must be free of obvious defects.
- PV modules shall be crystalline silicon and shall be qualified and classified by Application Class A according to IEC 61730, IEC 61215 and UL 1703 or UL61730.
- PV module efficiency not less than 17 % @ STC.
- Operating module temperature -40 to +85 °C.
- Number of Busbar not less than 5.
- Positive power tolerance.
- Module should hold maximum system voltage not less than 1000V according to IEC certificate.
- Total degradation not more than 20% for 20 years.
- Module Junction box IP 67 (with at least 3 bypass diodes).
- Temperature Coefficient of  $P_{max}$  not more than  $|-0.42|$  % / °C
- Front glass must be made of high transmission tempered glass with anti-reflective (AR) coating.
- PV module frame made from Anodized aluminum alloy.
- Holds Anti PID certificate (IEC 62804).
- Module should have flash test certificate.
- On each module the following information has to be provided in the label: Manufacturer's name, module serial number, type of module, nominal voltage and current at STC and date of manufacture.
- Serial number must be inside and outside the module.

## 2- Battery

- Battery must be free of obvious defects.
- Battery should be deep cycle type.
- Battery life cycles shall be not less than 2000 cycle for OPZV, 600 cycle for AGM, 750 cycle for Gel, 3000 for lithium ion and for 2000 lead carbon @ 50% DoD and 25°C according to IEC61427 or IEC60896. Any other technology not listed is subjected to PENRA approval.
- Battery operation temperature: 10°C to 30°C.
- Self-Discharge rate (@25°C) less than 3%/month.
- Tested according to IEC60896-21 and fully compliant with IEC60896-22 requirements for valve regulated batteries.

- Tested according to the safety requirements of EN50272-2 for stationary batteries.
- New date of manufacturing not more than six months.
- Non-Gassing battery.
- The design lifetime of the batteries shall be of at least 5 years without losing more than 20% of the nominal capacity at 25°C.
- Low internal resistance (not more than 6 m  $\Omega$ ).
- Battery container must be flame redundant (for example ABS (Acrylonitrile Butadiene Styrene)).
- On each battery the following information has to be provided in the label: Manufacturer's name, battery serial number, type of battery, nominal voltage and ampere hour capacity @C10 & 1.8V and date of manufacture.

### **3- PV Inverter**

#### **(a) Single phase PV Inverter/ON grid**

- Inverter must be free of obvious defects.
- The inverter must be suited to any PV module configuration, and depending on the system design and installation.
- Built-in MPPT solar charge controller.
- MPPT range of voltage from 90 to 500 V.
- Total harmonic distortion THD < 3%
- Efficiency not less than 97%
- Unity power factor.
- Must have anti-islanding protection mode.
- Input reverse polarity protection.
- **Output:** AC voltage 230VAC  $\pm$  5%.
- Waveform: Pure sine wave.
- Operating temperature: -25°C to 60°C.
- Have over temperature and short circuit protection.
- The inverter unit shall be suitable for indoor and outdoor installations with IP65.
- Have these certifications: AS4777.2 or SI 4777, IEC61727, IEC62116, IEC 62109-1&2 and IEC61000.
- The following information has to be provided in the inverter label: Manufacturer's name, Serial number, Type of Inverter, Nominal Power and Date of manufacture.

#### **(b) All in one single phase inverter**

- Inverter must be free of obvious defects.
- The inverter must be suited to any PV module configuration, and depending on the system design and installation.
- Built-in MPPT solar charge controller.
- MPPT range of voltage from 70 to 500 V.
- Selectable charging current based on applications.

- Input voltage 230 VAC with Selectable voltage range: 170-280 VAC and frequency Range: 50 Hz (Auto sensing for frequency).
- **Output:** AC voltage: 230VAC  $\pm$  5%.
- Waveform: Pure sine wave.
- Operating temperature: -25°C to 60°C.
- Peak Efficiency not less than 90%.
- Be compatible with PV input and multiple battery type setting.
- Programmable supply priority for PV, Battery or utility.
- Unity power factor.
- Have overload, over temperature, short circuit protection.
- The inverter unit shall be suitable for indoor and outdoor installations with IP65.
- Have these certifications: AS4777.2 or SI 4777, IEC61727, IEC62116, IEC 62109-1&2 and IEC61000.
- The following information has to be provided in the inverter label: Manufacturer's name, Serial number, Type of Inverter, Nominal Power and Date of manufacture.

**(c) Three phase PV inverter/ON grid**

- Inverter must be free of obvious defects.
- The inverter must be suited to any PV module configuration, and depending on the system design and installation
- AC output grid voltage 3/N/PE 230V/400 3PH, 50Hz
- DC Input voltage 800V or more with particular MPPT voltage range from 200 – 900 V.
- Country standard according to SI4777 or AS4777.
- Number of independent MPPT inputs 2 at least.
- THD at nominal power < 3%.
- Operating temperature range -25°C to +60°C.
- Max Efficiency not less than 97%.
- Must have anti-islanding protection mode.
- Ground fault monitoring / grid monitoring.
- Integrated DC disconnect.
- The inverter unit shall be suitable for indoor and outdoor installations with IP65.
- Phase balance capability, over temperature and short circuit protection.
- Adjustable power factor according to load (from -0.8 to 0.8).
- The inverter must include the safety and communication management devices such as (cutting edge grid management functions, integrated plant control, ground fault and grid monitoring, dc reverse polarity protection, DC side disconnection device, graphic display, multistring capability) to ensure max availability.
- Protection class (according to IEC 62109-1) / overvoltage category (according to IEC 62109-1)
- Warranty for the inverter not less than 5 years.
- The following information has to be provided in the inverter label: Manufacturer's name, Serial number, Type of Inverter, Nominal Power and Date of manufacture.

**(d) All in one three phase inverter**

- Inverter must be free of obvious defects.
- The inverter must be suited to any PV module configuration, and depending on the system design and installation.
- AC output grid voltage 3/N/PE 230V/400 3PH, 50Hz
- Built-in MPPT solar charge controller.
- MPPT range of voltage from 200 to 900 V
- Number of MPP trackers not less than 2.
- THD < 3%
- Efficiency not less than 90%
- Operating Temperature -25 to 60°C.
- Selectable charging current based on applications.
- Be compatible with PV input and multiple battery type setting.
- Programmable supply priority for PV, Battery or Grid (hybrid mode).
- Input reverse protection, input under-voltage protection, output overload protection, output short circuit protection, thermal protection.
- The following information has to be provided in the inverter label: Manufacturer's name, Serial number, Type of Inverter, Nominal Power and Date of manufacture.

**4- Battery Inverter**

- Inverter must be free of obvious defects.
- Intelligent battery management for maximum battery life.
- Have off-grid management system.
- Excellent use for grid-tied with battery backup.
- Rated AC output voltage: 210 – 265 V.
- Frequency range: adjustable to utility (50 HZ).
- Adjustable power factor from -1 to 1.
- THD at nominal power < 3%.
- Rated AC input voltage: 160 – 300 V.
- Rated battery DC input voltage: 41 – 63 V.
- Fully automatic charge control.
- Compatible with different battery type (for example: Lead, Ni Cd, Li-ion etc.)
- Maximum efficiency not less than 94%.
- The inverter must include the safety and communication management devices such as (cutting edge grid management functions, integrated plant control, ground fault and grid monitoring, dc reverse polarity protection) to ensure max availability.
- Surge current should not be less than 200% of rated current.
- Operating temperature range –25°C to 60°C.
- Warranty for the inverter not less than 5 years.
- Have these certifications: AS4777.2 or SI 4777, IEC61727, IEC62116, IEC 62109-1&2, IEC61000, VDE0126 or VDE4105.

- The following information has to be provided in the inverter label: Manufacturer's name, Serial number, Type of Inverter, Nominal Power and Date of manufacture.

## **5- Solar pump inverter**

- Inverter must be free of obvious defects.
- Input frequency from 47 – 63 Hz.
- Output frequency from 1 to more than 400 Hz (default: 1 – 50 Hz).
- AC input Voltage 50Hz  $\pm 5\%$ , 330-480V for Three Phase and 185-260V for single phase.  
EMC Filters: to IEC/EN 61000 2<sup>nd</sup> Environment C3 (Industrial)
- Operating temperature range  $-25^{\circ}\text{C}$  to  $60^{\circ}\text{C}$ .
- Cabinet solution: IP65.
- Have multiple protection (PV over voltage, reverse polarity, over temperature, phase lost, dry pumping and motor locked).
- MPPT tracking efficiency not less than 97%
- DC Input voltage 800V or more with particular MPPT voltage range (220-450 V for single phase and 450-800 V for three phase).
- Start up voltage more than 120 VDC.
- The following information has to be provided in the inverter label: Manufacturer's name, Serial number, Type of Inverter, Nominal Power and Date of manufacture.
- Inverter must support with specified filters (sine wave filter and harmonic filter).

## **6- Fuel Save Controller**

- Controller must be free of obvious defects.
- Management of reserve capacity.
- Reactive Power control via PV inverter.
- Back-feed protection for diesel generator.
- Fully automated system operation.
- Enclosure type protection class IP65 according to IEC60529.
- generator minimum load and reverse power protection.
- Operating temperature range  $-25^{\circ}\text{C}$  to  $+60^{\circ}\text{C}$ .
- The following information has to be provided in the controller label: Manufacturer's name, Serial number, Nominal voltage, current and Date of manufacture.

## **7- Solar Charge Controller (SCC)**

- Charger must be free of obvious defects.
- Work according to MPPT algorithm which looks for the maximum power available from PV.
- Nominal battery voltage: 12 V or 24 V or 48 V.
- Maximum solar open circuit voltage: 60 V to 1000 V
- Maximum output current ranges from 20 A to 300 A



- Operating voltage range: 7V - 68 V.
- Efficiency should be not less than 90%.
- Minimum Charging stages: 3 stages (Bulk, Absorption, Float).
- Have self-protection systems: PV reverse polarity, battery reverse polarity, battery overvoltage, over temperature and reverse current at night.
- Operating ambient temperature range:  $-30^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .
- Minimum Ingress protection of enclosures IP21 according to IEC/EN 60529:2001
- General warranty not less than 2 years.
- Support Parallel operation with separated PV arrays for each one.
- Tested according to safety certificate IEC/EN 62109-1:2010 and UL1741.
- EMC (Electro Magnetic Compatibility) IEC/EN 61000-6-3:2011 and IEC/EN 61000-6-1:2005.
- The following information has to be provided in the charger label: Manufacturer's name, Serial number, Nominal voltage, maximum charging current and Date of manufacture.

## **Technical Specifications of the Photovoltaic Solar system**

### **Technical Specifications of the P.V. Solar system components**

<b>Item No</b>	<b>Name of Item</b>	<b>Technical Specifications and Standards</b>
<b>1</b>	<b>PV array:</b>	<ul style="list-style-type: none"> <li>• Module Efficiency at NOCT at least 15% and more</li> <li>• Operating Module Temperature -40 °C to +85 °C</li> <li>• Maximum System Voltage 1000 V DC (IEC)</li> <li>• Positive Power Tolerance 0 – 5 watt.</li> <li>• Maximum Series Fuse Rating 15A</li> <li>• Junction Box IP67 rated (3 bypass diodes)</li> <li>• Connectors MC4 connectors or Amphenol H4</li> <li>• Temperature Coefficients of P not more than - 0.42 % / °C</li> <li>• Certifications</li> <li>• Anti- Potential Induced Degradation</li> <li>• IEC 61215 &amp; IEC 61730 Application Class A</li> <li>• ISO 9001 quality standards and ISO 14001 environmental standards</li> </ul> <p style="text-align: center;"><b>Warranty: 20 Years on performance.</b></p>

2	<b>Inverters 45KW</b>	<ul style="list-style-type: none"> <li>• 3-phase inverters</li> <li>• String inverters</li> <li>• Island grid operation setting</li> <li>• Input (DC)</li> <li>• Max. DC power (@ <math>\cos \phi=1</math>) 45000 W</li> <li>• Max. input voltage 1000 VDC</li> <li>• MPP voltage range /rated input voltage 320V – 800V/600V</li> <li>• Min. input voltage / initial input voltage 150 V / 188 V</li> <li>• Output (AC)</li> <li>• Rated power (@400 V, 50 Hz) 45000 W</li> <li>• Max. apparent AC power 45000 VA</li> <li>• Nominal AC voltage 3 / N / PE; 220 / 380V 3 / N / PE; 230 / 400 V 3 / N / PE; 240 / 415 V</li> <li>• Nominal AC voltage range 160 V – 280 V</li> <li>• AC power frequency / range 50 Hz, 60Hz / -6 Hz ... +5 Hz</li> <li>• Rated grid frequency / rated grid voltage 50 Hz / 230 V</li> <li>• Max. output current 64 A</li> <li>• Power factor at rated power 1</li> <li>• Adjustable displacement factor 0.8 overexcited ... 0.8 under exited</li> <li>• Phase conductors / connection phases 3/3</li> <li>• surge arrester type 2</li> <li>• Efficiency</li> <li>• Max. efficiency 98%</li> <li>• Must include all necessary Interface modules &amp; data cables and all connections needed to complete and connect the monitoring system to internet.</li> <li>• Certificates:</li> <li>• CE (European Markets Made not china Export), VDE0126-1-1, AS4777, IEC61727</li> <li>• Note: The inverters capacity must be divided at least 3 inverters.</li> </ul> <p style="text-align: right;"><b>Warranty: 5 Years</b></p>
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3	<b>Inverters 40KW</b>	<ul style="list-style-type: none"> <li>• 3-phase inverters</li> <li>• String inverters</li> <li>• Island grid operation setting</li> <li>• Input (DC)</li> <li>• Max. DC power (@ <math>\cos \phi=1</math>) 40000 W</li> <li>• Max. input voltage 1000 VDC</li> <li>• MPP voltage range /rated input voltage 320V – 800V/600V</li> <li>• Min. input voltage / initial input voltage 150 V / 188 V</li> <li>• Output (AC)</li> <li>• Rated power (@400 V, 50 Hz) 40000 W</li> <li>• Max. apparent AC power 40000 VA</li> <li>• Nominal AC voltage 3 / N / PE; 220 / 380V 3 / N / PE; 230 / 400 V 3 / N / PE; 240 / 415 V</li> <li>• Nominal AC voltage range 160 V – 280 V</li> <li>• AC power frequency / range 50 Hz, 60Hz / -6 Hz ... +5 Hz</li> <li>• Rated grid frequency / rated grid voltage 50 Hz / 230 V</li> <li>• Max. output current 60 A</li> <li>• Power factor at rated power 1</li> <li>• Adjustable displacement factor 0.8 overexcited ... 0.8 under exited</li> <li>• Phase conductors / connection phases 3/3</li> <li>• surge arrester type 2</li> <li>• Efficiency</li> <li>• Max. efficiency 98%</li> <li>• Must include all necessary Interface modules &amp; data cables and all connections needed to complete and connect the monitoring system to internet.</li> <li>• Certificates:</li> <li>• CE (European Markets Made not china Export), VDE0126-1-1, AS4777, IEC61727</li> <li>• Note: The inverters capacity must be divided at least 3 inverters.</li> </ul> <p style="text-align: right;"><b>Warranty: 5 Years</b></p>
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3	<b>Inverters 30KW</b>	<ul style="list-style-type: none"> <li>• 3-phase inverters</li> <li>• String inverters</li> <li>• Island grid operation setting</li> <li>• Input (DC)</li> <li>• Max. DC power (@ <math>\cos \phi=1</math>) 30000 W</li> <li>• Max. input voltage 1000 VDC</li> <li>• MPP voltage range / rated input voltage 320V – 800V/600V</li> <li>• Min. input voltage / initial input voltage 150 V / 188 V</li> <li>• Output (AC)</li> <li>• Rated power (@400 V, 50 Hz) 30000 W</li> <li>• Max. apparent AC power 30000 VA</li> <li>• Nominal AC voltage 3 / N / PE; 220 / 380V 3 / N / PE; 230 / 400 V 3 / N / PE; 240 / 415 V</li> <li>• Nominal AC voltage range 160 V – 280 V</li> <li>• AC power frequency / range 50 Hz, 60Hz / -6 Hz ... +5 Hz</li> <li>• Rated grid frequency / rated grid voltage 50 Hz / 230 V</li> <li>• Max. output current 40 A</li> <li>• Power factor at rated power 1</li> <li>• Adjustable displacement factor 0.8 overexcited ... 0.8 under exited</li> <li>• Phase conductors / connection phases 3/3</li> <li>• surge arrester type 2</li> <li>• Efficiency</li> <li>• Max. efficiency 98%</li> <li>• Must include all necessary Interface modules &amp; data cables and all connections needed to complete and connect the monitoring system to internet.</li> <li>• Certificates:</li> <li>• CE (European Markets Made not china Export), VDE0126-1-1, AS4777, IEC61727</li> <li>• Note: The inverters capacity must be divided at least 2 inverters.</li> </ul> <p style="text-align: right;"><b>Warranty: 5 Years</b></p>
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4	<b>Battery Inverter</b>	<ul style="list-style-type: none"> <li>• 50 KW off grid battery inverter rated power</li> <li>• Compatible with string inverters</li> <li>• Number of phases (grid operation / backup operation) (3/3)</li> <li>• AC input</li> <li>• Voltage (range)230 V (172 – 264 V)</li> <li>• Frequency (range)50 Hz (40 to 70 Hz)</li> <li>• Typical interruption time during grid failure not more than 50 ms</li> <li>• Input battery</li> <li>• Nominal voltage 48 v</li> <li>• Battery type VRLA , FLA , VLA</li> <li>• IUoU charging process with automatic full and equalization charge</li> <li>• Efficiency / self-consumption</li> <li>• Max. efficiency in backup operation 95%</li> <li>• Must include all necessary data and interface cables, interface modules and connections for masters &amp; slaves, temperature sensing.</li> <li>• Self-consumption day / night (silent mode) 360 W / 230 W.</li> <li>• Certificates. (European Markets Made not china Export).</li> <li>• EC declaration of conformity (meaning of the EU directive) EN 61000-6-3:2007, EN 61000-6-4:2007, EN 61000-3-11:2000, En 61000-6-1:2007, EN 61000-61000-6-2:2005, EN 62109-1:2010,EN 62109-2:2011, compliance to IEC 61683</li> </ul> <p style="text-align: right;">Warranty: 5 Years</p>
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5	<b>Battery Inverter</b>	<ul style="list-style-type: none"> <li>• 6 KW off grid battery inverter rated power</li> <li>• Compatible with string inverters</li> <li>• Number of phases (grid operation / backup operation) (3/3)</li> <li>• AC input</li> <li>• Voltage (range)230 V (172 – 264 V)</li> <li>• Frequency (range)50 Hz (40 to 70 Hz)</li> <li>• Typical interruption time during grid failure not more than 50 ms</li> <li>• Input battery</li> <li>• Nominal voltage 48 v</li> <li>• Battery type VRLA , FLA , VLA</li> <li>• IUoU charging process with automatic full and equalization charge</li> <li>• Efficiency / self-consumption</li> <li>• Max. efficiency in backup operation 95%</li> <li>• Self-consumption day / night (silent mode) 360 W / 230 W.</li> <li>• Must include all necessary data and interface cables, interface modules and connections for masters &amp; slaves, temperature sensing.</li> <li>• Certificates (European Markets Made not china Export).</li> <li>• EC declaration of conformity( meaning of the EU directive) EN 61000-6-3:2007, EN 61000-6-4:2007, EN 61000-3-11:2000,En 61000-6-1:2007,EN 61000-61000-6-2:2005, EN 62109-1:2010,EN 62109-2:2011, compliance to IEC 61683</li> </ul> <p style="text-align: center;"><b>Warranty: 5 Years</b></p>
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6	Battery Bank	<ul style="list-style-type: none"> <li>• <u>Sealed construction valve regulated lead acid (VRLA) tubular design.</u></li> <li>• New date of manufacturing not more than six months.</li> <li>• Non-Spillable, Non-Gassing</li> <li>• Designed Service Life 10 years</li> <li>• High quality and reliability</li> <li>• Stainless steel attachment bolts &amp; washers</li> <li>• Heavy duty grids (plates)</li> <li>• Designed for frequent cyclic discharge</li> <li>• Low internal resistance</li> <li>• Maintenance free operation</li> <li>• High Charging Capabilities</li> <li>• Safety valve installation for explosion proof</li> <li>• Exceptional deep discharge recovery performance</li> <li>• Low self-discharge characteristic (must be taken into account when sizing the battery bank)</li> <li>• Specifications must include characteristics curves.</li> <li>• The capacity of the battery/cell will be in the range of (800AH – 2500AH) @ C10 &amp; 1.8 V.</li> <li>• The cycle life at 20°C @ 50% DOD is 2500 cycle and more than.</li> <li>• Shelf Life (% of nominal capacity at (25°C)</li> <li>• Case flame retardant.</li> <li>• EU or US product made.</li> <li>• Manufactured to European CE.</li> <li>• Compliance to IEC 61427 requirements for photovoltaic energy sys.</li> <li>• Certificates: DIN (technical performance), IEC 60896-21, 22 EN 50272-2 and ISO 9001:2000.</li> </ul> <p style="text-align: center;"><b>Warranty: Minimum 10 Years</b></p>
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7	<b>PV Hot Galvanized Steel Mounting Structure</b>	<p><b>The mounting structures for the PV panels should include the following:</b></p> <ul style="list-style-type: none"> <li>• The mounting structure uses 40*40*3mm fix hot galvanized steel profile foundations for stands.</li> <li>• The mounting structure uses 40*40*3mm hot galvanized steel angles foundations for PV modules.</li> <li>• The mounting system provides a fixed inclination of the modules from 30 degrees.</li> <li>• The mounting structure components are bonded together to guarantee potential equalization.</li> <li>• The mounting structure is earthed according to internationally accepted standards.</li> <li>• Bidder can prove that the mounting structures and the foundations thereof are structurally suitable to withstand all static loads (weight of modules, wind loads etc) that might occur according to the Site conditions.</li> <li>• The mounting structure uses standardized profiles and mounting</li> <li>• The contractor should provide shop drawing to the mounting structure of the PV before start the work.</li> </ul>
8	<b>PV Aluminum Mounting Structure</b>	<p><b>The mounting structures for the PV panels should include the following:</b></p> <ul style="list-style-type: none"> <li>• The mounting structure uses Aluminum Profile structures for stands and PV modules.</li> <li>• The mounting system provides a fixed inclination of the modules from 30 degrees.</li> <li>• The mounting structure components are bonded together to guarantee potential equalization.</li> <li>• The mounting structure is earthed according to internationally accepted standards.</li> <li>• Bidder can prove that the mounting structures and the foundations thereof are structurally suitable to withstand all static loads (weight of modules, wind loads etc) that might occur according to the Site conditions.</li> <li>• The mounting structure uses standardized profiles and mounting</li> <li>• The contractor should provide shop drawing to the mounting structure of the PV before start the work.</li> </ul>

9	Battery Mounting Structure	<p><b>The mounting structures for the Battery Bank should include the following:</b></p> <ul style="list-style-type: none"> <li>• Battery banks rack from the same manufacturer of the batteries.</li> <li>• The shape of the structure must be enough to carry all the weight of the required batteries for the system.</li> <li>• Bidder should prove that the mounting structures and the foundations thereof are structurally suitable to withstand all static loads that might occur according to the Site conditions.</li> <li>• Galvanized steel bars, plates and angles, the fixation accessories, should be painted with one primer coat &amp; two coats of oil paint.</li> <li>• Batteries must be fixed in their positions according to standard</li> <li>• Battery should be easy access to periodic maintenance.</li> <li>• The contractor should provide shop drawing to the mounting structure of the Battery Bank before start the work.</li> <li>• Well-Ventilated for Increased Battery Safety and Longevity</li> <li>• Protective Terminal Covers</li> <li>• Space-Saving Design with Smaller Footprint</li> </ul>
10	Battery Fuse Box	<ul style="list-style-type: none"> <li>• Nominal voltage: 12/24/48 volt DC</li> <li>• Nominal current depending on the fuse plug: 125/200/250A</li> <li>• Fuse Type: NH01</li> <li>• Bracket: Load Disconnecting Switch</li> <li>• Fuse number: 6</li> <li>• Protection Degree IP65</li> <li>• Mounting: Wall mounting</li> <li>• Ambient temperature: -20C ...+60C</li> <li>• No. of battery inlets: 6</li> <li>• No. of connected battery inverters: 3</li> <li>• EC Declaration of Conformity. DIN EN 50272-2, DIN EN 60529 and DIN EN 50178</li> <li>• Width x Height x Depth: 500 x 375 x 255 mm</li> </ul> <p style="text-align: right;"><b>Warranty: 3 Years</b></p>

11	<b>DC and PV Cables</b>	<p><b><u>PV, DC wires and Cables:</u></b></p> <ul style="list-style-type: none"> <li>• All PV, DC cables and wires are designed to withstand the demanding environmental conditions that arise in any fixed, mobile, roof or architecturally integrated photovoltaic installation, all should be according to the following specifications:</li> <li>• Solar guarantees the maximum efficiency in the energy transmission throughout the full service life of your installation.</li> <li>• Conductor: tinned copper flexible Class 5.</li> <li>• Insulation: halogen-free cross-linked elastomer</li> <li>• Jacket: halogen-free cross-linked elastomer</li> <li>• Standards: TÜV 2 Pfg 1169/08.2007 , UTE C 32-502</li> <li>• Voltage: 1.8 kV DC - 0.6/1 kV AC</li> <li>• The DC cables must be sized such that the voltage drop between the PV array and the inverter is less than 1% of the total PV array DC voltage.</li> <li>• Handle 1, 3 times the source short-circuit current (PV modules) for the string wires.</li> <li>• Cable tray must be installed for DC cables minimum 10*10 cm tray</li> <li>• Maximum conductor temperature 120° C (1) IEC 60216</li> <li>• Resistance to extreme temperatures Minimum: -40°C IEC 60811-504, -505, -506</li> <li>• Resistance to ultraviolet radiation (UV) UL 1581</li> <li>• Resistance to ozone IEC 60811-403</li> <li>• Resistance to water absorption IEC 60811-402</li> <li>• The sizes of Dc cables must be two colures and sized in accordance with the installation requirements applicable on site.</li> </ul> <p style="text-align: right;"><b>Warranty: 3 Years</b></p>
12	<b>3-Phase Digital Meter (KWH meter)</b>	<ul style="list-style-type: none"> <li>• Voltage Input: 230 VAC <math>\pm</math> 15% per phase.</li> <li>• Current Input: / 5 A, 1 A (optional)</li> <li>• Low Current: 1% (50mA).</li> <li>• Include a currents transformer (CT's).</li> <li>• The KWh meter has digital screen with data &amp; interface connections for monitoring by the Remote Monitoring System</li> </ul> <p style="text-align: right;"><b>Warranty: 2 Years</b></p>