

# CPCL Solar Electric Generator

## SPECIFICATION

This document specifies the requirements for a complete Solar Electric Generator (SEG) to power a cathodic protection (CP) load. This specification enables organisations to procure quality industrial solar power systems for use in environmentally demanding locations.

### Using this document

SEG vendor offer must include full details of all equipment. Itemised 'Comply', 'Non comply' or 'Part comply' statements shall be provided for each requirement of this specification. 'Part comply' statement shall be accompanied by explanations/justifications.

### Environment

The equipment shall be constructed and rated to withstand the following external environmental parameters:

- Maximum ambient shade temperature: 55°C (131°F)
- Relative Humidity: 90%
- Abrasive sandstorms
- Intensive solar radiation
- Occasional heavy rainstorms
- Airborne corrosive agents
- Location: Iraq

### Safety

The equipment shall meet all applicable safety codes and requirements in respect of both electrical and structural design and construction.

### General

A complete solar electric generator (SEG) shall include all parts required for fully automatic, low maintenance and long life operation in remote industrial cathodic protection applications.

SEG vendor offer must include full details of all equipment.

Proposed system shall be well proven in remote industrial applications in Iraq.

Vendor staff shall have a proven history of at least 10 years in the successful sizing, design and implementation of industrial solar power equipment for industrial application.

Supplier shall have a proven track record supplying into the Iraqi oil and gas sector.

All goods shall be of EU origin.

Training and support services shall be provided in the EU.

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### Sizing

Solar array shall be sized using internationally recognised sunlight and environmental data.

Overall system sizing shall include the following:

- 20% derating of PV array to account for dust, debris, temperature and other factors
- 40% battery derating to account for maximum depth of discharge, temperature, ageing and other factors
- 5% minimum derating to account for battery to CP output conversion efficiency
- All cables, connectors and electrical equipment shall be derated for temperature and 20% spare capacity

### Equipment specification

The complete solar power system shall be self-contained with controller and battery capable of being located in the shade beneath the PV array. System controller and Cathodic Protection Controller should be of renowned international brand.

Item	The Solar Electric Generation to Comprise of the Following Major Elements
<b>Solar Array</b>	Total capacity in peak watts (Wp), number and type of PV panels to be stated.
<b>Solar Array Mounting Structure</b>	C/W module fixing bolts & hardware bird spikes.
<b>System Charge Controller</b>	PV array and output power to be specified (amps and volts). Designed for industrial applications. In painted steel, IP66 enclosure. To include battery circuit breaker. Industry standard communications capability shall be a standard feature of the controller.
<b>Battery</b>	3+ Days (minimum) sealed lead acid battery bank. Capacity to be stated in volts and amp-hours and to include discharge (C rate) at which capacity is stated. Number of cells and capacity of each cells to be stated. Battery to include all interconnects.
<b>Battery Box</b>	Non-metallic preferred, including ventilation and stainless-steel locking facilities.
<b>Complete Cable System</b>	Including Junction Boxes (IP65). Cable in PVC or armoured as appropriate. To include all labelling and appropriate accessories.
<b>Output Cathodic Protection Controller</b>	Continuous output voltage and current range to be stated. CP controller to be housed in painted steel, IP66 enclosure. Industry standard communications capability shall be a standard feature of the controller.
<b>Documentation &amp; Drawings</b>	All documentation required for installation, operation and maintenance shall be included.

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### TECHNICAL REQUIREMENTS

Item	<p>Scope of supply shall include all components required for stand-alone operation</p> <p>Major items as follows:</p>
<p><b>Solar Array</b></p>	<p>Solar (photovoltaic) modules to be 36 cell with nominal 12V output and designed specifically for industrial 'off-grid' battery charging application.</p> <p>Junction box to be IP65 minimum, fitted with compression glands suitable for 4mm single core cable. Modules should not be supplied with pre-installed cables and connectors.</p> <p>Frame to include 8 x mounting holes per module. In addition, frame shall include:</p> <ul style="list-style-type: none"> <li>• drain holes at corners to prevent accumulation of debris</li> <li>• fixing holes for bird spikes</li> </ul> <p>PV modules should be high strength design tested to 5400pa.</p> <p>Supplier label permanently attached to the module. Module shall include unique barcode identification. Solar modules shall include permanent identification (that cannot be removed without destroying the module). Solar module shall allow client branding to be incorporated.</p> <p>Modules to be supplied with factory test I-V performance data. Modules shall be manufactured in the EU or USA and supplied with a country of origin certificate.</p>
<p><b>Conformity</b></p>	<p>The materials and finished module shall conform to all relevant international standards. These include, but are not limited to the following:</p> <ul style="list-style-type: none"> <li>• IEC: Compliance with the requirement of IEC 61215 and IEC61730 ☐</li> <li>• TUV: To the requirement for class II equipment, Schutzklassen II ☐</li> <li>• European specs ESTI503 ☐</li> <li>• EEC: Electromagnetic compatibility to directive 89/336/EEC ☐</li> <li>• Manufactured to ISO 9001-2015 &amp; 14001 standards ☐</li> <li>• MCS accredited BABT 8501 ☐</li> </ul>
<p><b>Warranty</b></p>	<ul style="list-style-type: none"> <li>• Freedom from defects in materials and workmanship for 5 years ☐</li> <li>• Electrical performance: 90% of rated output current for a minimum of 10 years; and 80% of rated ☐ output current for minimum of 20 years ☐</li> <li>• Life expectancy: Minimum of 25 years ☐</li> </ul>

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Item	Major Components Required (Continued)
<b>Solar Array Mounting Structure</b>	<p>Structure to be manufactured from mild steel section, hot dip galvanised to BS EN ISO 1461, supplied complete with galvanised steel fasteners and ground anchor bolts (if required).</p> <p>Wind loading to 120km/h with module inclination adjustable in minimum of 10-degree increments. Tilt to be secured using through bolts.</p> <p>All components for site assembly shall be provided. These shall include, but not be limited to all module fixing bolts, ground mounting and associated hardware. A4 stainless steel fasteners with nylon isolation washers required for module mounting.</p> <p>Bird spikes shall be included for the whole top PV module row.</p> <p>Structure should be of modular design and allow additional structures/capacity to be installed at a later date.</p> <p>Foundation requirements and layout drawing of structure shall be supplied at the bid stage.</p> <p>No specialist tools shall be required for the assembly of the structure.</p>
<b>Control System</b>	<p>Battery charge and system controller shall be designed and manufactured for industrial 'off-grid' battery charging applications with an operational life expectancy of &gt;25 years without maintenance.</p> <p>Complete control system to be supplied in an IP66, lockable enclosure with detachable gland plate on the bottom edge for cable entry.</p> <p>No active power conversion such as PWM (Pulse Width Modulation) or MPPT (Maximum Power Point Tracking) shall be used (because these reduce operational life to &lt;10 years).</p> <p>All incoming cables are via appropriate glands.</p> <p>All connections within the enclosure are via clearly labelled DIN rail mounted terminals.</p> <p>Battery isolation to be included.</p> <p>Minimum of RS232 communication to be included.</p> <p>Controller shall be supplied calibrated to the battery bank, complete with independent battery power and measurement cables, and battery-mounted temperature sensor.</p> <p>Alarms and monitoring facilities shall be provided for the following: battery voltage below minimum value, battery voltage above maximum value, array failure and controller failure. Adjustable time delays shall be provided to prevent alarm activation to account for the transient conditions.</p> <p>Volt-free contact (normally open and normally closed) shall be provided for a minimum of 1 configurable alarm.</p> <p>Optimisation of the control system for the Iraq environment is required.</p>

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Items	Major Components Required (Continued)
<b>Battery Bank</b>	<p>Batteries shall be of industrial heavy-duty type maintenance free, sealed lead acid, valve regulated gas recombination type in accordance with BS 6290 Part IV. Batteries shall be designed specifically for long life in industrial off-grid solar applications.</p> <p>Proposed batteries shall be from a respected manufacturer and well proven in remote industrial locations and applications. EU manufacture preferred.</p> <p>High-cycle (not just deep cycle) type with minimum manufacturer cycle life of 2500 cycles at 50% Depth of Discharge (DOD).</p> <p>Battery bank supplied complete with insulated interconnects.</p> <p>The batteries shall be capable of supplying continuous power 24 hours per day.</p> <p>The battery shall be capable of 4000 cycles at 20% depth of discharge. The manufacturer shall state the life cycle performance of the battery supplied.</p> <p>The self-discharge rate shall be sufficiently low to allow at least 16 months storage time at 20°C (68°F) without permanent damage.</p> <p>40% battery derating shall be included to account for maximum depth of discharge, temperature, ageing and other factors.</p> <p>Battery data sheets and installation operational and ownership documents shall be supplied. These shall include number of cycles vs. depth of discharge and self-discharge graphs.</p>
<b>Battery Enclosures</b>	<p>To be specifically designed to house the system batteries.</p> <p>IP23 ventilation (minimum) and IP65 enclosure. Lockable with all fittings in stainless steel.</p> <p>Enclosures should be sized and designed for location beneath the solar array such that the batteries are in constant shade.</p>
<b>Cables &amp; Connections</b>	<p>A complete cable system shall be supplied including sub-array Junction boxes as required. Junction boxes shall be IP65 minimum (metal or non-metal).</p> <p>Supplied with all required cables, conduit, conduit adaptors, crimp connectors, cable ties and cable labelling.</p>
<b>Cathodic Protection Controller</b>	<p>CPC shall be designed and manufactured for industrial 'off-grid' applications with an operational life expectancy of &gt;25 years without maintenance.</p> <p>The unit shall be solid state and cooled by natural convection only.</p> <p>Industry standard communications capability shall be a standard feature of the CPU.</p> <p>Complete control system to be supplied in an IP66, lockable enclosure with detachable gland plate on the bottom edge for cable entry.</p> <p>All incoming cables are via appropriate glands.</p> <p>All connections within the enclosure are via clearly labelled DIN rail mounted terminals.</p> <p>An interrupter facility utilising GPS shall be available to enable scheduled removal of CPC output.</p>

## TESTING

The vendor shall submit schedules of factory and site acceptance tests that are required for approval by the client prior to the start of the testing programme.

### 3.1 Factory Acceptance Testing (FAT) and Inspection

Testing shall include the following:

- Solar module testing and inspection at module manufacturer premises
- Charge controller (output controller) FAT at manufacturer premises
- Cathodic Protection Unit FAT at manufacturer premises
- All goods assembled at a single location for visual and quantity inspection Packaging for each item shall also be available for inspection

## DOCUMENTATION

All documentation and drawings required for installation, operation and maintenance of the complete solar power generator shall be provided.

Documentation that shall be submitted by the Vendor shall include the following:

- General arrangement drawings
- Wiring Schematics and Single Line arrangement drawings
- Proposed system operation and design
- Detailed performance and specification of the equipment supplied
- Factory acceptance tests and results
- Proposed acceptance tests at site
- Mounting/installation instructions
- Operating Instructions
- Maintenance instructions

Mechanical, electrical and site foundation drawings shall be included at the bid stage.

Installation, Operation and Maintenance (IOM) manual, including as-built drawings to be supplied with equipment.