



Date: _____

Tender N°: T/15DBV/8A/CON-RWI/ALD/PGM/07-01-2019/001

Tenderer's name: _____

Tenderer's address: _____

SUPPLY AND INSTALLATION OF A SOLAR POWERED PUMPING SYSTEM

A. Objectives of the Project

The project aims to provide a solar power system for water pumping in the borehole/spring/stream as per the attached BoQs for each area, water supply schemes in those areas in order to;

- To meet the domestic water needs of the communities and IDPs living in those areas at minimum costs
- Improve the overall technical soundness and efficiency of the pumping systems
- Implement a system that will contribute towards environmental sustainability

B. Project Information

Bidders should consider and design a solar power water pumping system which delivers the water needs as specified in this document.

It is envisaged that the system is made up of the following components.

- Solar generator to provide power
- Pump and pump motor to pump the required water
- Some control equipment for optimisation and control of the system

Metric measurements – Cubic meters, Kilowatts and Meters should be used as standard in responses.

C. System Design

- Due to the complex nature and multiple variables involved in calculating solar system performance for every hour of a year it is deemed unrealistic to be able to do this without the use of proven computer based modelling tools. Therefore the system must be designed and planned using computer based tools that can closely model the irradiation, rainfall, power generated from the solar array, typical pump performance and can verify this through comparison with actually installed systems.
- All bidders must use solar radiation (insolation) data from the databases such as NASA Surface meteorology and Solar Energy (SSE) group
- Solar module degradation due to solar module cell temperature rising above 25°C must be factored into the sizing result. The solar module temperature coefficient that was used to calculate these losses must be indicated in the sizing report to allow for comparison. The calculations on hourly losses per day must be shown.
- Other Solar module losses such as dirt and wiring losses must be factored into the sizing result and clearly stated
- Planning and design should be done showing monthly pumped water outputs in line with the water requirements below.

- The system must deliver the specified cubic meters per day based on the month with least solar irradiation in the targeted areas as per the BoQs.
- All components of the solar system shall be robust, neatly assembled, firmly fixed supports in ground and designed to allow easy access using adequate tools.
- System designs should eliminate the use of components with a short life, for example batteries (typical life of 3-5 years). Typical component lives should be: 20 years solar generator; 7 years pump motors; 10 years pump ends; 7 years control equipment; 30 years Structures; 30 years mechanical and electrical fittings. All components should be subject to minimal servicing and without expensive parts.
- All components and accessories shall be made from corrosion resistant material and made good to be rust-free by galvanizing and or painting of all surfaces that are exposed to the ambient conditions. All materials shall be resistant to effects of excessive moisture, water, and ambient temperature. Resistance to corrosion shall be according to DIN 8985 standards.
- All equipment, parts and accessories shall be well designed and fastened against theft, with considerable difficulty to unscrew the solar modules or metal parts from the entire assembly.
- The system should be of high quality and designed for use in remote locations. The bidder should outline the key design elements that make the solution suitable for the environment it will be installed in

D. Site Details

The location is in Yemen County. The bidder is free to seek any clarification on the site characteristics from [ACTED] prior to commencement of the works. Bidders are encouraged to visit the site prior to bidding at their own expense.

When considering the design of the systems the following criteria should be made.

	Area 1	Area 2	Area 3
Location (Lat., Long.)			
Daily Water Demand (m ³)			
Ground water temperature (°C)			
Cable Length (m)			
Borehole/Spring/stream Yield (m ³ /hr)			
Depth of Borehole/Spring/stream (m)			
Size of Casing (inches)			
Static Water Level (m)			
Dynamic Water Level (m)			
Tank Height (m)			
Ground Elevation (m)			
Trans. Pipeline length to Tank (m)			
Total Dynamic Head (m)			
Dirt Allowance	5%	5%	5%
Max allowable cable losses	3%	3%	3%
Ambient Temps	Max. 45°C	Max. 45°C	Max. 45°C
Existing Tank Capacity (m ³)			

E. Bidder Qualification

- The bidder should represent a manufacturer of good international standing and with experience to meet the requirements of this project. The bidder must provide a letter of authority from the manufacturer stating that this information has been provided with their co-operation and is true and accurate.
- The bidder must have a minimum of 3 years' experience of designing, installing and maintaining solar pumping solutions of a similar size, scope and application. As evidence of experience and success is able to demonstrate they have similar pumps in operation for the last 3 years
- The bidder must make available a minimum of 5 reference projects in which they have worked. The reference projects must be of a similar scope, size and implemented within Yemen. References will be followed up.
- The bidder should be able to provide positive references from international organisations within the country. There should be an overall positive reputation for good business practise, professionalism and financial stability.
- The bidder must operate a quality management system that is ISO 9001 or equivalent and have recognised third party verification. Have UL / MET listed products for supply. Solar modules, pumps, motors, and control equipment must meet the necessary CE / international standards for safety and where applicable functionality.
- The bidder must have qualified and trained staff that is certifiable with the equipment manufacturer. Training must be of a level to successfully implement the project.
- The bidder must have access to spare parts supply with backing from the equipment manufacturer. Spare parts should typically be available within 5 days of payment.
- The bidder must have access to the manufacturers design support team.
- The bidder must be able to demonstrate that they have a safety management system in place and have a good history of employee health and safety.

F. Equipment Specification

The following forms a guide on the equipment specifications required for this project. Any equipment that does not meet these basic requirements will not be considered. **The bidder MUST attach equipment datasheets detailing equipment characteristics and features.**

Solar Generator

The solar generator must be designed to provide adequate power to the system in real world conditions. Pure theoretical models must be avoided and bidders should show what assumptions have been made in calculating the solar generator size and include it in the design

- Only certified Polycrystalline and Mono-crystalline silicon modules are generally acceptable. The modules should be certified for compliance with IEC/EN 61215 and 61730 or UL 1703 certified and listed
- All modules must be of a robust design and bidders should provide evidence of successful prior off grid use
- Modules shall be guaranteed for 25 years with 10% derating for the first 10 years, and 20% derating within 20 years. The efficiency of solar-PV cells shall be minimum 16% and solar modules total efficiency of minimum 14%, European standards.
- The PV Modules shall be clearly labelled and permanently marked with a data plate containing the following information: manufacturer's name and physical address, type/model number, the watt-peak power rating at STC, open circuit voltage and short circuit current, voltage and current at maximum power point, tolerance and temperature coefficient, country of manufacture, certification, e.g: UL listing, IEC 61215, ISO certification, with fool-proof +ve/-ve connectors

Pump

- The borehole/Spring/stream pump shall be of multistage centrifugal type closely coupled to an AC motor constructed from AISI 304 Stainless steel or higher. All metal material used for pump construction shall be corrosion resistant, permanently lubricated and maintenance free for one year.
- The motor end shall be constructed with the following features: 1-phase or 3 phase AC motor based on the market and the design submitted by the bidder (50Hz speed controlled, +5hz selectable speed), corrosion-resistant, all stainless steel exterior construction, stainless steel shaft, ceramic bearings, NEMA mounting dimensions, hermetically-sealed windings, water lubrication, pressure equalizing diaphragm, able to withstand min water temperature 40°C.
- The pump end of the water pump shall be constructed with the following features: centrifugal multistage direct-coupled pump end, non-return valve, stainless steel (AISI 304 or higher), water lubricated rubber bearings, able to withstand maximum sand content 100g/m³, able to withstand min water temperature 40°C.
- For solar systems, a water pump equipped with a variable frequency/speed induction motor is highly recommended.
- The pump motor must have an efficiency of at least 80% and not be limited to less than 20 start / stop cycles in one hour so as to maximise water output in early morning late afternoon and on cloudy days
- The pump must meet EN 809 and EN 60034-1 or internationally recognised equivalent standards
- The pump set must be of modular design to allow for replacement of individual parts (pump end, pump motor and electronics) if failure occurs.
- The system must have dry run protection to protect the system in event of low water levels.
- The pump set should be able to fit into the existing structure.

Control Equipment

A power inverter shall be used to convert DC power from solar PV modules and AC power (can be generated from back-up generator) to AC power that can be used to power an AC motor based water pump. The inverter shall act as a pump drive or controller manufactured and supplied to work with the specified pump type, and universally works well with induction motors; suitable for solar water pumping applications. The inverter shall be designed to provide convenient information about voltages, switch and sensor status, and overload conditions; and provide maximum power [maximum power point tracking (MPPT) and current boosting] under varying conditions. It should provide direct solar connection as standard and have the ability to add on an optional power back up if required in the future. The control equipment must meet EN 61800-1, EN 61800-3, EN 60204-1 or internationally recognised equivalent standards

Other desired features include:

- Controlling of the pump system and monitoring of the status of system operation
- Has two control inputs for well probe (dry running protection), float or pressure switches for remote control, with automatic reset after well probe turns pump off
- Protections for over current, under voltage, over speed, over temperature, reverse polarity and dry running.
- Data logging of operating parameters including running time, starting/stopping time, max power/voltage of day and total energy generated in the day. The data can be recalled for reference
- Selectable display of operating including input/output amperage, power and voltage, pump speed and temperature.
- Control equipment must have simple system health indicators that are user visible for trouble shooting purposes: typically of pump status, pump speed, well dry, tank full, low source power information
- Integrated MPPT (Maximum Power Point Tracking)
- Maximum efficiency 97 %
- Inverter enclosure: IP 54 or higher (sealed, weatherproof, insect proof, lizards proof)

- Ambient temperature: -10 to +45°C
- Inbuilt fan which efficiently cools the controller

Module Support Structure:

- The structural steel for the support of the PV module shall be consist of 3" Pipe Class A poles, drilled plates 160*160*8mm, 50x50x3mm rafters, 50x50x3mm SHS struts and ties, 40x40x4mm angle iron to support the quantity of panels. All joints to be bolt and nuts with spot welding. The height of the support structure shall be a minimum of 2 metres above ground at the lowest point.
- Angle iron shall be used only to support the PV modules and not anywhere else. All steel surfaces shall have a red oxide prime coat and two coats of aluminium paint upon erection
- All welding will be continuous and of full penetration on both sides.
- In case the steelwork is prefabricated away from site, a final coat of paint shall be applied upon erection of the structure on site.
- The structure will be joined and fastened using bolts and nut with spot welding for vandal proofing
- A drawing for the structure should be included with the submission showing.
- For this location, the solar array should be installed on a fixed pole with a tilt angle as the design submitted by the bidder, in order to capture maximum irradiation from the sun

Cabling

- The cabling will be as follows: From the PV generator to the controller and switch gear, from the generator to the switch gear, from the switching gear to the borehole/Spring/stream head, sensor cable from the control panel to the borehole/Spring/stream head, earthing cable.
- Cable distances should be kept as short as possible to minimize wire size [voltage drop precautions] and installation cost. The appropriate cable size should be selected for use with respect to the distance, voltage and current values involved.
- All the structural components and electrical enclosures shall be bonded together to a common earth connection.
- The ground wire of the pump shall be connected to one of the ground connections in the controller, or to the controller enclosure. Grounding helps to prevent shock hazard if there is a fault in the motor or Lightning and Thunder.
- An effective discharge path for the surge should be created for earth. One or more 3-foot copper-plated ground rods, preferably in moist earth, should be installed
- A lightening arrestor must be erected such that it will remain the tallest structure on site and grounded with a copper strips of not less than 25mmx4mm
- Proper termination of cables must be used using well crimped cable lugs and cable glands
- All submersible cable shall be 4-core copper strand, 100% water-tight with PVC or rubber insulation suitable for temperatures up to 40°C. A high quality, waterproof connection between the pump wires and supply cable is very important.
- All underground cables shall be armoured.

G. Scope of work

The scope will include but not limited to the following:

- Transport and delivery of all the equipment and structural parts to the sites

- Installation of the submersible pump complete with pipes, cables and dry running protection
- Construction of a suitable base of reinforced concrete to support the solar panel support structure
- Erection of the solar panel support structure, positioning of the solar modules on the structure, securing with bolts and nuts with vandal proofing such as spot welding.
- Installation of all the protective and control equipment including solar controller, change-over switch, cable connections between pump, controller, solar modules and generator, grounding, earthing and lightning protection
- The controller and all controls shall be housed in a lockable powder coated steel enclosure complete with rodent proof cable access to the enclosure and provision for enough air circulation.
- Upon completion of the installation the contractor shall conduct a short term pumping and equipment test lasting for the duration of 24hrs to monitor both solar and generator.
- On completion of all works, the contractor shall submit to [ACTED] a hard and soft copy of the test certificate comprising a test sheet of parameters including insulation resistance, tested peak flow in m³/hr and peak frequency in Hz and others.
- The contractor shall submit to [ACTED] head of sub-Office in Ibb, a delivery, installation and commissioning report (both soft and hard copies) of all the on works de including an operation manual detailing in an easy to follow manner, the operation and maintenance regime to be employed in managing the newly installed solar pumping facilities.
- 1 days training of pump attendants and at least 2 [ACTED] staff on the operation and maintenance of the solar system by a qualified approved trainer.

H. Warranty, Defects Liability, Service and Maintenance

Bidders shall provide a one year warranty and defects liability period (DLP) from the date of commissioning. During this period the bidder will be responsible for making good at their cost repair and replacement of faulty parts and shall promptly attend to faults on demand.

The bidder should also detail as part of the technical proposal their availability and capacity to provide backup support from within the country.

I. Deliverables

- The contractor, in consultation with [ACTED] Ibb office, will be responsible for logistical issues required to facilitate delivery, installation, testing and commissioning of a complete, suitable Solar PV pumping system {coupled with diesel power generation}
- On completion of all works, the contractor shall submit to [ACTED] a hard and soft copy of the test certificate comprising a test sheet of parameters including insulation resistance, tested peak flow in m³/hr and peak frequency in Hz and others
- Upon completion of the installation the contractor shall conduct a short term pumping and equipment test lasting for the duration of 24hrs to monitor both solar and generator.
- The contractor shall submit to [ACTED] head of sub-Office in Ibb, a delivery, installation and commissioning report (both soft and hard copies) of all the works done including an operation manual detailing in an easy to follow manner, the operation and maintenance regime to be employed in managing the newly installed solar pumping facilities **(must be provided before final payment is made)**
- The contractor shall conduct 1 days training of pump attendants and at least 2 [ACTED] staff on the operation and maintenance of the solar system by a qualified approved trainer **(must be done before final payment is made)**

J. Proposed items for the solar system

The bidder should be free to suggest any components that have been omitted and which form a critical part for the sound operation of the system.

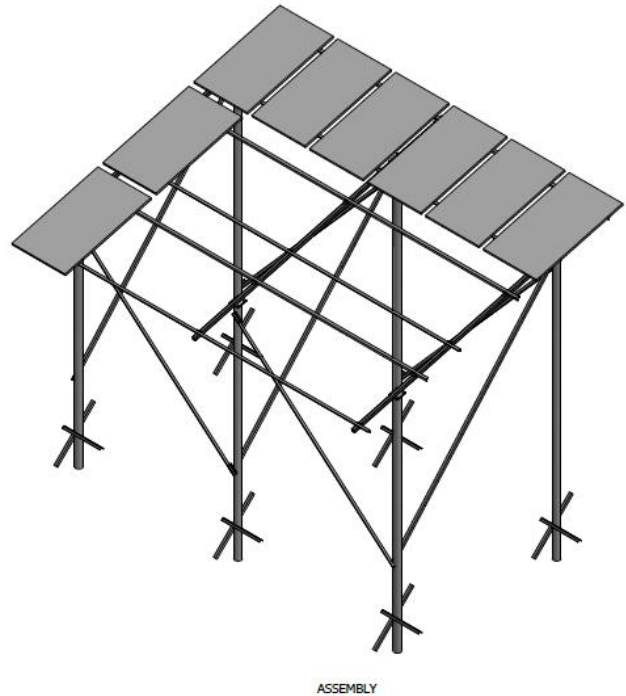
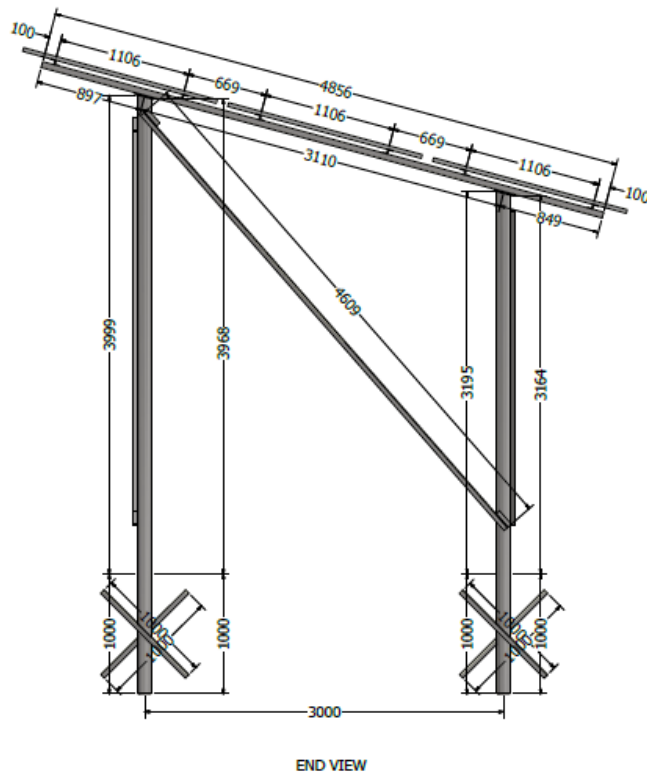
ITEM	ITEM DESCRIPTION
1.	Motor
2.	Supply and install electro mechanical control panel
3.	Controller with data module
4.	Metallic Enclosure for housing the controls, well ventilated and lockable
5.	watts crystalline solar modules – equivalent to Yingli, Jinko or Solarworld
6.	4 mm ² 4-cores PVC SUBMERSIBLE 99% copper cable from well head to pump. (POWER CABLE)
7.	Appropriately sized cable joint
8.	6 mm ² 4-cores PVC/SWA 99% copper armoured cable from controller to well head. (UNDERGROUND CABLE)
9.	0.75 mm ² 2-core PVC round hardened submersible WELL PROBE cables waterproof
10.	1.5 mm ² 4-cores PVC/SWA 99% copper armoured cable from control panel to well head for WELL PROBE
11.	Well probe kit for dry run protection and which must be compatible with the supplied controller
12.	UPVC pipes and sockets DN 50
13.	5/8 100% copper earth rod.
14.	6mm ² Copper earth cable
15.	PV Disconnect
16.	PV combiner.
17.	PV surge protector.
18.	DN50 water meter c/w pulse cable connection and connect to the controller
19.	Lightning arrestor

20.	Allow for civil works of reinforced concrete and foundation bolts, the whole foundation must be raised to a level such that steel column won't be in contact with storm water
21.	Supply and erect a panel support structure made of 3" Pipe Class A poles, drilled plates 160*160*8mm, 50x50x3mm rafters, 50x50x3mm SHS struts and ties, 40x40x4mm angle iron, tilt, and lower end to be minimum 2m above ground level to support the quantity of panels above. All joints to be bolt and nuts with spot welding
22.	Transport and installation of all the equipment and materials

Others

ITEM	ITEM DESCRIPTION
23.	Alarm system set with siren for intrusion and safety protection of solar modules, where intrusion detection is based on mechanical vibrations/ tampering of the solar array structure, wired and integrated within the installation; complete with all accessories
24.	Design and production, maintenance manuals, catalogues
25.	And not limited to any necessary to accomplish the project deliverables.

Support Structure [Example]



Technical Evaluation of the solar system

Evaluation criteria

For the award of this project, [ACTED] has established evaluation criteria which will govern the selection of offers received. Evaluation is made on a technical and financial basis.

No.	Evaluation Criteria	Total score
1.	Technical - System design & compliance with specifications	60
2.	Financial and legal requirements	40
Total		100

Activity Timeline

The delivery, installation and commissioning of a complete, suitable Solar PV power system for each borehole/Spring/stream should take a maximum of 2 weeks from the date of award of the contract. A work plan should be provided along with the bid offer.

Technical Evaluation check list

No	Deliverable	Yes/No	Weight	Score	Comment
1.	Full list of equipment provided & meets technical specifications		15		
2.	Meets design requirements (daily demand and total head)		15		
3.	Computer based performance curves attached		5		
4.	Spare parts and maintenance schedule provided		5		
5.	Bidder meets qualification requirements and has attached evidence		5		
6.	One year Warranty and DLP provided		5		
7.	Realistic work plan attached		5		
8.	Ability to provide back up support from within the country		5		
Total Score			60		