



## **EXPRESSION OF INTEREST (EOI)**

**TENDER REF NO:**

**NYAHUWASCO/EOI/FSP/011/2020-2021**

**TENDER REF NAME:**

**FINANCE, DESIGN AND BUILD OF A SOLAR PV PLANT FOR NYAHURURU WATER  
AND SANITATION COMPANY**

## **TECHNICAL SPECIFICATION**

### **INTRODUCTION**

Nyahururu Water and Sanitation Company Ltd (NYAHUWASCO) is a registered company under Company's Act Cap 486 Laws of Kenya and is licensed to provide water and sanitation services in Laikipia West Sub County of Laikipia County. The company presently abstracts all its water from Narok River a few meters upstream of the famous Thompson Falls using surface pumps operated on grid power (electricity). As the demand for water supply has been growing over the years in Nyahururu, so has been the case for the cost of electricity to run the surface water pumps at our water production stations.

In order to enhance sustainable and affordable water supply, NYAHUWASCO is planning to carry out a Solarization project for its water intake and treatment facility. The project entails equipping the intake and treatment station with solar system for generation of solar energy for running the water pumps. The broad objective of this project is to cut down the cost of electricity for running water pumps by shifting from total reliance on grid power to solar power, to enhance consistency in water production and supply in Nyahururu town and its environs regardless of grid power supply downtimes, and to cut down the operation cost of the utility in the long run.

The following document contains the complete technical specifications for the solarization of the water intake and treatment facility.

### **1. SCOPE OF TECHNICAL SPECIFICATIONS**

The scope is for design, supply, installation and maintenance of solar system that will power the mentioned water pumping stations. The systems shall comprise of the following:

- Crystalline Solar panels
- Solar Pv disconnects
- AC/DC Converters
- Pump unit controllers
- Communication devices for remote monitoring and management of Pump Systems.
- Surge protection devices
- Residual current devices
- PV combiners
- Solar panels ground mounting structures
- Cabling
- Earthing including earth electrodes and bonding
- Change over switches
- safety signs
- lightning protection
- Fireman switches
- All items required for completing the installation

### **APPLICABLE STANDARDS AND CERTIFICATION REQUIREMENTS**

All goods and equipment supplied under these specifications shall conform to the referred standards unless otherwise specified. Other national or manufacturers' standards shall be accepted on condition that they ensure substantial equivalence or higher.

The goods or equipment to be supplied must have a type-test certificate from an accredited testing and certification organization stating that the PV system components meet or exceed the specifications. Organizations accredited according to ISO 17025:2005 (General requirements for the competence of testing and calibration laboratories, and have those specific standards within their scope of accreditation), or equivalent standards will be acceptable for issuing the component certifications.

For components made using same (i) production processes and construction methods, (ii) materials and (iii) quality control procedures, as the certified components, but are of different sizes/capacities a Manufacturer's Self Compliance Certificate if accompanied by the certificate of the tested component will be acceptable.

The Manufacturer's Self Compliance Certificate must be signed by an officer of the manufacturing company and attest the following: "We confirm that the xxxx component(s) listed below have the same design and operating principles as the [state, make and model number] of xxxx component that has a certificate acceptable to this project. We further confirm that these xxxx components use the same (i) production processes and construction methods, (ii) materials and (iii) quality control procedures as the said component during manufacture. [List make and model number of xxxx components]".

The Contract works must be carried out strictly in accordance with the following documents:

- BS 7671: 2008: Requirements for Electrical Installations or "The IET Wiring Regulations" published by the Institution of Engineering and Technology, London (with local amendments, where applicable),
- Kenyan laws and by-laws and supply and local authority requirements,
- Relevant British Standard Specifications and Codes of Practice, published by the British Standards Institution (hereafter referred to as B.S. and C.P. respectively) as implemented in Kenya,
- KS IEC 62253:2011 photovoltaic pumping systems,
- Any working drawings produced by the Bidder and approved by the Engineer and

- The Engineer’s instructions, drawings and details.

The Bidder shall undertake all modifications demanded by the authorities in order to comply with the regulations, and produce all certificates, if any, from the authorities without extra charge.

**Operating Conditions**

The solar PV pumping systems are designed to withstand the average environmental conditions found in the project area (Nyahururu ) as indicated below.

Altitude (above sea level): 2,300 m

Irradiation: 5.0 kWh/m<sup>2</sup>/day

Air temperature: Average of 17°C

Relative humidity: Average of 77%

The Bidder shall ensure that all equipment offered is suitable for satisfactory operation under the specified site conditions.

**SOLAR PV PUMPING SYSTEMS CONFIGURATIONS AND PERFORMANCE**

The solar PV pumping systems are based on the power requirements of each existing pump units as specified by the Engineers. The successful Bidder shall check the Engineers’ specifications and concur with them that the specified solar PV system is sufficient for meeting the power requirements of the existing pump units. The table below gives the capacity of the pump units in each site.

| Pumps                                 | Motor rating |
|---------------------------------------|--------------|
| Main Water Intake-Nyahururu           | 110 KW       |
|                                       | 110 KW       |
|                                       | 110 KW       |
| Main Water Treatment Plant- Nyahururu | 110 KW       |

**GENERAL TECHNICAL SPECIFICATIONS**

1. All components of the solar PV pumping system shall have a proven and documented record of reliable performance in similar applications and in operating conditions described above.
  - a. All equipment specified for outdoor use shall be splash waterproof to IP54 and UV resistant.
  - b. All wiring, enclosures and fixtures that are mounted indoors shall be resistant to insect and dust intrusion.
  - c. All material will be appropriate to local operating conditions.
    - i. Steel and aluminum shall be of high commercial quality. The composition including the percentage and nature of any impurities shall be stated in the technical data sheets.
    - ii. Bolts, nuts and washers on outdoor equipment shall be of non-corroding material or hot dip galvanized.
    - iii. Successive coats of paint shall be applied to a clean, dry and properly prepared surface. Each coat shall be compatible with the preceding coat and the coat to follow.

2. All components shall be delivered with their appropriate fixing nails, screws or bolts according to local building conditions.
3. All set point voltages will be verified and documented with the results dated and the records maintained at the Bidder's facility.
4. The solar PV systems shall be designed in such a way that the maintenance and inspection requirements are minimized and only required in one (1) year intervals. Where special tools are required for routine maintenance, they are to be supplied as part of the contract and included in the tender price.
5. The solar PV system design and configuration shall allow for easy fault-finding by system operators. This may include the use of visual indicators, alarms, instruments, and volt/amp meters to determine whether various components or groups of components are performing as per specification, or are faulty.
6. The main components of the solar PV system shall be integrated in such a way as to allow easy access/replacement (in case of failure) with a similarly functioning component.
7. All equipment shall be clearly and permanently labelled in English, to the approval of the Engineers. Where labels are provided for clarifying the operation of equipment, they shall be concise and illustrative in nature.

## **SOLAR PV COMPONENTS TECHNICAL SPECIFICATIONS**

The following clauses present the minimum requirements of the individual components within the solar PV pumping systems. Bidders are requested to submit detailed technical specifications for all the main components offered

### **Solar PV Modules**

1. The solar PV array shall consist of the specified number of poly/mono-crystalline frameless silicon modules. Cells shall be laminated between high transmissivity, UV protected, tempered glass, and weather resistant back-sheet to protect from moisture penetration.
2. Single or multi-junction thin film modules (a-Si, CdTe, CIS) are not accepted in this procurement.
3. PV modules must be certified for compliance with IEC 61215, "Crystalline Silicon Terrestrial Photovoltaic Modules; Design Qualification and Type Approval". The rated peak power of the PV module shall be stated at Standard Test Conditions (STC) as defined in IEC 61215 and IEC 60904-3.
4. Solar PV modules should be identical throughout all the sites.
5. The tolerance on rated peak power of photovoltaic array is -0%/+20% under Standard Test Conditions (STC) as defined in IEC 60904-1. This means that none of the PV modules can have an actual peak power output lower than the specified rated value.
6. Actual peak power shall not be less than the nominal peak power minus 5%. All PV module performances shall be certified by a measurement sheet from the manufacturer.
7. The PV module shall be equipped with a sealable waterproof IP54 junction box or with a pre-embedded cable with an equivalent junction box fitted to the PV module mounting structure. Junction boxes shall include a provision for strain relief glands.
8. The connection terminals in the PV module junction box shall be clearly marked as positive and negative.
9. Each PV module shall be protected by a blocking diode integrated in the junction box. By-passing diodes are only required if more than one module is connected in series.
10. The modules shall be frameless, have ability to withstand corrosion and allows secure connection to the solar PV array mounting structure.
11. Each module shall be clearly marked (fixed label), indicating: manufacturer, model name/number,

serial number, maximum system voltage, peak power rating ( $W_{\text{peak}} \pm \text{tolerance}$ ), current at MPP (Maximum Power Point), voltage at MPP, open circuit voltage and short circuit current.

12. The Bidder's name should be added on a separate label with contact information (such as land and email addresses) and order date, to assist with warranty inquiries.
13. The PV module warranty shall be of minimum ten (10) years on product and twenty-five (25) years on power performances. Minimum 80% of the nominal power after twenty-five (25) years.

### **Solar PV Mounting Structure**

1. The PV modules shall be mounted to one independent array structure for each system. The array structures shall be ground mounted and shall be designed and fabricated to withstand wind gusts of up to 100 km/h without damage. The mounting array structures shall be sufficiently rigid to prevent twisting in the wind.
2. The solar module support structure shall be anchored in concrete mix 1:2:3 not less than 1m below ground.
3. The Bidders shall provide with their bids the design of an array support structure.
4. All fasteners (nuts, bolts, washers) within the array mounting structure shall be supplied by the Bidder and shall be galvanized or of stainless-steel material.
5. All bolts/screws used within the structure shall be tamper-proof (non-removable) for protection against theft.
6. The module array structure shall be able to withstand at least ten (10) years of outdoor exposure without appreciable corrosion or fatigue.
7. Tilted angle to the horizontal (after installation) should be selected to optimize the energy collection during the lowest ratio of the monthly mean daily irradiation, to the monthly mean daily load. Appropriate values in Kenya range from  $10^\circ$  to  $12^\circ$ , facing true North.
8. Accurate drawings and calculations of the mounting structure should be provided by the Bidder to justify tilt, solidity and integrity of the structure.
9. Location of the solar PV array and structure shall allow expansion possibilities to accommodate additional modules

### **Pump Controller**

1. The pump controller should have true hybrid capabilities which automatically blends grid and generator power with the core solar power supply to provide consistent 24-hour pumping when required, thus maximizing the use of installed solar capacity.
2. The controller should have Integrated data logging of all relevant technical parameters, flow and fuel cost savings easily accessible via a smartphone App.
3. The controller should have advanced configuration options for daily flow rate, constant and min/max pressure, level and flow rate sensing.
4. The controller should have active temperature management for full power up to  $50^\circ\text{C}$  ambient temperature and power derating from 50 to about  $60^\circ\text{C}$  ambient temperature.
5. The controller should have integrated SunSensor for extended pump lifetime.
6. The controller should have integrated MPPT (Maximum Power Point Tracking) for maximum solar energy conversion efficiency.
7. The controller should have protection against reverse polarity, overload and over temperature.
8. The controller enclosure should be IP54.
9. The controller should operate at an ambient temperature of  $-30^\circ + 50^\circ\text{C}$ .
10. The controller should operate at a speed range of 1400-3135rpm.

## **Communication device**

1. The communication device should have a self-contained controller and GPRS/cellular modem.
2. The communication device should be able to connect to each pump in turn and send current running data and status via mobile Internet to a central server.
3. All data in the communication device should be encrypted and secure.
4. The communication device should be able to provide remote monitoring configuration and management of pumps.
5. The communication device should be able to provide active reporting of any alerts or problems.
6. The communication device should have the ability to switch on, switch off, monitor external sensors and control pump speed remotely.

## **Grounding and Lightning Protection**

1. Grounding (or earthing) refers to the provision of a low resistance conduction path from various points in the solar PV system to the earth. The following items are to be bonded to a common earth connection through 10 mm<sup>2</sup> Bare Copper Earth Wire (BCEW):
  - a. the solar PV array structure and
  - b. the controller casing (earth).
2. The items above are to be connected to an earth spike (copper plate ground rods of diameter 15 mm) driven at least 1.5 m deep into the ground. In rocky locations a six (6) meter trench will serve as the earth electrode, by running BCEW in the trench and placing the earth spike horizontally in the trench. The earth spike or rod will be positioned near the solar PV array pole structure. The final impedance of the protection ground shall be lower than 5 ohms (VDE 141 Standard).
3. All connections shall make use of cable lugs crimped to the BCEW and bolted to the array structure and pump controller. Twisted connections are unacceptable and special attention shall be made to connect dissimilar metals (use special connectors for Al/Cu).
4. No breakers shall be installed in a grounded conductor.
5. The grounding shall be in accordance with IEE regulations and codes of practices.
6. Lightning protection shall be provided.

## **Warranties on Goods and Services**

The Bidder warrants that all the goods are new, and of the most recent or current models, and that they incorporate all recent improvements in design and materials, unless provided otherwise in the contract. The Bidder shall be assigned for a “full warranty service” of (1) year including the terms given below.

1. The Bidder shall provide a minimum twelve (12) months warranty against manufacturer’s defects on all system parts from the date of commissioning of the facilities.
2. Pump controllers should also be warranted for at least one (1) years.
3. Specifically, the warranty on PV module performance should ensure a power output of more than 80% of rated capacity over a twenty-five (25) year period. The product warranty against defects on the PV module shall be at least ten (10) years.
4. The Bidder shall estimate the expected lifetime of each of the components supplied according to its previous field experience and specify the maintenance requirements.
5. All warranties shall start from the day the system is commissioned and accepted by the Client and an acceptance receipt is signed.
6. The Bidder shall also warrant the service provided by the solar PV systems for the financing period starting from the date of commissioning. Therefore, he shall be responsible for preventive maintenance visits and on-demand interventions for repair/replacement of all defective parts.

## Technical Data Sheets

The technical data sheets are to be filled in by all bidders

| <b>Solar PV Module</b>  |  |                |
|---|--|----------------|
| <b>Technical description</b>  | <b>Specification offered by Bidder</b> | <b>Remarks</b> |
| Manufacture and model   |  |                |
| Panel type, cell size   |  |                |
| Total Wp and tolerance  |  |                |
| Panel voltage and number of cells                                       |  |                |
| Junction box and IP protection  |  |                |
| Cable Connector type  |  |                |
| Module dimensions (mm x mm)   |  |                |
| Warranty number of years at capacity                                    |  |                |
| <b>Supporting documentation</b>   |  |                |
| Product brochure  |  |                |
| IEC Standard Test Certificates provided, & issuing laboratory           |  |                |
| ISO 17025 Laboratory - Statement of Compliance                          |  |                |
| ISO 17025 Laboratory Certificate - to conduct the tests                 |  |                |
| Manufacture's Authorisation - to bid                                    |  |                |
| Manufacturer's Warranty Certificate                                     |  |                |
| Manufacturer – Power of Attorney to sign the Authorisation and Warranty |  |                |

| <b>Pump Controller</b>          |  |                |
|---------------------------------|--|----------------|
| <b>Technical description</b>    | <b>Specification offered by Bidder</b> | <b>Remarks</b> |
| Manufacture and model           |  |                |
| Type (DC-DC, DC-AC etc)         |  |                |
| Test report and IEC standard(s) |  |                |

|   |  |  |
|---|--|--|
| Output power (kW) <ul style="list-style-type: none"> <li>voltage(V) &amp; phases</li> <li>frequency (Hz)</li> <li>rating temperature (°C)</li> </ul>                      |  |  |
| Number of array inputs and independent MPPT's   |  |  |
| Array voltages and power  |  |  |
| Auxiliary power inputs: number <ul style="list-style-type: none"> <li>voltage (AC/DC)</li> <li>power</li> <li>Automatic array / genset / grid changeover (Y/N)</li> </ul> |  |  |
| Efficiency curves   |  |  |
| Max humidity (%), max temperature (°C) enclosure IP rating,   |  |  |
| Warranty number of years at capacity  |  |  |
| <b>Supporting documentation</b>   |  |  |
| Product Brochure  |  |  |
| IEC Standard Test Certificates or LG Certificate  |  |  |
| ISO 17025 Laboratory - Statement of Compliance  |  |  |
| ISO 17025 Laboratory Certificate - to conduct the tests   |  |  |
| Test results from ISO 17025 Laboratory  |  |  |
| ISO9001 Manufacturer - Declaration of Compliance  |  |  |
| ISO9001 Manufacturer Certificate  |  |  |
| Test results from in-house laboratory   |  |  |



|   |  |  |
|---|--|--|
| Manufacture's Authorisation - to bid                                    |  |  |
| Manufacturer's Warranty Certificate                                     |  |  |
| Manufacturer – Power of Attorney to sign the Authorisation and Warranty |  |  |

| <b>Communication Device</b>  |  |                |
|--|--|----------------|
| <b>Technical description</b>   | <b>Specification offered by Bidder</b> | <b>Remarks</b> |
| Manufacture and model  |  |                |
| Test report and IEC standard(s)  |  |                |
| Power supply and back-up   |  |                |
| Variables: <ul style="list-style-type: none"> <li>• solar radiation</li> <li>• pump status</li> <li>• pump power</li> </ul>                          |  |                |
| <ul style="list-style-type: none"> <li>• pump speed</li> <li>• flow rate</li> <li>• pump temperature</li> <li>• pump pressure</li> </ul>             |  |                |
| Status indicators <ul style="list-style-type: none"> <li>• level</li> <li>• alarms</li> </ul>  | •                                      |                |
| Cumulative performance daily/monthly / totals <ul style="list-style-type: none"> <li>• kWh used</li> <li>• water delivered</li> <li>• etc</li> </ul> | •                                      |                |
| Communication type   |  |                |
| Software link for off-site logging   |  |                |
| Warranty number of years at capacity   |  |                |
| <b>Supporting documentation</b>  |  |                |
| Product Brochure   |  |                |
| IEC Standard Test Certificates   |  |                |
| ISO 17025 Laboratory - Statement of Compliance   |  |                |
| ISO 17025 Laboratory Certificate - to conduct the tests  |  |                |
| Test results from ISO 17025 Laboratory   |  |                |

|   |  |  |
|---|--|--|
| ISO9001 Manufacturer - Declaration of Compliance                        |  |  |
| ISO9001 Manufacturer Certificate  |  |  |
| Test results from in-house laboratory                                   |  |  |
| Manufacture's Authorisation - to bid                                    |  |  |
| Manufacturer's Warranty Certificate                                     |  |  |
| Manufacturer – Power of Attorney to sign the Authorisation and Warranty |  |  |

| <b>Mounting Structures</b>  |  |                |
|---|--|----------------|
| <b>Technical description</b>  | <b>Specification offered by Bidder</b> | <b>Remarks</b> |
| Manufacture and model   |  |                |
| Test report for Rails, Scews and Clip locks                             |  |                |
| Test reports for mounting structures                                    |  |                |
| Warranty number of years  |  |                |
| <b>Supporting documentation</b>   |  |                |
| Product Brochure  |  |                |
| IEC Standard Test Certificates  |  |                |
| ISO 17025 Laboratory - Statement of Compliance                          |  |                |
| ISO 17025 Laboratory Certificate - to conduct the tests                 |  |                |
| Test results from ISO 17025 Laboratory                                  |  |                |
| ISO9001 Manufacturer - Declaration of Compliance                        |  |                |
| ISO9001 Manufacturer Certificate  |  |                |
| Test results from in-house laboratory                                   |  |                |
| Manufacture's Authorisation - to bid                                    |  |                |
| Manufacturer's Warranty Certificate                                     |  |                |
| Manufacturer – Power of Attorney to sign the Authorisation and Warranty |  |                |

#### **MAINTENANCE KIT, SPARE PARTS AND OPERATIONS & MAINTENANCE BOOKLETS**

The Bidder shall provide a maintenance kit and a minimum stock of spare parts at each site.

#### **Maintenance Kit**

The Bidder shall provide during the installation phase one set of equipment for regular basic maintenance at each site, including at least:

1. Set of minimum adapted tools, for example, screw drivers and spanners, to tighten cables in electronic device terminals and strip connectors and
2. measuring instruments for measuring at least 0-1000 Adc/100 Aac, 0-1000 Adc/100 Aac and 0-infinity resistance.

### **Spare Parts**

Spare parts have been provided for use during the maintenance period. A bidder is expected to quote for spare parts to be supplied during the maintenance period.

### **Operation & Maintenance Booklet**

The Bidder shall ensure that all necessary information for Operation & Maintenance (O&M) is provided. The Bidder shall prepare and provide a comprehensive O&M booklet for the systems in this contract. The Operation & Maintenance booklet shall be submitted before final acceptance of the installations.

The Operation & Maintenance booklet shall be written in English and shall be graphically illustrated for unambiguous interpretation and understanding by O & M staff.

Special attention shall be drawn to fault finding and remedial action. The Operation & Maintenance booklets shall include step-by-step procedures required for system startup, operation and shutdown. The Operation & Maintenance booklets shall also include the manufacturer's name, model number, parts list and brief descriptions of all equipment and their basic operating features. The basic operating features shall include: routine maintenance procedures, possible breakdowns and repairs, recommended spare parts, troubleshooting guide, equipment layout and simplified wiring and control diagrams of the system as installed.

### **Training**

A field training course for O & M staff and Users of the systems shall be organized after completion of the installations. Staff or system users shall be trained by the Bidder in basic operation and first-line maintenance, as part of the Contract, using the O & M booklet developed, as a guideline document. Operation & Maintenance staff shall be carefully and thoroughly taught how to diagnose systems and faults, as this could prevent unnecessary call-outs during the initial maintenance period.

### **Operation & Maintenance Requirements**

The solar PV pumping system require regular inspection and sometimes component replacement. Inspections and component replacements should be undertaken by trained and qualified solar PV technicians and maintenance contractors. Procedures for maintenance of the solar PV systems will depend on equipment supplied. Procedures for maintenance of the solar PV system within a Maintenance & Service Contract will be developed by the Bidder, and approved by the Project Manager.

### **ENVIRONMENT AND SOCIAL MANAGEMENT PLAN**

The Bidder shall implement the Environmental and Social Management and Monitoring Plan (ESMMP) below during the supply and installation Contract and the Maintenance and Service Contract. **(Insert ESMMP)**

## EMPLOYEE CODE OF CONDUCT

The Bidder shall develop an Employee Code of Conduct that is in line with the ESMP where applicable, to which his employees shall adhere to during execution of the Contract.

**NB// ALL BLANK SPACES MUST BE FILLED**

## EVALUATION CRITERIA

**TENDER NO: NYAHUWASCO/EOI/FSP/011/2020 -2021**

**TENDER NAME: EXPRESSION OF INTEREST (EOI) FOR FUNDING, DESIGNING AND CONSTRUCTION OF NYAHURURU WATER SOLARIZATION PROJECT**

**BIDDER'S NAME:** \_\_\_\_\_

### MANDATORY REQUIREMENTS

Evaluation and comparison of Tenders:

Indicate with **Y/N** (Yes/No) if MR was submitted to full satisfaction of tender committee.

Indicate with **P/N** (Pass or Fail) in last row if the tender's submission is responsive or not.

| MR-<br>No.   | ITEM DESCRIPTION  | SPECIFIC REQUIREMENTS   | REMARKS |
|--|---|---|---------|
|  |   |   | YES/NO  |
| <b>I</b>   | Proof of legal existence  | -Copy of Certificate of Incorporation/ Registration<br><br>-Copy of KRA PIN<br><br>-Copy of valid Tax Compliance  |         |
| <b>II</b>  | Ability to mobilised financial resources as credit and grand required for the project   |   |         |
| <b>III</b>   | Technical experience in implementation of works of similar nature and complexity in the last 10 years   | <b>(Attach Copies of)</b><br>- NCA 5 and above,<br><br>-LPOs for similar projects ,<br><br>-Contracts for similar projects,<br><br>-Completion certificates |         |
| <b>IV</b>  | Necessary equipment for construction of Project Components  | List and photos of owned/ leased equipment used for similar project   |         |
| <b>IV</b>  | Availability of appropriate skilled staff including solar expert, water engineering/ Hydraulic/Civil Engineers, ICT skills, Environmental and Social experts, Construction Supervisors and Foremen etc. | -Electrical Engineer<br><br>-Civil/Water Engineer<br><br>-ICT skills<br><br>-Environmental and social expert<br><br>-Construction Supervisors and Foremen.  |         |
| <b>TENDERER'S SUBMISSION STATUS (indicate P/F)</b> |   |   |         |

