# **TERMS OF REFERENCE (TOR)**

1. **Background information**

UNDP Zimbabwe through funding from the Global Fund installed four hundred and five (405) solar systems at health facilities (HF) throughout the country under the Solar for Health (S4H) Project. They ranged from 5kW to 40kW depending on the energy needs of the facility. They were installed at Government HF with Ministry of Health and Child Care (MoHCC) being the beneficiary. The HF included district hospitals, rural health facilities, polyclinics and clinics. The installations by different international companies through their local Zimbabwe agents started in 2017 and ended in 2018. All the 40kW systems at the HF were supposed to power the critical loads at priority areas which included the pharmacy to maintain the cold chain, the laboratory for quality diagnosis, the Health Information system for timely and complete data transmission and the maternity for quality baby deliveries. However, 22 of the HF were connected to a few a critical loads and leaving the rest. Of the 22 connections, 20 are functioning properly though not fully utilising the power generated despite the need to connect loads at priority areas. The remaining two are no functioning at all. The 22 HF have since not been commissioned. All the other installed solar systems were inspected and certified by the Ministry of Local Government, Public Works and National Housing (MoLGPWNH) to confirm that they meet standard national and international guidelines. They had a one-year warrant for preventive and corrective maintenance after installations which elapsed at the beginning of 2020.

**2. Objectives**

To optimise the utilisation of 22 x 40kW sites through:

1. Connecting possible priority areas
2. Carrying out corrective maintenance for any of the 40kW solar systems with identified faults for maximum performance.
3. Drafting a simplified training programme for HF users of the solar system.
4. On-site training of end users on preventive and corrective maintenance

In the event of excess power more loads can be recommended for connection. The potential contractor may use the information provided in Annex A to propose how the critical loads at priority areas can be connected, propose corrective maintenance work of identified faults, prepare a certificate of completion and develop a training program for end users.

**3. Scope of Work**

The potential contractor can use information in Annex A and B and will visit the HF at their own expense. The potential contractor will:

1. Carryout load and capacity assessment of loads in priority areas
2. Provide a technical and financial proposal on the connection of loads in priority areas
3. Determine the nature of any identified faults in any of 40kW solar systems
4. Identify the causes (whether they direct or indirect causes) and corrective measures to be taken for faults identified in any of the 40kW solar systems
5. Undertake and work on the connection of loads in priority areas.
6. Undertake preventive and corrective maintenance work on identified faults
7. Prepare a certificate of completion
8. Secure the solar PV system
9. Provide a step by step simplified manual to the end users on what they need to do to avoid/reduce future occurrence of the same faults.
10. On-site training of end users

**4. Deliverables**

The specific deliverables that the potential contractor will provide for the extension of power to priority areas and corrective maintenance of solar systems include but not limited to those in Table 1 below.

Table 1: Deliverables for the extension of power to priority areas and corrective maintenance of solar systems

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| # | **Activity** | **Deliverable** | **Time allocated** |
| 1 | Carryout load and capacity assessment of loads in priority areas | Load and capacity assessment report with load profiles | 10 days |
| 2 | Provide a technical and financial proposal on the connection of loads in priority areas | Technical and financial proposal on connections of loads | 5 days |
| 3 | Carrying out an assessment of faults with causes and draft a proposal on how the faults can be rectified. | Assessment report and technical proposal to rectify the faults | 30 days |
| 4 | Undertake and work on the connection of loads in priority areas. | At least 85% of the loads in priority areas connected | 10 days |
| 5 | Carrying out the proposed corrective maintenance work | Completion of maintenance work and functional certified solar system | 40 days (subject to review depending on the nature of the preventive and corrective maintenance) |
| 6 | Testing and certification of completed work by MoLGPWNH Engineers | Certification of completed work | 14 days |
| 7 | Draft a simplified manual to provide a step by step guide on how to avoid or reduce similar faults in future. | User friendly preventive guide/manual | 5 days |
| 8 | Onsite training of end users | Trained staff on preventive and corrective maintenance of installed system | 40 days |
| 9 | Draft a detailed report for all the work carried out and completed. | Detailed report | 1. days |

**5. Expected Results**

The expected results from the deliverables listed in Table 1 include a:

1. At least 85 % of the loads in priority areas connected to a fully functional solar system
2. A fully functional, certified secured solar system with at least 95% of all reported faults corrected.
3. A user friendly preventive guide/manual
4. A trained staff on preventive and corrective maintenance

**6. Duration of the work**

The timeframe for the implementation of the activities is 1 October 2020 to 31 December 2020

**7. Institutional Arrangements**

In terms of the project governance, the client is the Government of Zimbabwe through MoHCC. Funding is from the Global Fund through UNDP Zimbabwe as the PR. Other actors are MoLGPWNH, Rural District Councils, Municipal and City Authorities.

UNDP will hire and manage the contract to ensure that the assignment is delivered in line with UN values, whilst MoLGPWNH through MoHCC shall provide the testing and certification of completed work. Overall supervision will be done by the UNDP Engineer in line with the core objective of the assignment. All contractual issues will be handled by UNDP.

The potential contractor shall timely provide the following reports:

* Weekly and monthly activities progress reports including pictures and short videos
* Ad-hoc reports upon the request of UNDP
* Final narrative report (reflecting challenges, and issues and how they have or should be resolved, risks and how to guard against them, impact, roles of various stakeholders, documentation of lessons learnt etc.).
* The corrective maintenance reporting template will be provided by the UNDP project team.

***NB:*** *All the reports and support documents by the potential contractor would have to be of high standards for both, internal and external use and would be subject to approval by UNDP.*

**8. Qualifications of the Potential Contractor**

The potential contractor should have an excellent record of accomplishment and adequate experience with a minimum of five (5) years of experience in the installations of at least 40kW solar system and carrying out preventive and corrective maintenance on solar system projects in Zimbabwe with UN agencies, International NGOs, private sector and Government of Zimbabwe.

The potential contractor, and its key technical employees should be guided by engineering ethics and should be clean from any past corruption or misuse of funds or misuse of power of any kind. If there is a staff member of UNDP, who has any relationship with the potential contractor, as an owner or relative of the owner or part of their management team, etc., it should be officially reported prior to starting any process. If not reported prior to the selection process, the potential contractor could be disqualified from the selection process.

**9. Scope of Proposal, Price and Schedule of Payments**

The potential contractor is required to provide the cost breakdown for the deliverables in the Table 1 above. Payment will only be released upon successful completion and approval of the following deliverables.

1. Load and capacity assessment of loads in priority areas report
2. Technical proposal to connect the loads in priority areas
3. Loads in priority areas connected
4. Assessment report and technical proposal on how to rectify the faults at HF
5. Completion of preventive and corrective maintenance work
6. Certification of completed functional work
7. Simple Preventive Guide/Manual providing step by step guide on how to avoid or reduce similar faults in future
8. On site trained end users
9. Solar P.V system fenced/ secured
10. Detailed report for all the work carried out and completed which include photos and videos

**10. Recommended Presentation of Proposal**

The potential contractor shall submit a technical proposal with a clear approach, methodology, implementation plan, budget and other relevant strategies and sections to undertake and cover the scope of work and deliver the expected outputs of the project outlined in the previous section. The technical proposal is expected to list the activities and the costs associated with the activity to address the faults. The proposal should also provide the timelines on how long it takes to address the faults.

The technical proposal should include the following:

1. Expertise of the organization

This section needs to reflect relevant work carried out by the potential contractor in areas related to the provision of maintenance and service of solar systems

1. Proposed Methodology, Implementation Plan and Quality Assurance Plan

This section should demonstrate the partner’s response to the Terms of Reference (TOR) by identifying the specific components proposed and how the outputs/delivery shall be addressed. The partner should also provide a detailed description of the essential performance characteristics and identify the works/portions of the work that will be subcontracted, if any;

Moreover, the proposal should demonstrate how the proposed methodology meets or exceeds the TOR, while ensuring appropriateness of the approach to the local conditions and the rest of the project operating environment. This methodology must be laid out in an implementation timetable and complemented by a quality assurance plan.

1. Management Structure of Key Personnel

This section should include a comprehensive description of the management structure of the potential contactor and further provide the profiles of the key personnel that will be assigned to support the implementation of the project, clearly defining the roles and responsibilities vis-à-vis the project itself. The profiles should establish competence and demonstrate qualifications in areas relevant to the TOR.

1. Minimum qualifications of Key Personnel

Project leader/manager

The qualifications must include a degree or higher national diploma in related areas (Electrical/Solar/Renewable engineering) and skills related to renewable energy provision. A project management qualification is an added advantage. Membership to a professional institution is a must.

General Experience

At least 3 years’ experience of managing preventive and corrective maintenance of solar projects in Zimbabwe and or in the region.

Specific Experience relevant to the assignment

At least 3 years’ experience in project management, solar system designs, installations, corrective and preventive operation and maintenance of solar systems of at least 40 kW.

Senior Expert Technician

At least a National Diploma in electrical/civil engineering or similar qualifications. Membership to a professional institution is desirable.

- General Experience

Over 5 years’ experience in Solar PV electrical Installations

- Specific Experience relevant to the assignment

At least 5 years’ experience in corrective and preventive operation and maintenance for systems of size at least 10kW

Training Expert /Facilitator

At least a social science degree or equivalent

- General Experience

At least 2 years’ experience in development work and trainings

Experience of working with NGOs is desirable.

- Specific Experience relevant to the assignment

Experience in facilitating workshops or working in the Renewable Energy sector is an advantage

1. Financial Proposal

This section should include a budget with the line items specified in Table 1 above.

**11. Criteria for Selecting the Best Offer**

The selection would be through the lowest technically qualified bidder

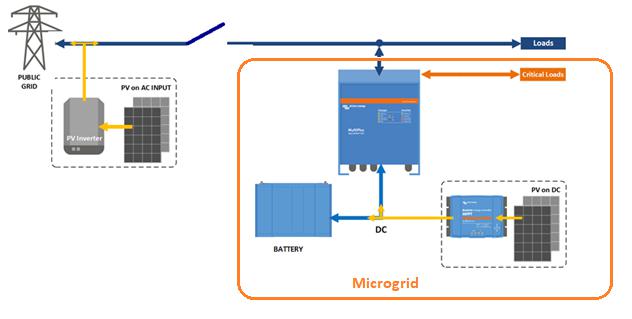
**12. Site-specific information**

1. Installation description at all sites

The installation system on the 22 site consists of PV panels (40kW) and AGM batteries (2400 Ah / 48V (115.2 kWh) contributing to the electrical supply of the HF. The installation is also connected to the public electrical grid. The Solar PV installation is divided in two groups. There is one (20kW) connected directly to the grid of the HF through a PV inverter and the other connected to a micro grid with battery support.

**The solar part connected directly to the hospital grid** can only be used whenthe public grid is available and it contributes to the reduction of the amount of power consumed from the public grid, contributing to the decrease of the electricity bill to a large extent. As solar resource is available only during the day, it can only service daily loads (for example air conditioners, microscopes, printers, water pumps…).

**The other solar part connected to the microgrid** operates normallydisconnected from the public grid and only connects to it when the battery and solar energy is not enough for the supply of the critical loads connected. They are always powered even during a power outage of the public grid (of course if the battery is not empty). The schematic diagram below illustrates the existing set up.



Solar and battery installation at HF

1. **Locations of the 22 health facilities with 40kW systems**

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| **Address** *(for the purpose of site visit)* | See list of the 22HF with 40kW installed system and locations on Annex A and also reticulation diagrams in Annex B. |
| **Site visit** | **For this assignment the potential contractor is mandated to undertake site visits. Note that the potential contractors will undertake site visits at their own costs.**  **Assessment Visits are** scheduled as per tender document**.**  Please confirm your intention to undertake Site Assessment Visit ***(without cost to UNDP)*** *as per tender document* by sending an email to: oscarz.zindoga@undp.org providing the **name, ID and contact details** of the staff involved in the site assessment visit in order for UNDP PSU to make the necessary arrangements for assessment. |
| **Site information** | Please find more details in the tender document. |

**13 Replacement of Solar PV components**

When replacing system components which have malfunctioned or stolen, the new components shall have same ratings as previous components unless there is justification for change which needs to be approved.

All replaced equipment shall be labelled with appropriate information.

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| **Environmental Conditions** | | |
| 1 | For all components replaced and installed | All components shall be fully operational in the following conditions:  • Relative humidity up to 95%  • Ambient temperature from -10ºC to 50ºC  • Rural environment with high presence of dust, insects, etc |
| 2 | For all external components installed | External components shall additionally withstand the following conditions:  • High ultraviolet radiation  • Wind speeds up to 120 km/h |
| 3 | Anti-theft and anti-tampering measures for components replaced | Measures to secure and protect PV modules, electronic equipment, batteries and others from theft and tampering. |

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| **PV Generator** | | | |
| **1** | **Installed PV capacity at STC (Wp)** | | As per site |
| 2 | Type of module | | Replacement modules should be crystalline silicon (60 or 72 cells) with a tolerance better than -0/+5%. Amorphous silicon and other thin film type cells are not acceptable. The modules shall have anti-reflective glass cover and must be PID (potential induced degradation) proof.  Warranties: Overall 10 years of 90% power output, 25 years of 80% power output warranty and 10 years on material and manufacturing faults or 25 years of linear performance. |
| 3 | Applicable Standards | | IEC 61215 edition 2 and shall be qualified to and be classified by Class according to IEC 61730 and local standards e.g SAZ solar installation standards and SAZ wiring standards |
| 4 | Orientation for optimum yield | | Where there is complete replacement of PV solar system  -The tilt angle of the modules shall be no less than 10 degrees. The orientation or azimuth should be due North as much as possible in such a way to maximize energy capture or at an angle determined by the site absolute latitude value plus 4o  - Shadowing of the PV modules from trees, buildings or any other obstacles should be minimized over the entire day and there shall be no shadows in a period of ± 4h w.r.t. solar noon. A shadow partially blanking off a photovoltaic cell may cause hot spots and loss of almost the whole production of this module, significantly reducing the performance of a complete string. |
| 5 | Mounting | | - In the event that the PV generator to be replaced it shall be mounted on a single sloped structure on top of and in connection with the electric cabinet.  - The surface for fitting photovoltaic modules to structures shall be perfectly flat in order not to induce mechanical stresses on securing the modules. Moreover, there shall be accessibility to perform periodical cleaning and inspection tasks. |
| 6 | Supporting structure | | In the event that structures are needed they shall be made so that the modules can withstand wind speeds up to 120 km/h.  - Supporting structures and mounting arrangements should comply with the applicable environmental conditions, local and international standards, and regulations.  - All structures shall be made of corrosion resistant materials. The same applies to all bolts, nuts, and fasteners.  - The support frame shall be of either lightweight aluminum or galvanized steel and it shall be easy for installation and maintenance. |
| 7 | Warranties | | Overall, 10 years of 90% power output, 25 years of 80% power output warranty and 10 years on material and manufacturing faults or 25 years of linear performance |
| **Batteries** | | | |
| 1 | Applicable Standards | Batteries to be replaced shall be the same as those installed in terms of capacity, performance, lifetime and nominal operating voltage and must be certified according to IEC 60086-4 or equivalent and they shall be compatible with the operating system  Warranty: The expected duration of the battery should be more than 10 years and the warranty period is 2 years. | |

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| **Inverter with charger** | | | |
| 1 | Type | | Stand-alone Inverter with AC charger |
| 2 | Functionalities | | The replacement inverters should have the same specifications as the one before and compatible with the rest of the system. It should have an AC power input to recharge batteries from an auxiliary source (grid or diesel generators).  Warranty: the expected duration of the replacement inverter should be more than 10 years and the warranty period is 5 years. |
| **User interface** | | | |
| 1 | User Indicators | LCD display in English | |
| 2 | Parameters monitoring | SOC, Energy meter (in & out), battery voltage, battery temperature | |
| 3 | Remote Monitoring | Remote monitoring: real-time & historical data with a storage capacity for main data (energy measurements, consumption data and alarms).  The minimum parameters to be monitored are (instantaneous and historical values) (select the applicable):   * Total energy (kWh) and power (kW) produced by PV * Energy (kWh) and power (kW) supplied from the grid * Energy (kWh) and power (kW) fed into battery for charging and supplied from the battery * Total consumption of loads * Solar fraction * Battery SOC and temperature * Alarms and configuration records   In addition, the remote monitoring system must:  a) provide analytics to understand if yield is as expected or designed b) determine whether under performance was caused by weather or by faulty equipment  c) have the capacity to detect problems and defects with panel strings and recommend repairs to the solar system setup.  The monitoring system shall have an LCD display in English and provide monitoring reports through:   1. Internet connectivity (LAN; Wi-Fi etc.) and, GSM connectivity, 2. Tablets or smartphones 3. Ability to store for minimum 12 months of monitoring data locally (solar PV system) in the event of extended internet/GSM outage.   Bidders are required to include in their offers all the necessary elements (SIM cards, annual subscription, modem, data management/reporting) to make possible a monitoring system through GSM connectivity even for the sites with internet connectivity. **Bidders are required to note that remote monitoring using cloud-base systems will not be accepted.** | |
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| **Technical Cabinet** | | | |
| 1 | Application | In the event that the technical cabinet needs replacement, all the components - i.e. the energy manager, PV charge controller, battery, multi-mode inverter, main board, switches and protective devices as well as connection of the different components - shall be installed in a cabinet that shall be placed under the PV array in a suitable area that combines good solar illumination and is not too far from the main fuse and metering box of the building. | |
| 2 | Size and type | - The cabinet will be located outdoor and under the PV array.  - The cabinet size must be adequate to contain all the components and also allow enough space for inspection during maintenance procedures.  - Apply ventilated enclosure (and protected from external conditions).  - Rack mounting for batteries and further cabinet for the racks of the batteries. | |
| 3 | Labelling | - A drawing on the cabinet shall provide visual warning about safety hazards, e.g. smoking, acid handling, etc. as well as emergency shutdown procedures. - A panel on the cabinet shall provide visual (and in English) basic operation instructions and system line diagram.  - The Supplier shall install an information panel with the updated contact details of the local partner in charge of the after-sales and maintenance attached to the technical cabinet. | |
| **Wiring and Safety requirements** | | | |
| 1 | DC and AC cables | | Replacement of cables shall be sized according to local and EU standards which must be stated. |
| 2 | Labelling | | The distribution board shall be clearly labelled after any intervention |
| 3 | MCBs | | To address the interface between 40KW system and existing electricity reticulation system |
|  | Accessories | | Any accessories to make the installations of the above items complete and connection to priority loads at HF |

**Annex A: S4H Solar System Faults Information and HF Locations**

The information provided is what is available. You may make some technical assumptions that will enable you to revert with your comprehensive offer**.**

**Annex B: Solar system sites reticulation drawings**

These are just to show how the existing lines are reticulated and should be a guide at points of intervention.

**ANNEX C** – See BOQs