



**BIDDING DOCUMENT
FOR THE SUPPLY & INSTALLATION OF 8 NEW
SOLAR FRIDGES & THIER COMPREHENSIVE
SOLAR SYSTEMS AT VARIOUS HEALTH
FACILITIES IN KALANGALA DISTRICT**

OPEN DOMESTIC BIDDING

SUBJECT OF PROCUREMENT

TENDER NAME	TENDER NUMBER
Supply & Installation of 8 New Solar fridges and their comprehensive solar Systems at various health facilities in Kalangala district of RHSP Operation	RHSP/SPLS/21/003

INVITATION FOR QUOTATIONS FOR SUPPLY AND INSTALLATION OF 8 NEW SOLAR FRIDGES AND THEIR COMPREHENSIVE SOLAR SYSTEMS AT VARIOUS HEALTH FACILITIES IN KALANGALA DISTRICT UNDER OPEN BIDDING

Rakai Health Sciences Program (RHSP) invites bids for **Supply & Installation of New solar fridges and installation of their solar work systems at various health Facilities in Kalangala district** as specified in the statement of requirements.

Procurement will be undertaken in compliance with RHSP's Procurement Policy and Procedures Manual guidelines on large sized tenders 2020.

1. Bid Price:

- a) The contract shall be for the full scope of work as described in the TOR's. Corrections, if any, shall be made by crossing out, initialing, dating and re writing.
- b) Prices for Goods supplied shall be quoted inclusive of delivery to the health facilities as per list below.
- d) The rates quoted by the bidder shall be fixed for the duration of the contract and shall not be subject to adjustment on any account.
- e) The prices For Supplies and Related Services originating in Uganda must be quoted in Uganda shillings and the prices For Supplies and Related Services originating outside of Uganda must also be quoted in Uganda shillings.

2. **Validity of Bid:** Bids shall remain valid for a period **not less than 60 days** after the deadline date specified for submission.

3. Bids should be fully signed, enclosed, and supported by any other documents required to be submitted under this invitation. You may also reply by sending a Bid on your own company's letterhead, but the terms and conditions specified in the RFQ will take precedence over any terms and conditions stated in your Bid.

4. Other documents required to be submitted along with the Bid shall include:

- Certificate of registration/incorporation
- A copy of trading license
- Presence of tax clearance certificate
- Power of Attorney
- Signed supplier code of conduct (Form 6) by the authorized representative.
- Written Confirmation of the authorization to sign on behalf of the Bidder
- Statement regarding its major operations
- Full contact information of the firm – physical location and postal address, telephone numbers and valid email address.
- Certificates of dealership to supply the equipment requested

5. Bid Submission

- a) The bid should be enclosed in an envelope that should be subsequently sealed and addressed to the address given below. **The envelope should have the RFQ number and date of opening boldly and conspicuously super scribed.**
- b) The Bidder shall prepare one original of the documents comprising the bid and clearly mark it "ORIGINAL". In addition, the bidder shall submit two other copies of the bid and clearly mark each of them 'COPY". In the event of any discrepancy between the original and the copies, the original shall prevail.

- c) It is the exclusive responsibility of the bidders to ensure that the sealed envelope containing the bid/bids reaches the indicated delivery address before the time and date indicated in paragraph 6 below. If being delivered by hand, the bids must be delivered at the below address during the working hours from 08.00 hrs. to 13.00 hrs. and from 14.00 hrs. to 17.00 hrs., Monday through Thursday, and on Fridays from 08:00hrs to 15:00hrs except for holidays being observed by the Government of Uganda.
6. **Delivery of Bids:** It is the responsibility of bidders to submit the Bid on or before **11.00 am** (local time) on **17th August 2021** either through post, courier or by hand- delivery to the address below:
- RHSP Offices, Old Bukoba Rd, Kalisizo Town Council, Kyotera District.
OR
RHSP Offices, Uganda Virus Research Institute, Nakiwogo Rd, Entebbe, Wakiso District.
7. Bids shall give a comprehensive description of the proposed items. If the proposed items do not comply exactly with the technical specifications and descriptions provided in the RFQ, the nearest functional equivalent or closest standard should be offered as an alternative.
8. Any deviation from the requested specifications shall be highlighted and explained. When comparative specification tables or other tables are provided by the Purchaser, such tables shall be completed, and item reference numbers should be referred to. The country of origin shall be specified for each item offered
9. **Evaluation of Bids:** The Purchaser will evaluate and compare the bids determined to be substantially responsive i.e., which (a) are properly signed; and (b) conform to the terms and conditions, and specifications. For the purposes of the evaluation, the rates including taxes and duties, expenses like packing and forwarding, freight, insurance etc. shall be considered. For purposes of comparison, prices are converted into local currency at the selling exchange rates prevailing on the date of opening of the Bids. The source of the exchange rate will be Bank of Uganda.
10. **Award of contract:** The Purchaser will award the contract to the bidder whose bid has been determined to be substantially responsive and who has offered the lowest evaluated Bid price. **The awarded supplier will be required to submit a performance security (5% of contract sum) before contract signing.**
11. Notwithstanding the above, the Purchaser reserves the right to accept or reject any bids and to cancel the bidding process and reject all Bids at any time prior to the award of contract.
12. The bidder whose bid is accepted will be notified of the award of contract by RHSP prior to expiration of the bid validity period. The terms of the accepted offer shall be incorporated in the agreement.
13. Payment shall be agreed upon with the awarded bidder and incorporated in the agreement.
14. Normal commercial warranty/ guarantee shall be applicable to the supplied goods.
15. You are requested to provide your offer latest by **11:00am by Tuesday 17th August 2021**. Any offers received late shall not be considered.

We look forward to receiving your Bids and thank you for your interest in this project.

Name: **Jannet Tayebwa**
Position of Authorised Official: **Procurement Manager**

Annex II: Technical Specifications

Procurement Reference Number: RHSP/SPLS/21/003

TERMS OF REFERENCE (TOR)

PROPOSED SPECIFICATIONS FOR SOLAR DESIGN, INSTALLATION, OPERATION AND MAINTENACE FOR REFRIGERATOR AT HEALTH FACILITIES IN KALANGALA DISTRICT

1. GENERAL SPECIFICATION

- 1.1. The contractor shall quote for the complete design, supply, installation, training of local staff, operation and maintenance and commissioning of photovoltaic solar powered refrigerator, as outlined in the specification.
 - 1.1.1. The current objectives are to design and install new photovoltaic solar power to support refrigerator system for at least 24 hours at different health facilities summarized in scope summary below; 7.8.
 - 1.1.2. And to supply, distribute, connect, install, test, and commission new refrigerator to the solar powered facilities to support the health system at different health facilities summarized in scope summary below; 7.8.
 - 1.1.3. The projects will be implemented concurrently over a period of three months.
- 1.2. The implementation will be phased or done concurrently depending on availability of funds; different vendors may cover selected health facilities to ensure timely completion. Nevertheless, the actual scope of work and distribution will depend on the affordability of the quotations submitted and competitively evaluated. Separate purchase orders shall be issued for each individual vendor, depending on the available funds. The Employer does not guarantee to issue purchase orders for any minimum amount or for a minimum number of assignments.
- 1.3. The contractor shall submit a proposal for the design and installation of a photovoltaic solar power plant/system with a nominal power output commensurate to the load requirements as may be determined and be used as a base for the purchase orders of each assignment of the project depending on funds availability.
- 1.4. The solar power installation will be locally connected without metering agreements with the local electricity distribution company.
- 1.5. The solar power installation shall include but is not limited to support structures, foundations and fixings, PV modules, inverters, control systems, circuit combiners, switchgear, metering equipment, transformers, and cabling; where applicable.
- 1.6. The contractor's complete design shall be submitted along with the quotation to the employer. This design shall include all drawings, equipment, and material specifications, in addition to methods of installation, training and maintenance plan and project programming for each element of the installation.
- 1.7. The contractor shall provide details of the manufacturer and the technical specifications for each item of equipment included in the design and quotation. This shall include separate details for all components parts of each installation. Please provide only one manufacturer/supplier for each item of equipment which shall be used as the minimum standard for the installation.
- 1.8. All designs, installation works, and equipment shall comply with local and international regulations and standards including the laws of the Energy and Minerals Regulatory Commission, the Ministry of Energy and Mineral Resources, local authorities, and the standards of the International Electro-technical Commission (IEC). The Contractor shall include for all necessary equipment, materials, and work practices to comply with these standards and regulations, even where not precisely specified in this outline specification.
- 1.9. All designs must be agreed with employer's Project Manager prior to commencement of the

contract. Notwithstanding this agreement, the contractor shall be responsible for all design works and ensuring that all installations function correctly in accordance with these designs. The contractor shall be responsible for any systems that do not function correctly because of improper design and/or improper workmanship.

- 1.10. All installations shall be designed and installed to facilitate inspection, cleaning, and maintenance and to ensure continued operation under conditions prevailing at the site, and under such voltage and load variations encountered in operating the systems.
- 1.11. All equipment shall be suitable for use from -5°C to 40°C and all external equipment shall be IP65-rated.
- 1.12. Any changes to these designs and specifications during the contract works shall be agreed with RHSP representative prior to the commencement of these installations. No payments shall be made for any additional works or changes to any aspect of the contract without prior written agreement.
- 1.13. Precise locations of all installations shall be agreed on site with Employer's management or their representatives in the presence of Employer's Project Manager (or his proxy) prior to installation.
- 1.14. The contractor shall supply and erect all necessary work signs, fencing, warning signs, lighting, safety barriers etc. required to ensure the safety of the public and workers on the site.
- 1.15. The contractor shall include for full site investigations in their system designs, including route surveys, ground testing, geo-technical, hydrological and any other testing necessary to properly design and complete the installations. The contractor shall be responsible for any difficulties encountered in site conditions that could reasonably have been foreseen or investigated.
- 1.16. All working methods employed and all plant and apparatus under this contract shall be subject to approval by the employer.
- 1.17. The Contractor shall include for all associated civil and construction works necessary for the complete installation of all equipment, including but not limited to excavations, concrete works, backfilling, earth ramming, foundations, building alterations and repairs. Pricing designs and specifications for these works shall also be fully detailed in the quotation.
- 1.18. The contractor shall be responsible for ensuring that all areas of the site are left in the same condition as prior to the commencement of these works.
- 1.19. In case water is not available on site and the contractor shall provide an adequate water supply for all installations. In case water is available, the contractor shall, in writing, enter a memorandum of understanding with the employer to stipulate the modalities of cost sharing where applicable.
- 1.20. The contractor shall maintain respect for all residents and workers at the employers. Legal action may be taken against the contractor should they threaten, coerce, or otherwise behave in a manner which negatively affects employer's population.
- 1.21. Should any incidents arise within the site that affects the work of the contractor, the contractor shall first advise RHSP for resolution of the issue. Should any serious incidents arise, which could result in the injury of persons or damage to property, the contractor shall contact employer's management immediately.
- 1.22. The employer reserves the right to assign individual contracts to separate parts of the works or to omit any section of the works detailed below from the overall contract. The employer is not bound to accept any tender or to award a contract to the lowest bidder.
- 1.23. In case employer may receive donations of specific items of equipment (e.g., inverters, solar modules), the contractor shall agree to accept these items supplied by the employer for installation as part of the contract, provided the equipment is of a suitable, approved standard and does not affect the integrity of the operation of the overall system. This shall be agreed in advance prior to the issue of any purchase orders.
- 1.24. Following the RFP/Q process, the employer will present the selected contractor with copies of letters and/or permissions to use the land/building for the purpose of constructing and operating a solar power installation on this specific site within the three campuses.

- 1.25. Specific contract details regarding penalties, incentive payments, programming, delays, bank guarantees, advance payments etc. shall be agreed later. The contractor should highlight any concerns in this regard in their tender submission.

2. HEALTH FACILITY AND LOCAL LABOUR

- 2.1. The Contractor might employ workers from the surrounding population within the locality to carry out the installations and in maintenance operations. Labor laws will apply where appropriate and this should be borne in the contractor's mind.
- 2.2. There are many qualified electricians, engineers, builders, and laborer's living around the township and suitable workers might be identified by the contractor from the localities. Candidates for skilled positions shall be subject to tests and interviews to evaluate their level of expertise before engagement.

3. TRAINING PROGRAM

- 3.1. The contractor shall undertake to train at least 3 staffs on operation and maintenance of solar PV installations and equipment immediately after tested completion.
- 3.2. Each person should sign for acknowledging successfully completed training. Contractor is to propose a training plan to staffs as part of the technical proposal.

4. ENVIRONMENTAL, HEALTH AND SAFETY CONSIDERATIONS

- 4.1. All packaging and wastes associated with the installations shall be carefully disposed of in accordance with the laws or public health facility norms.
- 4.2. The contractor shall be responsible for ensuring that waste materials, packaging, and any other items associated with these installations, do not get blown or otherwise distributed around the site. They shall also be careful not to create excessive dust or debris in any area. Any costs incurred in cleaning wastes or debris generated by the contractor shall be charged to the contractor.
- 4.3. The contractor shall be responsible for repairing and/or replacing anything which has been damaged by the contractor or their sub-contractors within the site. They shall also be responsible for the cleaning of any debris, wastes or other items created during these works.
- 4.4. The contractor shall be responsible for ensuring that all its staffs shall abide by the Standard Operating Procedures (SOPs) aimed at managing pandemic occurrences. All necessary Personal Protection Equipment (PPE) shall be always available to staffs and failure to withstand such requirements may lead to dismissal of contractor's staff by any responsible beneficiaries without prior notice.
- 4.5. The contractor shall, as required by practice to offer Corporate Social Responsibility (CSR) services: through promotion of health trainings/messaging on common epidemics like HIV/AIDS, among others.

5. PREVIOUS PROJECT EXPERIENCE

- 5.1. The contractor shall submit details of previous similar projects completed by the contractor (and for any proposed subcontractor), outlining the suitability and capacity of their operation to carry out these works. The Contractor shall also provide details of the experience and qualifications of the key personnel proposed for the project.
- 5.2. The contractor must have completed at least four solar photovoltaic power design and installation tasks with single project size of 500kWp or greater, which must be in operation for at least 2 years, and at least one solar design and install project in the region, or preferably in Uganda. Clear details of the employer for this particular installation shall be stated in the proposal.
- 5.3. The contractor must have experience in the operation and maintenance of a solar power plant/installation of minimum 500kWp for at least 2 years.
- 5.4. The Contractor must have a registered operation in Uganda or an established partnership with suitable local sub-contractor/implementation partner.

- 5.5. Any local subcontractor/implementation partner proposed by the contractor, must be in operation for a minimum of 2 years in the supply, installation and maintenance of solar PV systems or related systems (MEP, solar thermal) within Uganda.
- 5.6. The contractor and/or sub-contractor must have adequate full-time employees with demonstrated relevant experience and expertise to implement this solar PV project. They should be registered professionals with the Engineering Association and law-abiding citizens.
- 5.7. The contractor and/or subcontractor must have a single solar PV project of minimum size 500kW for which they have taken through the required government, Regulatory Authority, National Electric Power Company and/or electrical distribution company approval processes in Uganda. The contractor shall provide an outline of the steps required to obtain all necessary permissions and approvals for the solar power plant/installation where applicable.

6. CONNECTION APPROVALS AND APPLICATIONS PROCEDURE

- 6.1. The Contractor shall allow for connecting the solar power plant/installation to existing installations which run within the facility if such requests come and fall within any supply contingency allowed. This shall include all necessary junctions, transformers, insulators, and any other items required to facilitate these connections. In all aspects, approvals must be sought before execution of the additional works, but should such works be undertaken without approval, it shall be deemed an act of good cooperation and not reimbursable/compensable.
- 6.2. All equipment to be supplied and installed by the contractor in the power plant/installation shall be subject to approval by RHSP. The contractor shall confirm that their proposed equipment meets minimum standards.
- 6.3. All necessary permits, load impact studies, environmental impact studies, geo-structural surveys, and any other required studies, certificates and licenses shall be organized and coordinated by the contractor as part of this project. These shall be detailed in the contractor's offer and separately priced in the BOQ. All fees payable to regulatory body shall be made by contractor including, all other charges shall be paid for by the contractor.
- 6.4. The contractor shall provide details of the steps required in this process and any evidence of previous experience in taking a Solar PV project through this regulatory process.

7. BILL OF QUANTITIES

- 7.1. The Contractor shall prepare a complete Bill of Quantities (BOQ) for a whole task, detailing all preliminaries and general matter works and individual items necessary to carry out the installations. A typical BOQ shall include tabulation showing item number, clear specifications write up, units of measure for the specified items, quantification of the design element, predetermined and competitively built-up tender rates, algebraic arithmetically computed product, allowable discounts, all summed up in the most explicit manner in the Tender. Contractor shall provide the reviewed and completed BOQ by adding items which are deemed necessary (if any) and removing item which are deemed unnecessary (if any). The BOQ shall be submitted the following way:
 - 7.1.1. The first BOQ for a complete design and estimates must be submitted as part of the technical proposal. It must include all the items, goods and services that are needed for the turnkey installation as defined by the scope of work. This first BOQ shall not contain any price information since it will be considered for the technical evaluation of the proposal only.
 - 7.1.2. Second BOQ for a complete installation must be submitted as the Financial Offer. The second BOQ shall be identical to the first BOQ with the addition of all pricing information. Individual prices shall be shown for all separate items of equipment in calculating the totals. Unit rates shall be deemed to include all direct and indirect costs. The item costs, labor and overheads should be separately detailed in calculating the total for each item.
- 7.2. The contractor shall provide full details of all insurances and any other expenses necessary to complete the installation of the solar power supply.

- 7.3. The contractor shall include for the operation and maintenance of solar power plant/installation and shall separately price for the first six months of operation, maintenance and security of this power installation as detailed in the BOQ.
- 7.4. The contractor shall also include cost of training of 3 people, within 12 months in the installation, operation and maintenance of solar PV installation and equipment, as outlined in section above.
- 7.5. These costs will be added to the Financial Offer (BOQ with pricing information) and will be considered as the final, all-inclusive turnkey price offered by the contractor. That will be the contractor's final price to be considered for the financial evaluation! Prices in the BOQ will be used as a basis for any purchase orders for each task of the project should RHSP decide to issue purchase orders.
- 7.6. The contractor shall allow for 2.5% of the value of the works to be retained by the RHSP for 12 months after completion of the works as a guarantee against faulty equipment or poor workmanship. Should any equipment require replacement or repair during this time, the costs shall be deducted from this retention amount, should the contractor fail to make remedials thereof within reasonable time upon notice. The contractor shall furnish the client with a schedule of inspection during the defects liability period to monitor performance of the installations and will promptly notify where need rises to perform any necessary remedials.
- 7.7. It should be carefully noted that, Bill of Quantities without pricing information shall be submitted as part of the technical proposal. No information regarding pricing shall be included in the technical submission.

7.8. Scope summary

#	Activity description: Design and installation of new photovoltaic solar power to support 90liter refrigerator with specifications in annex A at:	No. of refrigerator	Location within Kalangala District
7.8.1.	Lujjabwa HCIII	1	Island
7.8.2.	Lulamba HCIII	1	Island
7.8.3.	Janna HCII	1	Island
7.8.4.	Bukasa, HCIV	1	Island
7.8.5.	Mazinga HCIII	1	Island
7.8.6.	Bubeke HCIII	1	Island
7.8.7.	Bufumira HCIII	1	Island
7.8.8.	Kachanga HCII	1	Island
	Grand total	8	

8. TECHNICAL SPECIFICATION OF WORKS

8.1. SYSTEM DESIGN

The contractor shall provide all design calculations for the output of the proposed installation. This shall include the following:

- 8.1.1. Solar irradiation at the site, detailing the average and monthly the Global Horizontal Irradiance and Direct Normal Irradiance
- 8.1.2. Output of each module and total number of modules required.
- 8.1.3. Module type, performance specifications and warranties
- 8.1.4. Mounting arrangements, inclination, and orientation of modules
- 8.1.5. Area of land/building required for total installation of design.
- 8.1.6. PV system losses
- 8.1.7. Electrical system losses
- 8.1.8. Temperature coefficients
- 8.1.9. Total Energy Produced
- 8.1.10. Performance Ratio
- 8.1.11. Total Energy output in kWh gadgets per hour(year) for solar power installation with nominal

power output required.

8.2. EXTERNAL SECURITY LIGHTING (NB; Not applicable in this scope)

- 8.2.1. The Contractor shall design and install a complete public lighting system with LED luminaires in the facility compound for the security of the installations and RHSP during night.
- 8.2.2. This shall include all necessary galvanized metallic poles, supports (foundations), fittings, connections, switchgear and cabling necessary to complete the lighting installation. Materials shall be corrosion resistant for the life of the complete system (i.e., 10 years). All parts shall be suitable for the conditions of the site in which they shall be installed.
- 8.2.3. The contractor shall provide a minimum warranty of 10 years for supports, fittings, housings etc. and 1 year warranty for luminaire components.
- 8.2.4. The Contractor shall provide a complete design for each system with their quotation. This shall include all drawings detailing pole and lamp position, minimum lux levels in each area, and, specifications of lamp performance, color temperature levels, photometric charts, and standards compliance certificates for each lighting system.
- 8.2.5. Pricing shall detail the individual costs of each type of light fitting, lighting controls, cabling, poles including substructure, and labor.
- 8.2.6. The contractor shall supply and install smart astronomic electronic time switches for the control of the public lighting circuits. These shall be 365-day programmable timers with USB port for uploading, downloading, and transferring of control programs, and shall be mounted within the distribution boards.
- 8.2.7. The lamps shall be installed at a minimum height of 5m above ground level. However, this may be adjusted to improve illumination that may be obstructed by permanent physical features at the facility.

8.3. STORAGE, WCs, AND SECURITY

- 8.3.1. There are no storage areas provided within facilities for equipment, tools, offices etc. The contractor shall allow for the supply and installation of all necessary rub halls, office caravans, WC's, electrical connections etc. to be placed within an agreed location at the facility. Should alternative options be allowable, the contractor shall have a memorandum of understanding with the facility authorities with clearly spelled terms.
- 8.3.2. The contractor shall also allow for the supply and installation of fencing and gates around these storage areas, if applicable.
- 8.3.3. The contractor shall store all tools, equipment, vehicles etc. at this location and shall also locate any administrative personnel, offices etc. at these points. The contractor shall also allow for providing security for all property and personnel at these locations to protect their property.
- 8.3.4. Facilities shall not be responsible for any damage, theft or other security issues arising at these storage areas and the contractor shall liaise directly with facility security should any assistance be required in this regard.
- 8.3.5. The contractor shall indicate the approximate area required for storage, vehicles, and administration buildings.
- 8.3.6. The Contractor shall be responsible for organizing all necessary permissions to enter the site from facility management for the duration of the contract. This shall include access passes for vehicles, equipment, personnel, and all other items necessary to complete the contract.

8.4. SITE FENCING

- 8.4.1. The Contractor shall supply and install perimeter fencing to surround and secure the complete solar power plant/installation area and all associated equipment.
- 8.4.2. This shall include all necessary foundations, fixings, supports and access gates to facilitate the operation and maintenance of the plant/installation.

8.4.3. The contractor shall provide specifications and working drawings for the proposed fencing installation and for the complete site layout, indicating locations of all items of equipment, as necessary.

8.5. OPERATION AND MAINTENANCE

8.5.1. The contractor shall include the cost for the operation and maintenance of installation and shall separately price for the first 12 months of operation, maintenance, and security of this power plant/installation. The contractor must train designated staffs in the operation and maintenance of the installation.

8.5.2. Equipment damaged during this period because of improper operations, inadequate maintenance or poor security measures shall be replaced or repaired by the contractor at their expense.

8.5.3. The contractor shall detail all personnel requirements, security measures, scheduled equipment replacements, maintenance schedules and operational procedures for the year.

8.5.4. The contractor shall include a guarantee of annual minimum energy output for the PV power plant quoted. Any shortfall in output below guaranteed minimum shall be rectified or paid by the contractor at rates chargeable at the time of the shortfall. This minimum energy output shall be detailed by the contractor in their proposal by completing the table below:

Size of PV Plant/installation	Total energy output in kWh to facility gadgets per hour	Guaranteed minimum annual output gadgets (kWh)
..... kWp		

8.6. DESIGN INSTALLATION

8.6.1. Extent of installation

The Contractor shall carry out all the necessary works for successful installation of the electrical services as described and set out in this section of the Technical Specification, Bills of Quantities, other sections of the electrical documents and accompanying Drawings in accordance with the General Electrical Specification herewith.

8.6.2. The Works,

the major elements of which are scheduled below, includes the supply of all labour, material, equipment, plant, and components necessary for complete installation and setting out work in respect of the entire electrical services requirements within the proposed development and rendering it in complete working condition in respect of but not limited to the following installations:

8.6.3. New Installations:

These shall include Supply, Installation, testing and commissioning of the following installations:

- 8.6.3.1. Solar photovoltaic panel Installation
- 8.6.3.2. Inverter installations
- 8.6.3.3. Charge controller installations
- 8.6.3.4. Battery back-up installations
- 8.6.3.5. Builders’ works associated with solar photovoltaic panels and battery installations.
- 8.6.3.6. Sub mains and distribution.
- 8.6.3.7. Electrical power distribution.
- 8.6.3.8. Lighting and power installations.
- 8.6.3.9. Trunking and cable trays.
- 8.6.3.10. Earthing and grounding systems.

8.6.4. Solar Photovoltaic Panels

8.6.4.1. Specifications

The output current and voltage of the modules or panels should be appropriate for the application and should be clearly established by the contractor from the manufacturer’s documentation and stated in the contract. The pertinent conditions are solar irradiation of Standards may be able to provide advice on

quality and finish of panels, and test new panels under local conditions where necessary. The contractor shall provide proof that the modules have been tested to IEC 61215 or IEC 61646 and that the manufacturing has ISO 9001:2000 certifications.

8.6.4.2. Locations of PV-Panels

No object (trees, buildings, etc.) should shade any part of the PV-panel at any time of the year between 90 minutes after sunrise and 90 minutes before sunset. Should shading be unavoidable, reducing the daily energy output in the system design shall compensate this for. Note that reduction in output due to partial shading will typically be much greater than the portion of the array that is shaded. PV-panel shall be installed on the roof of a building near the controller and battery bank directly below.

8.6.4.3. Orientation

The panel must be installed facing in the prescribed direction, at the prescribed angle to horizontal plane, for the location.

8.6.5. Lightning Protection

PV-panels should be installed lower than the highest point of the building. The support frame may be provided with a short lightning rod if this becomes the highest point of the building. The local National Bureau of Standards or other specialized contractors will provide expert advice in case of doubt. The contractor should make the client aware of the risks that can arise due to unsafely earthed structures. Where grounding of structures for lightning protection is needed a cable of 16mm² minimum cross-sectional area connected to a 1.5m earth spike should be used.

8.6.6. Support Structure

The support structure for panels shall be made of permanent materials, be strong enough to withstand all climatic conditions (wind, heat, water) without deflection or vibrations and be securely braced and fixed to the roof or the wall of a building or the ground. Frames, support structure and other metal parts shall be made of non-corroding materials, or protected against corrosion by galvanization, painting, etc. as appropriate for the material used. It is good practice to keep dissimilar metals separate, unless they are well sealed against water by paint or sealing compound. Calculations and supporting documentation to demonstrate adequate design may be required.

8.6.6.1. Tabulation of structural Properties:

Wind velocity withstanding	At least ≥ 40 km/hour (or values authenticated by Meteorological Center)
Structure material	Hot dip galvanized steel with a minimum galvanization thickness of 120 microns or aluminum alloy.
Bolts, nuts, fasteners, panel mounting clamps	Stainless steel SS 304
Mounting arrangement	With removable concrete ballast made of prefabricated PCC (1:2:4), M15 for RCC-flat roofs
Mounting arrangement for metal sheet roofs	Mounting directly on the sheet metal, ensuring stability, water tightness and wind withstanding capacity, or penetrating the sheet metal and fixing to the sub-structure, ensuring that the roof remains waterproof and ensuring stability and wind withstanding capacity.
Mounting arrangement for elevated structures	The elevated structure must be securely anchored to the supporting surface. Concrete foundations of appropriate weight and depth for elevated structures mounted directly on the ground. Bolted with anchor bolts of appropriate strength for elevated structures mounted on RCC surfaces.
Mounting arrangement for ground installations	With removable concrete ballast made of prefabricated PCC (1:2:4), M15; assuring enough ground clearance to prevent damage of the module through water, animals, and other environmental factors.
Installation	The structures shall be designed for simple mechanical on-site installation. There shall be no requirement of welding or complex machinery at the installation site.
Minimum distance	0.6m between roof edge and mounting structure
Access for panel cleaning and	All solar panels must be accessible from the top for cleaning and from the bottom for access to the module- junction box.
Panel tilt angle	South-facing orientation with a minimum fixed tilt angle of 24.76 degrees (depending on location).

8.6.7. Roof Mounting

Fixing to roofs shall be done so that leakages are prevented, and no corrosion of roofing materials will occur. Bolts to be fixed through top of corrugations on corrugated metal roofs, to be secured to purlins, or special supports to be fixed to the roof structure if the purlins are of poor quality. All holes in the roofing shall be thoroughly sealed and made waterproof with UV-resistant silicone sealant or suitable sealing compound.

8.6.8. Ground Mounting

This method of mounting should be avoided whenever possible. Solid foundations shall be provided at each corner of the array with additional support as required by the design of the supporting structure. Panels shall not be mounted closer than 0.8m from the ground to avoid shading by grass and other vegetation. Small arrays may alternatively be fixed to a single pole, securely buried into the ground and if necessary, secured with stays. The location shall be chosen such that animals can cause no damage and the site shall be fenced.

8.6.9. Earthing

The solar panels and combiner box shall be earthed (a combination of mat and rod) in compliance with BS 7430, BS 6004, 6651 and other relevant standards. BS 7430 outlines the elements for making a proper earthing arrangement for a low voltage installation, with a main earthing terminal, protective conductors, earthing conductors and circuit protective conductors, and the use of earth electrodes to dissipate currents to the general mass of earth.

8.6.10. Inverters

The inverters convert DC power from the photovoltaic panel array to AC power. These shall be true-sine wave grid tie inverters and shall comply with IEEE 1547 and IEEE 1547.1

8.6.11. Power Specifications

Inverters are to be specified as required depending on the loading. It shall be possible to couple them for higher power outputs and shall support charging of lithium-ion batteries.

8.6.11.1. Other inverter properties:

Property	Value
Total harmonic	<5%
Idle power consumption	<7W
Grid Tie	Yes
Efficiency	>95%
Intelligent features	Grid sell, peak load shave, generator support, prioritized consumption of battery or external DC energy
Off-grid AC coupling	Frequency control
Multi-unit operation	Single phase: up to appropriate units in parallel

8.6.12. Environmental Specifications

8.6.12.1. Operating Temperature: -10 °C to 60 °C during normal operation

8.6.12.2. Storage Temperature: -20 °C to 60 °C

8.6.12.3. Relative Humidity: >95% without condensation

8.6.12.4. Altitude: 2000m ASL without derating

8.6.13. Charge Controller

This is a device that controls the voltage and current delivered to a battery bank from a charging source, protecting the batteries from damage and preventing hazardous conditions

arising from over-charging. These will be Maximum Power Point Tracker (MPPT) type charge controllers.

8.6.14. Overcharge and Over-discharge Protection

Controllers shall be designed and installed to protect the batteries against overcharging, as well as over-discharging. Voltage disconnect/reconnect settings will depend on the type of battery. The rated capacity of the controller shall be selected to handle the maximum short circuit current from the PV-array (defined as $1.25 \cdot I_{sc} @ STC$) and the maximum load. The charge controllers and circuit breakers/fuses shall be certified under a recognized program such as the Global Approval Program for Photovoltaics. This certification shall provide the assurance that an accredited testing laboratory has tested the item to an appropriate standard or specification, that the manufacturing facility is certified to ISO 9001:2000, and that the product manufacturing is subject to periodic auditing.

8.6.15. Warning of Over-discharge

A warning system consisting of a light and or an audible alarm providing at least three minutes advanced warning of disconnection should be installed. Where the controller is installed in a room, which is not regularly used, a remote alarm should or may be installed at a place where it can be easily noticed.

8.6.16. Bypass of Over-discharge Protection

Essential Service (ES) circuits may be provided with a switch to facilitate bypass or the over-discharge protection or to bypass the regulator completely. Warning for low battery shall however be included as for Non-Essential Services (NES). The owner's manual and markings on the bypass device should clearly indicate the implications and potentially irreversible damage that may be caused by bypassing this protection.

8.6.17. Circuit Breakers/Fuses

The system shall be protected against damage due to accidental short-circuits by use of fuses or circuit breakers. Consumer circuits shall have circuit breakers. Individual circuits from the battery shall have a maximum rated capacity of 15 Amperes for sockets and 6 Amperes where not otherwise specified. Each circuit shall be so designed that the peak demand does not exceed 80% of the rated capacity of the fuse or circuit breaker.

8.6.17.1. Installation

Required circuit breakers may be integrated in the controller box or installed separately in a distribution box positioned near the controller and battery. Each circuit breaker shall be clearly marked with rated capacity and for which circuit it is used.

Property	Value
Nominal Battery Voltage	24, 36 and 48VDC
Max. PV array open circuit voltage	600VDC
Power conversion efficiency	>94%
Nighttime power consumption	<1w
Degree of protection	IP20(protected against ingress by solid
Battery Type	GEL
Regulatory approval	UNBS (Uganda National Bureau of
MPPT Operation	Yes

8.6.18. Battery

8.6.18.1. Type

Batteries shall be lithium-ion type suitable for PV applications. Deep discharge and long cycle life batteries are recommended.

Note: Conventional car/truck starter batteries are NOT acceptable. The batteries must comply with BS EN 60086-4:2000, IEC 60086-4:2000 for photovoltaic systems (under development).

Property	Value
Technology	Smart Lithium Ion
Voltage	12VDC
Capacity	200AH
Life Expectancy	>4000 cycles
Auto Low voltage cut-off	8VDC
Auto Over voltage cut-off	16VDC

8.6.18.2. Installation

Batteries shall be installed in securely lockable fabricated, primed painted mild steel metallic grilles of not less than 25x25x1.5mm SHS boxes, racks, or cupboards to protect the connections (terminals) against accidental short-circuiting while still being accessible for checking. At least 25mm free space shall be left between the batteries, the wall, and the top of the box. Ventilation of the enclosure shall be ensured to avoid buildup of explosive gases during charging. The box shall be made of suitable durable materials. If made of wood, it shall be well preserved against insects (termites), rot and acid. The box must be securely fixed in position. Each battery shall be marked with the date of manufacture and year and month of installation by the installer. Maintenance requirements shall be clearly laid out in the owner's manual and preferably summarized, sealed(laminated) in transparent polythene materials and pinned around the box.

8.6.19. Electrical distribution (Only where applicable)

8.6.19.1. Scope of Work

The Contractor shall supply and install, test and commission new distribution cables as indicated on the drawings and the specifications to complete the electrical distribution system, all in accordance with the IEE Wiring Regulations BS 7671.

8.6.19.2. Sub-main Cables

The Contractor shall supply new PVC insulated or armored cables with stranded copper conductors as shown on drawings. All low and medium voltage cables shall be rated at 600/1000 Volts and shall comply with the relevant British Standard or other approved international standards. The Contractor shall supply, install, test, and commission the entire sub-main cable system. All the sub-main cables to consumer units for lighting and power shall be drawn in conduit/ducts concealed in walls, floors, and ceilings slabs of the buildings.

8.6.19.3. Distribution Boards

The Contractor shall supply new distribution boards of the surface/flush mounted metal enclosure type complete with MCBs. The Contractor shall ensure that each distribution board is complete with hinged lid and is so constructed that the circuit breaker toggles are concealed when the lid is closed. An isolating switch integral within the boards shall control the distribution boards. The Contractor shall ensure that all circuit breakers are provided with thermal overload and magnetic short-circuit tripping and a quick trip-free mechanism. The Contractor shall ensure that the necessary discrimination between each main panel and final sub-circuit is provided. The Contractor shall ensure that circuit breaker and distribution boards used throughout the installation are of the same pattern, range, and manufacture and all MCBs have short circuit capacity not less than 10kA.

The final fixing and mounting height of each board and other associated switchgear shall be agreed on site to suit the plant, benches, trunking, services, cupboards etc. The rating of all distribution boards breakers shall not be less than 63Amp.

Where surface boards are installed sub-circuit conduits shall be suitably terminated within adaptable conduit boxes, flush mounted behind the surface mounted distribution board. The Contractor shall ensure that this is correctly done.

8.6.19.4. Consumer Units

The Contractor shall supply new as appropriate the consumer units of the flush mounted metal enclosure type complete with MCBs and isolating switches, like those described under necessary Clauses.

8.6.19.5. Contactors

The Contractor shall ensure that contactors where required are suitable for continuous heavy duty and fitted with 240 voltage coils. They shall be of robust construction to BS 775 or approved equivalent standard where applicable and rated at not less than the current carrying capacity of the outgoing circuits. *NB: This section is not applicable to this solar system design.*

8.6.19.6. Armoured Cables

The Contractor shall ensure that underground cables (PVC/SWA/PVC) are made of stranded copper conductors. The cables shall be rated at 600/1000 volts grade to BS. 6346 or approved equivalent international standard. The cables shall be terminated in brass compression type glands of the correct size to secure the cable inner sheath and ensure effective electrical continuity between the cable armouring wires and the metal enclosure on which the cable is terminated. A copper earth link shall be provided at the cable termination point for earthing of the cable armour and cable gland to the sub-boards earthing point.

8.6.19.7. Electrical Distribution System

The Contractor shall be fully responsible for the necessary liaison and co-ordination of all works on site. The final cable routes and layouts are to suit pipe work, drainage, cables foundations and the like. The Contractor shall produce Drawings for approval indicating the alternative proposed routes of cables. These shall in general follow an agreed service reserve decided by the contractor's Engineer, in conjunction with the Employer's engineer (RHSP).

8.6.20. Lighting Installation

8.6.20.1. Scope of the Work

The Contractor shall supply, install connect, test and commission the lighting fittings as shown on site and set out in the Schedule.

8.6.20.2. General

The lighting installation shall be generally concealed throughout, the conduits being run above the false ceilings, cast within the concrete slabs, or chased into the walls. The various positions for all lighting fittings are as indicated on the drawings. These, however, are subject to minor changes and adjustment to suit the false ceiling details and the locations of services and facilities.

All supports, fixings, the like to be supplied and ceiling arrangement under this contract, shall be the contractor's responsibility. Where false ceilings are provided, all openings, services access, trims, suspensions, and connections to suit the fittings supplied, are to the approval of RHSP Engineer.

The position of the various electrical item switches, lighting points, sockets, telephone points, television points etc. shall be marked on site prior to chasing. The contractor shall invite the engineer to inspect the points prior to casting of slabs or chasing of walls. The contractor shall ensure consistency of his installations.

8.6.20.3. Method of Wiring to Fittings

The circuit wiring shall be continuous throughout on a loop-in loop-out system and there shall be no joints other than at the lighting fitting positions/boxes. The final connections to lighting fittings shall be from a conduit box complete with domed lid and cord grip. The circuit wiring terminating within the box at a suitably rated terminal block and wiring (via the cord grip) to the fitting carried out in recommended flexible and twin cables in 3-core PVC/PVC cable. Flexible cables shall be used in DC and twin used in AC lines. The lighting fittings shall be wired, in general, with 1.5mm² single core PVC cables, the final connections to all fittings being carried out in heat resisting cable. The Contractor shall inspect to ensure that this is correctly done on site.

8.6.21. Power Installation

8.6.21.1. Scope of the Work

The Contractor shall supply, install, test and commission the power installation as shown on the Drawings.

8.6.21.2. Ampere Switched Socket Outlets

The circuit wiring is rated/sized to IEE Regulations and shall not be less than 2.5mm² PVC. The wiring shall be inside conduits and/or trunkings to suit the requirements of the area, a concealed installation being provided throughout. The phasing and circuit wiring for all socket outlets, power outlets and lighting circuits shall be agreed. Details shown on the Drawings are, at this stage, for information only.

The contractor shall ensure consistency of his installations and all socket and power outlets shall be fully earthed and bonded-up complete, especially, where located and mounted close to sinks, taps, etc. All sinks, taps and water pipe work and appliances shall also be fully bonded up as required by the relevant IEE Wiring Regulations BS 7671 to ensure equipotential between all items.

8.6.21.3. Isolators

Isolators of the indicated ampere ratings shall be supplied and installed for connection to the various items as indicated on the drawing.

8.6.21.4. Motor Control Cubicle

The motor control cubicle shall be supplied and erected as required for the installation. It shall be complete with switchgear, starters with all types of protections, facility for remote control, instruments, relays, lights for start/trip and items necessary for the complete installation and setting to work. The control cubicle is of the industrial enclosed cubicle type, constructed and installed as described for the LV switchboard. The Contractor shall submit the details to the Engineer for discussion and approval prior to the manufacture.

8.6.22. Cables, Wiring and Accessories

This section of the Specification includes the inspection, delivery to site, unloading, complete installation, putting into commission and handing over in the approved working order, the whole of the main and auxiliary power cables and other cables and wiring as detailed herein and in the tender.

8.6.22.1. Scope of work

The work includes the supply, delivery and erection of all cable racks, cable cleats, conduits, trunking, pipes, Unistrut and fittings required for the support and accommodation of the cables and wiring, grouting of rag bolts for the fixing of cable racks, supports, and all required trenching. The work also includes the installation of cables and wiring within the trenches, conduit, trunking and the proper protection, marking and terminations of all such cables.

Jointing of cables shall not be permitted under this contract, as the distances are short and therefore continuous cable lengths can be used. However, where the Engineer permits joints for any reason they shall be of an approved type and manufacture and of the cast resin type. Where joints are required for control cables, they shall be housed within a purpose made concrete pit with lid and jointed/terminated such that testing can easily and readily be carried out. The cables shall be as manufactured and tested in accordance with the appropriate International Standards as applicable.

8.6.22.2. Standards applicable:

8.6.22.2.1. Copper conductors shall be provided throughout and shall comply with BS 6360/IEC 228 or BS 4109 or approved equivalent.

8.6.22.2.2. PVC (Polyvinyl Chloride) insulation and PVC sheath shall comply with BS 6746/IEC 227 and BS 6346 or approved equivalent.

8.6.22.2.3. Non-armored PVC insulated cables shall comply with BS 6004/IEC 227 or approved equivalent.

8.6.22.2.4. Armored cables with XLPE insulated copper conductors (25 mm² cross sectional area or higher) where used shall comply with BS 5467/IEC 502, IEC 811, or approved equivalent.

8.6.22.2.5. The tenderer should submit a fully detailed technical description and manufacturing data of the cables offered together with full test certificates of all cables and wiring provided.

8.6.22.2.6. All cables shall be delivered to site in the same coils as dispatched from the manufacturer and the labels showing size, type and length and shall be removed only in the presence of the Engineer or his representative and handed to him.

8.6.22.2.7. All cables and wiring shall be of adequate rating in accordance with the relevant IEE Wiring Regulations BS 7671:2001(2004), 17th Edition (or latest), protected in conduits or trunkings, placed on cable trays, in underground pipe ducts or trenches, or when cleated to Unistrut inserts etc. safe-guarded to prevent danger.

8.6.22.2.8. The Contractor shall agree with the Employer's Engineer/representative route of all cables, conduit and cable trunking and shall not install such trunking or conduits until agreement and approval has been given.

8.6.22.2.9. The main supply cables shall be extended from the LV switchboard position in the service areas. It will be necessary for the Contractor to liaise with employer's Engineer/representative when finalizing the cable routes.

8.6.23. Types of Cables, Conditions and Wiring

8.6.23.1. Power Cables

In general, these shall be multi-core cables, insulated with PVC single wire armored and PVC outer sheath. These cables are 600/1000-volt class to BS 6346, the conductors being copper. The numbers of cores are as indicated on the drawings and these cables shall be used for all LV distribution requirements where indicated.

For XLPE/SWA/PVC cables, 600/1000-volt class to BS 5467 for cable sizes of 25 mm² or higher shall be used where indicated.

8.6.23.2. Control/Alarm Cables

Multi-core control cables are PVC/SWA, and PVC sheathed overall where run in the ground with every core color coded. Conductor sizes are to suit, and details of cores and cable lengths are set out in the Drawings. Details of cables offered are to be forwarded with tender.

8.6.24. Domestic, Lighting and Small Power

In general, these shall be PVC insulated single core cables with stranded copper conductors, to meet the general requirements of the installation.

8.6.24.1. Terminations of Cables

The ends of each PVC, SWA, PVC cable shall be terminated in brass compression-type cable-glands of the correct size which shall secure the cable inner sheath and ensure effective electrical continuity between the armor wires and the cubicle metal enclosure in which the cable is terminated. Where cables are required to be terminated in terminal boxes or other items of plant which have not been supplied by the Contractor, the Contractor shall be responsible for completing the terminations in accordance with the requirements specified above, including testing, and verifying of the correct phase sequence of the cores. Cables shall be identified inside all manholes at the cubicle terminations by tags made of brass, PVC or other types of insulating materials on which circuit identification marks shall be indelibly inscribed. Power cables shall have phase identification on each core done on tags made of crimped or sweated sockets of the correct size. Control and protection cables shall have each core identified by an insulated numbered ferrule. All instrumentation cables shall have their armors or screens earthed at only one end preferably at the control cubicle end.

8.6.24.2. Cable and Wiring Tests

On completion of the installation, the cables shall, in the presence of RHSP Engineer or his representative, be subjected to the following tests as laid down in the IEE Wiring Regulations BS 7671:2001(2004), 16th Edition, and the Electric Power Act (1997).

8.6.25. Insulation level

8.6.25.1. Polarity

8.6.25.1.1. Voltage Drop

The Contractor shall inspect, test, and ensure that the size of every cable conductor is such that the drop in voltage from the main LV switchboard to any point in the respective installations shall not exceed 4% of the normal declared voltage.

The Contractor shall inspect, test, and ensure that the final circuit wiring for small power and lighting circuits shall not be less than 1.5 and 2.5mm² respectively as stated.

8.6.25.1.2. Conduits

In general, the installation shall be surface throughout and shall be fixed by distance type spaced at not more than 900mm apart.

Unless otherwise installed on site all surface conduits used shall be white rigid super high impact heavy gauge 25mm diameter PVC in accordance with BS.

Conduits installed on surface shall be supported with saddles every 60mm.

Conduit PVC connections shall either be by a demountable (screwed up) or adhesive fixed and made watertight. The tube and fittings must be clean and free of all grease before applying the adhesive. When connections are made between conduit and switch boxes, care shall be taken that no rough edges or conduit stick out into the boxes.

Conduit accessories and fittings for the heavy-duty PVC conduit shall match fully the requirements of the conduit used and shall be agreed.

The drawings with these specifications indicate the approximate positions only of points and switches, and it shall be the Contractor's responsibility to mark out and center on site the accurate positions where necessary in consultation with RHSP Engineer and the health facility. The Contractor shall be responsible for the accuracy of the final positions.

Conduit outlets and junction boxes, where used in conjunction with PVC conduit, are to be PVC manufactured to BS 4607: Part1, 1970.

Outlet boxes for lighting fittings are to be of the loop-in type where conduit installation is concealed and the Contractor shall allow one such box per fitting, except where fluorescent fittings are specified when two such boxes per fittings are used. However, florescent shall not be used in this case.

Where applicable, it shall be entirely the Contractor's responsibility to ensure that conduits and other equipment, are installed at the appropriate stage of building progress, and no extra payment shall be made for chasing, boring, cutting or any other work arising from failure to meet this requirement.

Conduits are installed in such a manner that all cables can be drawn-in after erection by means of a draw-in tape.

Where a steel conduit system is required and specified the exposed outlet boxes shall be cast metal type and flush boxes shall be cast or sheet metal. No knockouts shall be removed unless used. Where conduits enter sheet metal boxes, they shall be lock-nutted back and front. Burrs and obstructions shall be removed before installation of boxes and conduits.

No conduit shall be smaller than 20mm nor shall accommodate more than 75% of the conductors permitted under the IEE wiring regulations.

Conduits to be concealed in structures cast-insitu are or shall be secured to the steel reinforcement work with heavy binding wire, spaced not more than 900mm to prevent movement of conduit boxes during the pouring and vibrating of the concrete. Outlet boxes shall be filled with paper to prevent ingress or concrete, and all boxes shall securely fix to the shuttering with nails or other measures, which must not be visible after removal of the shuttering unless they later can be concealed e.g., by plaster. Conduits shall be installed after the chasing work has been completed. Couplings plugged with a suitable non-metallic stopping plug shall protect all open ends of conduit.

Conduit run in chases in walls, or the like shall be fixed by means of mild steel pipe hooks or saddles spaced at not more than 900 mm. Where the conduit is concealed behind the plaster it shall be sunk 20 mm below finished plaster level before application of the plaster. Surface conduit shall also be fixed 200 mm from boxes, the boxes themselves being securely fixed. Where such an arrangement of boxes and saddles would prove to be both unsightly and unnecessary, short lengths of conduit not exceeding 900mm between boxes need not be secured further than by connection to the adjacent boxes. In such cases the Engineer reserves his right to insist upon having additional fixings provided should he for any reason whatsoever consider additional fixings necessary.

Special care should be taken to prevent dirt and plaster to enter any section of conduit system.

All bends in conduits shall be formed without any decrease or increase of the cross-section diameter of the conduits. The radius of the bend shall not to be less than indicated by British Standard. For concealed work, this radius should be increased. No manufactured tees, elbows, and bends will be permitted. All conduits shall be thoroughly cleaned for sharp edges.

The conduits shall be installed avoiding unnecessary bends or changes in directions. Conduits shall be laid in straight lines. Where straight rows of conduits are installed, inspection boxes

shall be placed at not more than 15-meter intervals. There shall not be more than 4 easy bends or 2 right-angle bends between boxes.

Sub-mains conductors shall not be bunched in the same conduit as other circuits.

Lighting sub-circuits shall not be enclosed in the same conduit as general-purpose power sub-circuits.

Single-phase sub-circuits shall not be enclosed in the same conduit as three-phase sub-circuit.

8.6.26. Cable Trunking

The Contractor shall supply new install, test all single, two and three compartments cable trunking installed on the site to ensure that they are electrically and mechanically sound. All trunking are or shall be provided with removable covers of an agreed and appropriate length for handling, removal and servicing. The color of the trunking shall be agreed to suit the Employer, the Contractor including in his prices for factory painting in a color agreed with the Architect.

In general, a renowned company shall manufacture all trunking. The cable trunking shall be made from hot galvanized sheet metal and approved to CEI 23-31 standards. It shall be factory painted externally where normally visible to match the finish of the walls as approved by the Architect and to suit the requirements of the other areas as agreed. A continuous cover of the same material is provided and fitted, for all areas except as for the laboratory trunking and cover screws so arranged that no sharp protrusions occur within the wiring space.

The mounting height of the trunking shall be agreed in general and shall be skirting in all working areas.

The trunking shall be complete with all supports, tee-pieces, angles, fixings, fillets, couplings, bends etc. as required and as necessary to complete the installation.

The trunking shall be sized in compliance with the capacity; the Contractor shall therefore inspect and ensure that the size all trunkings comply with this requirement.

Each conduit take-off from the cable trunk shall be lock-nutted on both sides, with no excess conduit protruding into the cable trunk unless it is properly bushed.

The Contractor shall inspect and ensure that the maximum number of cables in the trunkings shall be that in aggregate would occupy 50% of the cross-sectional area of the trunking.

UPVC trunking shall, unless otherwise specified be manufactured to BS 5750 part 2. All sections shall be rigidly fixed together and fixed to building structure at intervals of not more than 1200mm.

8.6.26.1. Cable Tray

The Contractor shall inspect and test to ensure that cable trays are manufactured of perforated enameled steel plate with returned flanges and with suspensions at intervals of not more than 1000mm. The final sizes shall be determined by the Contractor to suit the requirements of the installations.

8.6.26.2. Continuity

The Contractor shall inspect, test all conduits, cable trunking and cable tray to ensure that they are mechanically and electrically continuous throughout. Where steel conduits cross expansion joints, flexible steel conduit sections, PVC sheathed are inserted, or other approved means used to provide the necessary continuity and flexibility.

8.6.27. Load Balancing

Where applicable, the Contractor shall test and ensure that the electrical load in respect of the entire installation is balanced to the satisfaction of the Engineer. The Contractor shall carry out

such alterations to the power off takes at the switchboard and at the distribution/control cubicle connections as may be required to balance the electrical load of the installation.

8.6.28. Labels

All items of equipment, apparatus and the like should be clearly labelled, labels being as previously specified. Starters controlling motors shall be labelled identically such that the motor and starting are readily identified.

8.6.29. Earthing

The Contractor shall install, test and commission the entire earthing installation in accordance with the IEE Wiring regulations BS 7671. The entire system of metallic conduits and trunking, metallic sheaths of cables, cases and enclosures of switchgear and electrical apparatus shall be connected to the earth point, according to the current rules and regulations. The Contractor is reminded that the resistance of the earth conductor from the earth-electrode to any point in the earthing system shall not exceed 0.5 ohms.

The Contractor shall supply and install all additional conductors, cables, tapes, earthing rods, inspection pits and all associated items for the installation of the complete earthing system.

The Contractor shall carry out earth resistivity tests to determine the best location for the main earth electrode. The results of such tests shall be clearly indicated on a site plan and submitted to employer's Engineer for approval 21 days prior to locating of the main earth electrodes.

The earth tape or cable between the main earth terminal and the earth electrodes shall be of high conductivity copper.

The earthing shall be carried out to an externally positioned inspection/earthing rod pits by means of copper tape (25x3.5mm) or the equivalent stranded copper conductor. The pits shall be complete with an inspection lid such that access to the rods shall be readily available. The number of pits or rods will be dependent upon the values recorded during the testing and it shall be deemed that the Contractor has included in his tender for all necessary materials to meet the requirements.

The earthing requirements, while being in accordance with the power supply authority regulations, shall also be fully in accordance with the requirements of the Institution of Electrical Engineers, Wiring Regulations BS 7671:2008, requirements for electrical installations, together with the British Standard Code of Practice BS 7430:1991.

The Contractor shall include for the bonding up complete of all sinks, taps, pipe work, metal branches and other similar items as required by the IEE Wiring Regulations, all details shall be agreed, this being particularly important in kitchen areas, pump houses and toilets.

8.6.29.1. The earthing/grounding method

A combination of earthing mat & rod has been preferred in this case and the contractor's design and installation shall follow suit according to standards which yield an effective defense system. All accompanied with detailed drawings which will be used as a basis for evaluating an explicitly comprehensive Bills of Quantities in commensuration with the work. If the rod faces ground resistance, another or more pits with copper mat shall be accepted to attain the required resistance.

Earthing mat is made by joining several copper taps of 25x3.5mm at spacings not exceeding 250mm each way and the overall size should not be less than 1square meter. It reduces the overall grounding resistance. Such type of system helps in limiting the ground potential. Earthing mat is mostly used in a place where the large fault current is to be experienced. While designing an earth mat, standard procedures shall be adhered to and similarly with the rod.

8.6.29.2. Constructing an earth pit

Earth pit is a pit in which connection is made between earthing electrodes that have been placed inside the soil and the earthing conductor that connects the electrical installation. In all aspects of designs for this work, typically but not limited, the following is an overview of the construction procedure of an earth pit which shall be costed by the contractor regarding earthing/grounding designs proposed.

#	Activity Description
8.6.29.2.1.	Excavate a pit of not less than 4feet by 4feet by 4feet (1.2x1.2x1.2meters depth).
8.6.29.2.2.	Lay the earth mat & drive the earth rode by three quarters to the ground.
8.6.29.2.3.	Make joints with heavy duty earth clamp to both the earth mat & earth rod with the earth wire from the installation.
8.6.29.2.4.	Add a mixture of crushed charcoal, rock salt, sand & water to a depth of 1.5ft-2ft.
8.6.29.2.5.	Cover the pit with loam soil or soil of equal attributes.
8.6.29.2.6.	Construct a complete and suitable standard inspection chamber in the right materials.
8.6.29.2.7.	Test the system with megger earth tester (or unless otherwise agreed alternative).
8.6.29.2.8.	Record the readings and determine suitability (10 ohms and below)

8.6.29.3. Testing and Commissioning

In addition to the requirements given under previous clauses of the Specification, the requirements given in this clause shall also apply to the inspection, testing and re-commissioning of the complete installation.

The Contractor shall be responsible for testing and commissioning the installation to ensure that it is in proper working order to the satisfaction of the employer's Engineer.

After inspection, testing and commissioning the installations, each part of the system shall be subjected to tests in accordance with the relevant international standards and the requirements of the power supply authority. In addition to these tests, the whole of the installation shall be subjected to complete functional tests to the satisfaction of the employer's Engineer.

Any defects, faults or omissions made apparent by such tests shall be corrected and re-tested to the satisfaction of the employer's Engineer.

9. ANNEXES

9.1. ANNEX A: Refrigerator Specification

#	Specifications	
9.1.1.	Gross capacity (refrigerated space)	90 liters
9.1.2.	Freezer compartment that can provide	Negative (-)20 °C
9.1.3.	In put voltage	12V DC
9.1.4.	Door	Single
9.1.5.	Color	Silver
9.1.6.	Temperature range	+2 to +8 degrees Celsius

Table of Forms

- i. Suppliers Bid Form
- ii. Price Schedule Form
- iii. Performance Security Form (Bank Guarantee)
- iv. Vendor Information Sheet (VIS)
- v. Supplier Code of Conduct

RFP/SP

BID FORM

Date: _____

To: **The Chairperson**
Bids Evaluation and Award Committee (BEAC)
RHSP
[insert Mission address]

We, the undersigned, declare that.

Having examined the Bidding Document for the *[insert project name and IFB No.]*, issued on *[insert date]*, the receipt of which is hereby duly acknowledge, I, representing *[insert name of company]* offer to complete the *[name of Contract and brief description of Services]* in conformity with the Bidding Document for the total fixed lump sum price of *[insert total bid amount in words and figures and currency]*.

I undertake, if my Bid is accepted, to provide services in accordance with the Price Schedule specifications set out in the Bidding Document.

If my Bid is accepted, I will obtain the guarantee of a bank in a sum equivalent to 5 million shillings for the due performance of the Contract, in the form prescribed by RHSP per lot.

I agree to abide by this Bid for the Bid Validity Period for 60 days from the time of bid closing

Until a formal contract is prepared and executed, the Bid, together with your written acceptance thereof and the Notice of Award, shall constitute a binding agreement between us.

I hereby certify that the Bid complies with the requirements stipulated in the Bidding Document.

Dated this _____ day of _____ 20_____.

[signature over printed name]

[in the capacity of]

Duly authorized to sign Bid for and on behalf of *[name of company]*

PRICE SCHEDULE

Item Lot.	Description of Goods	Unit	QTY	Unit Price (UGX)	Amount	Grand Total Price (UGX)

Name of Bidder: _____

Signature of Bidder: _____

Date: _____

PERFORMANCE SECURITY (Bank Guarantee)

To: *[name and address of Employer]*

WHEREAS *[name and address of Supplier]* (hereinafter called “the Supplier/ Vendor”) has undertaken, in pursuance of Contract No. *[number]* dated *[date]* to execute *[name of Contract and brief description of Services]* (hereinafter called “the Contract”);

AND WHEREAS it has been stipulated by you in the said Contract that the Supplier shall furnish you with a Bank Guarantee by a recognized bank for the sum specified therein as security for compliance with his obligations in accordance with the Contract;

AND WHEREAS we have agreed to give the Supplier such a Bank Guarantee.

NOW THEREFORE we hereby affirm that we are the Guarantor and responsible to you, on behalf of the Supplier, up to a total of *[amount of Guarantee]* *[amount in words]*, such sum being payable in the types and proportions of currencies in which the Contract Price is payable, and we undertake to pay you, upon your first written demand and without cavil or argument, any sum or sums within the limits of *[amount of Guarantee]* as aforesaid without your needing to prove or to show grounds or reasons for your demand for the sum specified therein.

We hereby waive the necessity of your demanding the said debt from the Supplier before presenting us with the demand.

We further agree that no change or addition to or other modification of the terms of the Contract or of the Goods to be performed thereunder or of any of the Contract documents which may be made between you and the Supplier shall in any way release us from any liability under this Guarantee, and we hereby waive notice of any such change, addition, or modification.

This Guarantee shall be valid until a date 28 days from the date of issue of the Certificate of Completion.

Signature and seal of the Guarantor _____

Name of Bank _____

Address _____

Date _____

ADVANCE PAYMENT SECURITY (Bank Guarantee)

To: [name and address of RHSP]

Contract: [name of Contract]

Gentlemen:

We have been informed that [name of Supplier] (hereinafter called "the Supplier") has entered into Contract No. [reference number of the contract] dated [insert date] with you, for the supply of [brief description of goods & related services] (hereinafter called "the Contract").

Furthermore, we understand that, according to the conditions of the Contract, an advance payment in the sum of [amount in figures & in words] is to be made against an advance payment guarantee

At the request of the Supplier, we [name of Bank] hereby irrevocably undertake to pay you any sum or sums not exceeding in total an amount of [amount in figures and in words]¹ upon receipt by us of your first demand in writing accompanied by a written statement stating that the Supplier are in breach of their obligation under the Contract because the Supplier have used the advance payment for purposes other than toward providing the required Services under the Contract.

We further agree that no change or addition to or other modification of the terms of the Contract or of Services to be supplied thereunder or of any of the Contract documents which may be made between [name of RHSP] and the Supplier, shall in any way release us from any liability under this Guarantee, and we hereby waive notice of any such change, addition, or modification.

This Guarantee shall remain valid and in full effect from the date of the advance payment under the Contract until [name of RHSP Mission] receives full repayment of the same amount from the Supplier.

Yours truly,

Signature and seal: _____

Name of Bank/Financial Institution: _____

Address: _____

Date: _____

¹ The Guarantor shall insert an amount representing the amount of the advance payment and denominated either in the currency of the advance payment as specified in the Contract, or in a freely convertible currency acceptable to RHSP.

VENDOR INFORMATION SHEET (VIS)

Name of the Company _____

Address Leased Owned Area: _____sqm

House No _____
Street Name _____
Postal Code _____
City _____
Region _____
Country _____

Contact Numbers/Address

Telephone Nos. _____ Contact Person: _____
Fax No. _____
E mail Address _____ Website: _____

Location of the company

Nature of business

Corporation Partnership

Business License No.: _____ Place/Date Issued: _____ Expiry Date _____

No. of Personnel _____ Regular _____ Contractual/Casual _____

Complete Products & Services

Payment Details

Payment Method Cash Check Bank Transfer Others

Currency Loc. Currency USD

Terms of Payment 30 days 15 days 7 days upon receipt of invoice

Advance Payment Yes No % of the Total PO/Contract

Bank Details:

Bank Name

Bank Account Name

Bank Account No.

Swift Code

Key Personnel & Contacts (Authorized to sign and accept PO/Contracts & other commercial documents)

Name	Title/Position	Signature
_____	_____	_____
_____	_____	_____
_____	_____	_____

Companies with whom you have been dealing for the past two years with approximate value in US Dollars:

Company Name	Business Value	Contact Person/Tel. No.
_____	_____	_____
_____	_____	_____
_____	_____	_____

Trade Reference

Company	Contact Person	Contact Number
_____	_____	_____
_____	_____	_____
_____	_____	_____

Banking Reference

Bank	Contact Person	Contact Number
_____	_____	_____
_____	_____	_____
_____	_____	_____

RHSP SUPPLIER ETHICAL CODE OF CONDUCT

This code applies to all RHSP suppliers (defined as a person or company or Organization supplying a product or service to RHSP) and applies to all products and services that RHSP purchases. The supplier is expected to comply with the standards set out in the code of conduct.

i. COMPLIANCE WITH LAWS AND REGULATIONS

The supplier shall adhere to all applicable laws and regulations in which the operate. This includes legal environment requirements like tax laws, labor laws, trade laws, among others.

In addition, RHSP encourages its suppliers to strive to comply with international and industry standards and best practices.

ii. BRIBERY AND CORRUPTION

Corruption, extortion, and embezzlement in any form are strictly prohibited. Bribes or other means of obtaining undue or improper advantage are not to be offered or accepted. In no circumstances shall the supplier offer bribes or facilitation payments or grant any advantage, whether directly or indirectly, or entertainment to RHSP officials with the aim of influencing it's decision or encourage the supplier to secure an improper advantage of RHSP.

Violations of these principles will result into termination of business relations with RHSP.

iii. CONFLICTS OF INTEREST

The supplier shall avoid all conflicts of interest in dealing with RHSP. Any conflict of interest in any business dealings with RHSP, of which the Supplier is aware should be declared to RHSP to allow an opportunity for appropriate action. Relationships that constitute Conflict of interest include, relative such as sibling, parent, child, spouse working with RHSP and any other party that is offered any payment or personal advantage in exchange of conducting business with RHSP.

iv. SAFEGUARDING RHSP ASSETS, INFORMATION, AND INTELLECTUAL PROPERTY

The supplier has a duty to safeguard and make appropriate use of RHSP Assets and funds under its control. Suppliers are not permitted to use RHSP resources for any other purpose other than supplying goods or services to RHSP. Any information provided by RHSP shall be used only for its intended and designated purpose.

v. ETHICAL BUSINESS CONDUCT

The supplier shall conduct its business using competitive and fair market prices. It must not engage in any understanding or agreements with competitors with the effect of biasing or improperly influencing the markets in which it operates.

vi. CONTINUOUS IMPROVEMENT AND MONITORING

Reaching standards established in this code is a dynamic process and RHSP encourages Suppliers to continuously improve their operations. RHSP will continuously monitor suppliers' compliance with the standards set out in this code of conduct by asking suppliers to provide relevant information and through audits by third parties and visits by RHSP personnel.

vii. REPORTING

If for any reason, suppliers have concerns about possible violations of this code of integrity by any RHSP representative, they can raise the matter with the Director Finance and Administration RHSP.

DECLARATION

I hereby confirm that I have read and understood the terms and conditions of RHSP Supplier Code of Conduct and agree to respect it and be compliant with it.

Company/Organization name:

Representative Name:

Representative Signature:

Title:

Date:

Stamp: