

TERMS OF REFERENCE (TOR)

Project	County Service Centres
Location	Sinoe (Green ville), Cape Mount (Robert sport), River gee County Service centres
Geographical coordinates	4.999444°, -9.037500° (04°59'58", -009°02'15"),6.755556°, -11.368611° (06°45'20", -11°22'07"),5.197873°, -7.875993° (05°11'52", -007°52'34")
Time zone	UTC+00, Africa/Monrovia [GMT]

This TOR sets the requirements for the supply, installation, commissioning, and after-sales services for Off-Grid Solar PV FOR Cape Mount (Robert sport),River Gee (Fish Town) and Sinoe (Green Ville) county service centers

The scope of the project includes:

1. Design, supply, installation, testing commissioning and user training of:
 - Site 1 – One off-grid PV generator of 15 kWp with 30 kWh of total battery capacity. AC inverter 8.0 KVA.
 - Site 2 – One off-grid PV generator of 15 kWp with 30 kWh of total battery capacity. AC inverter 8.0 KVA.
 - Site 3 – One off-grid PV generator of 30 kWp with 85 kWh of total battery capacity. AC inverter 15.0 KVA.
2. After-sales services of 1 year including maintenance (preventative and corrective) and technical support (on-site and/or remote), continued online system and performance monitoring.
3. Training on operations and maintenance (operator and end-user), including provision of operation and maintenance documentation.
4. Spare parts for 1 year (list of spare parts is to be included as part of the technical proposal).

Functionalities and general requirements:

OFF Grid Photovoltaic power system with battery to consist of **PV generator, module mounting structure, MPPT battery charger, battery inverter, surge overvoltage protection, LiFePO4 battery bank with BMS battery Management system, data logger with its sensors, and system monitoring via GSM/Ethernet.**

Technical and Operational Specifications

General

An energy audit of the electricity of the county service centers below shows expected daily power consumption. The table in Annex II is an end-use breakdown of power consumption of various

systems in the building. The systems in the building are mainly categorized into the following,

- Air conditioning
- Lighting, and
- Miscellaneous office equipment

Operational

The system will operate as follows:

The system will be an off-grid PV system with backup generators, supplying electricity directly to the building

The county service centers will be powered by the PV system as the primary power source and the existent generators as the backup and on some instances for charging the batteries.

All system components must meet guarantee/warranty terms and high-quality standards (provide certification) to ensure long-term sustainability of the PV system.

The local conditions have to be taken into consideration (proximity to the sea, strong wind).

The system will be constructed such that a user can perform routine maintenance and replacing works, and a technician can easily perform system diagnostics or replace components.

The bidder will provide the most appropriate system integration, components, assembly, and packaging that meet all specifications.

PV Modules

PV modules must be listed on any applicable UN's list of preferred Solar PV module list, and must qualify for eligibility under such program.

System must comply with IEEE 1262 "Recommended Practice for Qualifications of Photovoltaic

Modules", IEC 61215 "Crystalline silicon terrestrial photovoltaic modules –Design qualification and type approval" and IEC 61730-1 and 61730-2 "Photovoltaic module safety qualification, requirements for construction and testing.

The available roof space for the PV installation for the three county service centers is approximately 400 m² . The space must be modified with a PV mounting allowing the installation of all photovoltaic panels for the provision of a total installed power of 15 kW for Cape Mount, River Gee and 30 KW for Sinoe County service centers. The solar panel should be prepared for installation in saline environment, with protection of IP 66 and a safety of class II.

The available space must be assessed by the bidder to accommodate the selected Solar PV modules with adequate room for maintenance

Inverters and miscellaneous accessories

The inverter has to be specified for the maximum load of the PV system.

SMA, X tender series (or equivalent from reputable manufacturers) hybrid-connected inverter of below Technical characteristic are to be used:

- Sine wave current output
- High conversion efficiency
- MPPT • MPPT efficiency >95%
- Voltage input at wide range
- Frequency transformer isolation
- Perfect protection function and high system reliability
- Various communication interface
- Simple installation and operation
- Optional multilingual LCD

- Settable protection and operational factor

Technical parameters:

- DC side: Max. DC voltage: 48Vdc
- Max. Power voltage tracking range: 9—68Vdc
- Max. Input loop: 1 AC side:
- Rated voltage: 230 Vac
- Rated frequency: 50Hz
- Total current waveform distortion rate: 0.99 (rated power)
- System Max. Efficiency: 96% Europe efficiency: 95% Protection grade: IP20 (indoor)
- Internal power consumption at night: 0W
- Operating temperature: -20°C—+40°C Cooling-down method: forced air cooling
- Relative humidity: 0-95%,
- Non-condensation Display: LCD Communication interface: RS232/485、Ethernet/GPRS/GSM
- Other accessories needed for the installation and operation of the system shall be specified according to the installed PV capacity and the local conditions (roof of the building).

Electric Power Requirements:

- Power provided must be compatible with the onsite distribution system (single phase voltage and three phase voltage).
- Power capacity should be measured at the inverter AC output using the PV USA Test Conditions (PTC), i.e. 1,000 Watts/m², 20 °C ambient temperature and wind speed of 1 m/s.
- The System must include all the hardware needed for the solar PV.
- All systems must be installed in accordance with all applicable requirements of local electrical codes and the US National Electrical Code (NEC), including but not limited to Article 690, “Solar Photovoltaic Systems” and Article 705 - “Interconnected Electrical Power Production Sources” or the EU equivalent.
- Systems must be designed and installed using UL or ETL listed components, including mounting systems.
- Modules must be certified to UL 1703 - “Flat-Plate Photovoltaic Modules and Panels” or equivalent.

Inverters must comply with the following requirements or EU equivalent:

- IEEE 929-2000 - “Recommended Practice for Utility Interface of Photovoltaic Systems”
- UL 1741 - “Standard for Static Inverters and Charge Controllers for use in Photovoltaic Systems”
- Listed on the CEC list of eligible inverters

Other technical codes that will apply include:

- US AMSE PTC 50 (solar PV performance)
- ANSI Z21.83 (solar PV performance and safety)
- US NFPA 853 (solar PVs near buildings) or equivalent
- US NEPA 70 (electrical components) or equivalent
- IEEE 1547 (interconnections) or equivalent
- US National Electrical Safety Code - ANSI C2 - 1999 or equivalent
- All applicable CV Building Codes and requirements

The remaining components of the system (wiring, component, wiring, conduits, and connections) must be suited for conditions for which they are to be installed. Inverters, charge controllers and other accessories are located inside technical cabinets with a minimum NEMA 12 enclosure or equivalent.

- All structures and structural elements, including array structures, shall be designed in accordance with all applicable CV Building Codes and standards pertaining to the erection of such structures.
- All structural components, including array structures, shall be designed in a manner commensurate with attaining a minimum 25-year design life. Particular attention shall be given to the prevention of corrosion at the connections between dissimilar metals.
- The structural design should provide for easy and cost-effective repair or replacement of the roof.
- For rooftop installations where there is no parapet or the parapet is less than 1.5 meters, a 2-metre safety zone from the roof edge to the PV system must be maintained. Clear path of travel must be maintained around all rooftop equipment.

Cables, Wiring and Electrical Connectors

All external wiring, cabling, insulation material, junction boxes and combiner boxes must be UV-resistant, and terminals should be protected against dust and moisture. The wiring installation shall be both physically robust against bumping and tugging, and electrically robust. All wiring and connectors should have a design lifetime of 20 years.

Junction Boxes and External Enclosures

All junction boxes shall be rated as specified. Any junction boxes used externally shall have bottom entry glands, and with drip loop installed externally. They shall be located to facilitate inspections with sufficiently long wiring loops internally.

Electrical Connectors and Cable-Ends

All wiring must be neatly done and secured by means of appropriate fasteners at regular intervals. Wiring lengths shall be sufficiently looped to allow ease of connection and disconnection in the case of component replacement, and for maintenance. Any wiring connections whether internal, external, high voltage or low voltage shall be inside accessible junction boxes. No visible connections. Conductor lugs should be used to terminate all DC wiring. Lugs and connectors should be crimped or soldered, and mechanically and electrically sound. All DC electrical connections shall be treated with corrosion inhibiting paste.

External wiring

All external wiring and cabling shall be straight and aligned vertically or horizontally, and cables firmly attached to the walls or cable trays at least every 500mm. Cable entries into buildings shall be made good, and with drip loops as necessary.

Certification

All AC wiring shall be as per the requirements of the electricity standards of IEC

Earthing

The bonding of equipment should prevent dangerous voltage differentials arising between metallic equipment during fault conditions and provide alternative conduction paths to power cables should ground surges from nearby lightning strikes arise. The main earth point for the system shall be a systems earth electrode. It shall be located directly below each array structure.

The earth electrode shall be the common point for the casings of all balance of system components, and the array structure. The risk of lightning strikes varies according to location. However, for this site location the basic guidelines shall apply, as the electrical distribution is contained within one building.

Earth Electrode

Bare copper or bare galvanized steel, in stranded, strip or rod form earth rods should be used. The down conductors shall be connected to copper or galvanized/stainless earth spikes of minimum length 1200mm. The spikes shall be driven vertically into the ground till buried to a depth of 300mm. If necessary, several spikes shall be interconnected as a trench earth to achieve the required resistance of below 10 ohm.

Earth Connections

16mm² bare copper straps shall be used as earth straps to bind components to the earth electrode. Under no circumstances shall connection points, bolts, screws, etc. be used for bonding or earthing be utilized for any other purpose. It shall be the responsibility of the Contractor to supply and fit earth terminals or clamps on equipment that must be earthed where these are not provided.

PV Array Structure Earthing

Each array structure shall always be bonded directly to the earth electrode. If there is electrical discontinuity between module frames and the array structure, then 16mm² conductors shall be utilized for bonding the module frames to the structure. Since there are two PV arrays, it is recommended that a trench earth be used to bond the individual earth spikes together underground.

Equipment Earthing and Bonding

All metal other equipment and casings (as outlined below) shall be bonded together, as they are inter-connected by the power cables. The bonding shall be made using copper conductors of 10mm² minimum. A separate conductor shall be used specifically for that purpose.

- The array structure shall be bonded directly to the main earth electrode with a resistance of less than 1.7ohms.
- The inverter casings shall be bonded (directly or indirectly) to the main earth electrode with a resistance of less than 1.7ohms.
- The resistance between any enclosures in any one location, shall be less than 0.2 ohms.
- The earth resistance of the earth electrode shall be less than 10 ohms.

Lightning and Surge Protection

Lightning protection is designed inherently into the system configurations, earthing, and some level of surge protection is built into the inverters themselves. For added protection, there is a need for additional protection or surge arrestors on the inverter DC inputs. This shall take the form of Class 2 protection on the DC cables in the PV Array junction box or Enclosure.

To protect against surge overvoltage from the utility side it is required to install an SPD (Surge Protective Device) as near to the inverter as possible. This equipment will leak the energy of the overvoltage to the ground. For this reason, it is essential that earth terminals be of a good quality and moreover, it is required that all of the earth terminals be properly connected so as to assure equipotentiality. The required SPD has to be able to discharge high currents caused by an induced overvoltage, for that reasons, it needs to be a type 2 according with IEC 61643 standard. To ensure safety of the equipment, it needs to be at least 40kA as maximum current (Imax). The inverter is a very sensitive equipment, the SPD needs to have been tested, in addition, as a type 3. The type 3 SPDs are specially designed to protect the most sensitive equipment's.

Labelling, Safety Signs and Notices

There shall be labelling and signage as appropriate. All notices, labels or signs shall be durable and not removable except by determined and deliberate action. The inscriptions shall be legible and indelible. Where possible, standard approved symbolic safety signage shall be used. All distribution board labels shall be professional quality signage.

Compliance with Regulations and Codes

The entire installation must be carried out in accordance with the latest revisions and amendments of IEC & ISO international standards, and the standards currently in force in Liberia.

- IEC 62548 latest edition: Installation and safety requirements for photovoltaic generators.

Where compliance is required in terms of codes and regulations, which is not already covered elsewhere in the Specifications, variations required after contract award and site visits shall be covered by contract variation orders if any.

Electrical PV Acceptance and Commissioning Tests

The Acceptance Tests shall depend on the exact equipment supplied. Essentially, the Project Coordinator shall test the systems for electrical performance as specified. Quality of equipment and quality of installation inspections shall also be part of the Acceptance Tests.

Other Services

The Consultant shall develop a simplified training manual (with graphic illustrations) in basic solar PV system maintenance and security and shall conduct a one-day training in the maintenance and security of solar PV systems for selected representatives of the beneficiaries.

Certification

The Client shall certify completion and operational acceptance of the installation by issuance of completion and operational acceptance certificates respectively.

Certificate of Completion

The Consultant shall be issued a Certificate of Completion by the Client after completing the services in accordance with all the terms and conditions of the Service Contract.

Certificate of Operational Acceptance

The Consultant shall be issued a Certificate of Operational Acceptance one month after the issuance of Certificate of Completion, which shall be defect liability period of the service.

Provide the following general information.

Solar array will be roof mounted

The batteries, power electronics and ancillaries shall be in a technical cabinet and shall be pre-assembled and tested in a Factory/Lab environment before shipment.

OFF Grid Solar PV system will operate with batteries and must be designed with necessary features to supply directly the power generated by PV to the loads while simultaneously charging the batteries for later usage.

The battery banks of these systems should be sized to provide an autonomy ranging between 1.5 and 3 days of the rainy season. (1.5 days in sites benefiting from existing gensets, 3.0 days for the other fully autonomous sites).

The equipment's manufacturer shall be a reputable entity and active in the solar sector for at least 5 years. It must have a quality (at least ISO 9001) and Environmental (at least ISO 14001) management system certification.

All equipment installed shall be labelled with the equipment's brand name, model and other. The label should be highly discreet and unobtrusive, and readable only from very near distances of less than 1m.

The supplier shall carry out all civil and electrical works for solar solutions to be compatible with the existing electrical systems and distribution lines. They shall also ensure that each & every piece of electrical equipment & apparatus shall be connected to the main earth bus by means of branch main connection of earth continuity conductors.

For the actual work to be carried out at the site bidder needs to execute the work in consultation with UNDP representative/Inspector.

The Supplier shall provide all necessary components except otherwise specified, and accessories as well as manpower, etc., at the Supplier's own expense to install complete operational units. The equipment shall conform in capability, strength, quality and workmanship to the accepted industry standards and relevant international quality standards. Any additional works not covered above, but necessary for the functioning of the system and required as per specification incorporated. The works of minor nature, which are not mentioned, shall be incorporated by the bidder.

The Supplier shall perform a detailed site assessment visit to the sites and confirm the suitability of the solution. The supplier will also inspect the solution and/or components prior to the installation and prepare an installation plan to collate the amount of work to be done.

Erection and commissioning of the supplied system on the specified site and do any other work urgently required as per site conditions.

The Supplier should remove the waste of works undertaken including the trash and dirt resulting from the works and attend to any snags caused by workmanship. The site should be returned to its initial state of cleanliness.

Local Partner:

Bidders are required to establish formal agreement with Local and/or Regional Representative for support in deployment of Solar PV System with regards to Site Visit, Installation; Commissioning; Training and After-Sales Services/Maintenance.

The bidder is requested to define a common deployment protocol for all teams on site to ensure the homogenization and quality of the plants' installation, commissioning and handing over.

Please include the following in the offer document:

- Letter signed by both parties confirming relationship between the supplier and local service provider.
- Profile of the local service provider including documentary evidence of relevant experience and services.
- Biannual maintenance by the local partner (for 1 year). Include the checklist for periodic inspection.
- A detailed list of services that are included in the O&M and after sales services.

Project Deliverables:

Deliverable 1:

- a) Detailed Planned Schedule of works.
- b) Detailed site survey report, including:
 - i. Identification for components' location(s),
 - ii. Identification of best available climatic data to be used in system sizing (at least monthly values of solar irradiance and temperature),
 - iii. Photo documentation and assessment of any shading objects,
 - iv. Review and calculation of consumption profile given by UNDP (appliances and daily use, including surge loads),
 - v. Selection of a suitable mounting system that does not compromise the integrity of the roof/ground.
- c) Design sizing and documentation, including (where applicable):
 - i. Site specific layout of the solar array.
 - ii. Appropriate sizing in piping lengths and sections for the entire installation.
 - iii. Bill of material (BoM) inclusive of technical specifications for the main components.
 - iv. Shop Drawings (*e.g. single line diagram, wiring layout including distances; protections; components etc.*).
- d) A Health, Safety and Environmental Management Plan.
- e) A description of the proposed performance and acceptance testing procedure that will be undertaken during commissioning phase.
- f) A letter certifying the compliance with requirements on warranties, spare parts and standards, etc.
- g) In case the PV modules are roof-mounted, supplier will take responsibility for structural integrity of the roof.

Deliverable 2:

- a) Pre-assembling and wiring: mounting of inverters, controllers and the likes done as much as possible in a factory/lab environment.
- b) Supply and delivery of the equipment at supplier Monrovia warehouse with all components needed for project delivery and operation.

Deliverable 3:

- a) Installation of complete Solar PV Plant with all components required for operation, and implementation of all related performance testing.
- b) Formal signed User Acceptance Test (UAT) and Commissioning of the Solar PV Plant, etc. Report shall be approved by the Project representatives beforehand.
- c) Submission of final Technical Report, inclusive of:
 - i. As-built drawings,
 - ii. Technical description of the final solution
 - iii. Testing/Commissioning report (inclusive of final testing and values),
 - iv. Datasheets,
 - v. Complete bill of materials (BOM),
 - vi. Static verification of mounting structure (if applicable),
 - vii. Warranty certification/documentation for the main components.
- d) Submission of photos, videos and visual material of the final system installed.
- e) Training on Operation and Maintenance (O&M) of the installed equipment for the beneficiaries' representatives (end users and beneficiaries' staff maintenance crews) and provision of training materials and O&M manuals. Inclusive of:
 - i. Basics on the Solar PV system commissioned (components and operation)
 - ii. Basic shutting-down procedures (in case it is necessary)
 - iii. Operation and Maintenance of the solar PV system (for future hand-over after maintenance period)
 - iv. Integration with gensets (where applicable)
 - v. All basic issues that might occur and the relevant troubleshooting.
 - vi. A special focus should be on using the online monitoring system and troubleshooting of basic errors and problems that occur frequently.
- f) Signaling labelling:
 - i. All components shall be labelled in English.
 - ii. Signs or labelling warning about safety hazards, e.g. smoking, water contact, etc.
 - iii. Emergency shutdown procedures (visual information) shall be provided.
 - iv. Panel with up keeping and operating instructions for the beneficiary shall be installed.
- g) Visual Material.

Deliverable 4:

- a) System monitoring inclusive of reporting as part of the maintenance service.
- b) After-sales services of 1 year: including maintenance (preventative and corrective) and technical support (on-site and/or remote) including continued online monitoring. This is inclusive of appropriate escalation or system modification procedures.
- c) The awarded LTA vendor must remain at the disposal of the beneficiary for at least two months (stabilization period) after handover/commissioning to assist in answering any technical or other related questions.
- d) Warranty and O&M for 12 months:
 - i. System Warranty: Required warranty period for all PV systems is 1 year from commissioning date. It should include monitoring, technical support and maintenance. This should be provided in the form of a warranty certificate/statement. During the referred warranty period, Bidder's shall further bear the cost of transporting equipment from its operating site to workshop appointed for provision of warranty services
 - ii. Warranty certification/documentation for the PV System Main Components including summary overview of warranty arrangements (technical and logistical).
 - iii. Overview of available warranty extension options for main components.
 - iv. Cost associated with warranty replacements during the warranty period will be borne by the supplier.
 - v. Cost associated with the maintenance and technical support for the PV system during maintenance subscription will be borne by the supplier.

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)

- Total energy (kWh) and power (kW) produced by PV
- Energy (kWh) and power (kW) fed into battery for charging and supplied from the battery
- Energy (kWh) and power (kW) supplied from the genset (where appropriate)
- Total consumption of loads
- Solar fraction
- Battery SOC and temperature
- Alarms and configuration records

The monitoring system shall have an LCD display in English and provide monitoring reports through:

- 1) Internet connectivity (LAN; Wi-Fi etc.) and,
- 2) GSM connectivity,
- 3) Ability to store for minimum 6 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.

Technical Specifications.

The equipment furnished to these specifications must meet or exceed all requirements herein. Modifications of or additions to basic standard equipment of less size or capability to meet these requirements will not be acceptable.

Site: Cape mount and River Gee

Item	Description	Requirement	Observations/Quality assurance	Deviations/Non-compliance
1	Site assessment	Done. Vendors must conduct further site assessment	To fine-tune/adjust system design and to facilitate the planning of logistics/installations.	
2	Off grid PV system	8.0 KVA		
2.1	Solar Panels	15 kWp	Mono Crystalline modules with 10 years manufacturer guarantee	
2.2	Mounting structure (s)	required	To be fixed on the roof.	
2.3	Technical cabinet	required	Lockable, ventilated and waterproof	
2.4	Solar Battery charger/controller	required	MPPT solar input	
2.5	AC battery charger	required	Automatic when genset is working	
2.6	Battery bank	30.0 kWh LiFePO4	>90% DOD 4000 cycles guarantee	
2.7	Battery Management system	required	Protection from over-charge Protection from under-charge Battery-balancing Ability to report SOC	
2.8	Inverter continuous service	8.0 KVA 1 phase 230VAC	5 years warranty	
2.9	Monitoring	Local and remote	Remote monitoring system through GSM connectivity including SIM cards, annual subscription for one year, modem, data management/reporting.	

3	Rewiring of existing electric installation	Required	To segregate non-critical loads and critical loads. The PV systems to power only the critical loads. Other loads categorized as non-critical – such as air conditioners – must be powered exclusively by gensets (if any) or other external electricity source.	
4	Anti-theft and anti-tampering measures	required		
5	Guarantee and O&M	required	System guarantee of 12 months, including two preventive maintenance visits and as many repairs as required.	

Bill of Quantities

Site: Cape mount and River Gee				
Item	Description	Quantity	Unit price	Total Price (USD)
1	Detailed site assessment, including assessment report			
2	Off grid PV system – Cape Mount and River Gee County service centre			
2.1	Solar Panels	68		
2.2	Roof Mounting structure (s)	1		
2.3	Technical cabinet	1		
2.4	Solar Battery charger/controller	5		
2.5	AC battery charger (if required as per annex2)	1		
2.6	Battery bank	1		
2.7	Battery Management system	1		
2.8	Inverter continuous service	1		
2.9	Anti-theft and anti-tampering measures	68		
3	Remote monitoring system through GSM connectivity including SIM cards, annual subscription for one year, modem, data management/reporting.			
4	Site preparation and civil works			
5	Ancillaries, protections and Cables			
6	Rewiring of existing electric installation (adding auto transfer switch)			
7	Installation and Commissioning of the PV system			
8	Training on Operations and maintenance of the PV systems and provision of training materials and Operation manuals			
	Total Cost			

Site: Sinoe

Item	Description	Requirement	Observations/Quality assurance	Deviations/Non-compliance
1	Site assessment	Done. Vendors should conduct further site assessment	To fine-tune/adjust system design and to facilitate the planning of logistics/installations.	
2	Off grid PV system	15.0 KVA		
2.1	Solar Panels	30 kWp	Mono Crystalline modules with 10 years manufacturer guarantee	
2.2	Mounting structure (s)	required	To be fixed on the roof.	
2.3	Technical cabinet	required	Lockable, ventilated and waterproof	
2.4	Solar Battery charger/controller	required	MPPT solar input	
2.5	AC battery charger	required	Automatic when genset is working	
2.6	Battery bank	85.0 kWh LiFePO4	>90% DOD 4000 cycles guarantee	
2.7	Battery Management system	required	Protection from over-charge Protection from under-charge Battery-balancing Ability to report SOC	
2.8	Inverter continuous service	15.0 KVA 3 phase 400VAC	5 years warranty	
2.9	Monitoring	Local and remote	Remote monitoring system through GSM connectivity including SIM cards, annual subscription for one year, modem, data management/reporting.	
3	Rewiring of existing electric installation	Required	To segregate non-critical loads and critical loads. The PV systems to power only the critical loads. Other loads categorized as non-critical – such as air conditioners – must be powered exclusively by gensets (if any) or other external electricity source.	

4	Anti-theft and anti-tampering measures	required		
5	Guarantee and O&M	required	System guarantee of 12 months, including two preventive maintenance visits and as many repairs as required.	

Bill of Quantities

Site: Sinoe				
Item	Description	Quantity	Unit price	Total Price (USD)
1	Detailed site assessment, including assessment report			
2	Off grid PV system – River Cess County service centre			
2.1	Solar Panels	80		
2.2	Roof Mounting structure (s)	1		
2.3	Technical cabinet	1		
2.4	Solar Battery charger/controller	5		
2.5	AC battery charger (if required as per annex2)	1		
2.6	Battery bank	1		
2.7	Battery Management system	1		
2.8	Inverter continuous service	1		
2.9	Anti-theft and anti-tampering measures	80		
3	Remote monitoring system through GSM connectivity including SIM cards, annual subscription for one year, modem, data management/reporting.			
4	Site preparation and civil works			
5	Ancillaries, protections and Cables			
6	Rewiring of existing electric installation (adding auto transfer switch)			
7	Installation and Commissioning of the PV system			
8	Training on Operations and maintenance of the PV systems and provision of training materials and Operation manuals			
	Total Cost			

Preliminary assessment of the Photovoltaic locations.

Lot No.	Name / Address	Current energy supply	Observations	PV field size (kWp)	Battery Capacity total (kWh)	Inverter AC output (KVA)	Inverter type
1	River Gee County Service center 5.197873°, -7.875993° (05°11'52", -007°52'34")	One 65 KVA Genset from the County, feeding other buildings as well, and running.	Air conditioning Units are the major loads in the building. Roofing length (24m X 11m) Available space for solar equipment needs civil works.	15.0	30.0	8.0	1 phase
2	Robert sport, Grand Cape Mount County Service Centre 6.755556°, -11.368611° (06°45'20", -11°22'07")	One 65 KVA Genset from the County, feeding other buildings as well, and running	Air conditioning Units are the major loads in the building. Roofing length approx (24m X 11m) Available space for solar equipment needs civil works.	15.0	30.0	8.0	1 phase
3	Sinoe County Service center 4.999444°, -9.037500° (04°59'58", -009°02'15")	One 65 KVA Genset from the County, feeding other buildings as well, and running	Roofing space is more than 400m ²	30.0	85.0	15.0	3 phase

Annex I

LOAD DATA (Sinoe County service centre)								
	No of offices	Occupancy of the building	Working Hours	No of Desktop Computers	No of air Conditioning Units	No of Printers	No of Light Bulbs	Any other Equipment
	25 offices	More than 50 persons	8 hours a day (8-5)	15-25	20	5 or more	50 or more	Water Pump
Load Data (Amps)				2 Amps	13.8 Amps	4 Amps	0.1 amps	20 Amps
Total Load (Amps)				24	69	8	3	20
Current Voltage in Premises	400 Voltage							

LOAD DATA (Cape mount Robert sport and River Gee)								
	No of offices	Occupancy of the building	Working Hours	No of Desktop Computers	No of air Conditioning Units	No of Printers	No of Light Bulbs	Any other Equipment
	At least 13 offices	Approx. 20 persons	8 hours a day (8-5)	15	13	2	20	Water Pump
Load Data (Amps)				2 Amps	13.8 Amps	4 Amps	0.1 amps	20 Amps
Total Load (Amps)				24	69	8	3	20
Current Voltage in Premises	230 Voltage							