



MINISTRY OF ENERGY AND MINERAL DEVELOPMENT

**UGANDA ENERGY ACCESS SCALE-UP PROJECT (EASP) -
P166685**

Terms of Reference for Consultancy Services: Identification of public institutions to be electrified with solar installations and development of an alternative payment option for energy

1. Introduction

The Government of Uganda (GoU), with support from the World Bank, is preparing the Uganda Energy Access Scale-up Project (EASP). The proposed EASP will support GoU's efforts to scale-up access to electricity for households, refugee and host communities, industrial parks, commercial enterprises and public institutions, so as to spur socio-economic transformation, in line with Uganda's Vision 2040 and other Government policies. EASP activities will build on earlier Government initiatives, in the energy sector, to support the expansion and strengthening of the electricity distribution network, scale-up service connections within the network, and increase access to off-grid electricity in refugee settlements and their host communities, and to clean cooking services outside the electricity distribution network.

Further, the project will provide technical assistance to strengthen the operational capacity of the Health, Safety and Environment Unit (HSEU) at the Ministry of Energy and Mineral Development (MEMD) and build capacities at other implementing agencies to ensure compliance with HSEU requirements under the project. Technical assistance will also be provided to the Electricity Regulatory Authority (ERA) to attract the private sector and enable its participation in increasing electricity access, both in grid and off-grid areas, including, where necessary, through the introduction of new regulations.

In addition, EASP will support Uganda's Nationally Determined Contribution (NDC) to mitigate climate change, through a series of priority and adaptation measures, including building enabling infrastructure such as medium voltage (MV) and low voltage (LV) networks, implementing associated electricity service connections, promoting the development and use of renewable energy sources through off-grid solar solutions for households, and for public institutions such as schools, health centers, administrative buildings, and water supply schemes, and increasing efficiency in the use of biomass.

The key output indicators of the EASP for public institutions will be:

- Number of public institutions (schools, health centers, administrative buildings, water supply schemes) provided with grid electricity;
- Number of public institutions (schools, health centers, administrative buildings, water supply schemes) provided with off-grid electricity

Off-grid electricity supply to public institutions in the EASP

Critical public institutions such as health centers, schools, water supply schemes and government offices, are at the heart of socio-economic development in any community. However, limited or no access to electricity often hampers the efficacy of such institutions and holds back services to the communities. In countries throughout Sub-Saharan Africa (SSA) including Uganda, many of these institutions are located far from the electric grid, thus making the economics of grid extension infeasible. Accordingly, off-grid electricity supply such as solar power sources have been used to meet the energy needs of remote public institutions. The off-grid solar systems offer the potential of providing clean, renewable electricity but they are affected by high failure rates, often caused by lack of maintenance and good operational practices.

The EASP approach to mitigate the shortfalls in maintenance and operational practices, and to improve reliability of electricity supply, will be to shift from procuring and maintaining the solar systems by the public institutions, to outsourcing the full-service to amortized-rent-to-own arrangements using private sector, energy service providers, under performance-based contracts. Additionally, the private sector must be encouraged to invest in the ownership of such installations since financing from governments and donors will be increasingly insufficient to serve all public institutions in Uganda. This approach will reduce the burden on the GoU to invest all capital cost upfront and will instead require it to arrange for regular payments to the private sector that include both capital cost (amortized) and operations and maintenance cost.

It is envisaged that private-sector-energy-service-providers will enter into medium- to long-term service agreements with the GoU, to provide electricity services using certified, standalone solar systems with guaranteed operations and maintenance.¹ Recent innovations in the solar home system sector, such as digital remote monitoring technology, allow the adoption of new approaches to improve the performance of off-grid solar powered systems and the reliability of services provided to public facilities. To achieve improved outcomes, off-grid solar systems for institutional applications should be financed in a manner that incentivizes on-going maintenance and reliable performance of the systems. Under such incentives, companies in the off-grid solar sector would not only finance and install solar PV systems but also enter into medium- to long-term payment contracts with public institutions to provide an appropriate level of service (based on key performance indicators) in return for guaranteed fixed monthly payments. The payments would be designed to cover the capital costs of equipment and installation, and the ongoing operation and maintenance costs over the contract period. At the end of the contract period, the service contract could be extended or handed over to the public institutions, considering the

¹ World Bank experience in Sub-Saharan Africa shows that despite availability of sizeable capital investment to install solar systems at health centers and schools, actual delivery is sometimes **non-existent or substandard either due to non-functioning equipment (inverters, panels, batteries) that has not received adequate O&M or no systematic plan for regular O&M**. Under the ERT-2 project in Uganda, approximately 13 percent and 30 percent of solar energy packages installed in health centers and schools, respectively, are not functional. Under ERT-1, the degree of non-functionality is even more significant, reaching approximately 50 percent of solar energy packages installed in health centers and schools. Failure are attributed primarily to issues with batteries (85 percent) and other factors (15 percent) due to a combination of issues – inadequate funds for routine maintenance and component replacement, late release of funds for maintenance contractors and for purchase of defective components with solar panels, fuses, inverters, etc.

projected residual lifespan and efficiency of the system, assessed by an independent technical and financial audit.

One major challenge anticipated in the energy service agreements, is the payment risk from the GoU against the energy consumed by the public institutions. During the on-going preparation of the EASP, discussions will be held with the GoU on suitable mechanisms to mitigate the payment risk. Lessons from other World Bank-funded projects addressing the payment risk will also inform the design of the component.

The tables below provide the status of electrification of health and educational centers and schools in Uganda.

CATEGORY OF PUBLIC HEALTH FACILITY	OWNERSHIP			Estimated proportion with access to Basic Energy (%)
	GOVT	NGO	TOTAL	
HOSPITAL	67	63	130	Not Available
HC IV	181	17	198	94.70%
HC III	976	324	1300	55.30%
HC II	1734	494	2228	37.70%
TOTAL	2958	898	3856	Not Available

Source and Date: MoH, August 27, 2019

Based on available data and inputs from MoH personnel, approximately 50% of public health centers in Uganda do not have access to electricity.

PUBLIC SCHOOL TYPE	ELECTRIFIED No.	NOT ELECTRIFIED No.	TOTAL No.	NOT ELECTRIFIED %
Primary	3,154	16,564	19,718	84
Secondary	1,047	11	1058	1
Other	288	4	292	1
All	4,489	16,579	21,068	79

Source and Date: MoES, September 27, 2018

Based on available data and inputs from MoES personnel, approximately 80% of public schools in Uganda do not have access to electricity.

Reports on the current state and functionality of stand-alone solar PV systems in public institutions reveal that approximately 50% and 30% of systems installed in schools and health centers that were electrified under Energy for Rural Transformation Project Phase One (ERT-I) project and Phase Two (ERT-II) respectively, are not functioning. Of the non-functioning packages, 85% failure can be attributed to issues with old/faulty batteries while the remaining cases are due to a combination of issues with solar panels, fuses, inverters, charge regulators, etc.

It is against this background that Government of Uganda has decided to explore an alternative approach of electrifying public institutions that will guarantee stable, reliable and lower cost electricity supply. This is expected to be achieved through performance-based service contracts with Government institutions, where off-grid solar PV service providers will be responsible to supply electricity to all health centers, schools and water supply schemes within a service territory at a pre-determined service standard.

2. Objective and Overview

The objective of this assignment (study) is to design a sustainable framework for universal access to adequate and reliable electricity services to prioritized public institutions in Uganda. The framework will be adopted under the proposed Energy Access Scale-up Project (EASP) to electrify schools, health centers and water supply schemes with the least cost technology (grid or off-grid), depending on their location. The study will involve identification and prioritization of public institutions that need to be electrified, conducting energy needs assessments for these facilities and a financial analysis to determine the costs and end-user charges associated with electrifying these institutions in a sustainable manner over a given period. The study will be informed by the nation-wide geospatial analysis currently under development to identify the least-cost technology (grid or off-grid) for the timely provision of access to electricity. The Consultant will also be required to design standardized solar energy service packages and performance contracts that will guarantee uninterrupted power supply to the public institutions.

3. Scope of Deliverables

Task 1: Situational Assessment

The departure point will be to determine the current electrification status of public institutions in Uganda, commencing with the Health centers, schools, water supply schemes and administration buildings. The consultant shall coordinate with the Ministries of Health (MoH), of Education and Sports (MoES), of Water and Environment (MoWE), of Local Government (MoLG), and of Energy and Mineral Development (MEMD), to establish their assessment of the situation, including planned interventions in existing off-grid supply sources, current roll-out planning to existing and new facilities and an in-depth analysis into technical and financial challenges being faced towards reliable cost-effective energy provision to these facilities. The MoLG will help understand challenges and opportunities arising from the proposed business model at the local government's level.

The consultant will have to determine, in close collaboration with the MoH, MoES, MoWE, MoLG, and MEMD which sites are earmarked for new off-grid installations, after careful consideration of current and planned grid electrification plans. The earmarked sites will then have to be visited and the following should be part of the on-site assessment:

- Verify the existence of the facility at the specified location (district, community etc.) and assess the suitability of the structures to be equipped with an off-grid power supply
- Record by GPS the coordinates of the facility and map it on Google My Maps platform
- Record the names and contact details of key facility personnel and local government officials responsible for the operations of the facility;
- Determine level of mobile phone service (voice/text only, GPRS, EDGE, 3G, H/H+, 4G, none) at each facility to determine if remote monitoring technology can be deployed
- Describe the operation activity of the facility, including the operating hours, and expected daily electricity consumption (demand) patterns
- Record the number of rooms and list the potential / earmarked electrical equipment per room and the expected daily usage pattern of electricity
- Record existing/potential electrical equipment/appliances on site (e.g., refrigeration, sterilization, etc.), including their current physical state and utilization
- Describe the current level of functionality of the facility (fully functional, partially functional, etc.) and highlight key constraints to functionality (medicine, vaccinations, water supply, electricity supply, etc.);
- List all lighting and other equipment destined to be replaced by electrical equipment and describe how it is perceived in terms of efficiency, reliability, service quality and provide photographic evidence. (e.g., candle, kerosene lamp, battery-powered torch, cooking utensils, heaters etc.)
- Record the condition of the existing diesel / solar /other generator (if any), the average amounts of money spent monthly on fuel/wood/charcoal, initial costs (if relevant) including photos of the equipment, capacity and brand specifications of the equipment and nameplates where available
- Record the terms and conditions of and existing O&M contracts that apply to the above power supply system(s) and equipment.
- Assess potential space (in m²) that could be made available for a solar system (rooftop, land adjacent), the existence of shading impediments, roof facing directions with photographic records and explanations
- Determine the approximate downtime of all equipment per day/per month, due to lack of budget or technical reasons.
- Complete the site-specific Environmental and Social safeguards checklist as per World Bank Performance Standards.
- Develop and populate a survey questionnaire for interviewing key beneficiaries (relevant government officials, administrative staff, medical staff, and patients) on:
 - The current and potential future electricity needs of the facility, including lighting and specialized appliances
 - The perceived (potential) benefits of solar power solutions;
 - Concerns about the potential negative impact of solar systems;

- Physical or other hazards that the solar installations might potentially be exposed to;
 - Perceived risk of theft or vandalism and potential mitigation measures;
 - The perceived progress of electrification state of all nearby villages within 5 km of the site
 - assess the facility's existing monthly, quarterly and annual expenditures on energy services
 - Review the approved budget and actual release of funds historically
 - assess their ability to pay for operation and maintenance costs of existing or new solar power systems
 - assess their ability to pay for the capital costs existing or new solar power systems
 - assess the potential of additional revenue streams if the facility is to be electrified. Proposals for potential revenue streams should be tested with local governments as they will require authorization under the Local Government's Act and, with Central Government as facilities would require authorization to collect non-tax revenue.
- The survey questionnaire should be used to interview at least the following: -
 - Members of the Management team
 - Staff responsible for operations and maintenance
 - Local Government staff
 - Analyze and consolidate the findings into a written report. This report shall be the basis of the planning and design phases to follow.

Task 2: Planning / Needs Assessment of required off-grid solar installations

Having completed the on-site surveys and assessments of installation earmarked for off grid solar power supplies, the consultant will now have to determine if these installations actually require interventions being,

- scrapping inadequate power supplies,
- upgrading existing functional units or
- providing new power supplies.

The consultant will also forecast the load pattern at each institution and categorize them into various groupings depending on the present and future energy loads. The projected loads will now have to be compared to the existing power supplies to determine if these supplies are adequate for the projected demand. Towards that end, the following has to be taken into account:

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- Listing electrical fittings and appliances required at each site with their electrical demand characteristics and usage patterns.
- Simulating the load curve of the facility allowing for at least 20% unforeseen load.

- Assessing the adequacy of existing solar systems installed on site to serve the perceived load.
- Assessing the viability to continue with existing systems in considering reliability, serviceability, technology, residual lifespan and contractual arrangements.
- Selecting standard design package to serve the perceived load.
- Determine the following cost aspects as inputs to the Financial and Economic analyses below: -
 - The capital costs for upgrading the existing supply systems
 - The capital costs for installing the new supply systems
 - The maintenance costs for upgraded existing supply systems
 - The maintenance costs for new supply systems
 - The capital costs savings realized by upgrading the existing supply systems
 - The operating and maintenance costs savings by upgrading the existing supply systems

Task 3: Standard Designs of Installations by Type

- Based on Tasks 1 & 2, design standardized solar-powered service packages appropriate for the facilities with different ranges (4-6) of capacities. The designs should utilize the latest technologies that enable long-term system sustainability, particularly focusing on optimizing storage through high-cycle, deep-discharge batteries.
- For each design, estimate the CAPEX and annual O&M costs (including refurbishment) over the recommended usage period. This should include costs of replacing expensive items such as batteries after 5-7 years.
- The standardized designs should address all facility needs and allow for future electricity demand growth, including a 20% kWh and kW reserve margin
- The designs should allow for remote monitoring by GSM mobile network or alternative modalities where GSM coverage is poor;
- The design shall specify resilience to theft and physical or other hazards.
- These designs then need to be confirmed and approved by the various user Ministries, UNBS (the standards bureau) and ERA (the regulator)
- Compile CAPEX and OPEX programs (un-prioritized) of the above, assuming a certain rate of implementation, based on realistic budgets and technical assumptions. These will serve as inputs to, and be iteratively adjusted after, the financial analyses below.
- The public institutions should be availed the opportunity to review and approve the designs including approval of the minimum serviceable condition at handover when it occurs after the contract has expired.

Task 4: Financial and Economic Feasibility Analyses

Having completed the situational analyses, the planning and designs, the costing and scheduling of the roll-out programs, the following analyses shall be conducted: -

- **Financial Analyses from the Service Providers position** to determine the expected amortized cost to the beneficiaries.
 - The financial analyses shall be conducted per the agreed categories and be

- aggregated to reflect the complete program per sector for each Ministry of the GoU benefitting from the program.
 - The Financial Analyses shall ultimately produce the expected monthly lease cost per category allowing for cost of capital, finance cost, O&M costs, equipment (such as batteries) replacement costs, independent technical and residual value audits, equipment disposal costs, taxes, depreciation and propose an agreeable and justifiable IRR and profits margins
 - The analyses shall assume that the ownership be transferred to the user Ministry at the end of the recommended lease period and reflect the estimated residual value at the end of the lease period, to be confirmed by an independent valuation in practice.
- **Economical Analyses from the beneficiary Ministries position** to determine the expected sustainability of implementing the proposed concept.
 - The Economic Analyses shall be conducted per the agreed categories and be aggregated to reflect the complete program per sector for each Ministry of the GoU benefitting from the program.
 - The Economic Analyses shall ultimately produce the expected cost and benefits per category considering current direct and indirect cost savings and the benefits derived from the implementation of the proposed concepts as compared to traditional procurement and maintenance of systems.
 - The analyses shall assume that the ownership be transferred to the user Ministry at the end of the recommended lease period and reflect the estimated residual value at the end of the lease period, to be confirmed by an independent valuation in practice.
- Review of GoU constraints on payment for electricity service
 - Interview Personnel at MoH, MoES, MoWE, MEMD, and MoLG on challenges regarding payment to private sector, if any
 - Explore avenues for government ministries to pay for both capital cost and O&M component of electricity service
 - Draft recommendations for adequate and regular release of funds to the private sector – for example: which government budgets or programs can be tapped into

Task 5: Roll-out Program / Prioritization

Following the above analyses, if required, adjust the sequence and timing of the roll-out program. Furthermore, in consultation with the client establish a suitable scoring system for assigning electrification priority to the earmarked sites.

Accordingly, coordinate with the MoH, MoES, MoWE, MEMD, MoLG, and the World Bank, to recommend the facilities to be electrified in a roll-out program.

Task 6: Development of an Implementation Strategy

In close coordination with the client, develop a detailed implementation strategy for the electrification of the facilities that are deemed feasible to benefit from the envisaged program considering the following strategies:

- The earmarked facilities shall be grouped into geographical lots, include optimum number of sites to allow economies of scale for the private sector to invest in electrification of facilities and adopt long-term service contracts;
- The Service Providers shall provide technologies meeting technical and quality standards like IEC standards and approved by the national institutions
- The Service Providers shall be responsible for the detailed designs and have the flexibility to make reasonable adjustments to the described designs to improve efficiency and adapt to conditions dictated by the selected equipment and site conditions.
- The Consultant shall recommend key performance indicators (KPIs) to be adhered to by the service providers such as system reliability and availability, ensuring sustainability related to system design, O&M services.
- The Consultant shall also suggest a third-party verification mechanism in case of disputes between Service Provider and Client on attainment of KPIs
- Once the implementation strategy is conceptualized, conduct a market sounding exercise to validate the approach and ensure there is adequate interest from potential Service Providers to ensure successful implementation and conclusion of contracts as earmarked in the concept. Based on feedback from the market-sounding stage, including from the client and other relevant stakeholders, revise the implementation strategy and develop appropriate tender documents.

4.

Deliverables

Deliverables	Due date (from start)
Inception Mission and Report Summarize approach, methodology and flag key issues to be addressed that may present challenges the study	Week 2
Report on Situational Assessment	Month 3
Report on Planning / Needs Assessment	Month 4
Report on Financial and Economic Feasibility Analyses	Month 5
Report on Roll-out Program / Prioritization	Month 5.5
Report on Development of an Implementation Strategy	Month 5.5
Draft Final Report	Month 6
Final Report	Month 7
Development of Tender Document	Month 8

5. Payment Schedule

This assignment is expected to be completed within a period of 8 months from the signing of contract. The consultant will be paid as per the following schedule:

S. No.	Milestone	Time Frame (Months)	Payment %
1	Signing of contract and submission of inception report	1	10%
2	Approval of Report on Planning / Needs Assessment	4	10%
3	Approval of Report on Development of Implementation Strategy	6	20%
4	Delivery of Final Report and Tender Documents	7	30%
5	Approval of all Deliverables	8	30%

6. Firm Qualifications

Interested consultancy firms should provide information demonstrating that they have the required qualifications and relevant experience to perform the services outlined.

- At least ten years of experience working in rural electricity distribution sector and renewable energy industry
- At least five years of experience working in solar energy industry
- Experience of at least two similar assignments involving support to governments in performing energy needs assessments and preparing and implementing design, installation, and maintenance of solar PV systems at public facilities;
- The firm must have staff with skills in the following areas:
 - Power systems, electrical engineering, energy and ICT;
 - Public-sector planning and development
 - Social and Environment Safeguards
- Experience on at least one assignment working in Sub-Saharan Africa
- Experience with World Bank projects will be considered an advantage;

Additionally, participation of a qualified local counterpart firm/professional personnel in Uganda is strongly encouraged. Professionals assigned by the qualified local counterpart should add value through demonstrable expertise and efficiency in data-gathering and site visits.

The proposal should include information on individuals who would participate in the team for this assignment, including their profile and relevant experience, and their expected levels of effort (LOEs) for the assignment as an input to the budget.

The team shall comprise the following key experts and be supported by the firm in matters relevant to the deliverables, the cost of which shall be included in the rates of the key expert listed below.

Position	Minimum Qualification	Specific Experience	Nature of Involvement	On site Duration
Project Manager	Degree in Engineering/ Finance/ Economy with Project Management Qualifications	At least 10 years of experience as Project Leader in implementing all aspects of the planning, design, implementation, Integration and operations of Off Grid Power Systems. Should have demonstrated analytical skills to analyze and interpret data. Good communication skills in local language and English and good written	Manage timely delivery of Pre-Implementation, Implementation and post-Implementation stages	8 months
Power Systems Engineer	Degree in Electrical Engineering with relevant post grad qualifications	At least 10 year's Progressive experience in at least 2 similar projects as well as Demonstrated Knowledge and credentials in the off-grid power industry.	Provide expert inputs and deliverables of Pre-Implementation, Implementation and post-Implementation stages	8 Months

Position	Minimum Qualification	Specific Experience	Nature of Involvement	On site Duration
Financial Analyst Specialist	Degree in Finance with relevant post grad Qualifications	At least 8 year's progressive experience in the financial analyses and feasibility assessment of similar programs	Provide Financial assessment / expert inputs on the assignment	8 Months
Solar Systems Specialist	Degree in Electrical Engineering with relevant Post Grad qualifications	At least 8 year's progressive experience in the design of off-grid solar industry and latest technologies.	Provide off-grid solar expertise inputs on the deliverables	8 Months
Social and Environmental Specialist	Degree in Social and Environmental Sciences or Equivalent	At least 8 year's progressive experience in social and environmental assessment of off-grid solar projects	Provide guidance on social and environmental impacts of interventions and propose mitigation measures as needed	8 Months

7. Support from the Client

While the Consultant shall be responsible for providing all the necessary tools required for successful execution of this assignment, including the necessary software, transport (foreign and inland), accommodation, communication, etc. and shall include the cost of these responsibilities and tools in their proposed price, the Client will provide available data and information related to the assignment. The client will also cover the cost of the stakeholders' workshops and will, upon request, introduce the Consultant to relevant stakeholders.