



MINISTRY OF ENERGY AND MINERAL DEVELOPMENT

ELECTRICITY ACCESS SCALE UP PROJECT (EASP)

TERMS OF REFERENCE

FOR THE

**STUDY ON OPTIMIZATION OF GRID EXPANSION &
INTENSIFICATION DESIGNS, CONSTRUCTION PLANNING
& DESIGN STANDARDS AND DISTRIBUTION MATERIALS
SPECIFICATIONS TO SUPPORT ACCELERATED
ELECTRICITY ACCESS IN UGANDA**

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LIST OF ABBREVIATIONS AND ACRONYMS

BoQ	BILL OF QUANTITY
BSC	BULK SUPPLY CONTRACT
CD	COMPACT DISK
C-ESMP	CONTRACTOR'S ENVIRONMENTAL HEALTH AND SAFETY POLICY
CU	CONNECTIONS UNIT
CV	CURRICULUM VITAE
DLP	DEFECTS LIABILITY PERIOD
EASP	ELECTRICITY ACCESS SCALE-UP PROJECT
ECP	ELECTRICITY CONNECTIONS POLICY
EHS	ENVIRONMENT, HEALTH AND SAFETY
EIA	ENVIRONMENTAL IMPACT ASSESSMENT
ERA	ELECTRICITY REGULATORY AUTHORITY
ERT	ENERGY FOR RURAL TRANSFORMATION
ESHS	ENVIRONMENTAL, SAFETY, AND HEALTH STRATEGY
ESHS-MP	ENVIRONMENTAL, SAFETY, AND HEALTH STRATEGY AND MANAGEMENT PLAN
ESMF	ENVIRONMENTAL AND SOCIAL MANAGEMENT FRAMEWORK
ESMP	ENVIRONMENTAL HEALTH AND SAFETY POLICY
ESRRI	ENVIRONMENTAL SYSTEMS RESEARCH INSTITUTE
FIDIC	INTERNATIONAL FEDERATION OF CONSULTING ENGINEERS
GEID	GRID EXPANSION, GRID INTENSIFICATION AND GRID DENSIFICATION
GIS	GEOGRAPHIC INFORMATION SYSTEM
GNSS	GLOBAL NAVIGATION SATELLITE SYSTEM
GoU	GOVERNMENT OF UGANDA
GPS	GLOBAL POSITIONING SYSTEM
GRM	GRIEVANCE REDRESS MECHANISM
HC	HEALTH CENTER
HV	HIGH VOLTAGE
IDA	INTERNATIONAL DEVELOPMENT ASSOCIATION
IPF	INVESTMENT PROJECT FINANCE
ISO	INTERNATIONAL ORGANIZATION FOR STANDARDIZATION
IVA	INVESTMENT PROJECT FINANCE
km	KILOMETER
kV	KILO-VOLT
kVA	KILO-VOLT-AMPERE
LIC	LINE INSTALLATION CONTRACTOR
LV	LOW VOLTAGE
M&E	MONITOR AND EVALUATE
MEMD	MINISTRY OF ENERGY AND MINERAL DEVELOPMENT
MLSP	MATERIAL LOGISTICS SERVICE PROVIDER
MV	MEDIUM VOLTAGE
NEMA	NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY
PAP	PROJECT AFFECTED PERSON
PB	PROJECT BRIEF
PDO	PROJECT DEVELOPMENT OBJECTIVE
PDSC	PLANNING DESIGN AND SUPERVISION CONSULTANT

RAP	RESSETLEMENT ACTION PLAN
REP	RURAL ELECTRIFICATION PROGRAMME
RPF	RESETTLEMENT POLICY FRAMEWORK
SACCO	SAVINGS AND CREDIT COOPERATIVE ORGANIZATION
SCC	SERVICE CONNECTION CONTRACTOR
SP	SERVICE PROVIDER
TOR	TERMS OF REFERENCE
WB	WORLD BANK

1.0 BACKGROUND

The Government of Uganda (GoU) has received funding from the World Bank for the implementation of the Electricity Access Scale-up Project (EASP) to be implemented over a period of five (5) years through the Ministry of Energy and Mineral Development (MEMD) as the lead agency. The EASP Development Objective (PDO) is to increase access to energy for households, commercial enterprises, industrial parks, and public institutions. Part of the funding under this project will go towards implementing both electricity grid infrastructure and connections under the Government Electricity Connections Policy (ECP) and will be implemented on an Investment Project Finance (IPF) and Results Based Finance (RBF) approach under the Ministry of Energy and Mineral Development (MEMD). The EASP has four components namely:

Component 1: Grid Expansion and Connectivity: Consumer connections (no-pole and one-pole) of up to 1,073,500 households, investments in new grid infrastructure to accommodate additional connections and electricity grid extensions;

Component 2: Financial Intermediation for Energy Access Scale-up: Soft loans through banks to Solar System Dealers to provide solar Systems to Schools, health facilities, water pumping facilities and communities far from the grid. Funds to be administered by Uganda Energy Credit Capitalization Company Limited (UECCC);

Component 3: Energy Access in Refugee Host Communities: This will provide interventions under components 1 and 2 but specifically in Refugee Host Communities.

Component 4: Project Implementation Support and Affordable Modern Energy Solutions: The component will raise institutional and public awareness on climate change mitigation and the importance of renewable energy technologies and efficient appliances. In addition, the component will provide grant financing to remove the entry and affordability barriers and incentivize performance to promote energy solutions for productive uses, efficient appliances, clean cooking solutions and public institutions.

The grid expansion and connectivity component of EASP aims at increasing access to electricity in all areas of Uganda through, among others, supporting attainment of Government's access goals in a timely manner thereby contributing towards achievement of Government's development goals outlined in the Electricity Connections Policy (ECP), Third National Development Plan (NDP III), Second Rural Electrification Strategy and Plan (RESP 2) and Uganda's Vision 2040. The Project will finance establishment of at least 1 million connections in rural, Peri-urban and urban areas by implementing Last Mile Connections from the existing network within and outside the Umeme Concession, Network Expansion and Strengthening, Energy Access in Refugee Hosting Communities and Industrial Parks.

Component 4 will support GoU's current initiative to rationalize the Uganda power sector institutional structure. With the growing initiatives towards accelerated electricity access, the Ministry identifies the need to assess the sector's grid electrification standards and regulatory frameworks to optimize the rapidly growing investments in the electricity sector. As part of component 4, the Ministry will undertake studies to establish how to optimize distribution network design methodologies based on location, accommodating change in terrain, transformer sizing, standardization of MV and LV length and respective protection and control designs to support and accelerate electrification rates and grid reliability in Uganda.

2.0 OBJECTIVE

The objective is to undertake a study to assess the country's standards in grid Planning & Designs standards for rural electrification and to make recommendations that optimise designs for the country's grid expansion and intensification projects and connection material specifications, including standardized rates for service connections and related infrastructure per connection.

The main deliverable will be the development of Planning and Design Manual, Specification and Tariffs for Appropriate Low-Cost Electrification Technologies and Implementation Strategy of these Technologies, which can be used under the EASP and other electrification initiatives.

2.1 SPECIFIC OBJECTIVES

The Consultant will:

- a) Review distribution (33kV and 11kV networks) sector to assess current methodologies for power line route selection and design.
- b) Document current standards, specifications and regulatory frameworks for grid expansion & intensification and connection materials.
- c) Evaluate standards, specifications and regulatory frameworks for grid expansion & intensification and connection materials and their impact on grid reliability, distribution network losses and timelines for project implementation. Develop and recommend standards, specifications and methodologies for grid expansion & intensification and connection materials specifications for optimal, cost effective and reliable network performance and accelerated electricity access in the country.
- d) Develop and recommend standardized rates for service connections and related infrastructure per connection.

3.0 SCOPE

It is envisioned that the study will cover technical and regulatory frameworks that directly impact distribution systems construction standards & practices as well as connection material specifications. In order to justify the necessity of rationalization of standards and specifications, this study will also undertake a cost benefit analysis (CBA) of improving on the prevailing standards and practices and develop frameworks that reduce capital costs, construction time, improve grid reliability and losses and support/accelerate grid expansion and intensification.

In order for this study to directly benefit the implementation of the EASP as well as the critical factors in the sector, the scope has thus been developed as follows

This study will cover aspects that will directly impact the EASP's Planning & Design Manual for low cost, yet appropriate electrification technologies, and the Manual for specifications for switchgear, poles, conductors, accessories, transformers, meters, ready-boards for mainly rural electrification and low-income urban areas. This scope will take into account the practical solutions for the immediate implementation under the EASP as well as propose long-term/wide reaching solutions which may be practical in the later or outside immediate implementation timeframe under the project.

Specific attention will be given to the following;

- i. Current distribution network setup, practices and reliability; the Consultant will assess the current practices and methodologies for distribution network planning, design and site selection in the country's distribution networks (on-grid and off-grid) including transformer sizing, conductor sizing as well as MV and LV line lengths in relation to the targeted loads. The Consultant will further assess the current state of grid configuration, protection and control technologies in the design practices of the country's previously implemented and on-going projects in the sector and establish the key factors affecting the distribution network's reliability and inform proposals for low-cost appropriate rural electrification designs, standards and specification.
- ii. Review existing technologies in the MV and LV network and recommend optimal technologies to support accelerated rural electrification.
- iii. Develop a Planning and Design Manual for Appropriate Low-Cost Electrification Technologies including a Manual for Standards & Specifications to facilitate acceleration of electricity access in Uganda with a focus on rural electrification and low-income urban areas. These specifications shall cover Switchgear, Poles, Conductors, Accessories, Transformers, Meters, Ready-boards, among other key electrification components.
- iv. Develop standardized rates for service connections, zero and one pole, and related infrastructure cost per stand/erf for various load and stand densities. These will include supply, installation, and reasonable return on investment costs.
- v. Assess the incorporation of GIS technologies in planning and database management of the distribution network. The Consultant will also incorporate GIS technologies in developing the distribution route selection methodologies taking into account the differences in access and terrain across the different geographical locations of the service territories; the developed methodologies, designs and respective material should be cost effective and geographically appropriate.

4.0 TASKS

The Consultant will be required to cover the above scope while/through undertaking the following tasks;

1. Assessing the current grid expansion and extension planning & design practices and material specifications (from distribution network construction material up to and including the customer connection material) under the major service territories and projects (where practice in projects varies from the norm of the SPs), and the resultant impact on implementation timelines, the overall electricity access rate, grid reliability and network performance,
2. Assess the current load, age, and conditions of existing equipment on the existing grid, and estimate costs of asset upgrade/replacement.
3. Review and record current standards, specifications and regulatory frameworks for grid expansion & intensification and connection materials.
4. Review the sector regulatory instruments that directly impact the design, construction and operation of distribution networks in Uganda as provided and regulated by the Electricity Regulatory Authority (ERA),
5. Evaluate the impact of respective distribution network materials & equipment and connection materials specifications on grid reliability and performance,
6. Engage sector stakeholders (MEMD, UEDCL, ERA, NPA, MoFPED, Distribution Companies, UECCC, and sector Development Partners) to assess statutory and regulatory impacts on the rate of electricity access,
7. Engage Distribution Network Suppliers and Contractors on costs, standards and specifications of materials & equipment and construction standards, to assess the shortcomings experienced in the construction distribution networks.

8. Engage existing and potential customers to assess the challenges faced by customers seeking connections and evaluation of grid performance from the consumer perspective,
9. Assessing the impact of the current embedded generation configuration (where small power producers are directly evacuating power onto the distribution grid) on the performance of the distribution grid (in terms of grid reliability and network losses),
10. Reviewing existing technologies in the MV and LV network and recommend optimal technologies to support accelerated electrification.
11. Develop standardized rates from an RBF perspective, where service providers are retro-financed for service connections installed, zero and one pole, and related infrastructure cost per stand/erf for various load and stand densities.
12. Assessing the different type of materials and equipment and their usage in the different regions of Uganda as per the current failure and replacement rates for example, why Wooden poles don't last long in the Northern Region, blowing of distribution transformers, effects of lightening and earthing methods of the distribution network etc.
13. Developing a planning methodology for design optimization favouring increased grid reliability and accelerated grid expansion and intensification, including development of demand side management options and demand forecast incorporation in planning.
14. The Consultant will develop methodologies for transformer sizing (3-phase or 1-phase), recommended MV and LV circuit lengths, protection and control, network structures and materials for both grid expansion and intensification,
15. Developing a methodology for optimizing connection material specifications that will favour increased reliability and optimal technical and commercial losses reduction and accelerated electricity access.
16. Developing a design methodology for mitigating the negative impacts of embedded generation, including material and equipment specification for the network where embedded generation has affected the distribution network performance
17. Proposing tiers for implementation in electrification and grid expansion based on cost, reliability, implementation timelines, local content, access levels,
18. Assess the cost of construction of distribution networks in Uganda. This is mainly affected by the following;
 - Line route selection
 - Construction structure design and configurations
 - Materials and Equipment Standards and Specifications
 - Procurement guidelines and modalities
 - Wayleaves acquisition
19. Coordinate Monthly Review Meetings
20. Provide monthly and quarterly progress reports.

5.0 RESPONSIBILITIES OF THE CLIENT

- Provide letters of introduction to other stakeholders, Service Providers, Local Authorities and other relevant offices as need may arise.
- Together with the ERA, provide regulatory instruments on the sector, including Laws, Polices, Regulations and Codes, Guidelines and Standards and any other regulatory instrument that is pertinent to the assignment.
- Appoint a contract manager / contract management committee to regularly interface with the Consultant to monitor progress of the Consultant's assignment
- Chair monthly Progress review meeting on the assignment
- All expenses related to the assignment such as office space, travel (inland and foreign), and accommodation, stationary shall be borne by the Consultant.

6.0 DURATION OF ASSIGNMENT

This assignment is expected to take a period of six (6) months. The timing of key milestones in the assignment is detailed in the expected deliverables below.

7.0 EXPECTED DELIVERABLES AND REPORTING REQUIREMENTS

7.1 DELIVERABLES

In addition to the deliverables/reports mentioned in the tasks above, the deliverables below will guide the progress of the assignment.

Item	Description of Output	Timing
1.	Draft Inception Report	Week 2
2.	Workshop for stakeholders' engagement on Draft Inception report	Week 3
3.	Final Inception Report	Week 4
5.	Draft Manual for Appropriate Low-Cost Electrification Technologies and Specifications and Tariffs	Week 16
6.	Final Planning and Design Manual, Specification and Tariffs for Appropriate Low-Cost Electrification Technologies and Implementation Strategy of these Technologies	Week 24

7.2 REPORTING REQUIREMENTS

The Consultant shall be reporting to and supervised by the Contract Manager to be appointed by the Client. The client and Consultant will agree on a regular progress monitoring engagement which will include monthly reporting.

All deliverables including work files, document files, databases, spreadsheets, drawings, and GIS data related shall be provided to the client in electronic format (on CD) upon completion of the consultancy, in addition to 5 copies of the hardcopy reports. The electronic data formats shall be compatible with the latest versions of:

- i. The Microsoft Office Suite;
- ii. Adobe Portable document format software (PDF)
- iii. Auto CAD;
- iv. ArcView GIS;
- v. Network analysis software (PSS© SINICAL or sub-sector compatible software).

Any other data formats shall be subject to prior approval by the client.

8.0 QUALIFICATIONS OF THE CONSULTANCY FIRM AND KEY PERSONNEL

8.1 QUALIFICATION OF THE CONSULTANCY FIRM

The Consultant will be a firm or consortium of firms with diversified technical competencies, including (but not limited to) energy sector institutional, regulatory and legal aspects; integrated energy sector planning; planning and design of power distribution systems; rural electrification (on-grid and off-grid); and utility management and operations. The Consultant shall have the following qualifications and experience:

- Proven experience in the preparation of electrification strategies and programs that integrate grid and off grid technologies in developing countries.
- Experience in the planning and design of systems for electrification of rural areas in developing countries.
- Demonstrated knowledge and understanding on different business models to promote on-grid and off-grid technologies in a sustainable manner.
- Proven experience in Uganda and or other developing countries in Sub-Saharan Africa
- Experience in public sector planning

The Consultant shall present at least two (2) similar assignments (in nature, value and scope) to prove possession of the above competences carried out over the last 10 (ten) years.

The Consultant will deploy a team of well qualified personnel/experts to undertake field activities who will be supported by a competent team at the Consultant home office. All the experts shall be highly skilled and experienced and shall score a minimum of 75%. Key Staff with scores of less than 75% shall have to be replaced if the Consultant progresses to negotiations stage.

The proposal of the Consultant shall be set out in detail showing the list of experts required for each stage of the assignment and the duration person/ days) for which the services are required. The Consultant shall present the staffing schedule in a manner that makes it clear as to which personnel will be involved in a specific activity. A staff organogram reflecting the envisioned activities should therefore be presented.

8.2 KEY PERSONNEL

The Consultant's team shall include the following key personnel:

Position & No.	Minimum Qualifications And Experience	Indicative Staff Man-Months
Project Manager /Team leader (1)	Should have a post graduate qualification in Engineering, Power Economics, Finance, Business Administration or Project Planning, Monitoring and Evaluation. He/She should have at least 15 years of similar experience in planning, design and/or operation of on-grid and off-grid distribution systems in developing countries. Should have participated in at least one similar assignment for preparation of a power master plan or energy sector development strategies in developing countries.	6
Legal and Regulatory Expert (1)	Should possess a degree in law as a minimum with at least 10 years' similar experience in developing strategic plans in the energy sector of developing countries. Should have a valid certificate to practice law in Uganda.	3
Planning and Design Engineers (2);	Should have a degree in Electrical Engineering as a minimum with at least 10 years of similar experience in planning and designing electricity distribution networks.	12
Power Economist (1)	Should have as a minimum of a degree in Economics, finance or Business Administration with at least 7 years' similar experience in developing business models to promote energy infrastructure development. Should have participated in the development of at least one similar model to foster development of an energy sector project involving transmission or distribution networks	6
GIS Specialist (1);	Should have a degree in land survey as minimum and able to demonstrate at least 10 years' similar experience in GIS based planning and design of rural electrification systems in developing countries.	6