TERMS OF REFERENCE OF REGULATORY FRAMEWORK FOR TARGET SETTING, MONITORING AND AUDITING OF ELECTRICITY QUALITY OF SUPPLY AND SERVICE

1 Background

In accordance with Section 10 (i) of the Electricity Act 1999, Electricity Regulatory Authority (ERA) is mandated to develop and enforce performance standards for the generation, transmission and distribution of electricity to protect the interests of consumers with respect to the electricity quality of supply and service. Further, Regulation 9 of the Primary Grid Code (2003), and Statutory instrument No. 24 (2003), emphasizes that the Authority is mandated to determine the requirements for Quality of service and supply performance of the electricity industry.

In order to improve electricity Quality of supply and service provided by electricity distribution licensees in Uganda, ERA developed the Quality of Service (QOS) Standards in 2015. These QOS standards relate to three aspects, namely; Access to supply (connection period of new customers), customer service and reliability of supply. These standards became effective in March 2015. Currently, the Authority is in the process of amending the Quality of Service Code to incorporate service level standards. This process is envisioned to be complete by December 2020.

Consequent to the above, the Authority undertook a review of the Quality of Service performance of one of its largest distribution licensee as part of its next six year performance parameter setting and the licensee's Quality of service baseline performance was established. Additionally, in 2019, ERA amended the tariff methodology for one of its distribution licensees to provide for a financial benefit/reward structure methodology against the

Quality of service standards/targets set by ERA (SAIDI, SAIFI, quality of supply (voltage and frequency)).

To effectively operationalize the incentive framework for the Quality of service and supply performance with regard to aspects of ; access (time taken to connect), customer service (meter reading, reconnection period, call center service level, emergency complaints, technical and non-technical complaints handling, period of faulty meter replacement), reliability of supply (notice of planned and unplanned works, execution of planned outages),the Authority will require the following;

a) A methodology and tool to determine and set the Quality of service targets. These will include; access (time taken to connect), customer service (meter reading, reconnection period, call center service level, emergency complaints, technical and non-technical complaints handling, period of faulty meter replacement) and reliability of supply (SAIDI and SAIFI).
b) Tool to aid periodic monitoring and performance measurement of licensees against target.
c) Methodology and tool for auditing the submitted performance statistics and related reports.
d) Methodology and tool for projection of QOS performance for subsequent periods.

The developed tools, methodologies and audit manual will be utilized by both the Regulator for QOS target setting and performance review against

the targets and for self-censure by the regulated utilities for the QOS data and performance analysis respectively.

Hence, these TORs provide the general objective of the assignment, the detailed specific objectives, the capacity building requirements, required team composition of the consultant team and the project deliverables.

2 Objective(s) of the Assignment

The overall objective of the assignment is to develop a regulatory framework to determine, monitor, audit and improve quality of service and supply performance of the electricity supply industry in Uganda. The framework (methodology, audit manual, tools) should also highlight non-compliance against the target.

3 Scope of Services, Tasks (Components) and Expected Deliverables

3.1 Task 1: Develop a methodology and tool for computation of Quality of Service and Supply annual performance targets.

The consultant should design and develop a model (in Microsoft Excel) to compute/calculate the quality of service and supply targets. The developed model shall provide methodology for handling the QOS data challenges such as incompleteness, inconsistency and inaccuracy of the submitted QOS data in respect to QOS standards pertaining to access (time to connect) and customer service.

In respect to reliability of supply standards, the developed model should have capability to compute the reliability of supply performance indices (SAIDI, SAIFI, CAIDI, MAIFI) as per the IEEE 1366 standard for both grid

connected and off –grid networks. The model should have features and abilities to conduct the following aspects;

a) Automated data cleaning
b) Smart data validation
c) Exclusion of outages in line with the IEEE 1366 major event days (MEDs);
d) Level of Customer indexation
e) Exclusion of outages due to third parties/ factors such as those from the transmission network.
f) Exclusion of Momentary outages in line with IEEE 1366 of less than 5 minutes
g) The tool should prescribe the standard classification of outage causes.

The developed model/tool should accommodate the current level of SCADA coverage and cover other optimal or equivalent cost effective technologies for incident recording and outage monitoring.

In addition, the tool should also make provisions for computation of the reliability performance at Low Voltage (LV) level and should incorporate other cost effective monitoring technology that can be deployed by licensees.

3.2 Task 2: Develop audit manual for the quality of service and supply performance verification.

a) The consultant shall develop an audit manual to guide the periodic auditing and monitoring of the underlying systems, processes and data capture mechanism/ procedures deployed by the licensed entity. The audit manual will clearly outline the procedure for raw data

verification in terms of completeness, accuracy and checking of the original on-site records at the customer premises.

b) The consultant shall develop an audit manual for authenticating the functionality and integrity of the systems that capture, process, analyze and manage power interruption data and processes. These systems primarily include SCADA, OMS, GIS and several call center software.

c) The consultant shall review and make recommendations on the necessary technologies and SCADA modules that will enable better management and improvement of reliability of supply performance.

3.3 Task 3: Develop tool and methodology for projection of Quality of Service and supply performance

The consultant shall develop a methodology and model that will be used to determine/set the Quality of Service and supply performance targets for the subsequent period for access, customer service and reliability of supply. With respect to the reliability of supply targets for the future periods, the consultant shall provide recommendations on the impact and contribution of reliability of supply improvement initiatives such as network maintenance, network investments (load growth, restoration, upgrade, refurbishment, quality of supply improvement), network automation, etc. This impact and contribution factors will be incorporated in the tool used for set the reliability targets. The expected outcome is the Quality of service and supply (Access. Customer service and reliability of supply) trajectory for the stipulated periods.

The developed model/tool should accommodate the current level of SCADA coverage but make provision for computing as SCADA coverage grows for medium voltage network (33 & 11 kV). In addition, the tool should also make provisions for computation of the reliability targets at LV level taking into consideration the most appropriate monitoring technology that can be deployed by licensees.

3.4 Task4: Propose regulatory framework for non-performance

The consultant shall recommend the most effective regulatory action (including but not limited to sanctions, penalties, incentives) that have been applied by other Electricity Regulators in different jurisdiction to promote quality of Service improvement. The recommendations have to be contextualized to the electricity supply industry of Uganda.

3.5 Task 5: Knowledge transfer and training of Electricity supply industry personnel

3.5.1 Training by consultant

During implementation of this assignment, the consultant shall provide training to selected Regulator, distribution , transmission staff members, and selected government officials in the fields detailed below;

i) Regulating Quality of Service: Planning, Compliance Monitoring, & Enforcement.
ii) Regulatory Impact analysis: institutional design and methodological approaches.
iii) System distribution automation, regulatory functionality monitoring, design, installation, commissioning, operation and maintenance;
iv) Reliability of supply performance determination amidst prevalent limitations such as aged network, limited network investment (SCADA,

network automation and limited network protection equipment), incomplete customer indexing, embedded distribution utilities, etc.;

v) Simulation software provision and actual usage of software to envision the impact of the proposed reliability of supply improvement interventions; and,

vi) In addition, the consultant shall identify and facilitate selected staff to undertake a benchmarking study/visit to utilities that have made significant quality of service and supply performance improvements over the last 5 years.

3.5.2 Other training

ERA wishes to enhance the technical capacity of its staff and the sector in order to ensure that Sector has the required knowledge and skills to operationalize the quality of service and supply regulatory framework. The capacity building will be in the areas of reliability and operational performance of electric power systems including protection; distribution automation, probabilistic reliability analysis and smart grids;

However, given the diverse expertise that will be required to meet the above requirement, the consultant will source the services of a sub-consultant (s) to provide training in the above listed areas with the content described below:

a) Reliability and operational performance of electric power systems
    I. Network Reliability Modelling
    II. Evaluation Assessment of Electric Power Systems – Generation, Transmission and Distribution.

b) Power system protection and reliability

c) Electric network Distribution Automation

d) Probabilistic reliability Analysis

e) Asset Management Principles and utility prudent practice

3.6 Task 6: Workshops

The consultant shall deliver two workshops ; the first workshop will be after completion of deliverable 1, 2 and 3 as per Table1 and the second workshop will be after completion of deliverable 5, 6 and 7.

Table1: Showing deliverables and corresponding timelines

No.	Deliverable	Timeline (weeks) from contract effectiveness
1	A methodology and tool for determination/calculation of Quality of Service and Supply annual performance targets.	5
2	Audit manual for the Quality of Service and supply performance verification.	5
3	A tool and methodology for projection of Quality of Service and supply performance	6
4	Workshop to share deliverable 1, 2 and 3	1
5	Propose regulatory framework for non-performance	3
6	Knowledge transfer and training of Electricity supply industry personnel	4
7	Capacity Building Reports	2
8	Workshop to share deliverable 5, 6 and 7	1

4 QUALIFICATION CRITERIA AND REQUIRED EXPERIENCE

The consulting firm should have completed at least two similar and two related assignments in an electricity sector, one of which should have been for an electricity regulatory agency or electricity distribution company. The firm should demonstrate its experience and knowledge of the electricity sector in Uganda, sub-Saharan African, and developing economies.

The firm shall provide assurance that the proposed key personnel for this consultancy service agreement shall be available for the duration of the assignment. Change in the proposed key personnel at the time of contract award resulting from causes beyond the firm's reasonable control such as retirement, death, and medical incapacity shall be endorsed and approved by ERA before such a change takes effect.

As a minimum, the firm's core team of specialists shall comprise at least the following highlighted below; each with the requisite academic qualifications in the professional field and demonstrable experience in undertaking similar assignments in the sub-Saharan African region, and developing economies.

4.1 Team Leader

Qualifications/Requirements:

Must be a graduate in natural or human resource sciences or engineering and not less than 10 years senior management. Three of those years must be in a similar position.

4.2 Electric Power System Engineer

Qualifications/Requirements:

a) Master's Degree in Electrical Engineering with a minimum of 12 years of professional experience in operating electric distribution networks with a bias to reliability improvement.
b) Experience in performing load flow analysis, power flow analysis, short circuit, Arc Flash, Network modeling, Protection and stability, Control and communication technologies, Electrical power system studies, Electrical power distribution design, distribution Automation, electric network reliability modelling.
c) Software experience: PSSE, PSLF, PSMOD, ASPEN, CAPE short circuit, ETAP

4.3 Utility Operations and Maintenance Engineer
Qualifications/Requirements:

a) Degree in relevant Electrical Engineering discipline
b) Minimum 10 years relevant work experience in distribution operations and maintenance.
c) Hands-on/field experience in electrical activities related to planned and unplanned maintenance.
d) Familiarity with international standards such as ISA, ANSI, API, ASME, NEC, IEC, IEEE etc., standard industry practices and engineering software.

4.4 SCADA and Network control Expert
Qualifications/Requirements:

Requires Degree in Computer Science, Computer Engineering, Industrial Engineering, Electrical Engineering or related field, and five (5) years of

experience in SCADA system operation and maintenance, telemetry systems and computer systems, electric network distribution automation.

4.5 Power system planning specialist
Qualifications/Requirements:

a) Bachelor's Degree in Electrical Engineering, with power related courses or relevant experience, required.
b) Strong computer skills using industry software such as PSS/E, ETAP, PSCAD, Dig Silent, Power World, etc.
c) 10+ years of hands on experience with power system modeling including electrical load flow, short circuit, and transient and dynamic stability.

4.6 Power system planning data analyst
Qualifications/Requirements:

a) Master's degree or higher in Electrical Engineering, Power Systems Engineering, Power Electronics, Energy Engineering or related field;
b) Three years related experience;
c) Expert in the area of static analyses of load flow, optimal power flow, short-circuit calculation, contingency analysis, and voltage stability;
d) Experience in dynamic programming (DP), linear programming (LP) and mixed-integer programming (MIP), solving very large problems involving hundreds of thousands of variables and constraints.

4.7 Information Technology System Specialist
Qualifications/Requirements:

a) Bachelor or Master's Degree in Computer Science or other related technical field.
b) Four years of service management experience.

c) Experience working with software product development team on feature enhancements.
d) Understanding of best practices of software deployment implementations, including design patterns, release management, deployment strategies, and testing best practices.

5 Planned Implementation Methodology and Approach

There shall be a technical committee constituted to provide technical guidance, support to the consultant, and oversee the implementation and delivery of the assignment. The technical committee shall be composed members from the MEMD and ERA. Furthermore, the consultant will be expected to interact extensively with ERA during implementation of this assignment.

6 Reporting Requirements and Time Schedule for Deliverables

ACTIVITY	PLAN DURATION
A methodology and tool for determination/ calculation of Quality of Service and supply annual performance targets	5
Audit manual for the Quality of service and supply performance verification	5
A tool and methodology for the projection of Quality of service and supply performance	6
Workshop 1	1
Propose regulatory framework for non -performance	3
Knowledge transfer and training of Electricity supply industry personnel	4
Capacity building reports	2
Workshop to share deliverable 5,6 and 7	1