REPÚBLICA DEMOCRÁTICA DE SÃO TOMÉ E PRÍNCIPE

MINISTRY OF INFRASTRUCTURE AND NATURAL RESOURCES

(Unidade – Disciplina – Trabalho)

ACCESS TO CLEAN RESILIENT ELECTRICITY PROJECT
TECHNICAL IMPLEMENTATION UNIT

TERMS OF REFERENCE

OWNER'S ENGINEER FOR DRAWING UP THE TENDER SPECIFICATIONS AND SUPERVISION FOR REHABILITATION AND EXPANSION OF THE MEDIUM AND LOW VOLTAGE NETWORK, THE UPGRADING OF DISPATCH CENTER AND CONTROL SYSTEM AND BATTERY ENERGY STORAGE SOLUTION (BESS)

1. Project Background

The Government of the Republic of Sao Tome and Principe (GoSTP) received a grant from the International Development Association (IDA) towards the cost of the Access to Clean Resilient Electricity Project (ACRE), whose objective is to increase access to sustainable and clean energy in Sao Tome e Principe. This is aligned with the ASCENT MPA Program Development Objective (PrDO) of accelerating access to sustainable and clean energy. The project will be implemented by the Ministry of Infrastructure and Natural Resources and consists of four complementary components:

Component 1: On-grid and Off-grid Electricity Access Expansion that aims to expand access to electricity through the following activities: (i) electricity network reinforcement to allow stable supply to meet growing demand; (ii) electricity network expansion in underserved areas; (iv) last-mile electricity connections including payment for connection fees to help customers better afford connection costs; (iii) deployment of grid-connected and off-grid solar PV systems for public facilities (particularly in education and health facilities) to build

resilience, reduce operating costs and to enable the provision of better health and educational services; and (v) off-grid connections for households to help close the energy access gap and foster greater inclusion.

Component 2: Solar PV scale-up through deployment of common infrastructure will finance investments and risk mitigation instruments to expand grid-connected utility-scale solar PV system in STP to reduce the average cost of generation by increasing the share of (privately financed) renewable energy. The proposed project will finance site preparation for up to 15MWp of solar PV capacity, an initial 5MWp solar PV plant (to be managed by a private operator), an interconnection line from the solar park to the network, battery energy storage, and provide risk mitigation instruments – namely a tariff buy-down solution to ensure the tariff is financially viable to the off-taker, and a liquidity guarantee, also covering off-taker risk – for a 10MWp plant to be developed through an independent power producer.

Component 3: Improved governance and institutional capacity building will build the capacity of sector institutions, namely MIRN, AGER and EMAE for improved policy formulation, policy implementation, regulation, and system operations in a sector undergoing transformation. Will also support to strengthen the performance of EMAE and Institutional capacity building, technical assistance, and project implementation support. Apart of this aspect the project will also finance implementation of agreed aspects of the National Training Plan for the Energy Sector (2021, financed by the UNDP), technical assistance, additional systems studies, and costs for project implementation and provide project implementation support, including operating costs for the Project Implementation Unit (PIU) under MIRN on procurement, technical aspects, and safeguards, and gender-informed trainings for EMAE technical staff supervising project implementation.

Component 4 is a Contingency Emergency Response Component (CERC).

1.1. Overview of the STP electricity sector

The energy sector in STP is small, and institutions are young with varying degrees of capacity and overlapping mandates. The Ministry of Planning and Finance (Ministério do Planeamento e Finanças, MPF) oversees the financial performance of the National Water and Electricity Utility (Empresa de Água e Electricidade, EMAE) and tariff approvals. The Ministry of Infrastructure and Natural Resources, (Ministério das Infraestrutura e Recursos Naturais,

MIRN) oversees EMAE's technical performance but has few technical resources of its own. The General Regulatory Authority (Autoridade Geral de Regulação, AGER) is the multisector regulatory agency with mandates in the telecommunications, water, post offices and electricity sectors. In December 2014, it was mandated with regulating the energy sector, including regulating tariff, permitting, and overseeing long-term sector planning. A planning entity was also recently created under MIRN.

The energy sector has a strong impact on fiscal sustainability and economic growth on two sides. First, high dependence on expensive diesel for power generation leads to high delivery costs exposed to the volatility of international fuel prices. Second, electricity, while expensive, is extremely unreliable with several hours of outages which reduces productivity and, consequently, revenue collection. The installed generation capacity is 39.64 MW of which 29.64 MW belong to EMAE and the remaining 10 MW belong to private company. Of the 39.64 MW installed, only 2.54 MW come from renewable energy with solar being 0.54MW and hydro 2 MW. STP experienced a severe energy crisis in middle 2022, where diesel generators systematically failed as result of inadequate maintenance. The government injected finance over the years 2022 and 2023 to reduce the supply deficit. Currently, the power available for electricity production exceeds the country's demand.

STP has the third-highest electricity supply cost in Sub-Saharan Africa. Although STP's average electricity tariff of US$0.22 per kilowatt hour (kWh) is among the highest in the region, it is still insufficient to cover generation costs. Aggregate technical and commercial losses is estimated at 37 percent, of which over 20 percent are non-technical losses. Payment discipline of energy consumers in STP is poor, and the high commercial losses are largely due to theft through illegal connections. On the other hand, tariffs have not been adjusted since 2007 and with the cost of service estimated at US$0.27 per kWh against an average tariff of US$0.22 per kWh (in 2022), EMAE is unable to cover its costs.

1.2. Description of the Assignment

As detailed above, the Access to Clean Resilient Electricity Project (ACRE) has four (4) main components, which include (amongst others) the i) Extension and Rehabilitation of the Power Grid in São Tomé & Príncipe to further the access to electricity and ii) Scale-up Solar PV deployment in the country.

To achieve both these goals, there are a set of preliminary steps that must be taken to ensure the readiness of the energy sector. One the one hand there is a need to develop a comprehensive grid study to identify the most relevant grid extension/rehabilitation projects (including BESS integration), on the other hand, to further integrate Variable Renewable Energy (VRE) in the grid of São Tomé, there is a need to upgrade of EMAE dispatch center, not only to accommodate a higher level of VRE penetration but also to include new BESS solutions on the island of São Tomé with the objective of meeting universal least cost access to electricity. There is also a need that both the network extension/rehabilitation as well as the upgrade of EMAE's dispatch center are developed in accordance to the environmental and social instruments of the World Bank, resulting in the need for the development of an Environmental and Social Impact Assessment (ESIA) and additional environmental and social instruments.

The general objective of the assignment is detailed below.

1.3. General Objective of the Assignment

Overall, this consultancy has three main objectives:

1. Prepare the necessary grid studies and identify the most relevant grid extension/rehabilitation projects (including BESS integration) in São Tomé and the general objective of the consultancy is to put together the specifications for the rehabilitation and expansion of the medium and low-voltage network and upgrade of EMAE dispatch center.
2. The consultant will also be responsible for supporting the EMAE in selecting the most high priority rehabilitation and extension projects and ensure the full Owner's Engineering support necessary during the pre-construction, construction and post-construction phases of i) the rehabilitation and expansion of the medium and low voltage network, ii) upgrade of EMAE dispatch center, and iii) the implementation of the selected BESS solution on the island of São Tomé with the objective of meeting universal least cost access to electricity.
3. Conduct an Environmental and Social Impact Assessment (ESIA) and additional environmental and social instruments for the identified sites which will include screening, scoping, defining baseline scenarios, predicting impacts, and developing robust and applicable management and monitoring plans to avoid, mitigate or remedy significant

potential and enhance benefits,, detailed in site-specific instruments such as Environmental and Social Management Plans (ESMP) and, if applicable, in Resettlement Plans (RP). including addressing them and incorporating their views into the ESIA.

.

2. General Scope of Work

2.1 Scope of Work for Rehabilitation and Expansion of the Medium and Low Voltage Network

The activities to be carried out by the consultancy are:

Task 1: Assessment of the Operational Condition of the Current Distribution (MV/LV) System:

In this task EMAE expects consultants to carry out a diagnosis/characterization of the current distribution system, identifying the main sources of inefficiencies and determining the procedures with the greatest potential with a view to resolving the identified problems.

One of the main focus of attention consists of identifying the main loss elements (lines, transformers, imbalances, etc.) and the main areas (Medium or Low voltage), with the aim of establishing priorities at the points most in need of intervention.

Also as part of this task, the consultant is expected to carry out an analysis of the behaviour of the network, so power transit studies are expected to be carried out, which will require the characterization of the networks under analysis: structure, line characteristics (lengths, resistances, reactance, etc.), typical loads.

At a minimum, EMAE will provide the consultant with the following:

1. Single line diagram showing the detail of all static loads
2. Line and Cable data (specify into diagram)
3. Transformer data
4. Generator data

5. Capacitor data

Furthermore, EMAE will provide the consultant, a list/table (in Excel format) of the areas that are currently off-grid and have an expected potential demand that may deem the area as a potential new addition to the national distribution grid.

After completing the general diagnosis, the consultant is expected to present the various alternative and/or complementary solutions that will be listed with a view to improving operating conditions. These alternatives will be characterized in terms of their potential for reducing losses, estimated costs and impact on other quality measures relating to the operating conditions of the energy system.

As experience and knowledge of the system are fundamental, the final phase of this task requires the collaboration of EMAE to identify and prioritize the main mitigation actions. EMAE's participation will also be fundamentally advantageous in preparing the detailed plan to be followed in the following phases.

All these studies will be the subject of a report (deliverable D1).

Task 2: /Distribution Network Design and Planning Criteria for Grid Extension

The aim of this task is to detail and analyse the assumptions, algorithms and procedures to be adopted by EMAE in planning and extending the electricity distribution network. These processes differ from country to country due to different circumstances in terms of extension, landscape, load and generation characteristics, implementation costs and others. In this sense, it will be important that the consultant will work in close collaboration with EMAE to obtain an understanding of the criteria and practices used in this type of projects – engaging with EMAE’s engineers with relevant field experience will be an added value.

Also, in cooperation with EMAE, hypotheses for changing voltage levels should be discussed, namely the creation of a sub-transmission level. The increase in voltage for distributing energy over longer distances is an advantage recognized in international practice. However, this solution has considerable costs that must be considered in this discussion.

Assessment of the advantages and disadvantages of possibly installing larger substations but in fewer quantities (or smaller substations but in larger quantities)., so the possibility of

planning autonomous networks should be analysed in comparison with the need to implement long connections. These facts must be considered when evaluating solutions.

The specifications normally considered in the design of substations, as well as information on the respective operating regimes, complete the characterization of the system in terms of its main nodes.

Task 2.1: Analysis of the Battery Energy Storage Solution (BESS) sizing and locational study

In line with the necessary studies to be undertaken in Task 3, the consultant is requested to simulate a scenario that includes the introduction of Battery Energy Storage Systems (BESS). To do so, the consultant is expected to identify options and develop an action plan to facilitate the integration of grid-connected energy storage for better grid management, given the country's renewable energy targets. As part of this task, the Consultant will carry out sizing study to determine battery parameters to accommodate the renewables target stated in the STP's National Energy Strategy.

As part of this task, the consultant is also expected to present:

- Based on best practices, advise on the pros and cons of distribution storage within the STP context.
- Propose estimated timeline, budget, and procurement plan for developing the Battery Energy Storage Solution.
- Provide the technical specifications of the optimal configuration recommended by the Consultant and approved by EMAE. EMAE will provide the RfQ and RfP documents of the Targeted Projects, allowing the Consultant to prepare the technical part of these documents.

Task 2.2: Medium Voltage Network Protection Plan

In line with the necessary studies to be undertaken in Task 2, the consultant is requested to develop and simulate a protection plan for medium voltage networks (6 and 30 kV). Developing a Medium Voltage (MV) Network Protection Plan involves designing and implementing protective measures to ensure the reliability, safety, and efficiency of the electrical distribution network. The main objectives of the Medium Voltage (MV) Network Protection Plan include:

- Ensure safety for personnel and equipment.

- Minimize interruption of service.
- Limit damage to network components during faults.
- Ensure quick fault detection and isolation.

Hence, the goal of this task is for the Consultant to develop a plan that will protect the network against faults and abnormal conditions, minimizing damage and ensuring continuity of service. It is expected that the comprehensive MV Network Protection Plan should include, but not be limited to:

1. Network Analysis and Data Collection
    a. Network Configuration:
        i. Collect data on the network layout, including single-line diagrams[1].
        ii. Identify all network components: transformers, switchgear, circuit breakers, and protective devices[2].

    b. Load Data:
        i. Gather information on load flow, peak loads, and demand patterns.
        ii. Prepare a load flow study for the existing distribution system, and a load forecast for 30 years"

    c. Fault Data:
        i. Analyse historical fault data and identify common fault locations and types.
        ii. Calculate short-circuit currents at various points in the network.

2. Protection Requirements and Standards
    a. Standards Compliance:
        i. Ensure compliance with national and international standards (e.g., IEC, IEEE).

    b. Protection Criteria:

[1] This data is to be provided by EMAE and complemented by previous existing studies to be made available by AFAP
[2] This data is to be provided by EMAE

i. Define criteria for fault detection, isolation, and service restoration.
ii. Set thresholds for fault current levels, operation times, and coordination with upstream and downstream protection devices.

3. Selection of Protection Devices
    a. Protection Relays:
        i. Select appropriate types of protection relays (e.g., overcurrent, distance, differential, earth fault).

    b. Circuit Breakers:
        i. Choose circuit breakers with suitable interrupting capacities and response times.

    c. Fuses:
        i. Use fuses where applicable, considering coordination with other protective devices.

4. Coordination and Selectivity
    a. Time-Current Coordination:
        i. Perform time-current coordination studies to ensure that protective devices operate in the correct sequence.

    b. Zone Protection:
        i. Define protection zones (e.g., transformer zone, feeder zone) and ensure devices within each zone coordinate correctly.

    c. Backup Protection:
        i. Ensure that backup protection is in place in case primary protection fails.

5. Protection Scheme Design

a. Primary Protection:
    i. Design primary protection schemes for immediate fault detection and isolation.

b. Secondary Protection:
    i. Implement secondary or backup protection schemes to cover primary protection failures.

c. Communication Systems:
    i. Integrate communication systems (e.g., SCADA) for real-time monitoring and control of protective devices.

6. Documentation
    a. Documentation:
        i. Create detailed documentation, including protection settings, coordination studies, and maintenance schedules.

Task 3: Preparation of Technical Solution Proposals for Technical Loss Reduction Program

The studies to be developed in the previous tasks should allow the consultant to specify the main sources of inefficiency. For the identified problems, it is expected that the consultant will recommend appropriate mitigation alternatives to be considered by EMAE, which may include:

- Raising the voltage level and implementing appropriate substations;
- Replacement of existing transformers with more efficient ones;
- Reinforcement of lines;
- Power factor compensation;
- Phase rebalancing;
- Introduction of Capacity limitation with consumers;
- Implementation of tariffs that create a tendency towards homogenization of the load diagram;

- Assessment of the need to analyse operational procedures to reduce losses: optimized reconfiguration (static and active), use of distributed production for reactive control, etc. The potential of microgeneration to influence the reduction of losses will also be analysed, through the consideration of scenarios of increased microgeneration in LV.

In each case, the most appropriate alternatives should be analysed, and the expected benefits should be evaluated over a horizon (typically 20 to 30 years) to be defined with EMAE.

All these studies will be the subject of a report (deliverable D2 – task 2 and 3).

Task 4: Technical-Economic Assessment of Technical Alternatives for Grid Rehabilitation and Expansion and Analysis of the Environmental and Social aspects

Each alternative technical solution for each Rehabilitation and Expansion project identified in the previous tasks should be monetized both in terms of implementation costs and in terms of benefits of the solution (namely, avoided losses, potential new customers, etc). These amounts will be integrated into a financial assessment that will consider financing conditions, return rates, administrative, operation and maintenance costs, and other terms to be defined/approved by EMAE.

Each alternative technical solution for each Rehabilitation and Expansion project identified in the previous tasks should be analysed for its environmental and social aspects. In this sense, the consultant should carry out the E&S screening to determine the subsequent necessary E&S studies for each identified project (Environmental and Social Impact Assessment, Environmental and Social Management Plan, Resettlement Plan, etc).

The result of this task should be part of the characterization of each alternative solution proposed for each case/project, which should be the subject of a report (deliverable D3).

Task 5: Recommendations for Acquisition and Training (Software, Tools and Equipment)

The objective of this project is not limited to identifying and resolving current problems in the São Tomé distribution system. It is also intended to establish practices leading to good system performance, which is why it is important to optimize the planning and operation processes of electricity distribution networks. In this sense, it is important to assess whether there are means

that allow good conduct, based on adequate training and computational means compatible with the demands of managing a modern energy system.

In collaboration with EMAE, the need for additional training in planning, operation and administrative and financial management of the company must be assessed. Computer resources for network modelling and simulation, power transit calculation, contingency analysis, identification of optimal points for installing capacitor banks, detection of anomalies and definition of protections must also be evaluated.

These recommendations should be summarized in a document (deliverable D4) to be delivered to EMAE.

Task 5.1 – Training Workshop in São Tomé

At the end of Task 5, the Consultant is requested to schedule, organize and develop a comprehensive Training Workshop, in São Tomé, for EMAE, TIU and AFAP experts focusing on the topics covered in Tasks 1, 2, 3, 4 and 5.

This Training Workshop is expected to be held in São Tomé, and should include a 3-day training course (to a maximum of 25 participants) covering how to develop and the main findings of the undertaken:

- Assessment of the Operational Condition of the Current Distribution (MV/LV) System
- Discuss results of Load Flow Study
- Distribution Network Design and Planning Criteria for Grid Extension
- Analysis of the Battery Energy Storage Solution (BESS) sizing and locational study
- Medium Voltage Network Protection Plan
- Preparation of Technical Solution Proposals for Technical Loss Reduction Program
- Technical-Economic Assessment of Technical Alternatives for Grid Rehabilitation and Expansion and Analysis of the Environmental and Social aspects
- Recommendations for Acquisition and Training (Software, Tools and Equipment)

Task 6: Preparation of Tender Documents

At this stage, the consultant is expected to prepare the tender processes and documents for the work and supplies necessary for the improvements identified in the previous phases.

The scope of service provision will include the following activities:

i) Tender Process

- Preparation of terms of reference and technical specifications
- Preparation of publicity documents for competitions and support in identifying appropriate means of publicity
- Support in the creation of a "data-room" for competitors to consult the tender documentation
- Definition of guarantees required from manufacturers and/or contractors including functional guarantees
- Guidance to prepare Contractor-ESMPs for the project intervention sites
- Establishment of a Grievance Mechanism (GM) sensitive to Sexual Exploitation and Abuse, and Sexual Harassment (SEA/SH) available for workers and for the affected persons/communities at the intervention areas.
- Establishment of formulas for calculating penalties applicable in case of non-compliance
- Preparation of Tender Process documents
- Support in the process of inviting bidders to present proposals
- Support in the stage of proposal evaluation

ii) Award and contracting process

- Preparation of proposal evaluation matrix
- Support in the proposal evaluation and supplier selection phase
- Support for contract negotiation

In addition to the activities listed above, all support in the preparation of documents and reports required by the financing entity during the tender process is considered within the scope of the services. Within the scope of the Project, it is expected that a single tender (*comprehending i) Grid Extension and Rehabilitation, ii) upgrading of EMAE Dispatch Center and iii) implementation of BESS*) will be launched. However, the consultant will be requested to advise EMAE on the best option for tender launching (single lot vs. multiple lots), hence a maximum number of 2 tender processes are expected to be launched, with WB (World Bank) procedures and models to be considered. It is considered that the works contracts will be under the EPC regime. The tender should include clear guidance on the Contractors' ESMP requirements,

which should be prepared in line with the Project ESMF and with the ESIA and ESMPs prepared for the intervention sites.

Task 7: Support AFAP, PIU and EMAE during the entire acquisition and installation process

As part of this task, the Consultant is expected to provide Owner's Engineering services to support AFAP, TIU and EMAE in the supervision and support during the construction and commissioning phase of the projects tendered under the previous task. To do so, it is expected that this consultancy will assist AFAP, TIU and EMAE as follows:

1. To ensure high standards of quality assurance in the execution and completion of work within stipulated time period;
2. Comprehensive supervision of project implementation activities carried out by the Contractor to ensure complete compliance with the drawings, technical specifications and various stipulations contained in the Contract Documents.
3. Efficient construction supervision by personnel who are experienced in least-cost technologies and methods of construction supervision and contract management;
4. Act independently and on behalf of EMAE to supervise and take immediate corrective measures/actions, if necessary, to all activities associated with Construction to ensure compliance of requirements of Contract Agreement in order to have a sound Project;
5. Prepare and submit Monthly and Quarterly Progress Reports to AFAP, TIU and EMAE on the financial, technical and Environmental and Social standards progress aspects of the project as well as monitoring and evaluation;
6. Assist the TIU in arriving at an amicable settlement in the event of any dispute;
7. Assist the TIU for effective project monitoring by providing project management and monitoring support.
8. The Supervision Engineer Consultant shall be required to inspect, examine and perform any site tests of all supplied material and equipment, if necessary, to verify if they meet the requirement specifications before final installation.
9. To ensure Environmental and Social risks management are in compliance during construction works as defined in WB ESF and by the Project's Environmental and Social Management Framework (ESMF).
10. To ensure that mitigation actions included in the Project's Policy Framework (RPF) are applied. Particularly on the implementation of site-specific RP and Labor Influx Management as needed. Gender and SE/SH Risk Management and Mitigation

Procedures should be monitored and ensure mitigations measures from the contractors are implemented.

Task 7.1: Support during Pre-Construction Phase

The support during the Pre-Construction Phase will focus mainly on the development of a preliminary field survey which will encompass 4 (four) main sub-tasks, namely:

a) The consultant is required to follow-up the site survey performed by the contractors to guarantee the minimization of environmental and social impacts and avoid resettlement and/or economic negative impacts. Final project design will be carried out for areas that are not environmentally sensible and where economic or physical displacement is not expected. Otherwise, Project Affected Persons (PAPs) need to be adequately compensated before the commencement of the works. As such final design drawings will be super imposed with the cadastral drawings of these environmentally sensitive areas which will be identified by the Environmental and Social Management Plans in the event of any economic or physical displacement, and a RP must be prepared, implemented before the commencement of the works.
b) The consultant is required to check and validate the contractor's distribution line route in compliance with maps of environmental sensitive areas and socio-economic activities of occupation of the distribution route.
c) Support and review/approve the supply and installation contractor's detailed engineering design for the respective electricity distribution projects, including scope verification, line route survey using real-time kinetic (RTK) GPS/GNSS equipment, network modelling using PLSCAD (or similar simulation software), structure spotting and pegging, and cadastral mapping.

d) Preparation of a detailed (master) implementation schedule for the project

Task 7.2: Support during Construction Phase

The support during the Construction Phase will focus mainly on the development of a preliminary field survey which will encompass 6 (six) main sub-tasks, namely:

1) *Approval of the Contractor's Plans, Projects and Drawings*
    a. Check whether all the contractor's calculation notes and assumptions, the drawings, diagrams and documents submitted are prepared according to the

contract specifications. Approve detailed designs, drawings and quality plans of all equipment covered in consultation and with approval of the EMAE.

b. Approve detailed designs, the preparation and implementation of a C-ESMP, drawings and quality plans of all equipment covered in coordination and approval of EMAE.
c. In the event of any resettlement or economic displacement, review the preparation of site-specific RP aligned with the WB ESS5 and with the RPF of the ASCENT project.
d. Review the preparation of Labour Management Procedures and SEA/SH related mitigation measures and risks.
e. Scrutinize and review the detailed work programs and implementation schedule including resource planning by the contractors for the overall project.
f. Advise EMAE on the status and management of pending compensations, as well as the impact on delayed project completion in terms of time and increased costs.

2) Supervision of Site Activities

a. Review and comment contractor's works schedule
b. Confirm that the contractor's schedule of personnel is as stated in the contract and recommend changes in the contractor's personnel where necessary
c. Ensure coordination and supervision of all the works, materials and equipment delivery and stored, construction procedures in compliance with the relevant WB ESS for the Project, EHS guidelines and Good Practice Notes for addressing the SEA/SH risks
d. Supervise the performance of all tests required to ensure the good quality of all materials used in construction, in particular soils, rocks, aggregates, cement, etc. and analyse test results to ensure good-quality construction;
e. Supervise the works to ensure works are carried out in compliance with the specifications and contract plans including procurement of materials and deployment of personnel as well as equipment.
f. Advise, monitor and ensure full implementation of the construction ESMP and occupational Health and Safety Management Plan.

g. Implement, manage and monitor the GM available for workers and communities in the intervention areas and ensure the subscription of the Code of Conduct by all workers and services providers,
h. Conduct regular site inspections and review the status of implementation and effectiveness of the environmental mitigation measures against the ESMF and/or ESMP (Environmental and Social Management Plan) and contract documents;
i. Provide regular feedback through environmental audit and investigation results of any non-compliance of the ESMF and ESMP.
j. Instruct the Contractor(s) to take actions to reduce or remedy impacts, within a specified timeframe, and carry out additional monitoring according to the contractual requirements and procedures in the event of non-compliances or complaints;
k. Instruct the Contractor(s) to stop activities which generate severe adverse impacts or creates high risk of injury or death, and/or when the Contractor(s) fails to implement the ESMP requirements / remedial actions.
l. In case of change (variation) orders, completion time extension and/or financial claims arising from the contractors, make in depth assessment and recommendations to the AFAP based on the day-to-day records and applicable conditions of contract.
m. Ensure enforcement of standard contract billing procedures, verification and certification of all contractor billing before submission to AFAP for issue of authorization of payment,
n. Witness and approve the contractors on site tests and commissioning for each equipment, accessories and materials covered by the Project.
o. Supervise and monitor construction of all project components, verify modifications of designs as required by site conditions and issue variation orders to all the contractors; check measurements for works completed and verify bills for payments to the contractors as per the conditions of contract;
p. Ensure adherence and compliance with environmental and social standards including: grievance mechanism for a) the community and b) the workforce; Stakeholder engagement plan including potential measures to enhance beneficial impacts to the affected communities; Awareness and mitigation plans for project related accidents such as traffic and public safety; Labour

force management; SEA/SH mitigation, Proposal of an appropriate monitoring programme;

3) Inspection, testing and acceptance during manufacturing

The work includes inspection and factory acceptance test (FAT) of a selected number of equipment and materials for the project. In this sense, it is expected that:

- Transformer
- Conductors and cables
- Battery Energy Storage System (BESS)

Will be inspected and tested in the manufacturers testing stations. A team, composed by a representative of the Consultant, a representative of EMAE and a representative of AFAP should be included in the factory acceptance test (FAT). The travel and accommodation arrangements for the 3 person team will be the responsibility of the consultant

The consultant shall also:

i. Ensure contractor's compliance with deadlines for manufacturing, testing, shipping and supplying equipment on site;
ii. Ensure that equipment and materials conforms with contract specifications and standards;
iii. Examine any modification in relation to the contract specifications that the contractor may wish to make. Any modification leading to additional costs must be submitted to the EMAE for approval;
iv. Ensure that the equipment and materials do not contain any internationally banned chemicals or substances and ensure that specifications (including environmental related like noise levels of transformers) are in line with the national environmental requirements and standards.
v. Examine and approve the program for factory testing and acceptance proposed by the contractor, participate in works acceptance procedures and draw up the reports for each works inspection;
vi. Ensure that all equipment and materials have been subjected to type tests already and certified and all additional test described in the Bid documents have to be performed accordingly.

vii. Participate in factory acceptance tests (FAT) for the items of equipment detailed in 3) at contractor/suppliers factories in collaboration with EMAE.

viii. Provide a report on each factory inspection and testing indicating: Team composition

ix. Factory brief, Factory audit report, Methodology adopted, Tests carried out and results, Conclusion and recommendation

4) Inspection of material and equipment deliveries

The Consultant shall ensure that equipment and materials delivered to the Contractor's warehouse are in conformity with the stipulated specifications and work schedules and shall:

i. Monitor the delivery schedule agreed by the suppliers;

ii. Check that materials delivered meet technical specifications;

iii. Inspect and monitor damages, defects and accordingly reject unacceptable materials, and ensure corresponding replacement of damaged equipment and materials;

iv. Issue delivery and site acceptance certificates for goods;

v. Checking proper storage of materials and equipment as per the manufacturer's storage procedure and recommendation.

vi. Check Contractor's materials ordering schedule; Check the quantities of equipment/materials supplied;

vii. Maintain records of all materials used in the construction of the Works;

5) Work Measurement and Payment Approval

i. Make measurements and keep measurement records;

ii. Check the consumption of the materials of executed items from the original bills/stores of the suppliers;

iii. Issue interim certificates for progress payments;

iv. Certify completion of part or all of the works;

v. Review the contractor's claims for additional time or costs and submit recommendations to EMAE; anticipate possible problems that the project execution might encounter and recommend appropriate solutions (in particular

identify possible sources of time delays and cost overruns and propose measures to overcome them).

vi. Prepare quarterly cash flow projections for the TIU in a format acceptable to the TIU. Cash flows should identify budget estimates for all outstanding work;

vii. Analyse any contractual claim submitted by the Contractor and prepare a report for the TIU addressing the contractual basis, in terms of both technical and financial issues, for the claim and recommendations for a response to the Contractor;

viii. Quality Control of installations delivered by contractors in accordance with specifications, environmental and social standards.

6) Works completion and site tests and commissioning

i. Notify EMAE on the readiness of the project to enable mobilization of key stakeholders.

ii. Coordinate all the tests to be performed by the contractor in line with the equipment and network test protocols. Carry out final inspection of the works, witness commissioning tests, perform acceptance procedures for all equipment, and issue the corresponding completion certificates in accordance with the relevant conditions of contract with prior consent of EMAE.

iii. Ensure the Contractor prepared and submitted the as-built drawings, operation and maintenance manuals as per the requirement and quantity specified in the contracts.

iv. Review for adequacy and completeness of the as-built drawings, operation and maintenance manuals provided by contractors.

v. Undertake a structure-by-structure audit exercise with the participation of EMAE (as needed) and prepare the report. EMAE shall provide the structure audit template.

vi. Approve the contractor's as-built drawings.

vii. Ensure availability of hand-over requirements including manuals, drawings, list of PAPs compensated, and wayleaves consent forms for handover to the selected bidder.

viii. All the areas (if any) and support facilities like storage yards are restored and decommissioned in line with the Contractor's decommissioning plans.

ix. Carry final environmental and social checks to ensure that no environmental liabilities are left behind by the Contractors. Prepare an environmental and social management closure report.

x. Upon completion of the project construction activities of all Contracts/Package, the Consultant shall prepare a Project Completion Report (PCR) which will form a

comprehensive record of the designs, construction and installation works accomplished as well as the environmental and social performance including the number of infringements, resolutions, work accidents, etc.

Task 7.3: Support during Post-Construction Phase

The support during the Post-Construction Phase will focus mainly on 3 (three) main sub-tasks, namely:

1) Assistance During the Defect Liability Period: The consultant shall:
    a. Ensure that all defects and remarks are properly cleared/removed by the contractors before the end of the defect liability period (DLP).
    b. Assist and advise EMAE with regard to any matter that may be subject to adjudication, arbitration, inquiry or litigation up to delivery certificate of completion.
    c. Maintain detail records of relevant events & activities, drawings & documents, minutes of meetings.
    d. At the end of the liability period, the Consultant shall undertake project closure activities, final project site inspection to prepare a final project closure report including:
    e. Highlight on the performance of the facility during the DLP;
    f. All snags recorded during DLP and the status on their rectification by the project closure date;
    g. Recommendations for future projects;
    h. Performance on environmental and social safeguards including social risk management.

2) Training and Transfer of Knowledge: EMAE considers this Consultant services contract as an opportunity for knowledge transfer to a number of their staff through formal courses combined with on-the-job training while the EMAE's staff monitor the Consultant and contractors.

    During the Consultant's services contract, the Consultant shall organize the following training and transfer of knowledge sessions:

a. Pre-construction: Organize 2-days classroom-training course on the Construction Supervision, for at least 10 EMAE staff that would include engineers, financial management specialists, procurement specialists, environmental specialists and socials management specialists. The goal of the session is to receive feedback and comments on the Manual, and to discuss;
b. Construction: One (1) month after mobilization of all contractors: Organize a 1-day classroom training course on the Construction Supervision, for at least 17 EMAE staff;
c. Construction: Six (6) months after mobilization of all contractors: Organize 1-day classroom training course on the Construction Supervision, for at least 17 EMAE staff. The goal of the training session is to review current questions and issues on the construction procedures;
d. Construction: Twelve (12) months after mobilization of all contractors: Organize 1-day classroom training course on on-the-job training provided by Consultant to the EMAE for at least 25 EMAE staff. The goal of the training session is to orient the local EMAE supervisors on how the supervision of construction shall be done, what are the key aspects and how to track the progress of activities as on-the-job training.

The cost of this training shall be borne entirely by the Consultant (conference/training rooms, coffee breaks, audio-visual support, printed supports, software, fees for trainers, etc.)

The Consultant should name a coordinator for the proposed program of formal and on-the-job knowledge transfer.

3) Management and Administration: The Consultants shall implement an acceptable Quality Management System (e.g. ISO 9001), either within the framework of their own organization's quality management systems or specifically for this assignment. In particular, the Consultant shall prepare a Project Quality Control Plan that shall define how they intend to ensure Key Deliverables are produced on time, within budget and to the technical standards required. The Project Quality Control Plan shall include:

a. Work schedule and timeliness controls;

b. Budget and cost controls (earned value analysis);

c. Technical verification and quality controls;

d. Risk management controls;

e. Document controls;

f. Project reviews and progress reporting requirements;

g. Quality Records to be maintained

The Consultant shall submit the Project Quality Control Plan to AFAP, TIU and EMAE for review and approval. AFAP, TIU and EMAE reserve the right to carry out audits to assess whether the Consultant is complying with their Quality Management System and Project Control Plan. The Consultant shall include Quality Management issues in their Quarterly Reports

Task 8: Final Report

The consultant is expected to prepare and deliver a comprehensive final report (deliverable D5), summarizing the main activities, analysis and recommendations of each developed task.

2.2 Scope of Work for Upgrading EMAE's Dispatch Center

The activities to be carried out by the consultancy are:

Task 1: Review Existing Control and Communication Systems

In this task, the consultants are expected to carry out a diagnosis/characterization of the current control and communication systems including Tele-Protection, Control, Command, Supervision and Data Acquisition ("SCADA"). The increased uncertainty in network operation due to the Rehabilitation and Expansion of the grid, which will result from the implementation of *Activity 2.1. Rehabilitation and Expansion of the Medium and Low Voltage Network*, will require improved supervisory and control capabilities.

The diagnosis/characterization of the current control and communication systems including Tele-Protection, Control, Command, Supervision and Data Acquisition ("SCADA") should focus on the monitoring, control and ICT infrastructure required to ensure technical and economic dispatch of the São Tomé electrical systems, considering generation forecasting capabilities as well as reconfiguration and network control and automation capabilities.

It is expected that current EMS/DMS applications will be analysed, and recommendations will be provided to ensure adequate security assessment capabilities, dispatch and network optimization capabilities. Alternative communication solutions should also be studied to facilitate future expansion of the SCADA/EMS/DMS capabilities[3] in São Tomé as well as to be able to monitor distributed generation[4]. Furthermore, the Consultant must also consider, as appropriate, ongoing developments in EMAE's Dispatch Center.

The result of this task should be part of the characterization of each alternative solution proposed for each case/project, which should be the subject of a report (deliverable D1).

Task 2: Technical Specifications of the Optimal Configuration Recommended

In this task, the consultants shall provide the technical specifications of the optimal configuration recommended by the Consultant and approved by EMAE and include them in

[3] Here, the Consultant shall propose appropriate changes to SCADA modernization to ensure that any proposed communication scheme and SCADA systems are compatible with existing and planned systems in short to medium term. The use of a fiber optic link as the main communication channel should be considered. A backup system must also be provided, as appropriate, via a PLC link.

[4] Here, the Consultant shall recommend the equipment and tools needed for the estimation of the generation in real time and the forecasting in the short and medium term.

the RfB and RfP documents of the Targeted Projects, allowing the Consultant to prepare the technical part of these documents. At this stage, the consultant is expected to support the preparation of the tender processes and documents (technical part) for the work and supplies necessary for the improvements identified in Task 1.

The scope of service provision will include the following activities:

i) Tender Process

- Preparation of terms of reference and technical specifications
- Preparation of publicity documents for competitions and support in identifying appropriate means of publicity
- Support in the creation of a "data-room" for competitors to consult the tender documentation
- Definition of guarantees required from manufacturers and/or contractors
- Establishment of formulas for calculating penalties applicable in case of non-compliance
- Preparation of Tender Process documents
- Support in the process of inviting pre-qualified bidders to present proposals
- Support in the stage of proposal evaluation

ii) Award and contracting process

- Preparation of proposal evaluation matrix
- Support in the proposal evaluation and bidder selection phase
- Support for contract negotiation

Task 2 will be the subject of a tender documents (deliverable D2).

Task 3: Propose estimated Timeline, Budget, and Procurement Plan

In this task, the consultants shall propose estimated timeline, budget, and procurement plan for improving (upgrading) the dispatch center and control systems.

All these studies will be the subject of a report (deliverable D3).**2.3 Scope of Work for Environmental and Social Impact Assessment**

The scope of basic services shall consist of the provision of the following deliverables or activities, but not limited to:

Under the development of *Activity 2.1. Rehabilitation and Expansion of the Medium and Low Voltage Network* a limited set of projects will be selected to be launched under an International Tendering process. For these projects, the consultant is expected to develop an environmental and social impact assessment of each project (which may include the rehabilitation and expansion of the low voltage network as well as the medium voltage line pathway and associated infrastructure). Hence, it is expected that, under this task, the Consultant will develop (for each identified project) a comprehensive ESIA following applicable policies and standards within national legislation, as well as of the World Bank's Environmental and Social Standards.

It should be noted that all activities in this TOR should be carried out in alignment with WBG E&S requirements, which include, for example, the following:

- Relevant WBG Environmental, Health and Safety Guidelines, such as the General EHS Guidelines (2007) and the WBG's EHS Guidelines on Transmission and Distribution (2007)[5]
- WB Good Practice Note for Addressing Sexual Exploitation and Abuse and Sexual Harassment (SEA/SH) in Investment Project Financing involving Major Civil Works
- IFC's Good Practice Handbook on Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Market (2013)[6]

Task 1: Desktop Review

The Consultant shall undertake a desktop review of E&S aspects characteristic of the selected projects. The Consultant will compile and review available, up-to-date information relevant to the assignment. The Consultant shall also include and review any additional relevant literature that might have not been considered at early stages. Data to review will include, for example, (i) existing environmental studies, scientific literature, or any other type of pre-existing assessments available for the proposed project site and/or adjacent areas; (ii) any existing spatial data on E&S aspects; (iii) national or regional plans (e.g., Strategic Environmental

[5] All WBG EHS Guidelines could be found here: https://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/policies-standards/ehs-guidelines

[6] https://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/publications/publications_handbook_cumulativeimpactassessment

Assessments, development strategies); and/or (iv) existing programs or initiatives in the area and its surroundings relevant to E&S issues (e.g., local NGO projects). The Consultant should assess the quality and representativeness of environmental, socio-economic, and other secondary data and should cover all E&S aspects covered in IFC's Performance Standards and guidance notes. During this activity, the Consultant should also plan for and identify opportunities to collect primary data as part of the Site Visits (see Task 3). The review should also aim to identify additional information on the contextual risks and how they may affect the Project(s).

Task 2: Preliminary Stakeholder Identification and Mapping

In coordination with AFAP, TIU and EMAE, conduct a preliminary mapping of key stakeholder groups with a focus on Affected Communities as defined in IFC's Performance Standard 1 (PS1). The Consultant shall provide a list of key groups of stakeholders, their interests, and concerns, and how they should be engaged/ in all phases of this assignment of this assignment. Where GoSTP has already started consultation activities, the Consultant shall review that process (including the existence and effectiveness of any external communications and/or grievance mechanism). The Consultant should note that this task is to be considered a working tool rather than a one-off activity. The Consultant is requested to develop a preliminary mapping before the Site Visits to inform the visit and to update the mapping, as necessary, at key milestones of the E&S work. An updated version of the Stakeholder Mapping will be included in the E&S Scoping Report.

Task 3: Site Studies

In this task, the consultant is expected to conduct detailed technical studies and site investigations on the site. The studies will include logistical studies, assessment of grid connection and site infrastructure requirements.

Also under this task, the consultant is expected to conduct an E&S scoping exercise to identify and characterize key risks and potential impacts, which includes carrying out site-specific biodiversity surveys in accordance with the ESS6 and land assessments.

Finally, the consultant will also develop a concise E&S Scoping Report, designed to inform the WB, AFAP, TIU and EMAE, and the bidders of the key E&S risks and impacts affecting the Project, related gaps in information, ways to close such gaps, and manage the key risks and impacts to support the Project´s development in line with WBG E&S requirements as a

framework of Good International Industry Practice (GIIP) in E&S management. The report will include the outputs of land and biodiversity workstreams as Annexes and a recommended list of actions and risk allocation.

All these studies (task 1,2 and 3) will be the subject of a report (deliverable D1).

Task 4: Resettlement Plan (RP) or Livelihood Restoration Plan (LRP)

In this task, the consultant will outline the principles and general procedures to secure land use rights and provide adequate compensation including resettlement and livelihood restoration support, if needed, in alignment with WB ESS 5, considering those with formal legal rights to the land, those with no formal legal rights but recognizable claim to the land, and those who have no recognizable legal rights or claim to the land and resources they occupy or use. To do so, the consultant is expected to develop: *Review of Context and Requirements*, based on relevant national legislative and regulatory framework related to land management and the acquisition of land and land use rights against WB ESS 5, *Initial Stakeholder Consultation,* with respect to the temporarily and/or permanent economic displacement, the Consultant will develop a general stakeholder map of the Affected Communities and prepare an entitlement matrix with the compensation measures (equivalent of better than the correspondent losses and/or economic restrictions affected) agreed with the project-affected parties (PAP). The *Resettlement Plan* will include (i) legal, regulatory and institutional framework, (ii) organizational arrangements, roles and responsibilities, (iii) principles for acquisition of land and land use rights, (iv) principles for compensation, resettlement and livelihood restoration, (iv) consultation and stakeholder engagement, (v) grievance mechanism specific for PAP, (vi) announcement of the cut-of -date, (vii) compensation and entitlements matrix, (viii) identification and support to vulnerable persons and/or groups (ix) fully-implementation of RP before the commencement of the works. (x) Develop and implement the necessary monitoring and evaluation mechanisms.

> and EMAE, will estimate potential impacts to outline an approach to compensation, resettlement and livelihood restoration, as appropriate, and develop an Eligibility and Entitlement Matrix based on the identified categories of potentially affected people and the type of impacts that are expected to materialize. This task will also likely require discussion with local legal counsel. It is important that the Preliminary Impact Assessment and Compensation Framework is developed in line with precedents set in the energy sector at large in the region.

Resettlement Action Plan: Finally, with the previous sub-tasks developed, the Consultant will develop and submit a comprehensive resettlement action plan, which should include (i) legal, regulatory and institutional framework, (ii) organizational arrangements, roles and responsibilities, (iii) principles for acquisition of land and land use rights, (iv) principles for compensation, resettlement and livelihood restoration, (iv) consultation and stakeholder engagement, (v) grievance mechanism, (vi) compensation and entitlements, (vii) identification and support to vulnerable people and (viii) monitoring and evaluation

This task will be the subject of a report (deliverable D2) which should summarize the problems identified and will include the presentation of a set of possible measures to combat these problems.

Task 5: Environmental and Social Management Plan

In this task, the consultant is expected to develop an Environmental and Social Management Plan (ESMP) that considers the requirements of the World Bank's ESF and The STP's national regulations.

Besides the legal and institutional requirements for the successful implementation of the relevant management plans, ESMP should also determine the roles and responsibilities of GoSTP and the prospective contractor / sub-contractors. The main objectives of ESMP are as follows:

- To provide an overview of the environment, health and safety (EHS), socio-economic and cultural heritage policies, standards and legal legislation that the Project is obliged to comply with,
- To provide guidance on how to manage EHS risks in the construction phase of the Project in compliance with EHS policies, standards and legal regulations and to ensure that Project commitments are fulfilled,
- To determine the roles and responsibilities of GDII and contractors to ensure compliance with EHS requirements during the construction phase of the project,

- To ensure that construction activities are properly checked to ensure that the Project is in compliance with EHS policies, standards and legal regulations;
- Ensure reporting systems are developed and streamlined to deliver EHS compliance performance;
- Enabling ongoing development and EHS compliance coverage.

Hence, the ESMP should include, but be limited to:

- *E&S/Technical Constraints Map*: The Consultant will compile the technical and E&S geo-referenced spatial data layers in a GIS database for analysis. The spatial layers shall encompass the various selected projects. The Consultant will develop a suitable methodology and undertake an analysis to illustrate the highest risk factors / constraints within each individual rehabilitation or extension project. The finalized Constraints Mapping exercise will be made available to AFAP, TIU and EMAE in the form of GIS data layers and also in a PDF document illustrating all constraints within each project and containing a scale and legend. The Constraints Map should be accompanied with a short document explaining both the methodology taken and the outputs.

- *Outline Design of Grid Connection*: The Consultant should develop an outline design of the grid connection for each project. These designs should include the following:
  - Interconnection layout;
  - Single line diagram;
  - Details of interface point with existing grid;
  - Maximum allowable power export and import levels; and
  - Any significant specific requirements of the grid operator.

  The intention is that the outline design should be sufficiently detailed so as to allow future prospective bidders to estimate the cost of the grid connection with a reasonable degree of certainty.

- *Roles & Responsibilities*: the Consultant shall map out the roles and responsibilities of those entities within GoSTP (and any other agencies that may be involved) responsible for managing E&S matters with respect to the Rehabilitation and Extension projects and identify any bottlenecks and/or areas that would benefit from

improvement (e.g., institutional arrangements and/or additional capacity building programs).

This task will be the subject of a report (deliverable D3) which should summarize the problems identified and will include the presentation of a set of possible measures to combat these problems.

Task 6: Obtaining Environmental Permits

In this task, the consultant is expected to support for obtaining the Environmental Permits for the project following the STP's Laws or Decrees, Procedures for carrying out and validating an environmental and social assessment.

- T

3. Methodology and Expected Outcomes

The assignment will be implemented in two distinct phases as follows:

- Phase I includes all tasks from technical design, environmental and social impact assessment, bid process until contract award, this phase will be managed via a Lump Sum contract.
- Phase II includes construction supervision and post construction activities and will be managed via a Time-Based Contract.

The procurement of the Consulting Firm for the whole assignment comprising Phase I and Phase II shall be done at the same time but only Lump-Sum contract for Phase I will be signed between EMAE and the best qualified consultant. However, the same best qualified consultant may be awarded the Time-Based Contract for Phase II of the assignment only in case of Good Performance during implementation of Phase I to the full satisfaction of the EMAE as well as subject to availability of funding for project continuation. If the best qualified consultant who will be awarded the Lump-sum contract does not perform satisfactorily during the implementation of Phase I, the EMAE will assign, on a timely basis, the Time-Based Contract to another consultant to ensure a satisfactory implementation of Phase II.

The results to be achieved by the consultant:

(i) Detailed technical report on the state of the MV and LV network, aerial and underground network, proposed improvement.

(ii) Medium Voltage Network Protection Plan for 30kV and 6 kV network.

(iii) Detailed technical report on the Battery Energy Storage Solution (BESS).

(iv) Environmental and Social Impact Assessment.

(v) Bidding documents for the rehabilitation and extension of MV and LV networks;

(vi) Bidding documents for supply and installation of Battery Energy Storage Solution (BESS).

(vii) Detailed technical report on the state of the dispatch center and proposed improvement.

(viii) Bidding documents for the upgrading of the dispatch center.

4. Experience, Level of Effort and Staffing

The Consultant must have prior experience in the completion of at least three similar assignments within the past 6 years, with sound knowledge of the general energy sector including its electric system. The Consultant shall provide experienced staff to carry out the mission throughout the duration of the study. The staff shall be fluent in Portuguese with working knowledge of English. Experience in the region with similar systems will be a considerable advantage.

Tasks shall be performed through in-house or subcontractor's expertise in the required technical fields. The Consultant's team shall include staff members who have work experience in similar regions.

The number of positions listed below is the minimum expected - the Consultant can adjust the required person-months inputs and the required staff depending on its methodology and work program. Dual language proficiency in Portuguese and English will be highly ranked. Based on the requirements of these Terms of Reference, the consulting firm is expected to define a detailed work schedule, including the proposed time in-country for each proposed expert.

Selection criteria will be heavily weighted on quality, capabilities, and experience of the consulting firm and proposed staff, the quality and completeness of the proposed work program and technical analyses, and the overall price of the assignment. The minimum

technical threshold is 75 points. The weighted scores are 80% for technical proposal and 20% for financial proposals. While the consulting firm may propose additional specialists, the total level of effort, over the 24-month implementation period and a 12 months DLP period, is estimated at 62 person-months, excluding support staff, and the indicative inputs for this assignment are as follows:

Table 1- Consultant's Qualification for the project

S/N	Position (number of staff)	Qualifications and Experience	Quantity	Level Of Effort – Phase I (Persons/Month)	Level Of Effort – Phase II (Persons/Month)
1	Project Manager	• The Project Manager shall have master's degree in electrical engineering or related fields. Post-Graduation in Project Management / Planning / Engineering/ Administration will be an advantage. • He/she shall have ten (10) years' experiences in Electrical Power Systems. • Eight (8) years' experiences in Distribution Power Network Construction of 6 kV or higher and five (5) years' experiences in Project Management. • The Project Manager shall have experience in leading/Managing the implementation of at least three (3) Distribution projects of 6kV or higher during the last eight (8) years including engineering, procurement and business administration. Minimum two (2) projects shall be of international turnkey contracts funded by international funding institutions (IFIs). • The Project Manager shall be fluent in Portuguese with working knowledge of English, shall have worked in the region. Previous work experience in São Tomé and	1	4	4

S/N	Position (number of staff)	Qualifications and Experience	Quantity	Level Of Effort – Phase I (Persons/Month)	Level Of Effort – Phase II (Persons/Month)
		Principe will be an advantage. • The proposed candidate shall have demonstrated relevant experience in promoting stakeholder engagement (senior staff, government decision makers), integrating reports from different specialists, providing quality control, and effectively managing cross-sector professional teams. • S/he must have excellent research and communication skills in both written and verbal English and Portuguese, and strong interpersonal skills. • Experience in modernization of dispatch center will be an asset			
2	Network System Studies Expert	• The Electrical Engineer shall have minimum Degree in Electrical Engineering or related fields. • Minimum eight (8) years of experience working on network system studies. • Advanced user of power flow simulation tools and energy planning tools (such as DIgSILENT, PSSE, ETAP, etc.) • Familiarity with load flow studies, • Ability to develop tailored training session for EMAE engineers (Planning & Operations Department), in the use of the relevant simulation software (DIgSILENT, PSSE, ETAP, etc.) • Ability to work with GIS tools for data representation. • Experience in Africa region or SIDSs will be highly appreciated • He/she shall have participated in minimum two (2) projects funded by	1	3	1

S/N	Position (number of staff)	Qualifications and Experience	Quantity	Level Of Effort – Phase I (Persons/Month)	Level Of Effort – Phase II (Persons/Month)
		International Funding Institutions experience. • The Network System Studies Expert shall be fluent in Portuguese with working knowledge of English and having worked in similar region will be an asset;			
3	Electrical Engineer	• A relevant degree in engineering with at least 8 years of relevant experience in the design and implementation of installation of electrical measuring systems in public electricity distribution companies. • The Electrical Engineer shall have minimum Degree in Electrical Engineering or related fields. • Minimum eight (8) years of experience in design and construction of distribution system projects of 6 kV or higher. • The Electrical Engineer shall demonstrate expertise of working in similar projects and conducting, design and test of equipment of MV/LV distribution system including household connection; • He/she shall have participated in minimum two (2) projects funded by International Funding Institutions experience. • The Electrical Engineer shall be fluent in Portuguese with working knowledge of English and having worked in similar region will be an asset; • Working experience in Africa in similar projects is desirable.	1	3	3
4	Battery Storage System	• A relevant degree in engineering with at least 10 years of	1	3	1

S/N	Position (number of staff)	Qualifications and Experience	Quantity	Level Of Effort – Phase I (Persons/Month)	Level Of Effort – Phase II (Persons/Month)
	Engineer (One)	relevant experience in the design and implementation of household, building and factory battery systems. • He must have at least good knowledge in the design, installation, maintenance and operation of small scale battery storage system.			
5	Technical Expert Telecommunication	• A relevant degree in engineering with at least 8 years of experience in power sector out of which at least 4 relevant experiences with systems such as SCADA; • Experience in management information system (MIS); • Previous experience in developing similar assignments is preferred.	1	2	2
6	Specialist in Electrical Network Protection Systems (one)	• A relevant degree in engineering with at least 8 years of relevant experience in the design and implementation of the electrical network protection systems in public electricity distribution companies. • The Specialist shall be fluent in Portuguese with working knowledge of English and having worked in similar region will be an asset;	1	3	1
7	Social Expert (one)	• S /he will have an accredited University Graduate Degree (preferably master's level or equivalent) in social sciences, sociology, anthropology, social development or other relevant social science areas);	1	4	2

S/N	Position (number of staff)	Qualifications and Experience	Quantity	Level Of Effort – Phase I (Persons/Month)	Level Of Effort – Phase II (Persons/Month)
		• S/he will have at least eight (8) years of general experience and must be involved in the assessment of land use, social and environmental impacts of at least three (3) infrastructure projects, as well as in the implementation of Environmental and Social Management Plans (ESMP); • Experience in preparing E&S instruments under the WB's ESS, applied to investment projects, such as: the preparation and/or implementation of the RP, GM management, and of gender and GBV sensitive measures; • Considerable advantage will be given to consultants with experience in aspects related to stakeholders' engagement, facilitation of sensitization trainings, and community health and safety risks management; •			
8	Environmental, health and safety Expert (one)	• S/he will have an accredited University Graduate Degree (preferably master's level or equivalent) in Environmental Engineering, Forestry engineering, biological sciences. Geographic and/or Land Management and other similar areas). • She/he will have at least eight (8) years of general experience and must be involved in the assessment of land and social and environmental, health and safety impacts of at least three (3) infrastructure projects, as well as in the implementation of Plans Environmental and Social Management (ESMP) Environmental and Social Impact Assessment (ESIA)	1	4	2

S/N	Position (number of staff)	Qualifications and Experience	Quantity	Level Of Effort – Phase I (Persons/Month)	Level Of Effort – Phase II (Persons/Month)
		• Experience in preparing E&S instruments under the WB ESS, applied to investment projects. Considerable advantage will be given to duly certified consultants. • Experience in aspects of occupational health, hygiene and safety, as well as labor issues and working conditions. • Experience in aspects of community health and safety;			
9	Financial Analyst	• Master's degree in finance with at least five (5) year of relevant experience in financial and economic analysis of electrical projects. Desirable to have experience in power sector. • At least 5 years of experience of conducting economic analysis. Desirable to have experience in power sector.	1	2	0
10	Site Supervisor (one)	• The General Site Supervisor will work as a resident deputy Project Manager and shall have minimum Degree in Electrical Engineering or related fields with minimum 10 years of general experience. • He/she shall have minimum eigth (8) years in project supervision/ coordination; shall have participated in minimum three (3) contracts as project supervisor and two (2) projects shall have been financed by international donor Institutions. • Good understanding of asset degradation and failure	1	6	12

S/N	Position (number of staff)	Qualifications and Experience	Quantity	Level Of Effort – Phase I (Persons/Month)	Level Of Effort – Phase II (Persons/Month)
		mechanism, the potential consequences of asset failure and how these influence asset management processes. • The General Site Supervisor shall be fluent in Portuguese with working knowledge of English, shall have worked in the region and having worked in similar region will be an asset.			
	TOTAL			**34**	**28**

5. Duration of the Phases and Deadline

The studies, supervision during construction and post-construction will be carried out over the following periods:

Table 2 – Duration of the Phases

Project phases	Time duration
Pre-construction phase (Phase I)	8 months
Construction phase (Phase II)	18 months
Post-construction phase/Defect Liability Period (Phase II)	12 months

5.1 Phase I: All tasks from technical design, bid process until contract award

The duration of the study to prepare EMAE's specifications for the network rehabilitation/expansion works and the upgrading of dispatch center and control system must not exceed 6 months (24 weeks). The Consultant will propose in his offer, a detailed schedule of execution of the consultation. For this purpose, the following schedule is proposed as an indication:

Table 3 – Deadline for submission of reports

Project phase	Deliverables	Time from date of effectiveness (weeks)
Pre-construction	Project kick-off meeting to discuss roles of stakeholders, detailed scope of work, proposed methodology, required data, proposed project schedule and key milestones.	**Within 1 weeks** after contract effectiveness
	Inception report to document the detailed scope of work, clear methodology, required data, stakeholders to be consulted, project schedule, and execution plan.	**Within 3 weeks** after contract effectiveness
Rehabilitation and expansion of the Medium and Low Voltage Network		
Pre-construction	D1 – Task 1: Assessment of the Operational Condition of the Current Distribution (MV/LV) System	**Within 10 weeks** after contract effectiveness
	D2 – (Task 2 and 3): Transportation/Distribution Network Design and Planning Criteria for Grid Extension and Preparation of Technical Solution Proposals for Technical Loss Reduction Program.	**Within 18 weeks** after contract effectiveness
	D3 – (Task 4 and 5): Technical-Economic Assessment of Technical Alternatives for Grid Rehabilitation and Expansion and Analysis of the Environmental and Social aspects and Recommendations for Acquisition and Training (Software, Tools and Equipment).	**Within 22 weeks** after contract effectiveness
	D4 – (Task 6): Preparation of Tender Documents be issued to pre-qualified EPC bidders	**Within 28 weeks** after contract effectiveness
	D5 – (Task 8): Final Report	**Within 32 weeks** after contract effectiveness
	Proposal evaluation report for the EPC Contractor	Draft bid evaluation report to be submitted 30 days after bid opening date.
Modernization of EMAE's Dispatch Center		
	D1 – (Task 1): Review Existing Control and Communication Systems	**Within 8 weeks** after contract effectiveness
	D2 – (Task 2): Technical Specifications of the Optimal Configuration Recommended and	**Within 13 weeks** after contract effectiveness

Pre-construction	D3 – (Task 3): Bidding documents to be issued to pre-qualified EPC bidders	**Within 22 weeks** after contract effectiveness
	Proposal evaluation report for the EPC Contractor	Draft bid evaluation report to be submitted 30 days after bid opening date.
Environmental and Social Impact Assessment		
Pre-construction	D1 - ESIA	**Within 18 weeks** after contract effectiveness
	D2 - ESMP	**Within 18 weeks** after contract effectiveness
	D3 – PR	**Within 18 weeks** after contract effectiveness

5.2 Phase II: Supervision of Construction and Post Construction

Following the contract award for Phase I, the Consultant shall support the TIU and EMAE in the supervision of subsequent goods and works contracts. Upon good performance of Phase I, the Consultant will be awarded the supervision and construction contract for Phase II, which will become effective immediately. The following will be the expected scope of work for pre-construction, construction and post-construction phases of the project.

For this purpose, the following schedule is proposed as an indication:

Table 4 - Deadline for submission of reports

Project phase	Deliverables	Time from date of effectiveness (days)
Construction	Approval of Contractor's Plans, Design	**Within 10 days** after contractor submission
	Monthly progress reports	**Within 5 days** of the end of reporting month
	Quarterly Reports	**Within 15 days** of the end of reporting quarter
	Non-compliance event report/ Critical issue reports (including serious accidents and SEA/SH incidents)	**Immediate** (in less than 24 hours)
	Inspection and SAT Reports	**Within 5 days** after completion site test
	FAT Reports	**Within 7 days** of the end of FAT

	Training and transfer of knowledge Report	**Within 7 days** of the end of training session
	Completion Report	**Within 30 days** after project commissioning
Post-Construction	Project Closure Report	**Within 45 days** after completion of Defect Liability Period

5.2.1 Construction Phase

(a) Approval of Contractor's Plans, Design Report

(i) The Consultant shall review/comment the work plan as well as all preliminary and final design submitted by the contractors for approval.

(ii) The draft report shall be submitted for comments/approval to TIU/EMAE.

(b) Monthly Progress Reports

(i) The monthly progress report shall report on the activities in progress and completed during the month, the percentage of completion of each task. The progress report will include work charts, S-Curves, status of the implementation of E&S mitigation measures and grievances received and addressed, the list of any problems that are causing or may cause delays, including proposed measures to correct the problems shall also be reported.

(c) Quarterly Progress Reports (QPRs)

(i) The Quarterly Progress Reports shall cover all aspects of Project implementation and disbursement schedules, financial summary, including implementation of environmental and social mitigation measures and the status of the GM in this activity. The QPRs shall also highlight issues affecting Projects implementation and proper corrective actions.

(ii) Update activity and staff schedule showing actual against planned progress and achievement milestones/ deliverables. Description of work completed in previous quarter and planned activities for coming quarter. Summary of issues addressed, identification of potential problems, delays, etc.

(d) Non-compliance event report/ Critical issue reports

a. The non-compliance event report shall cover all critical issues that may occur at site during the implementation and must be reported immediately.

b. E&S requirements that are not addressed prior the start of the works are also subject to non-compliance issuing, specially related to ESS1 (i.e. ensuring that site-specific ESMPs are implemented accordingly with the recommended

work phase), ESS2 (i.e. ensuring recommended working conditions and GM accessible at workplace), ESS5 (i.e. ensuring the implementation of all guidance detailed in the RPF, including the full implementation of the respective RPs or LRPs prior to the start of any works), and ESS10 (i.e. ensuring that local communities were consulted and are adequately informed about the workplan at each site and GM accessible to communities, prior to the start of any works).

c. Serious accidents and SEA/SH incidents must be reported to TIU coordination in less than 24hours.

(e) Inspection and SAT

(i) The inspection report shall compile the inspected materials supplied to the contractor warehouse and shall ensure if the materials are in accordance with the specification/standards required.

(ii) The SAT report shall compile all tests carried out before/during and/or after installation/commissioning on site. The SAT certification shall be signed by the consultant, contractor and EMAE site representative that are witnessing the tests.

(f) FAT Reports

(i) The FAT report shall compile all tests carried out at factory of the Manufacture premises.

(ii) The FAT shall state the procedures of all tests carried out and its result.

(iii) All reports shall be signed by the consultant, EMAE representative and contractor.

(g) Training and transfer of knowledge

(i) The training report shall state all training carried out during training session, the participants, and the results.

(h) Project Completion Report

(i) The draft will be submitted to employer for approval within one month after the project completion. The Employer and the funding institutions will take three weeks to comment on draft reports.

(ii) Upon completion of the project construction activities, the Consultant shall prepare a Project Completion Report (PCR). The PCR will form a

comprehensive record of the design, construction and erection works accomplished including:

- A description of changes or modifications to the design,
- Problems encountered and solutions adopted,
- Routine maintenance practices to be followed completion the works,
- Overall construction volume, quantities, and final cost (with comparison of the initial)
- Suggestion and recommendation and;
- Lessons learned

(iii) The final PCR will incorporate comments from EMAE and TIU. PCR shall be sent to the World bank for final approval.

The reports shall be submitted as mentioned below:

Table 5 - How to submit reports

Report	**No. of Copies**	**Submitted To**
Preliminary Field Survey	One (1) soft copy memory stick for TIU and One (1) to EMAE	Project Coordinator
Environmental and Social Management Closure Report	One (1) soft copy memory stick for TIU and One (1) to EMAE	Project Coordinator
Approval of Contractor's Plans, Design	One (1) soft copy memory stick for TIU and One (1) to EMAE	Project Coordinator
Monthly progress report	One (1) soft copy memory stick for TIU and One (1) to EMAE	Project Coordinator
Quarterly progress report	One (1) soft copy memory stick for TIU and One (1) to EMAE	Project Coordinator
Non-compliance event report/ Critical issue reports	To be agreed	Project Coordinator
Inspection and SAT reports	One (1) hard copy and One (1) soft copy memory stick for TIU and EMAE	Project Coordinator
FAT Reports	One (1) hard copy and One (1) soft copy for TIU and EMAE	Project Coordinator

Training and transfer of knowledge	One (1) hard copy and One (1) soft copy memory stick for TIU and EMAE	Project Coordinator
Project Completion Report	One (1) soft copy memory stick for EMAE and One (1) soft copy memory stick for TIU	Project Coordinator
Project Closure Report	One (1) soft copy memory stick for EMAE and One (1) soft copy memory stick for TIU	Project Coordinator

5.2.2 Post – Construction Phase

a) Assistance During the Defect Liability Period

The consultant shall:

- Undertake, one (1) month before the end of the Defect Liability Period (DLP), a site inspection to identify snags, and issue instructions to the contractors to rectify all snags. Any material failures occurring during the DLP should be recorded by EMAE and the relevant information to be sent to the consultant.
- Ensure that all defects and remarks are properly cleared/removed by the contractors before the end of the defect liability period (DLP).
- Assist and advise the Client with regard to any matter that may be subject to adjudication, arbitration, inquiry or litigation up to delivery certificate of completion.
- Maintain detail records of relevant events & activities, drawings & documents, minutes of meetings.
- At the end of the liability period, the Consultant shall undertake project closure activities, final project site inspection to prepare a final project closure report including:
    - Highlight on the performance of the facility during the DLP.
    - All snags recorded during DLP and the status on their rectification by the project closure date.
    - Recommendations for future projects.
    - Performance on environmental and social safeguards including social risk management.

b) Training and transfer of knowledge

EMAE considers this Consultant services contract as an opportunity for knowledge transfer to a number of their staff through formal courses combined with on-the-job training while the EMAE's staff monitor the Consultant and contractors.

During the Consultant's services contract, the Consultant shall organize the following training and transfer of knowledge sessions:

1. Pre-construction: Organize 2-days classroom-training course on the Construction Supervision, for at least 10 EMAE staff that would include engineers, financial management specialists, procurement specialists, environmental specialists and socials management specialists. The goal of the session is to receive feedback and comments on the Manual, and to discuss.
2. Construction: One (1) month after mobilization of all contractors: Organize a 1-day classroom training course on the Construction Supervision, for at least 17 EMAE staff.
3. Construction: Six (6) months after mobilization of all contractors: Organize 1-day classroom training course on the Construction Supervision, for at least 17 EMAE staff. The goal of the training session is to review current questions and issues on the construction procedures.
4. Construction: Twelve (12) months after mobilization of all contractors: Organize 3-day classroom training course on on-the-job training provided by Consultant to the EMAE for at least 25 EMAE staff. The goal of the training session is to instruct the local EMAE supervisors on how the supervision of construction shall be done, what are the key aspects and how to track the progress of activities as on-the-job training.
    i. The cost of this training shall be borne entirely by the Consultant (conference/training rooms, coffee breaks, audio-visual support, printed supports, software, fees for trainers, etc.).
    ii. The Consultant should name a coordinator for the proposed program of formal and on-the-job knowledge transfer.

c) Management and Administration

1. Quality management

The Consultants shall implement an acceptable Quality Management System (e.g., ISO 9001), either within the framework of their own organization's quality management systems or specifically for this assignment. In particular, the Consultant shall prepare a Project Quality

Control Plan that shall define how they intend to ensure Key Deliverables are produced on time, within budget and to the technical standards required. The Project Quality Control Plan shall include:

(i) Work schedule and timeliness controls.

(ii) Budget and cost controls (earned value analysis).

(iii) Technical verification and quality controls.

(iv) Risk management assessment and controls.

(v) Document controls.

(vi) Project reviews and progress reporting requirements.

(vii) Quality Records to be maintained.

The Consultant shall submit the Project Quality Control Plan to TIU/EMAE for review and approval. TIU/EMAE reserves the right to carry out audits to assess whether the Consultant is complying with their Quality Management System and Project Control Plan. The Consultant shall include Quality Management issues in their Quarterly Reports.