GOVERNMENT
OF SIERRA LEONE
MINISTRY OF ENERGY

POWER SECTOR REFORM AND INSTITUTIONAL CAPACITY BUILDING PROGRAM DEVELOPMENT SIERRA LEONE

ELECTRICITY SECTOR REFORM ROADMAP

Acknowledgement

This Electricity Sector Reform Roadmap was developed for the Government of Sierra Leone with funding support from the Millennium Challenge Corporation.

The roadmap reflects a shared commitment to strengthening the country's electricity sector through coordinated reforms, improved governance, and sustainable investment. It is intended to support the Government's efforts to enhance energy access, reliability, and long-term sector performance for the benefit of all Sierra Leoneans.

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Acronyms/Abbreviations	Definition
AfDB	African Development Bank
ATAF	Automatic Tariff Adjustment Formula
ATC&C	Aggregate Technical Commercial and Collection
CA	Constraints Analysis
CIC	Coordination and Information Centre
CLSG	Côte d'Ivoire-Liberia-Sierra Leone-Guinea Interconnection Project
EDSA	Electricity Distribution and Supply Authority
EGTC	Electrical Generation and Transmission Company
EIF	Enter Into Force
EPA-SL	Environemental Protection Agency-Sierra Leone
ESIA	Environmental and Social Impact Assessment
ESLEAP	Enhancing Sierra Leone Energy Access Project
ESRP	Electricity Sector Reform Project
ESURP	Energy Sector Utility Reform Project
EWRC	Electricity and Water Regulatory Commission
E&S	Environmental and Social
FCDO	Foreign, Commonwealth and Development Office
GBV	Gender-based Violence
GIS	Geospatial Information System
GoSL	Government of Sierra Leone
IBT	Increasing Blocks Tariff
IFC	International Financial Corporation
IMS	Integrated Management System
IPP	Independent Power Producer
IRRP	Integrated Resource and Resilience Planning
IT	Information Technology
JICA	Japanese International Cooperation Agency
LAN	Local Area Network
LRMC	Long Run Marginal Costs
MO	Market Operator

MoE	Ministry of Energy
MoEnv	Ministry of Environment
MoF	Ministry of Finance
MYT	Multi-Year-Tariff

Acronyms/Abbreviations	Definition
NEEAP	National Energy Efficiency Action Plan
NESP	National Electrification Strategy and Plan
NIB	National Investment Board
NODE	Online Digital Electrification Platform
OMT	Operation , Maintenance and Training
PAYGO	Pay-As-You-GO
PCB	Polychlorinated Biphenyls
PIR	Policy and Institutional Reform
POG	Public Owned Generators
PPP	Public-Private Partnership
P3TSF	Public Private Partnership Transaction Support Fund
PSFM	Power Sector Financial Model
PSFSP	Power Sector Financial Sustainability Plan
PWC	Pricewaterhouse Coopers
RBF	Results- Based Finance
RofR	Rate of Return
RREP	Rural Renewable Energy Project
SL	Sierra Leone
SLCDU	Sierra Leone Compact Development Unit
SLEM	Sierra Leone Electricity Market
SLIHS	Sierra Leone Income and Household Survey
THP	Threshold Program
TOU	Time-of-Use
TNO	Transmission Network Owner
TR	Task Report
TSA	Transmission Services Agreement
TSO	Transmission System Operator
T&D	Transmission and Distribution
USAID	United States Agency for International Development
VIDA	Village Data Analytics
WAPP	West Africa Power Pool
WAN	Wide Area Network

1.0 INTRODUCTION

BACKGROUND

The first edition of this Roadmap was released in 2017 under the MCC threshold program's Electricity Sector Reform Project (ESRP). The roadmap outlined a broad vision for the electricity sector's development over the period 2017–2030, including institutional, policy, and market reforms intended to improve sector performance in terms electricity access, grid reliability, and cost of supply. The roadmap further identified and assigned responsibility for discreate actions, such as policy reforms, regulatory decisions, and investment programs, required to achieve sector goals.

The roadmap is a living document meant to aid in the coordination of key sector reforms across government, donors, and private stakeholders. The activities and actions included in the first edition were informed by a series of studies and consultations conducted during the ESRP, as well as government policy documents and legislation, including the Electricity Act. It underwent a rigorous process of review and institutional buy-in and a sector steering committee was established to oversee its implementation.

This 2023 version of the roadmap updates the reform activities and extends the horizon to the period 2023–2040. Building from previous versions, this update captures progress along key activities, brings new focus to cross-cutting issues such as gender, social equity and inclusion and climate change, and proposes new activities and actions. Those updates and new proposals are informed by studies conducted under the MCC Power Sector Reform and Institutional Capacity Building Program Development project.

Finally, the structure of the roadmap has been revised to enhance understanding of its recommendations and provide context and tools for managers and implementers working at all levels of the sector. Although presented in a new format, many of the actions and priorities included in this edition will be familiar to sector stakeholders.

PURPOSE

The purpose of this roadmap is to:

- Communicate the government's vision for the electricity sector and build the rationale for proposed reforms.
- Serve as a practical guide for implementation by identifying institutional responsibilities, timelines, monitoring indicators, and risk management strategies for individual activities and the overall sector.
- Promote buy-in and alignment among sector stakeholders and provide a basis for ongoing discussion and strategy development.

STRUCTURE

This edition of the roadmap builds on the previous version, outlines the reform activities and provides a strategic framework for better aligning reform activities with the sector and GoSL priorities.

Strategic Framework

The Figure 1-1 presents of the strategic framework used to communicate the roadmap. The framework is shown as a roof supported by pillars comprised of segments. The roof represents high level principles that promote alignment throughout the structure. The pillars represent supporting main focus areas.

Mission and vision – High level guideposts to provide strategic alignment across all proposed activities and monitoring indicators. Mission describes the sector's role in the economy and what it does at present to drive the sector towards the goal. Vision describes the sector performance goals that drive the strategy.

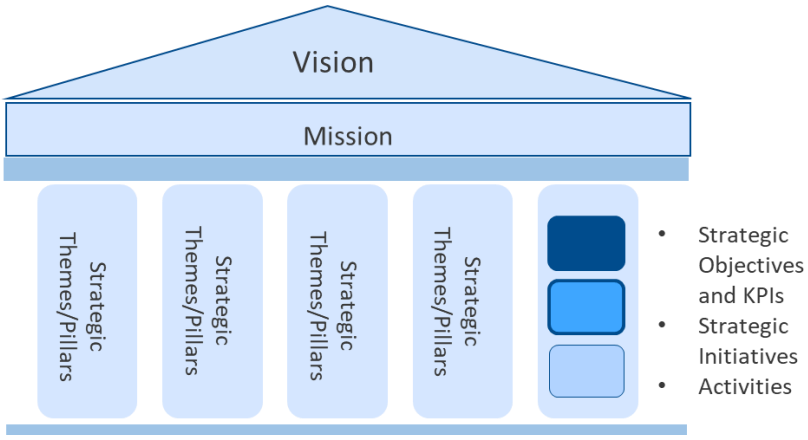


Figure 1-1 Strategic Framework

Strategic themes, strategic objectives, and KPIs – Strategic themes are thematic categorizations of the various workstreams. Alignment of activities within these pillars is further informed by strategic objectives which add a layer of detail to the guiding strategic results. KPIs describe the desired future state of the sector in terms of measurable achievements.
They serve as a link between high level guideposts and activities.

Strategic initiatives – Initiatives are programmatic reform agendas – a series of individual activities and milestones – that advance a specific reform path. Each activity is assigned a lead institution and timeline period

Timeline

The prioritization and sequencing of activities is described in terms of short, medium, and long-term timelines.

Short Term	**2023-2024**	**Priority 1**	Ongoing and priority actions addressing immediate sector needs
Medium Term	**2025-2030**	**Priority 2**	Actions that propel intensive investment and institutional growth
Long Term	**2031-2040**	**Priority 3**	Actions indicating progressive development, long-term reform milestones, and market maturation

Table 1-1 Timeline and Priority for Reform Activities

SCOPE

The roadmap serves as a guiding document for power sector policy and institutional reform and capacity building. As such, the activities and milestones included in the roadmap generally exclude specific investments in infrastructure and off-grid energy programs. While such projects are critical to advancing the goals of the sector, there are practical and conceptual benefits to maintaining the roadmap's focus on institutional reform. Practically speaking, a narrow focus simplifies the Steering Committee's work of tracking and updating the roadmap, especially at the pipeline of investment projects will change and grow over the course of the roadmap's implementation. Conceptually, a firm delineation between investments and enabling reforms will allow sector leadership to communicate the rationale and intended results of the roadmap's initiatives and maintain sector alignment toward shared goals more clearly.

Generally, the Roadmap includes:

- Statutory measures to advance existing or new policies,
- Institutional restructuring and realignment to streamline roles,
- Coordination and monitoring mechanisms,

- Change management[1] activities intended to develop sector norms and organizational culture for adopting change and efficient functioning,
- Capacity building for staff, and
- Procurement and development of tools and training

assets. And, does not include:

- Investment projects
- Donor initiatives

OVERVIEW OF ROADMAP UPDATES

A significant number of the activities in this update of the roadmap are found in 2017 version. Existing initiatives were updated to reflect progress or changed circumstances, and in some cases supplemented with new supporting activities. This version also brings renewed focus to sector sustainability and inclusion by introducing new initiatives related to environmental and safety management, climate resilience, women's participation in energy sector, and social equity.

The following is a summary of progress on roadmap initiatives since 2018.

MOE

- The December 2017 amendment to the Electricity Act enables (i) the establishment of the Sector Collection Account, (ii) the transfer of assets owned by EDSA and EGTC to third-party utilities licensed by the Electricity and Water Regulatory Commission and (iii) the establishment of a class of eligible customers that will be able to directly purchase electricity from licensed generators under specific conditions to be defined by the Ministry of Energy.
- The MOE Planning Unit was set up as part of the MCC THP but has not since been fully incorporated into the MoE Energy Directorate structure and remains siloed from other departments. The unit is currently not fully staffed. The roadmap recommends that the MOE Planning Unit be fully integrated and staffed.
- A Steering Committee was formed during the conception of the initial Roadmap to promote and coordinate its implementation. It then became inactive before being reinstituted in 2022 to include donor partners and working groups.
- The interim sector collection account is established and jointly managed by MOF and EDSA.

[1] Change management refers to application of structured processes and management tools leading to people side of change for a desired outcome. It helps people impacted by a change to make personal level transitions to engage, adopt and use a change.

Transition from interim to full-fledged collection account is pending.

EWRC

- EDSA-EGTC PPA update –The PPA between EDSA and EGTC was signed in February 2021, including the definition of the system operator. The PPA formula needs to be reformed to better reflect the cost of generation and should be re-visited after 2-3 years.
- The interim grid code has been prepared and awaiting finalization and adoption for implementation.

EGTC and transmission

- The FCDO and AfDB have funded the ongoing Bo-Kenema Transmission and Network Rehabilitation Project.
- The TRANSCO-CLSG interconnection line is functional in parts of the country. In Sierra Leone, it is a 530-kilometer interconnection through five substations at Kenema, Bekongor, Bumbuna, Fadugu and Kamakwie. The PPA with CI Energies and a Transmission Services Agreement (TSA) with TRANSCO was concluded in December 2021, with subsequent energization and supply of power to Bo and Kenema. Originally a 10 MW Take-or-Pay Agreement was negotiated, but that has been increased to 27 MW, due to increased demand.
- Several sub-transmission lines are planned to connect the 5 substations of the CLSG to major towns, agro-processing and mining centers along its path.
- The India Exim funded 200 km transmission line linking the CLSG station at Yiben to Freetown via substations at Port Loko and Newton is a critical component of Phase I of the proposed National Transmission Network, which will bring bulk power to major load centers throughout the country.

EDSA and distribution

- The process for private sector participation in EDSA has been initiated with launch of solicitation for engaging a transaction advisor in consultations with the WB and MCC.
- Energy Sector Utility Reform Project (ESURP) supported by the WB has led to significant upgrade and expansion of distribution network in Freetown. The project is designed to improve power evacuation and supply to Freetown urban and rural areas, particularly to Freetown east.
- WB is supporting the roll out of IMS that integrates post-paid metering into the accounting/CMS systems.
- Electricity theft is an issue that EDSA is addressing through a program that began in November 2022 to encouraging behavior change, grant amnesty with the installation of pre-pay meters, use data mining to reveal use patterns, and impose fines for large consumers that do not self-identify.
- Phase two of JICA's ongoing support will expand and stabilize the power supply in the southern part of the Freetown peninsula by constructing new substations and a distribution network. The project commenced in Q1 of 2023.

Rural electrification

- The National Electrification Strategy is being developed with WB support using the VIDA spatial mapping tool. The Directorate of Rural Energy is expected to receive support for implementation. Other donors such as GEAPP are also expected to support renewable energy and rural electrification in Sierra Leone. The Roadmap recommends that the Directorate be converted to a standalone rural electrification agency or directorate further strengthened accelerating rural electrification.
- The FCDO Rural Renewable Energy Project (RREP) and UNOPS's implementation mandate formally ended in December 2022. RREP has established a model for commercial mini-grid development and effective public-private partnership.
- The European Union's proposed Transformational Energy Access project for Sierra Leone project is expected to generate 6 MW through approximately 45 solar mini grids. These efforts will result in the installation of about 350 mini-grids over the next 3 years, benefiting over 500,000 Sierra Leoneans.
- Seven District HQ towns Electrification Project - MOE undertook the construction of distribution networks funded by GoSL at Kambia, Kabala, Pujehun, Bonthe. Kailahun, Moyamba and Mattru Jong. Work on the distribution network is at an advanced stage, while procurement activities for generation are ongoing.

Procurements

- IPP Frameworks for solicited as well as unsolicited proposals was developed under the THP. PPP Unit started using some of the standard templates developed during the THP but still deals mostly with the unsolicited proposals. The IPP framework is awaiting finalization, approval and adoption for implementation.
- A National Investment Board (NIB) has just been formed and would serve as a one-stop-shop (single window) for project investments and approvals.
- MOE's PPP Unit is requesting donor support to seed the PPP Transaction Support Fund. The fund would be used to gather project development data. A complete design study and documentation has been produced by a consultant.

The following is a summary of new focus areas in reforms roadmap.

E&S Management

- Establish EHS units in EDSA and EGTC – EHS units should be established within EDSA and EGTC consisting of an environmental specialist, a biodiversity/climate specialist and a social /gender/resettlement specialist. EDSA and EGTC will nominate 'EHS Champions'.
- Establish EHS capacity and tools at EDSA and EGTC – EDSA and EGTC should conduct health and safety audits against IFC EHS guidelines and develop environmental and social management systems and an OHS Policy for improved data collection and workplace safety.
- Develop sector EHS guidelines and coordination mechanisms – EPA should develop improved EHS guidelines to better coordinate with EGTC and EDSA, as well as with the private sector

through ESIA standards, PCB disposal management, and compliance audits.

Climate Resilience

- Develop climate change policy for power sector aligned with NDCs and other national level commitments.
- EGTC and EDSA develop and maintain national climate vulnerability assessment and mapping – EDSA an EGTC should introduce measures for improving climate resilience by improving technical specifications, grid hardening interventions, and training on Integrated Resource and Resilience Planning (IRRP) concepts.
- Conduct capacity building on GHG inventory management – the existing GHG inventory has not adequately reflected the carbon intensity of the economy and is still a work in progress. A robust data collation tool is needed if Sierra Leone will successfully evaluate, monitor, and implement a GHG inventory in the energy sector.

Women in Energy

- Gender policy and audit – A gender policy audit should examine sector policies and practices focusing on compliance with Gender Equality and Women's Empowerment Act.
- Implement gender-based violence (GBV) policy – Sector institutions should develop and implement a (GBV) policy that establishes a strong survivor-cantered grievance management process and post-sexual harassment support services.
- Internships, mentorship, collaborations – Partner with educational institutions to design outreach programs, internship and mentorship programs, career fairs, and networking events.
- HR training and gender manual – Training will be provided to HR managers and senior managers on how to develop and implement best practices across the employee life cycle and to develop a gender guidance manual, handbook, or code of ethics.
- Establish women in energy forum to provide a platform for power sector entities to share experience and learn about best practices.

Equity & Inclusion

- Draft and publish pro-poor connection policy – A pro-poor connection policy developed by MoE and implemented by EDSA will overcome some of the challenges to increasing access in poor communities. The policy needs to focus on providing affordable connections by use of subsidies or grants, make processes simpler and services accessible.
- Launch pro-poor connection program – Launching a pro-poor connection program will require several activities, including a dedicated implementation unit, a detailed assessment, the reform of business and connection processes, and a public awareness campaign.

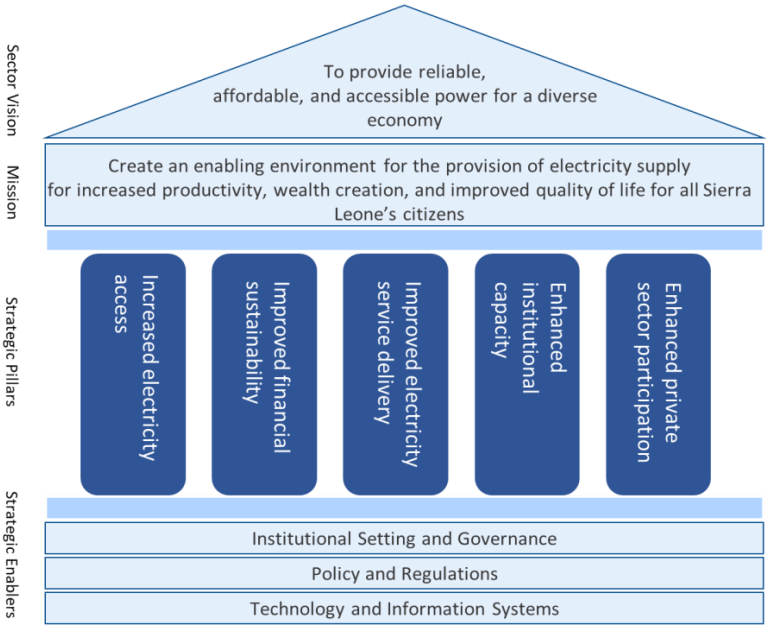
2.0 HIGH-LEVEL STRATEGY

CONTEXT

Sierra Leone's energy sector faces a range of operational, financial, and institutional challenges that limit its ability to meet the needs of the Sierra Leonean population and economy.

- Electricity access is estimated to be around 23 percent nationally, or 6 percent in rural areas and 48 percent in urban areas. While donors and private service providers have made important contributions to the availability of mini-grids and standalone power systems, their growth is constrained by inadequate government planning and regulatory frameworks.
- The cost of electricity, including cost of generation, system operation, returns on investment, and system losses (currently 51% for aggregate technical and commercial losses), is high. Meanwhile, consumer tariffs are not cost reflective. This gap in sector funding needs to be filled with significant subsidy from the Ministry of Finance.
- Reliability of service is poor. The number of outages and average downtime are on the rise.
- Systems and processes for reliable estimation of key sector parameters such as losses and quality and reliability indices are not fully in place.
- Private sector investment is hampered by concerns about sector financial sustainability and an unreliable off-taker, weak implementation of the IPP framework, and the poor and limited state of the transmission and distribution network.

MISSION, VISION AND STRATEGIC THEMES



The Figure 2-1 shows the vision, mission, strategic themes for the sector reforms road map.

The high-level mission and vision for Sierra Leone's electricity sector are informed by the Government of Sierra Leone though its development goals, and Ministry of Energy's vision for the sector as recently presented during Energy Sector Roundtable 2022.

The **mission** of Sierra Leone's electricity sector is to:

"Create an enabling environment for the provision of modern energy services for increased productivity, wealth creation

and improved quality of life".

The **vision** for the future of Sierra Leone's electricity sector is to provide:

"Reliable, affordable, and accessible power for a diverse economy".

The main focus and result areas for the sector framed as strategic themes for the sector reform road map are :

- Increased electricity access;
- Improved financial sustainability;
- Improved service delivery;
- Enhanced institutional capacity; and
- Enhanced private sector participation that leads to lower cost electricity.

The Figure 2-2 presents the strategic themes and related strategic objectives for the sector reforms roadmap.

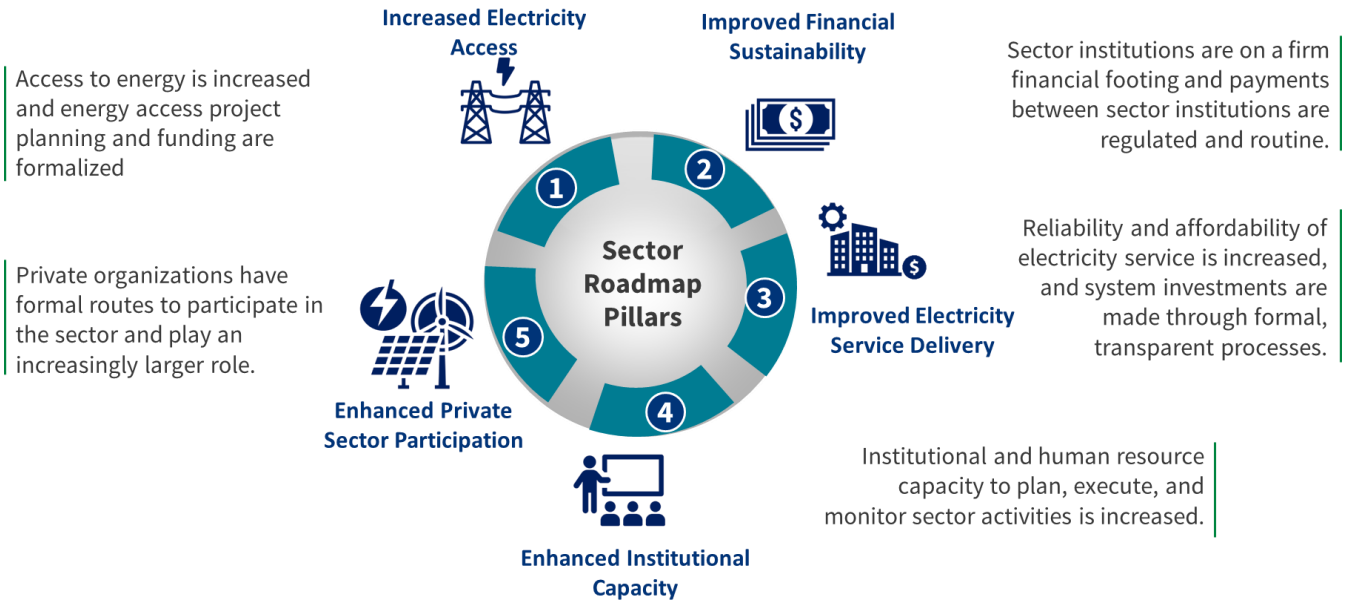


Figure 2-2 Strategic Themes and Strategic Results

The Table 2-1 provides snapshot summary of the strategic themes, strategic objectives, KPIs and related strategic initiatives. Each strategic initiative has multiple activities. Chapter 3.0 provides description of strategic themes, objectives and activities.

OVERVIEW OF STRATEGIC THEMES AND INITIATIVES

To realize this high-level mission and vision, Sierra Leone's electricity sector must achieve five over-arching strategic results, each of which informs one of the strategic themes used to organize the proposed reform and capacity building activities.

Table 2-1 Summary of Strategic Objectives, KPIs and Strategic Initiatives

Strategic Themes	Strategic Objectives	KPIs	Strategic Initiatives	
Electricity access	• Increase electricity access (including low-income households)	• Electricity access rate • Ctkm T&D lines • SHS systems sold/mini-grid connections	• Energy access policy and planning • Eligible customer[2] regulation	• Concession and mini-grid regulation • Tariff affordability
Financial sustainability	• Improve financial flows in line with sector structure • Increase collection of bills, fees, and fines across stakeholders	• Cost of service • Cost recovery ratio • System losses	• Collection account • Final NPA unbundling • Regularize sector payments	• Consumer tariffs • Loss reduction • Sector financial model and budget • Sector stakeholder tariffs • Energy efficiency policy
Electricity service delivery	• Reduce cost of electricity • Improve reliability of service • Improve technical and operational standards	• SAIDI, SAIFI • Customer satisfaction score • System losses	• Sector policy • GIS and ICT • Market transformation	• Sector planning • Grid code

[2] Eligible Customers refers to customers above certain load threshold who are eligible to get supply directly from generators and IPPs

Institutional capacity	• Improve planning and project management capacity • Improve O&M performance	• Number of people trained • Number of sector policies proposed and adopted • Number of women in management	• MOE operations EDSA operations • EGTC operations • EWRC operations	• EPA-SL operations • Environmental, health, and safety management • Climate change planning • Women in energy
Enhanced private sector participation	• Increase opportunities for private participation • Increase formality of sector roles	• Number of IPPs • New MW capacity added through competitive procurement • USD leveraged from private or public sources • Cost of generation (USD/kWh)	• PPP support • Procurement systems and rules	

3.0 STRATEGIC THEMES

STRATEGIC THEME 1: ELECTRICITY ACCESS

Table 3-1: Strategic Objectives and KPIs – Electricity Access

Strategic objectives	KPIs
• Increase energy access	• Electricity access rate • Ctkm T&D lines • SHS systems sold/mini-grid connections

Sierra Leone's electricity sector faces several challenges in increasing electricity access.

Lack of government capacity to coordinate and incentivize private participation. Government capacity to plan, fund, and execute rural electrification programs is limited by capacity constraints within the Ministry of Energy and EDSA. Furthermore, rural electrification projects tend to present lower financial and economic return as compared to other priority investments such as EDSA's collection capability and strengthening of the existing grid. While donors and the private sector have demonstrated their interest and ability to develop the rural power sector, government capacity to oversee and contribute funding is essential to the long-term growth of those initiatives. This roadmap recommends the development of a standalone rural electrification agency as well as a dedicated rural electrification fund.

Lack of regulatory mechanisms for private participation. Private involvement in the rural electricity sector is held back by a lack of regulated mechanisms for participation including licensing and concessioning schemes. Sierra Leone's Electricity Act makes provision for the licensing of both captive power suppliers and distribution concessions. This roadmap recommends the development of licensing mechanisms for captive power, local mini-grids, and larger-scale concessions. It further recommends the development of a concession scheme for district capitals.

Affordability of grid connection and electricity. Affordability is an important demand-side barrier to expanding electricity access. Sierra Leone's current tariff model does not efficiently target the poorest consumers with subsidies and could be reformed to further reduce their cost of electricity. Even where grid electricity is accessible and lower cost than off-grid alternatives like candles or kerosine, connection fees can pose an insurmountable barrier to formal grid connection. This roadmap recommends the adoption of tariff models that can reduce these affordability barriers, including the establishment of a social tariff category, the adoption of progressive service charges, and the adoption of measures that allow customer to pay for connections fees by installment. These tariffs related recommendations aligned with those presented tariff reform activities proposed under pillar 3.

Energy Access Policy and Planning

Activities

Table 3-2: Strategic Initiative – Energy Access Policy and Planning

Energy Access Policy and Planning	Lead	Timeframe
Prepare National Electrification Strategy and Plan	MOE	Short-term
Draft and Publish Formal Pro-Poor Connection Policy & Program	MOE	Medium-term
Establish standalone rural electrification agency	MOE	Medium-term
Launch pro-poor connection program	MOE	Medium-term
Establish and finance a rural electrification fund	MOE	Medium-term
Develop Results-Based Finance facility	MOE	Long-term
Develop off-grid PAYGO mechanism	MOE	Long-term

The Government has set ambitious goals in terms of rate of access to the electricity service: reaching 70% (64% gird and 6% off-grid connections) in 2030 which would be a 34% increase in grid connections from the 2022.
Approximatively 75,000 new households would have to be connected every year on average over the 2023-2030 period. The government aims at near universal electricity access by 2040. Hence, to achieve these targets, there is need for developing a national level electrification strategy, policies for connecting poor households, establishing rural electrification agency of similar structure for implementing the electrification strategy and findings ways for creating a rural electrification fund to support the electrification fund and agency.

Activity Description

Prepare National Electrification Strategy and Plan

- The National Electrification Strategy and Plan (NESP) is being developed with assistance from the WB's Enhancing Sierra Leone Energy Access Project (ESLEAP), including through the launch of a National Online Digital Electrification Platform (NODE).
- NODE is hosted on the Village Data Analytics (VIDA) platform, a private technology solution used to identify and characterize human settlements. In turn, data from VIDA will be fed into the OnSSET tool for least cost electrification planning.
- The NESP is expected to l cover all grid, mini-grid, and off-grid electrification strategies and

support the electricity access targets set by GoSL.

- MoE should complete the preparation of NESP in the short term and formally adopt it for implementation.

Draft and Publish Formal Pro-Poor Connection Policy & Program

- As per the 2018 Household Income Survey, A pro-poor connection policy developed by MoE and implemented by EDSA will overcome some of the above challenges and increase access in poor communities. The policy needs to focus on providing affordable connections by use of subsidies or grants with nominal downpayment (e.g., $1 per connection), making connection processes simpler and services more accessible, and launching an intensive public awareness campaign. The policy will further define the number of households to be connected, eligibility criteria, bulk procurement approach to minimize costs, and monitoring and evaluation mechanism.

Launch pro-poor connection program

- Once a pro-poor connection policy is published and adopted, the GoSL will launch the pro-poor connection program that would connect new low-income users with the design of a preferential financial connection offer with a minimum level of service.
- Launching a pro-poor connection program will require many intermediate steps such as
    - setting up a dedicated PIU for implementation, management and monitoring,
    - conducting study and analysis on procurement and cost optimization for meters, connection board and other accessories,
    - simplifying administrative requirements for address proof and minimum contribution from customers etc.,
    - institutionalizing business processes for pro-poor customer management including application stands/camps, billing and customer care,
    - design and launch of public awareness campaign focused on connection offer, social tariff, content of connection kit, application process and any subsidies available,
    - set-up of permanent application stands in urban and rural areas;
    - Developing and launching communication/awareness campaigns on pro-poor connection offer and social tariffs in urban and rural areas.

A 5-year pro-poor connection program would target connecting about 43,900 per year: 4,500 per year in Freetown urban area; 14,400 in other urban areas and 25,000 per year in rural areas. Total cost of implementing such a pro-poor connection program will be in the range of $21.5 million for five years. The program cost considers only no-pole connections and $100 ($75 for meter, $20 for ready board and $5 for two lamps). Given the large investment requirement, the GoSL will work with donor partners to arrange funds for the program.

Establish standalone rural electrification agency

- MOE should formally create a standalone rural electrification agency to strengthen the policy action

for rural electrification. Alternatively, the rural electrification directorate within MOE's energy directorate can be further strengthened.

- A rural electrification agency would be responsible to:
    - collect and make available information on potential renewable energy sites at the local level;
    - develop the national electrification plan to be integrated into the national electricity sector plan;
    - promote electrification through technical and financial support for public or private initiatives;
    - establish a multi-annual program for the implementation of the electrification plan;
    - establish and lead the tendering process for engaging contractors for supplying equipment and works required for rural electrification;
    - support the development of electrification projects through coordination at the local level, mobilization of funds, and provision of key regulatory services;
    - manage finance, promote, and monitor the implementation of electrification projects;
    - raise funds and monitor donor relations and follow-up funding requests in collaboration with the relevant departments of the MOE and MOF

Establish and finance a rural electrification fund

- MOE should formally create a Rural Electrification Fund for supporting activities of the Rural Electrification Agency and co-financing priority energy access projects.
- The Fund would partner with commercial banks and donors to leverage funding and capabilities such as corporate credit assessment.
- The MOE would specify the source of ordinary and exceptional resources allocated to the Fund and their conditions of use.
- MOE would specify the procedures for awarding grants and loans via the Fund as well as establishing partnership agreements between the Fund and the commercial banks.
- Fund design would consider principles of eligibility, evaluation, and selection of projects and specify the methods of administration and management of the Fund.
- The fund could be financed using a levy on the electricity tariff
- MOE or the Rural Electrification Agency will prepare Operation Manual that will detail various aspects of the Fund such as financial management and use of funds, information disclosure through information systems, procurement of projects and equipment and award of grants, monitoring and evaluation of electrification projects, environmental and social screening and management plans etc.

Develop Results- Based Finance (RBF) facility

- The Rural Electrification Agency may explore the development of RBF facility to accelerate the pace of electricity access. Traditional procurement models for electricity access can be time consuming and impose high administrative costs of government, donors and project developers.
- As an alternative to the traditional model, under RBF facility governments and donors provide grants to project developers or third-party contractors that are paid upon delivery of the electricity connections.
- Under the facility the cost of each connection is pre-defined and delivered connections are verified through a robust monitoring and evaluation system. Thus, through RBF the risks are transferred to

private sector while developers and third-party contractors are incentivized to accelerate connections.

Develop off-grid Pay-As-You-GO (PAYGO) mechanism

- MOE and/or Rural Electrification Agency should explore the development of an affordable PAYGO solar home system commercial offer for very poor households (Tier 1 and Tier 2).
- This action supports universal access to electricity in a financial sustainable manner.
- A PAYGO commercial offer would consist of lump-sum tariffs for different system options. For example, 10W, 20W and 50W solar home systems would be sold at $1, $5 and $10 per month, respectively.
- The commercial transaction associated with this offer will be served by the EDSA or Rural Electrification Agency or a third party using a pay-as-you-go type of business model. EDSA or Rural Electrification Agency could contract the technical and sales functions to local off-grid service providers.

Tariff Affordability

Activities

Table 3-3: Strategic Initiative - Tariff Affordability

Tariff Affordability	Lead	Timeframe
Restructure social tariff category and its application	MOE/EWRC	Short-term
Implement connection fee installments	EDSA	Medium-term

Activity Description

Restructure social tariff category and its application

- The MOE and EWRC should work together to restructure the social tariff and its application to enable better focus on the basic needs of poor households.

- The lower social tariff (T-1 Social tariff 0-25 kWh) currently benefits all residential customers. This is an "error of inclusion" as it benefits those households as well who do not need it. This benefit should normally be restricted to households who consume less than 25 kWh.
- The social variable tariff has been increased by 150% on July 01 2022, while the normal tariff has been increased only by 59% for consumptions below 200 kWh and 72% for consumptions above, in a context in which inflation had added up to approximatively 150% since the initial tariff was adopted. The only justification for the sharp increase of the social tariff (the only one that would compensate

inflation) is that it was and still well below the minimum tariff signal to send to users, which would be the cost of production estimated at 2,117 SLL/kWh in 2022.

- Analysis of 2018 SL Income and Household Survey (SLIHS) inflation adjusted to 2022 shows that electricity bill for 25kWh consumption (including service charge and GST) would represent more than 4.2% of household income for Q1 wealth households and would be higher than 5% threshold for many in that wealth quantile.
- To avoid a potential situation where the electricity bill would weigh more than 5%, an option would be to lift the service charge and the GST for consumptions inferior to 25 kWh, and only for those (it would be an exclusive benefit). Lifting taxes such as the GST is not unusual in Africa. For example, the VAT has been lifted in Niger for domestic consumptions up to 150 kWh and in Senegal for consumptions up to 250 kWh. The lifting proposed here would be much more limited as applied only to consumptions up to 25 kWh and only for such consumptions.
- Now, given the electricity rates and levels of income, it may be prudent to extend the benefit to consumption inferior to 50kWh (such consumers would then pay, as of today, 25 kWh at the social tariff and the next 25 kWh at the rate applied for consumption between 25 and 200 kWh) to potentially reduce significant impact on such households due to exclusion from social tariff.

Implement connection fee installments

- High connection costs and tedious connection process are two main barriers to electricity connections.
- According to EDSA, the connection cost in 2022, including a single-phase meter, is NL2,850 or Le 2,850,000 (US$ 150 at NL19 to 1US$). The connection cost with a three-phase meter is NL4,700 (US$ 247). Those costs would be valid for applicants close to the network (requiring no pole). In terms of Q1 and Q2 urban households' income (refer 2018 SLIHS) who are not connected to the grid, the lowest cost connection (single phase) would represent 2 times the Western area (Freetown) Q1 monthly income (Le 1,446) and nearly 50% of the average Q2 monthly income (Le 5,984).
- If the applicant is not close to the network and poles are required, EDSA communicates an average cost of NL 15,000 (US$ 788) for a single-phase customer with 3 pole distances. Therefore, if three poles are required (one of the worst scenarios[3]), that would represent 10 times the average Q1 monthly income and 2.5 times the average Q2 monthly income (Le 5,747).
- Such high multipliers are a main obstacle to connection and could also be an incentive to illegal connections.
- As per 2017-2018 willingness to pay study[4] the current connection cost for the basic configuration (Le 2,850,000) is way above the willingness to pay of all quintile urban households. For the Q1 and Q2 quintiles, it would be equivalent to, respectively, 10 and 4 times their willingness to pay. It would still represent 2.2 times the Q4 monthly income. When there is no access to electricity in an urban

[3] At least in cases where the network is not that far; still in some cases of more isolated dwellings, a transformer could also be required.

[4] Study on Willingness and Ability to Pay for Electricity Service (WATP-E). Final Report. Jan 23, 2018.

area, the households living in that area are only willing to pay 17% of the current cost for the basic connection. Rural households are only willing to pay between 5 and 11% of the cost in effect.

- Given these high connection costs, the connection fee should be through installments over a 12-month or 24-month period. For low-income households covered by pro-poor connection policy on a symbolic (say $1) downpayment should be collected towards connection fees.

Concession and Mini-grid Regulation

Activities

Table 3-4: Strategic Initiative - Concession and Mini-grid Regulation

Concession and Mini-grid Regulation	Lead	Timeframe
Fully implement 2019 mini-grid regulations	MOE	Short-term
Establish guidance for transfer of EDSA and EGTC assets to concessions	MOE	Medium-term
Procure district concessions - Kailahun, Pujehun, Bonthe, Moyamba, Kambia, Koinadugu	MOE	Long-term
Procure city concessions - Bo and Kenema, Makeni and Magburaka, Port Loko and Lunsar	MOE	Long-term

Activity Description

- Fully implement 2019 mini-grid regulations The Sierra Leone Electricity and Water Regulatory Commission (Mini-grid) Regulations, 2019 establishes the licensing process as well as the tariff setting process for mini-grids. This regulation is a big step forward on reforms agenda. In 2022, there were about 94 mini-grids built on a PPP model where the government owns the distribution assets and private operators own generation and are licensed to perform O&M through 20-year contracts.
- The mini-grid regulations are quite robust and establish elaborate and specific requirements for mini-grid licensees and EWRC such as tariff determination on yearly basis (section 57), detailed technical and financial information (schedule 8 & 9 and section 59) etc. It is not clear if these provisions have been fully implemented.
- EWRC needs to implement all provisions of the mini-grid regulations and develop mechanisms and tools for collecting and analyzing technical and financial data from mini-grids for long term sustainability.

Establish guidance for transfer of EDSA and EGTC assets to concessions

- A concession model is preferable for locations with significant growth potential, where high expected investments require greater regulatory certainty.
- The concession approach would include provision for the transfer of decentralized public assets owned by EGTC and EDSA to the concessionaire until the expiration of the concession.

- The benefit of the concession approach for large rural towns is increased planning and financial sustainability for the joint development of generation, distribution, and supply capabilities. In particular, the rapid expansion of the concession customer portfolio will promote least cost generation.
- Private electricity service for rural areas will tend to reduce cross-subsidy burden. EGTC will no longer need to develop and supply decentralized thermal generators, and EDSA will no longer need to maintain distant decentralized grids with small customer bases and lower than average collection rates. This would reduce the operational losses of both utilities and improve the quality of supply of consumers.

Procure district concessions – Kailahun, Pujehun, Bonthe, Moyamba, Kambia, Koinadugu

- Where population centers are within close geographic proximity, a single mini-grid contractor should be licensed to provide service to the entire cluster. This strategy would capture efficiencies in project development and operations.
- Clusters of mini-grid sites should be identified by the EWRC in consultation with local authorities who may provide guidance on priority social loads, tariff levels, and service expectation. In some cases, mini-grid clusters may coincide geographically with entire districts. This option should be explored for: Kailahun, Pujehun, Bonthe, Moyamba, Kambia and Koinadugu.

Procure city concessions – Bo and Kenema, Makeni and Magburaka, Port Loko and Lunsar

- For larger population centers, greater than 20,000 inhabitants, private electricity service providers could be contracted to develop and operate local networks using a concession model.
- Where larger population centers are within close geographic proximity the same concession agreement should cover both locations as well as the interconnecting sub-transmission line. This option should be explored for: Bo and Kenema, Makeni and Magburaka, Port Loko and Lunsar.
- When a city is close to a renewable energy site and to a bulk substation (e.g., Koidu, Bo-Kenema), the concessionaire may use the opportunity to develop relevant generation assets to serve the local loads to export any surplus to bankable off-takers (in country or outside the country through the CLSG interconnector) using the transmission network operated by EGTC.

Eligible Customer Regulation

Activities

Table 3-5: Strategic Initiative – Eligible Customer Regulation

Eligible Customer Regulation	Lead	Timeframe
Define criteria for eligible customers	MOE	Short-term

Activity Description

Define criteria for eligible customers

- The National Electricity (Amendment) Act 2018 introduced the provision of eligible customers under Section 11 (1) b "Functions of the Company"[5] for – "the sale of electricity to the Authority and to customers eligible for such sale as the Minister may, by statutory instrument prescribe". Further, section 11 (2) states that Without prejudice to the generality of subsection (1) the Company may – (a) enter into agreements with third parties jointly or otherwise for – (iii) "the sale of electricity by such third parties on behalf of the Company to customers eligible for such sale as the Minister may, by statutory instrument prescribe". Further, section 81 (1) & (2) states that – the Minister may by statutory instrument make regulations prescribing – (k) the criteria to become an eligible customer and the conditions under which the Company or an independent power producer shall sell electricity to customers meeting the criteria to be classed as eligible customers.
- The Minister (or MOE) has not yet prescribed the regulations defining the criteria for becoming eligible customers. Also, as per the 2018 amendments, the Company (EGTC) and IPPs only can supply to eligible customers and not the Authority (EDSA).
- The MOE/minister should prescribe regulations defining eligible customer and provide further clarity on who should supply to such customers to maintain a defined sector structure and governance.
- At present EDSA seems to be signing supply contracts with large mining companies who by industry standards should qualify for eligible customers and hence should be supplied by either EGTC or IPPs. MOE/Minister should bring clarity to this anomaly either by further amending the Act , prescribing regulations or transferring the supply contracts to EGTC or IPPs.

[5] In the Act EDSA is referred to as Authority while EGTC as Company

STRATEGIC THEME 2: FINANCIAL SUSTAINABILITY

Table 3-6: Strategic Objectives and KPIs – Financial Sustainability

Strategic objectives	KPIs
• Reduce cost of electricity • Improve financial flows in line with sector structure • Increase collection of bills, fees, and fines across stakeholders	• System losses • Cost of service • Cost recovery ratio

Misalignment of financial flows between sector stakeholders. Financial flows within Sierra Leone's electricity sector are not guided by clearly defined divisions of assets or market roles. Where tariffs, fees, and fines are established, they are not regularly made and lack enforcement mechanisms. To realize financial sustainability, the sector must enforce regular payments, develop transparent mechanisms for determining payments, and unintended cross-subsidy.

Incomplete operationalization of the collection account. The Electricity Act amendment of 2018 created provision for the Collection Account in response to the sector's insufficient and non-transparent financial flows. The collection account is still in interim phase. The collection account acts as a mechanism for ensuring that revenue collected from EDSA is fully and appropriately distributed across sector stakeholders so as to ensure that maintenance and operational costs are met and that EDSA's PPAs with IPPs are honored. The waterfall arrangements in the collection account gives priority to IPPs and keeps public entities at the bottom. The operation of the Collection Account is not transparent, and stakeholders (such as EGTC and donors) have limited visibility which defeats the purpose for which the account was set up. This roadmap recommends the continuation of efforts toward a transparent and fully operational collection account.

Non-transparent tariffs for state entities. Generation and transmission tariffs paid by EDSA are not properly established and fail to reflect the distribution of assets across the sector. The tariff structure for state entities is misaligned due to both incomplete and non-transparent accounting of capital assets, and a culture of non-payment. This roadmap recommends the government complete the un-bundling of NPA by dividing remaining unallocated assets between EGTC and EDSA and writing off any pre-unbundling arrears from the balance sheets of both companies. The companies should then undergo complete financial audits to establish a transparent basis for tariff setting. The roadmap further recommends that the tariff models and methodologies for generation and transmission by state-owned companies be formally reviewed and established.

Incomplete implementation mechanisms for collection of fees and fines. Fees and fines are important sources of revenue for sector entities, especially EWRC. Furthermore, they serve incentives for transparent

participation by private actors and customers. The Electricity Act stipulates the use of fees relating to licensing of private operators and professional licensing of service providers. The Act also makes provision for use of the fines in response to electricity theft or other violations of the Act. This roadmap recommends that fees and fines be operationalized through official statutory decisions, the establishment adjustment methodologies, and the creation of dedicated accounts for their collection and management.

Non-transparent tariffs for consumers. Sierra Leone's current tariff structure introduces a major cross-subsidy from large consumers to, ostensibly poor, very low consumption consumers. This non-transparent form of subsidization fails to precisely target low-income consumers as the social tariff benefits all residential customers at present. This roadmap recommends the reform of EWRC's tariff model to allow for automatic tariff adjustments, restructure social tariff category, and make other adjustments related to progressive tariff blocks, fixed fees, and connection fees. New tariff structures, such as time of use tariffs, should also be explored. These reforms must be achieved through the establishment of transparent methodologies and accounting systems.

Lack of oversight. The lack of transparency and alignment of financial flows also complicates the overall understanding and management of the sector. The MoE and MoF require improved visibility over the sector's financial state to better monitor payments between actors, reduce the overall cost of service, and assure donors and private investors of their functional oversight. This roadmap recommends measures for financial auditing and budget tracking as well as actions to enhance coordination of sector investments.

Collection Account

Activities

Table 3-7: Strategic Initiative - Collection Account

Collection Account	Lead	Timeframe
Adopt operations manual	MOE	Short-term
Establish the Collection Account Committee, appoint independent agent, collection account bank and give oversight to Steering Committee	MOE	Short-term
Achieve pari passu in collection account waterfall	MOE	Medium-term

Activity Description

General notes

- The Collection Account enables a cash waterfall arrangement that provides a payment guarantee for prioritized payments to sector players. The highest priority is given to Government tax and levy in

order to contribute to the public budget. The second priority is given to the payment of operation and maintenance expenses of all activities through the value chain, in order to maintain the integrity of the electricity supply service. The third priority is given to the payment of investment charge of private investors (also pari passu of PPP projects). The fourth and last priority is given to the payment of a public investment charge not covered by a guarantee instrument (other than sovereign guarantee). With such an arrangement, the Government bears the full responsibility of insufficient revenue due to price set below cost recovery level. The GoSL will therefore manage the trade-off between subsidy injection in the sector and electricity prices. As a result, it is expected that a policy for phasing out the sector deficit will be set in place, through progressive tariff increase, reduction of the cost of the generation mix, increase of the transmission capacity and improved efficiency of distribution and sales.

Adopt operations manual

- The collection account is still in interim phase where EDSA's account is jointly managed by EDSA and Ministry of Finance (MOF). An operations manual was drafted for review in 2016 but has not been formally adopted yet.
- The MOE, MOF and other relevant stakeholders should review and/or update the draft operations manual and adopt it for operationalizing the collections account.

  The operations manual at a minimum will set guidelines and instructions for (i) management, reporting and control of the collections account, (ii) legislative or other institutional changes needed to facilitate operationalization, (iii) constitution of a Collection Account Committee and its functions, (iv) selection, appointment and responsibilities of Independent Agent (IA), (v) selection, appointment and responsibilities of a Collection Account Bank, (vi) conditions precedent to commencement operations of collections account, (vii) accreditation and listing procedures for suppliers (generators, fuel suppliers etc.) who would be paid from collections account, (viii) sector budget model, (ix) annual cycle of actions including monthly and quarterly operations, (x) payment waterfall scheme and (xi) oversight and reporting.

Establish the Collection Account Committee, appoint independent agent and collection account bank and give oversight to Steering Committee

- Collection Account Committee configuration and responsibilities will be defined in the operations manual. The collection account committee will primarily be needed to oversee the functioning of independent agent and collection account bank. The committee should be formed to facilitate operationalization of the collections account. The Collection Account Committee would report to the sector Steering Committee established to support the implementation of the sector reforms roadmap.

Achieve pari passu in collection account waterfall

- The interim Collection account waterfall keeps public owned generators (POG) at a lower footing

than private suppliers. For sustainability of public suppliers like EGTC, it is important that they achieve a pari passu status with private suppliers. The MOE, MOF and other stakeholders should make efforts transition from current waterfall arrangement to a new one providing pari passu status to all suppliers in medium to long term

Consumer Tariffs

Activities

Table 3-8: Strategic Initiative - Consumer Tariffs

Consumer Tariffs	Lead	Timeframe
Refine the inclining block tariff (IBT) tariff structure	EWRC	Short-term
Implement automatic tariff adjustment	EWRC	Short-term
Assess relevance of TOU tariff	EWRC	Medium-term
Prepare for MYT	EWRC	Medium-term

Activity Description

General Note

- Sierra Leone has a tariff regime equivalent to what is known as a rate or return (RofR) or cost-plus regimes wherein the tariffs are set once a year on basis of the historical costs ("backward-looking") of the previous year which may not be economically efficient as the "forward-looking" multi-year tariff regimes wherein tariffs are set based on future planned and expected costs.
- Similarly, the current tariffs are not cost reflective and are not automatically adjusted based on price changes which affect financial sustainability. At the same time the IBT tariffs for residential customers has inclusion and exclusion errors impeding the fairness objective. Tariff structures such as time-of-use that promote efficient use in commercial and industrial sectors have not been assessed yet.
- In terms of tariff methodology, EDSA current revenue requirement formula has flaws that result in improper tariff and revenue requirement calculation.
- In terms of process, the current framework does not specify scheduled (e.g., yearly) reviews, and regular reviews are not performed effectively. Moreover, there is no automatic periodic tariff indexation mechanism, which puts in danger service viability given fuel prices and exchange rate fluctuations.
- Delaying tariff reviews may affect the service economic equilibrium equation, as costs might not be properly reflected in the tariffs. EDSA might not have the capacity to complete the tariff filing process on its own and does not provide all the information to EWRC to perform the tariff review.

Refine the IBT tariff structure

- Tariff structure can be used to achieve a social fairness or equity objective. In order to do so, decision-makers sometimes implement what is called Increasing Block Tariff or IBT structures, which is the case in many countries in West Africa and in Sierra Leone as well. As it is an instrument to achieve social fairness, the IBT structure design must seek to reduce (as any social instruments/programs) what are called errors of inclusion (i.e., including in the financial benefit households who do not need it given their income/wealth situation) and errors of exclusion (excluding from the financial benefit household who need it). The minimization of such errors is the driving rationale for the design of the structure, in addition of course of the relations of the different block tariffs to the full cost of service that has been established. In relation to that last point, a typical IBT structure would follow 3-blocks (i) the 1st block tariff is set below service cost for a lifeline consumption allowance (the 1st block limit);(ii) the 2nd block tariff would be set at cost of service; the block limits would be set to gather the bulk of the customers; and (iii) the 3rd and last block tariff would exceed the cost of service to pay for the subsidy of the 1st block; the block limit would be set so that it would apply to high consumers with supposedly high capacity to pay.
- Sierra Leone uses actually three blocks for (0-25; 25-200 and above 200); it would use two if the social tariff would be only eligible only to the clients not consuming more than 25kWh (inclusion error; an action on electricity access pillar recommends action for restructuring the social tariff). Studies are not available to demonstrate that these blocks are optimal and achieve the tariff objectives. There are inclusion and exclusion errors. The IBT tariff needs to be refined in terms of number of blocks, cross subsidy and impact on low-income households. Detailed and robust customer billing information (to be provided by EDSA) is crucial for a correct assessment of the effect of the tariff design on low-income households.
- Cost allocation to customer classes must be put in practice. Load measurements per customer category should be obtained by EDSA through dedicated data collection campaigns, with supervision from EWRC.

Implement automatic tariff adjustment

- An ATAF approach consists of adjusting the retail tariff based on the variation of the average cost of the generation purchased by EDSA.
- Use of an ATAF will help to preserve EDSA's operating margin.
- Tariff restructuring is an ultimate but delicate goal of the reform process. It will bring more distributional equity to the sector by ensuring that costs and benefits are distributed in a fair manner across all customer segments and that affordability is safeguarded.
- The current tariff structure has limited economic and social efficiency in terms of price signals, in part due to unavailability of data inputs and poor tariff design.

Assess relevance of time-of-use (TOU) tariff.

- There are no TOU tariffs in Sierra Leone for commercial and or industrial customers. EWRC and

EDSA should assess relevance of TOU on the basis of load profiling data and possibility for non-residential users to shift consumption. At present lack of automatized hourly system dispatch data impedes proper calculation of hourly generation cost and assessment of TOU tariff relevance.

Prepare for MYT

- Sierra Leone has a tariff regime equivalent to what is known as a rate or return (RofR) or cost-plus regimes, even if it is not formally defined as such in Tariff Rules. In such regime, tariffs would be set once a year on basis of the historical costs of the previous year. This approach is "backward-looking" as it uses historical data. Other regulatory regimes, such as price or revenue cap regimes use a "forward-looking" approach (like when a company elaborates a business plan for a future period): prices (tariffs) or revenues of the operator are set for a future period (multi-year usually 3 to 5 years) on basis of revenue requirements calculations to recover all future economic efficient costs, including a return on the capital invested. MYT regime is while forward looking is complex that RofR and requires strong capabilities in planning and forecasting demand, costs and investment requirements and cost of service (COSS) studies. Shifting to MTY also requires a major improvement in terms of collection, organization and analysis of required regulatory financial, commercial and operational (technical) information.
- EWRC is aiming at shifting to "forward-looking" multi-year tariff (MYT) setting approach, which would require EGTC, EDSA and EWRC to enhance their capabilities in areas discussed above.
- As an intermediary action, on top of the new required guidelines (defining forward-looking approach, new regulatory period, review processes), a test MTY exercise should be conducted which would include the new tariff model development and a strong capacity building/training component.

Finalize NPA Utility Unbundling

Activities

Table 3-9: Strategic Initiative – Finalize NPA Unbundling

Final NPA Unbundling	Lead	Timeframe
Review asset audit and complete liability audit	MOE	Short-term
Complete transfer of EDSA and EGTC assets	MOE	Medium-term

Activity Description

Review asset audit and complete liability audit

- During the THP, Price Waterhouse Coopers (PWC) was engaged to conduct asset study for EDSA

and EGTC. The study employed various methodologies such as (i) expert inspections based on physical and desk review to determine replacement costs of assets for high value assets, (ii) comparative valuations for assets with short useful economic life, and (iii) indexation for general plant, furniture and for materials of low value.

- The study estimated asset values for EGTC (with generation and transmission split) and EDSA and created asset lists. Most of these assets are not recorded in the accounting system of the utilities. There is need for these assets to be properly recorded in the books of EGTC and EDSA as recommended by the study and should be revalued by indexation annually and by physical revaluation every five years.
- For NPA assets that have not been transferred yet or are in dispute, further unbundling will require a technical and financial audit to be commissioned by the MOE under the supervision of the Steering Committee.
- While the PWC study competed the asset valuations, the study of liabilities was not done. As a result, there is limited documentary evidence on which assets are grant or loan funded. Thus, the liability side study is important to determine the treatment of assets from tariff (regulatory asset base) perspective.

Complete transfer of EDSA and EGTC assets

- Unbundling will require the transfer of "title deeds" of assets to one of the new entities.
- It is the responsibility of the corporate boards of EDSA and EGTC to ensure that the corporatization process is complete.

Loss Reduction

Activities

Table 3-10: Strategic Initiative – Loss Reduction

Loss Reduction	Lead	Timeframe
Develop turnaround action plan for EDSA	EDSA	Short-term
Implement losses reduction program	EDSA	Medium-term
Develop policy and procedures on electricity theft	EDSA	Medium-term

Activity Description

Develop turnaround action plan for EDSA

- EDSA exhibits significant weaknesses in its performance including system losses, revenue protection, customer service, quality and reliability of supply, corporate governance, organizational

structure, and environmental and societal (including social inclusion) aspects.

- A detailed and robust performance turnaround action plan is needed for EDSA which looks at all aspects of distribution business including organizational structure, human resources, business and management processes, financial and accounting management, commercial processes – metering, billing, collections and revenue protection, grid operations and management, knowledge management, ICT and corporate and legal management. Such a turnaround action plan should be developed with support from an international firm and intensive involvement of EDSA management over a period of one to two years.
- If O&M concessionaire is onboard during this period, then the new management should be part of the study. The action plan will have a comprehensive strategy for EDSA performance improvement and implementation framework for 5-10 years with key milestones, targets and resource requirements and resource commitments from relevant stakeholders.

Implement losses reduction program

- Aggregate technical, commercial and collection (ATC&C) losses in excess of 51%[6] present one of the biggest threats to the financial sustainability of the electricity sector in Sierra Leone.
- Technical losses are estimated to be around 15% (though no authoritative technical loss study has been done so far) and remaining are non-technical and collection losses.
- Technical losses are mostly due to poor network condition, overloaded low voltage lines and transformers, deficient reactive compensation, long feeders (low high voltage to low voltage line length ratio) and lack of regular maintenance. Non-technical losses are mainly due to deficient metering, billing, collection, and revenue protection processes, and electricity theft.
- EDSA with help of embedded advisors should develop and implement a losses reduction program. At least two embedded advisors should be contracted hired through a firm with institutional knowledge and demonstrated experience in losses reduction to oversee field activity. The embedded advisors should be hired for at least three years for sustainability, capacity building of field staff and transfer of knowledge. This approached has worked well in many SSA countries including Nigeria, Kenya and Ethiopia under
  USAID's Power Africa Program. The key activities of these advisors should include:

  - Work with EDSA management to clarify responsibilities for losses and related activities;
  - Strengthen revenue protection and internal control system;
  - Establish energy balance practice at EDSA;
  - Support procurement of meters, testing kits and network equipment as needed;
  - Ensure proper and accurate metering at input points (EDSA-EGTC interface points), primary sub-stations and distribution transformers. Distribution transformer metering should be

[6] Analysis based on data provided by EDSA for year 2022.

prioritized to target high loss areas first;
- Lead GIS based customer mapping exercise for cleaning customer database and proper energy balance;
- Lead field teams for inspection of metering installations, in-field meter testing and identification of metering anomalies;
- Lead field teams for surveillance and enforcement activities for electricity theft identification and revenue realization; strengthen supply disconnection, recovery processes;
- Support technical losses reduction activities such as feeder cleaning and refurbishment, load balancing on feeders and transformers, and reactive compensation assessments etc.
- Help procure tools and equipment including metering sets to support loss reduction;
- Help initiatives for strengthening policy and legal provisions for reducing theft;
- Build capacity of EDSA staff through "learning by doing"

approach.

Develop policy and procedures on electricity theft

- National Electricity Act 2011 (Part XI- Offences) lays down financial penalties and imprisonment provisions for electricity misuse, willful tampering, negligent use, theft, damage to meters and other electrical assets etc. These provisions are quite wide and elaborate.
- EDSA and MOE should develop a policy aimed at combatting electricity theft by implementing the provisions laid down in the Act.
- An electricity theft policy should define the procedures for collecting fines resulting from an offence to the provisions of the Electricity Act and those arising from false declarations.
- EDSA should establish an account for receipt of fines as well as the procedures for the management of fees and fines.

Regularize Sector Payments

Activities

Table 3-11: Strategic Initiative - Regularize Sector Payments

Regularize Sector Payments	Lead	Timeframe
Revise PPA formula used in the EDSA-EGTC PPA	MOE	Short-term
Sector-wide collection of outstanding payments	MOF	Medium-term

Activity Description

Revise PPA formula used in the EDSA-EGTC PPA

- EGTC-EDSA PPA has fixed base price of 900 SLL/kWh, escalated by an US$/SLL and by the cost of fuel.

- *Price in SLL / kWh = [900 + 75 x (fuel price index - 1)] x (20% x Exchange rate index + 80%)* The PPA formula and clauses have many deficiencies such as (i) the PPA formula is not reflective of the actual costs of generation , (ii) the approval of the PPA by EWRC is an ex-ante review and no formal ex-post review is defined, (iii) its energy only contract and no payments for capacity, (iv) no breach of contract is defined, (v) payment default and liquidated damages clauses exist but have not been operationalized, and (vi) while scheduled and forced outages are defined, no penalty mechanism for forced outages are included.
- The PPA formula based on current costs of generation should be as shown below[7] and should account for Euro exchange fluctuation (for Bumbuna O&M contract), Euro fuel price fluctuations and inflation in Sierra Leone for local costs such as personnel, administration and O&M.

$$PPA_s \left(\frac{SL}{kWh}\right) = 953 * (34\% * \frac{CPISL_s}{CPISL_0} + 9\% * \frac{Fuel_s}{Fuel_0} + 57\% * \frac{EUR_s}{EUR_0})$$

- As the costs of operation change after certain period, the formula needs to be re-visited after 2-3 years.
- The above new formula should be validated through short-term technical assistance and adopted by EDSA and EGTC to better reflect the realities of business.

Sector-wide collection of outstanding payments

- EDSA to collect arrears of public agencies with support from MOE and MOF.
- EDSA begin billing and collection for street lighting
- EDSA collect outstanding post-paid customer bills. Overall collection rate for post-paid customer in 2022 is around 50%.
- EGTC collect outstanding payments from EDSA
- EWRC invoices EDSA and EGTC for licensing fees

Sector Financial Model and Budget

Activities

Table 3-12: Strategic Initiative - Sector Financial Model and Budget

Sector Financial Model and Budget	Lead	Timeframe

[7] Based on analysis of generation and fuel data provided by EGTC and MoE.

Adopt and maintain sector financial model	MOE	Short-term
Develop sector wide budget	MOE	Short-term

Activity Description

Adopt and maintain sector financial model

- A power sector financial model (PSFM) was developed during the MCC threshold program. The model has been further simplified and updated with latest information (2022). The updated model has been accepted by sector stakeholders and need to be formally adopted for decision making and sector progress monitoring by MOE and Steering Committee.
- The purpose of the sector wide financial model is to understand the financial status of the electricity sector on a year-to-year basis as well as its long-term sustainability based on the knowledge of its technical, economic, commercial, and financial fundamentals.
- The financial model is intended to be used as a reference for estimating the eligible costs and expected revenues that will feed into the sector wide budget.

Develop sector wide budget

- A sector wide budget should be developed by MOE, and with EWRC approval. The sector wide budget will be derived from the sector financial model.
- The scope of the sector-wide budget will be restricted to those entities whose activities may create potential burdens on the state budget, including EDSA and EGTC and wherever the tariff is controlled by the Government.
- The remainder of the market that is not connected to EDSA and EGTC and where the retail tariff is independently approved by EWRC under the principle of cost recovery may be excluded from the sector-wide budget.
- The sector-wide budget should be used regularly to inform financial decisions related to the electricity sector, such as determining required subsidies or assessing exposure to foreign exchange liability.

Sector Stakeholder Tariffs

Activities

Table 3-13: Strategic Initiative – Sector Stakeholder Tariffs

Sector Stakeholder Tariffs	Lead	Timeframe
Tax relief for power sector projects	MOE	Medium-term
Reform standard PPA to include local content currency provision	MOE	Short-term

Determine and implement transmission tariff	EGTC	Medium-term

Activity Description

Tax relief for power sector projects

- Fuel tax exemption for thermal generation should be put in place to improve tariff affordability.

Reform standard PPA to include local content currency provision

- All PPA contracts signed by EDSA should be revised to make sure that the local content part of the service (as defined in the mandatory local content plan) is expressed in Leones leaving the only imported content of the service in foreign currency (usually USD).

Determine and implement transmission tariff

- While EGTC owns and operates (through an O&M contract to Salini) transmission network, it does not get compensated for transmission services. As transmission function (as TSO) is expected expand with growing transmission network and establishment of national control center, a mechanism needs to be set-in place for compensating EGTC for transmission services.
- The regional regulator ERERA requires that a transmission tariff is determined for each member country. However, ERERA proposes a sophisticated methodology based on load flow (*point-to-point MW-Km load flow-based tariff methodology*) which given the nascent stage of grid in Sierra Leone is not practical to implement. Hence, a simpler postage stamp methodology should be adopted in interim with goal of transitioning to ERERA proposed methodology in long term. Based on the assessment of current transmission costs the below transmission tariff is proposed[8] (which comes to SLL 72/kWh and SLL 138/kWh for national and regional tariff).
- The above formula and weightages should be validated through a STTA and then adopted and implemented for ensuring fair compensation for transmission services and ensuring financial sustainability of EGTC.

$$Transmission\ Tariff_s\ \left(\frac{SL}{kWh}\right) = 72 * (40\% * \frac{CPISL_s}{CPISL_0} + 60\% * \frac{EUR_s}{EUR_0})$$

[8] Analysis based on data information shared by EGTC and MOE.

EE Policy

Activities

Table 3-14: Strategic Initiative – Energy Policy

EE Policy	Lead	Timeframe
Reestablish the EE Steering Committee and the EE Technical Committee and provide TA including to Standards Bureau	MOE	Short-term
Set EE policy and targets for lighting, standards and labeling, and public buildings	MOE	Short-term
Implement National Energy Efficiency Action Plan (NEEAP)	MOE	Medium-term

Activity Description

Reestablish the EE Steering Committee and the EE Technical Committee and provide TA including to Standards Bureau

- The Energy Efficiency Division needs support and hasn't seen very explicit support from other donors except capacity building/trainings from JICA and ECOWAS Center for Renewable and Energy Efficiency (ECREE)

Implement National Energy Efficiency Action Plan (NEEAP)

- The EE Steering Committee will be responsible to drive implementation of the NEEAP, to:
  - Establish energy efficiency fund with participation from donors and commercial banks
  - Establish standards and labelling program for household equipment
  - Design and implement EE programs for households and government buildings
  - Educate, train and inform the public on EE benefits and practices through public awareness campaigns

Set EE policy and targets for lighting, standards and labeling, and public buildings

- MOE will promote specific energy efficiency policy instruments in order to deliver on the policy objectives which bear mostly on;
  - phasing out of incandescent lighting bulbs,
  - promotion of energy efficient street lighting,
  - reduction of grid losses,
  - development of energy efficiency standards and labelling program,
  - promotion of energy efficiency in buildings and industries.

STRATEGIC THEME 3: ELECTRICITY SERVICE DELIVERY

Table 3-15: Strategic Objectives and KPIs – Electricity Service Delivery

Strategic objectives	KPIs
• Improve quality and reliability of supply • Improve customer service • Improve technical and operational standards	• SAIFI, SAIDI • Customer satisfaction score • System losses

Lack of adopted and implemented grid code for Sierra Leone. A Draft Grid Code was prepared as part of the Regulatory Strengthening and Tariff Determination Project under MCC THP. The grid code review process led by EWRC was launched in November 2019. A Grid Code Review Committee comprising sector participants and other stakeholders was constituted supported by a Technical Committee. The final draft as *'Interim Grid Code for Sierra Leone Electricity Market'* was presented to stakeholders on March 22, 2021. The roadmap recommends that the interim grid code is reviewed and formally adopted for implementation.

Insufficient sector planning and T&D infrastructure. Sierra Leone's grid infrastructure suffers from lack proper planning and thus investment and maintenance which directly contributes to high technical and commercial losses and the sector's challenge to expand access and improve reliability.

Informal institutional roles. EGTC and EDSA struggle with unclear and overlapping sector roles that undermine the sector structure and stymie private participation. One important example is the voltage threshold used to split responsibility for ownership and management of certain distribution lines between EGTC and EDSA. Another example of sector informality is the lack of signed licensing agreements between EWRC and EGTC and EDSA, or the lack of a signed PPA between EGTC and EDSA. This roadmap recommends that sector roles be clarified and formalized. These formalization measures with contribute to the improving sector performance and delivery of electricity services to customers.

Lack of target setting and monitoring. The electricity sector lacks consistent monitoring towards high level policy goals and targets with respect to key sector objectives such as loss reduction and electricity access. This includes monitoring and coordination of the activities included in this roadmap. Greater sector transparency will enable better monitoring and more informed policy and target setting. This roadmap includes measures to guide improvements in sector monitoring.

Sector Policy

Activities

Table 3-16: Strategic Initiative – Sector Policy

Sector Policy	Lead	Timeframe
Update energy policy, including EE and RE policies	MOE	Medium-term
Complete update and adoption of the IPP framework	MOE	Medium-term
Amend Electricity Act or draft and publish new electricity act	MOE	Medium-term

Activity Description

Update energy policy, including EE and RE policies

- The MOE should issue an energy policy update that reconciles and simplifies the various reference policy documents for the energy sector (i.e., Energy Policy 2009, Policy Letter 2016, Renewable Energy Policy 2015 and Energy Efficiency Policy 2015). Further these policies should align with Nationally Determined Contributions (NDCs), climate strategies and country climate goals.
- The renewable energy section of the energy policy update will call for the development of a Feed-in-Tariff Policy as a policy instrument to support the development of small-scale renewable energy.
- The electricity access section of the energy policy update will assign short-, medium- and long-term objectives to the expansion of electricity access, differentiating between urban areas connected to the main grid, rural towns already served but not yet connected to the main grid, and rural without any electricity service at all.
- The energy efficiency section of the energy policy update will assign short-term objectives to the reduction of grid loss and penetration of energy efficient appliances.

Complete update and adoption of the IPP framework

- IPP Frameworks for solicited as well as unsolicited proposals were developed under the THP. The overall objective of the frameworks was to implement clear, fair, and transparent processes for attracting private sector participation. Because of time constraints during THP the frameworks could not go through the final stages of development, review and GoSL approval. Thus, the framework needs to be further reviewed, updated as needed and formally adopted for implementation.

Amend Electricity Act or draft and publish a new electricity act

- The Electricity Act 2011 and its amendment in 2018 have several weaknesses that need to be resolved as the sector expands and structure becomes complex. Key aspects that need strengthening include (i) explicit definition of the market structure and arrangements, (ii) explicit allocation of single-buyer

status,
(iii) reallocation of dispatch function to transmission from distribution, (iv) separation of generation and transmission functions, (v) clarity in definition and responsibilities of IPPs (currently EGTC qualifies as IPP; IPPs may own, construct and operate transmission lines which may create issues of equal access in future), (vi) detailing and improving the process and requirements for recruitment of EDSA and EGTC Board Chairman and DGs, (v) clarity in commencement date of dispositions (provisions from NPA Act 1982 might continue in operation if not explicitly repealed), (vi) licenses for EDSA and EGTC operations, and (vii) definition of eligible customers to avoid confusion (at present EDSA seems to be signing up mining customers who per the Act should be EGTC or IPP customers).

- Based on detailed assessment a new electricity act or another comprehensive amendment should be drafted.

Sector Planning

Activities

Table 3-17: Strategic Initiative – Sector Planning

Sector Planning	Lead	Timeframe
Merge all planning functions at MOE into fully staffed Planning Directorate	MOE	Short-term
Develop and implement a sustainability plan for the Planning Unit	MOE	Medium-term
Procure long-term licenses for sector planning tools	MOE	Medium-term
Update of IRP and adoption for implementation	MOE	Medium-term

Activity Description

Merge all planning functions at MOE into fully staffed Planning Directorate

- The Planning Unit was set up in March 2020 during the MCC THP but has not since been fully incorporated into the MoE Energy Directorate structure (civil servant structure) due to significant difference in remuneration between donor funded and government paid officials. As a result, while the unit still advises the minister directly, it is still siloed from other departments.
- The role of planning unit is becoming more important as the aggressive targets for electricity access and expansion of the sector is envisaged. Many functions for the planning unit are emerging, some of which are:
  - Integrated resource planning including T&D and generation expansion planning and creation of climate resilient infrastructure for the electricity sector;
  - Hosting sector tools such as WB supported VIDA, and GIS platform including management of

shared licenses and sector level databases;
- Management of sector financial model and its use for decision making. Within MOE, the planning unit will be the owner of the sector financial model and manage it with support from other stakeholders such as EWRC, MoF , PPP Unit and utilities.;
- Data validation and reporting. Availability of accurate and consistent data from energy agencies such as EDSA and EGTC is an issue. Planning units should play the role of validating data received from these organizations and report at sector level.

Develop and implement a sustainability plan for the Planning Directorate

- Another important aspect of the support will be to clearly delineate and define the roles and responsibilities of various energy agencies with respect to planning functions. The Planning Unit should be concerned with sector level demand forecast and generation and transmission expansion planning in the form of IRP. EDSA should be focused on distribution level expansion planning which is usually kept separate from sector master plans. EGTC should be focus on operation of generation and transmission assets with sector level master plan taking care of generation and transmission expansion planning. The Planning unit should form IRP Modelling Working Group(s) drawing participation from EDSA, EGTC and other relevant energy agencies to inform the modelling.
- MOE should seek donor support for the planning unit through an embedded advisory firm that will build capacity of the unit along the emerging functions of the unit.

Procure long-term licenses for sector planning tools

- The licenses for planning tools LEAP, OSeMOSYS and ArcGIS procured during THP have expired and the tools are no longer in use.
- The planning unit should assess the available open source and commercial tools in the market and identify the tools most appropriate for their use. Preference should be given to open-source tools that are available at no-cost to developing countries.

Update IRP and adopt for implementation

- Integrated Resource Planning (IRP) provides a national, coordinated, long-term, least cost power sector development plan that aligns with policy objectives such as security of supply, universal access to electricity, economic growth, and the adoption of renewable energy and energy efficiency technologies.
- The IRP provides a framework within which more detailed network development plans (NDPs) and mini-grid and concession initiatives are planned. An IRP was prepared in 2018 and needs to be updated and formally adopted for implementation.

Grid Code

Activities

Table 3-18: Strategic Initiative - Grid Code

Grid Code	Lead	Timeframe
Publish and implement grid code	EWRC	Short-term
Establish norms and standards for equipment and service providers	MOE	Short-term
Implement safety testing programs for power equipment	MOE	Medium-term

Activity Description

Publish and implement grid code

- 'Interim Grid Code for Sierra Leone Electricity Market' was presented to stakeholders on March 22, 2021. The grid code is aligned with the requirements of ECOWAS Regional Electricity Regulatory Authority (ERERA) for the regional cross-border trade of electricity in West Africa. The Interim Grid Code aims to ensure safe and efficient operation for all parties connected to the Grid. It establishes the basic rules, requirements and procedures that govern connection, operation, maintenance and development of the high voltage transmission network in Sierra Leone. The Interim Grid Code identifies and defines the responsibilities of two key independent functional entities in the Sierra Leone industry, namely the Transmission Network Operator(s) and the System Operator. These functional entities, and all parties connected to the transmission network, or generators operating within the Sierra Leone Electricity Network must comply with the provisions of the Interim Grid Code. The interim grid code needs to be finalized and adopted for implementation.
- Develop technical procedures, methodologies and standards as required by the interim grid code to enable its implementation;
- Build capacity of EGTC, EDSA and EWRC for implementing the grid code.
- .

Establish norms and standards for equipment and service providers

- EWRC should establish the technical criteria and required standards of performance for licenses for generation, transmission, dispatch, import, export, distribution, captive load supply (if necessary), on-grid sale of electricity, off-grid sale of electricity, and the provision of related services.
- These criteria specify the terms and conditions of the license agreements and are reported in a technical and regulatory annex.

Implement safety testing programs for power equipment

- Implement testing program to document the safety and performance of electricity supply

technologies, based on published standards and protocols.

GIS and ICT

Activities

Table 3-19: Strategic Initiative – GIS and ICT

GIS and ICT	Lead	Timeframe
Procure and manage a shared GIS enterprise license for use by EDSA, EGTC, and MOE	MOE	Medium-term
Establish a dedicated GIS team at EDSA	EDSA	Short-term
Audit IMS design and implementation and bridge the identified gaps	EDSA	Short-term
Harmonize data structures and develop data governance and information security change management plan for EDSA	EDSA	Short-term

Activity Description

Procure and manage a shared GIS enterprise license for use by EDSA, EGTC, and MOE

- To better manage GIS data, the MOE should be strengthening to host sector GIS data alongside VIDA and to manage a shared GIS enterprise license amongst sector agencies. This would provide 50 Users ArcGIS online account in addition ArcGIS pro license would be for desktop application for EDSA, & EGTC.

Establish a dedicated GIS team at EDSA

- GIS is one of the key tools' distribution utilities use for supporting losses reduction, asset management and outage management. Electrical assets are mapped to create a GIS based network map and asset base. GIS linked assets are then tracked through their life cycle and operating condition for effective asset management. Customers are also mapped to network assets (i.e., transformers) to localize and reduce losses. Further the GIS linked customers are integrated with call centers to implement an outage management system.
- With effective deployment of GIS, EDSA has opportunity to enable all the above functionalities. In fact, EDSA would be the one most benefiting from the shared GIS enterprise license at MOE.
- Thus, it is recommended that a dedicated GIS team is established and strengthened to fully utilize the GIS tool, especially for losses reduction and outage management.
- EDSA team should be supported by experience advisors for building technical capacity,

customer mapping and losses localization using GIS tool.

Audit IMS design and implementation and bridge the identified gaps

- One Sait Customer Management System integrated with Microsoft Dynamics AX 2012 ERP is being implemented as Integrated Management System (IMS) at EDSA. The scope does not cover any Business Process Re-engineering nor any integration with Third Party Systems would be addressed and/ or developed. The ICT Infrastructure is designed based on COTS and planned to be integrated with existing ICT Infrastructure. It is essential that a comprehensive system audit is carried out for IMS to identify the gaps and take measures for successful implementation of IMS.
- Significant effort and investment have been made by EDSA well supported by Donors to take steps for effective utilization of ICT to reduce systemic losses and improve operational performance. These steps include studies; creation of asset register for Distribution Network in Freetown and setting up GIS database creation and validation facility in EDSA along with a dedicated team. IMS, being implemented, provides facilities for Meter Data Management. Proposed Meter Testing Bench and required field training will ensure that installed Prepaid Meters are working and not faulty.
- The proposed ICT Infrastructure for IMS is designed on the principles of flexible architecture with extensive use of COTS products. Such a design approach facilitates Add/ Upgrade / Swap of the Infrastructure components, and the common base infrastructure of Data Centre like Firewall, LAN and common servers are taken advantage of. This ICT Infrastructure designed for deployment of IMS Solution is planned to be integrated with existing infrastructure in terms of WAN, LAN, Perimeter, Monitoring and DNS Services. As EDSA will become dependent more and more on automated systems for improving reliability and quality of service for distribution of electricity to an expanding base of customers, it is essential to have an appropriate Information Security Policy and Secured System and also a clear Business Continuity Plan.
- EWRC regulatory activities can be significantly enhanced and made Business and Investor Friendly by designing and implementing a comprehensive Regulatory Information Management System in EWRC in an ICT Infrastructure complying with defined Information Security requirements, with disaster recovery arrangement addressing the requirement of accepted business continuity plan.

Harmonize data structures, develop data governance, information security and change management plan

- Harmonize data structures across energy sector entities and especially for EDSA that is implementing IMS system. GIS data should be gradually harmonized with the IMS database for uniformity.
- Data governance structure should be established at sector level which should include (i) policy and rules for data quality management, (ii) metadata management (iii) master data management (iv) data security with improved reliability, traceability, and authenticity. Effective Data Governance shall ensure clear data ownership, business rules, operational requirements, tools usage and business processes, stakeholder interaction and business access. Data Governance shall also address the

multi dimensions of Business Continuity and Data/ Information Security

- This Digital Transformation needs to be supported with a well thought out Change Management Program to ensure effective utilization of the Regulatory Information Management System for efficiency, effectiveness, and transparency

Market Transformation

Activities

Table 3-20: Strategic Initiative – Market Transformation

Market Transformation	Lead	Timeframe
Develop WAPP integration roadmap	EWRC	Short-term
MOE specifies functions of TSO	MOE	Short-term
Develop and operationalize TSO functions	EGTC	Medium-term
Transform from single buyer model to market model	Parliament	Long-term

Activity Description

Develop WAPP integration roadmap

- EWRC should establish a roadmap for integration of the Sierra Leonean electricity system with the Regional Electricity Market of West Africa including the progressive development of trading functions (including establishment of a market operator).

Establish system operator (SO), market operator (MO) and transmission network operator (TNO) functions

- The Interim Grid Code for Sierra Leone clearly defines roles of EGTC as system operator (SO), market operator (MO) and transmission network operator (TNO). The transmission functions of EGTC are expected to expand much more than the generation function as all new generation is expected to come from IPPs. In line with the interim grid code EGTC should be restructured along three functional verticals (see Strategic Theme 4 EGTC Operations). Till the time the electrical system and operations grow to necessitate unbundling of EGTC into SO, MO and TNO, these functions should be established within EGTC.
- Transmission Network operator (TNO)
  - Prepare network planning criteria and methodology,
  - Develop network investment plans;
  - Develop transmission network to support the current approved National Transmission Expansion Plan (including any WAPP requirements), regional power development plan(s), and any current connection contracts; and meet the network performance criteria;

- Provide fair and transparent access to transmission network.

- System operator (SO)
  - Undertake security constrained economic dispatch, issue dispatch instructions, and keep an electronic log of dispatch instructions;
  - Monitor compliance with dispatch instructions and report any non-compliance;
  - Annually submit to EWRC a recommended set of dispatch tolerance bands for all classes of generators;
  - Delegate parts of SO duties to specifically trained TNO staff where such staff are certified by the SO as having adequate general knowledge of the power system;
  - Maintain overall real time security of supply and ensure certain ancillary services are dispatched in real time.
  - Procure, schedule and dispatch following ancillary services as needed;
    - Spinning Reserve
    - Regulation reserve
    - Fast Start Reserve
    - Cold Start Reserve
    - Reliability Must Run Reserve
    - Reactive Power
    - Black Start
  - Determine the marginal cost of provision of each ancillary service for each generator or power pool operator according to ancillary services pricing methodology published from time to time by EWRC;
  - Generate day-ahead schedule based on the energy offers, ancillary service marginal costs of all generators and power pool operators in the system;
  - Prepare forecast of day-ahead demand;

- Market operator (MO)
  - Provide the SO with the final energy and ancillary service offers from all generators and power pools participating in the SLEM;
  - Confirm trade verification and settlement.

Transform from single buyer model to market model

- A starting point to market transformation is to enable eligible customers to set-up bilateral contracts as exceptions to the single buyer market model.
- A major objective of sector reform is to transform the sector market from a single buyer model to a bilateral model.
- In a mature, bilateral market, typically over 90 percent of the trade is conducted under bilateral arrangement where generators sell directly to power retailers (including distribution companies)

that sell power to end users, power marketers (traders that deal with other traders and retailers), and large end users of electricity.

- Bilateral trading requires that third parties are able to access the network and are backed by regulatory support in the form of reasonable wheeling and backup charges.

STRATEGIC THEME 4: ENHANCED INSTITUTIONAL CAPACITY

Table 3-21: Strategic Objectives and KPIs – Enhanced Institutional Capacity

Strategic objectives	KPIs
• Improve planning and project management capacity • Improve O&M performance	• Number of people trained • Number of sector policies proposed and adopted • Number of women in management

Low institutional and human resources capacity. All key sector institutions face constrains on the capacity of their staff, processes, and technology to realize their full range of sector functions. These shortfalls are particularly evident in planning and project management. This roadmap recommends a suite capacity building programs tailored to the needs of each institution.

Poor track record of O&M. EDSA and EGTC are challenged to undertake O&M activities sufficient for reliable operation of the grid. This roadmap recommends measures to outsource O&M functions to outside contractors as a means of overcoming capacity gaps and reversing grid deterioration in the short term. In addition to core O&M, this roadmap recommends the outsourcing of fuel supply management at EGTC as well as the processing and connection of new customer at EDSA.

MOE Operations

Table 3-22: Strategic Initiative – MOE Operations

MOE Operations	Lead	Timeframe
Assess board functioning at EDSA, EGTC and EWRC	MOE	Short-term
Coordinate roadmap implementation	MOE	Short-term
Contract administrative assistance for Steering Committee and Technical Committee	MOE	Short-term
Voltage split decision	MOE	Short-term
Sector Knowledge Management	MOE	Medium-term

Activity Description

Assess board functioning at EDSA, EGTC and EWRC

- A high-level review of corporate governance at EDSA and EGTC has shown significant weaknesses. For instance, at EDSA (i) three DGs have been appointed in last five years, (ii) frequent intervention by the MoE in board affairs, (iii) common board members at EDSA and EGTC boards, (iv) limited due-diligence in selecting board members though they are ratified by the parliament, (v) lack of board performance assessment, (iv) limited involvement of the board in IPP agreements, (v) EDSA-EGTC PPA not honored and (v) non-payment by government institutions and weak enforcement. At EGTC, in addition to similar issues as EDSA, two board positions have been vacant for quite some time and board meetings are infrequent.

- When comparing the board functioning at EDSA and EGTC with industry benchmark framework such as OECD Guidelines on Corporate Governance of State-Owned Enterprises (2015) significant weaknesses are seen on autonomy of EDSA and EGTC, Board member independence from state interference, and disclosure and transparency.
- To strengthen the corporate governance at these agencies can use the following two provisions in the National Electricity Act 2011:
    - Section 29 (8) of the Act allows the Board to *"co-opt any person to attend and participant in its deliberations on any matter but such person shall not vote on any matter for decision by the Board"*
        - This provision can be used by MCC and other donors to participate in the Board meetings or appoint a representative for observing / monitoring the Board functioning
        - The provision can also be used to help the Board with an experienced international expert on board functioning
    - Section 33 of the Act allows the Board to *"appoint one or more committees"* and *"a committee shall consist of members of the Board or non-members or both as the Board may determine"*
        - This provision can be used by donors to support the Board with appropriate experts for the committees in key areas.

Coordinate roadmap implementation

- A Steering Committee (SC) was formed during the THP to support implementation of the Energy Sector Roadmap; however, it became inactive after the conclusion of the THP. Based on the lessons learned during the THP period, the SC has been reinstituted which now includes donor

partners and establishment of various working groups. The SC will meet on quarterly basis to coordinate the actions and activities of all partners and its mandate will evolve based on sector needs and priorities.

- The SC has set eight objectives for initial period of one year including reviewing technical advice for sector planning; coordinating investments to reduce losses; identification and implementation of key reforms to improve sectors financial outlook; reviewing and providing support for pipeline of generations projects; providing strategic direction for key development partner programs; setting annual electricity access targets; coordinating update of key sector studies; coordinating the set-up, implementation and reporting of KPIs for the sector.
- The SC will be supported by a technical committee (TC) drawn from SC member institutions (MoE, MOF, EDSA, and EGTC) and may be organized into working groups.
- The SC is key sector entity and lever for sector coordination and pushing forward the reforms agenda. The SC will provide oversight and guidance for the implementation of the implementation of the updated sector reform roadmap.
- The TC or a its sub-set is expected to act as PMO for the roadmap implementation discharging key functions such as (i) communications and stakeholder management, (ii) financial management – plan, track and manage the program budget, schedule and benefits, (iii) Project Planning - maintain and enforce an integrated project plan (IPP). Identify, prioritize, track, and manage risks and issues, (iv) Change Control Management - manage all changes in existing actions, added activities, and schedule of the roadmap, (v) Strategic Theme/Pillar Engagement - Enable collaboration within strategic pillars through status reporting and integration issue management, (vi) Working Group Management -form WGs to support roadmap implementation as needed, and (vii) Program setup – create a close group (control room) for managing and monitoring the implementation of the roadmap.

Contract administrative assistance for Steering Committee and Technical Committee

- The SC and TC will need assistance in establishing a proper structure for the PMO and establishing processes for its proper functioning. Technical assistance will also be needed on specific technical subjects to help the SC in decision making.
- Support to SC and TC should include:
    - Establishing a PMO for implementation of the reform roadmap and its implementation;
    - Setting processes for the PMO/TC for effective roadmap implementation;
    - Provide need based technical assistance to the working groups or the SC/TC for decision making.

Voltage split decision

- MOE should determine the voltage threshold that divides network infrastructure between transmission and distribution. This decision will determine the future ownership of new lines with a voltage between 30 kV (maximum current voltage operated by EDSA but with technical design up to 66 kV) up to 161 kV (minimum current voltage of the transmission grid allocated to EGTC).

Sector Knowledge Management

- One way of mitigating this risk from staff departure is to establish a strong knowledge management system at MoE that can be shared by EDSA, EGTC and EWRC as repository of institutional knowledge and centralized training.
- MOE should procure and implement a standard (on-premises or cloud based) knowledge management system for the sector.

EDSA Operations

Activities

Table 3-23: Strategic Initiative - EDSA Operations

EDSA Operations	Lead	Timeframe
Design and implement a change management program	EDSA	Short-term
Design and establish model customer care center in Freetown	EDSA	Medium-term
Establish technical training center and transformer repair workshop	EDSA	Medium-term
Establish SCADA/ Distribution Management System (DMS)	EDSA	Medium-term
Build EDSA capacity in key operational aspects	EDSA	Medium-term

Activity Description

Design and implement a change management program

EDSA and EGTC are in the process of deploying major IT systems such as the WB funded MIS system and national dispatch center respectively. These systems are designed on best practices which will mean that existing business processes in EDSA and EGTC will need to be re-engineered to meet the standards. At the same time employees need to be trained on the new systems and made technology ready for leveraging the benefits. Some support will be provided by the WB on these change management issues[9]; however, they may not be sufficient for long term sustainability. This activity includes:

- Change management study to identify the areas of support and their priority
- Identification of change champions and their mentoring through change management coaches
- Design and implementation of change management

[9] Change management refers to application of structured processes and management tools leading to people side of change for a desired outcome. It helps people impacted by a change to make personal level transitions to engage, adopt and use a change

program Design and establish model customer care center in Freetown

- Bringing in a customer centric culture is essential for improved services. Establishing a model customer care center will help establish a customer centric approach which can then be replicated in other parts of Freetown and then other parts of EDSA service area.

Establish technical training center and transformer repair workshop

- For improving efficiency of T&D operations and building capacity of EDSA and EGTC staff, a technical training center is needed. The existing training school in Kingtom can be upgraded for this purpose, which in past has served similar purpose.
- The training center will focus on providing hands-on technical training to technicians involved in operation and maintenance of lines and feeders, generators, transformers, and switchgear. Being focused on hands-on technical training the training center can have immediate impacts on the quality of workmanship at the field level that will help reduce both technical and non-technical losses and improve O&M practices. The training center can also include technical level trainings for IT networking and troubleshooting and GIS mapping and data upload.
- Many utilities in SSA including in Ghana, Kenya and South Africa run such training centers and can be engaged through 2-3-year partnership to provide support in establishing trainings and preparing a pool of trainers for sustainability. Short term technical assistance experts can be used for specific and specialized needs.
- If the training center is upgraded quickly and is run successfully, then management trainings can be introduced. However, to start with the focus of the training center should be on technical trainings and management trainings should be accessed from training centers based in the region, industry conferences and other platforms.
- EDSA spends about $100,000 every month for outside services on repair and replacement of faulty transformers. This is quite high for a utility of EDSA's size. Establishing a transformer repair workshop in proximity to the technical training center serves the dual purpose of reducing expenditure on repairs and helping build capacity of staff in maintenance while supporting reduction network downtime.
- This intervention is needed for establishing the training center (i) develop a business and operational plan for the training center with emphasis on sustainability – funding and training resources; (ii) 2–3-year partnership with a regional or international utility/ training center for developing curriculum and establishing training; (iii) Upgrade of training center physical infrastructure and procurement of training tools;(iv) Establish transformer repair workshop;(iv) STTA engagements for specific technical topics; and
  (v) Training of trainers and

Establish SCADA/ Distribution Management System (DMS)

- To improve quality and reliability of supply, EDSA should establish DMS system.
- DMS helps improve quality and reliability of supply by helping reduce power outages, minimizing

outage time, maintaining acceptable levels of frequency and voltages in the distribution system.

- DMS will also help EDSA precisely estimate reliability indices such as SAIDI and SAIFI.

Build EDSA capacity in key operational aspects

- Estimation of technical losses through network modelling and load flow analysis. Segregation of technical and non-technical losses. Calculation of aggregate technical, commercial and collection (ATC&C) losses.
- Segregation of losses and their sources
- Preparation of GIS network maps and mapping of customers with grid network for losses localization
- Revenue protection, in-field testing and inspection of customer installations
- Business process re-engineering for metering-billing-collection (MBC) processes
- Data collection procedures and estimation of reliability indices such as SAIDI and SAIFI.
- System operation and maintenance procedures
- Network and personnel protection
- SCADA/ Distribution Management system
- Advanced metering infrastructure

EGTC Operations

Activities

Table 3-24: Strategic Initiative – EGTC Operations

EGTC Operations	Lead	Timeframe
Re-structure EGTC along Corporate Services, Generation Business and Transmission Business	EGTC	Short-term
Create financial separation between generation and transmission function	EGTC	Medium-term
Fully establish and staff the Transmission Services Unit	EGTC	Medium-term
Establish national dispatch center	EGTC	Medium-term
Re-skill and train staff for TSO and national control center functions	EGTC	Medium-term
Conduct capacity building for generation and transmission O&M	EGTC	Medium-term
Develop spare part and workshop rehabilitation plan	EGTC	Medium-term

Activity Description

Re-structure EGTC along Corporate Services, Generation Business and Transmission Business

- The Interim Grid Code for Sierra Leone clearly defines roles of EGTC as system operator (SO), market operator (MO) and transmission network operator (TNO). The transmission functions of EGTC are expected to expand much more than the generation function as all new generation is expected to come from IPPs.
- EGTC will need support from an embedded firm experienced in transmission system operations to conduct detailed organizational assessment and finalize the new structure and help transition EGTC to the new structure during the compact period.

Create financial separation between generation and transmission function

- The regional regulator ERERA requires financial separation between generation and transmission functions for accurate determination of transmission wheeling charges.
- These requirements necessitate re-structuring of EGTC along three verticals, namely
    - Corporate Services which handle shared services such as finance, administration, HR, logistics and procurement, E&S management, HSE and ICT etc.
    - Generation Services which handle generation functions such as thermal, hydro and RE, O&M, fuel management, generation planning and development, and
    - Transmission Services which handle functions related to SO, MO, TNO, national control center, transmission line maintenance, planning and development.
- The re-structuring along three functions will allow for financial accounting along these verticals where corporate services cost can be apportioned to generation and transmission services, thus fulfilling the requirements of regional guideline and at the same time aligning with the interim grid code.

Fully establish and staff the Transmission Services Unit

- A Transmission Unit was formed in EGTC during THP and has not been fully staffed till now mainly because of its precarious financial position.
- When fully staffed the unit will have seventeen staff at various levels.
- Transmission activities are currently limited to the country's single transmission line from Bumbuna to Freetown but will expand with the opening of the Northern Corridor project. The current transmission line has been successfully maintained through an O&M contractor- Salini.
- EGTC management is focused on generation assets and does not fully recognize its role as transmission system operator (TSO) and a transmission asset owner.

Establish national dispatch center

- Personnel should be re-skilled and trained for emerging functions of SO, MO and TNO as defined in the interim grid code.

Re-skill and train staff for TSO and national control center functions

- Some of the capacity building will be done by the Operation, Maintenance and Training (OMT) contractor engaged for the newly built or refurbished asset.
- To build capacity on TSO functions and exposing the EGTC to best practices a combined approach of "twinning" with an established TSO in the SSA or another developing country and embedded firm should be adopted.
- Build capacity of transmission services to discharge TSO functions – transmission system operation and maintenance grid security; demand-supply balance; CLSG interconnection management; merit order dispatch; non-discriminatory grid access to generators and eligible customers; the information exchange with the sub-regional system balancing manager based in Guinea and the WAPP Coordination and Information Centre (CIC) based in Cotonou, and; grid code compliance.
- Build capacity on thermal, hydro and renewable generation system operation and maintenance.

Conduct capacity building for generation and transmission O&M

- The technical training center (see EDSA Operations section) will focus on providing hands-on technical training to technicians involved in operation and maintenance of lines and feeders, generators, transformers, and switchgear.
- Many utilities in SSA including in Ghana, Kenya and South Africa run such training centers and can be engaged through 2-3-year partnership to provide support in establishing trainings and preparing a pool of trainers for sustainability. Short term technical assistance experts can be used for specific and specialized needs.

EWRC Operations

Activities

Table 3-25: Strategic Initiative - EWRC Operations

EWRC Operations	Lead	Timeframe
Conduct capacity building for tariff methodologies	EWRC	Short-term
Establish regulatory accounting system	EWRC	Medium-term

Activity Description

Conduct capacity building for tariff methodologies

- Given that key regulations have already been developed, EWRC will benefit from "twinning" with another regulatory authority from the region or developing country that has implemented similar regulations and can provide appropriate guidance to EWRC. The twining approach in addition to embedded firm will bring in complementary benefits and synergies.
- The key activities under this intervention will include:

- Support implementation of approved electricity regulations;
- Standardize and implement data collection templates to inform rate making process;
- Improve and strengthen annual tariff review process;
- Support cost of service studies and transition towards cost-reflective tariffs;
- Provide training on cost-of-service studies, long run and short run marginal cost concepts, transmission tariffs and other related topics useful for EWRC.
- Build capacity of consumer protection agencies on tariff

methodologies. Establish regulatory accounting system

- EWRC licensing process is manual and requires collection, verification and validation of a large number of documents like certificate of incorporation of applicant organization, business registration, MoU, Articles of Association, Deed of Partnership, Lease document, and arrangements with financial institutions etc.
- There is need for digitalizing the licensing and license monitoring processes as well as the data collection process for informing tariff setting process. Digitalization will improve the efficiency of the processes at EWRC resulting is quicker turnaround timelines and availability of relevant sector data for decision making. These can be achieved by developing and implementing a RIMS. EWRC should procure a RIMS and implementing it to support following;
  - Digitalizing the licensing processes and strengthening the license monitoring system;
  - Collecting periodic data from energy agencies such as EDSA, EGTC and mini-grid operators through dedicated interface dashboards for informing tariff setting process; and
  - Digitizing Consumer Protection, Dispute Resolution, and Handling of Grievances processes.

Climate Change Planning

Activities

Table 3-26: Strategic Initiative – Climate Change Planning

Climate Change Planning	Lead	Timeframe
Conduct climate change capacity building for Planning Unit	MOE	Short-term
Develop climate change policy for power sector	MOE	Medium-term
Create a Just Transition Task Force for the power sector	MOE	Medium-term
Conduct capacity building on GHG inventory management and resilient infrastructure	MOE	Medium-term
EGTC and EDSA develop and maintain national climate vulnerability assessment and mapping	EGTC, EDSA	Long-term

Activity Description

Conduct climate change capacity building for Planning Unit

- Aligned to climate change mitigation and adaptation measures to overall power sector planning and operations.
- Reinforce Integrated Resource and Resilience Planning (IRRP)

concepts. Develop climate change policy and action plan for power sector

- Actions of GoSL in the different policy documents on climate change mitigation and adaptation such as the NDC, NCCP & AP and iNAP are in line with the global commitment of reaching net zero emission by 2050. Mitigation actions and priorities are set and controlled by EPA with MoE functioning as the supervisory ministry in charge of formulating mitigation priorities and adaptation options. The national level policy and actions have not percolated to power sector yet.
- The link between climate change with energy generation has not been fully emphasized at EGTC. While institutional will to address climate change exists, the policy on the climate change impact of EGTC operations is largely addressed through national policy rather than organizational policy. The impact of climate change in the energy generation sector has not been clearly defined or internalized as an integral aspect of EGTC operations.
- Similar to EGTC, the mitigation and adaptation to adverse climate change have not received favorable attention at the EDSA. Limited numbers of staff have knowledge and background in climate risk, resulting in a knowledge gap. No clear path has been laid out in policy documents for limiting climate vulnerability.
- Hence, it is imperative for the MOE to develop climate change policy for power sector aligned with the national level priorities and prepare an action plan for implementation. MOE should engage with donors in the sectors to provide support in developing the policy, action and its implementation through technical assistance programs.

Create a Just Transition Task Force for the power sector

- The Energy Directorate should act as task force lead to ensure cross sectoral coordination as needed and oversee implementation of the climate policy and other national instruments as applicable to the power sector.
- The task force will promote effective monitoring and evaluation of policy implementation, and support implementation through legal, technical, and financial tools, as appropriate.

EGTC and EDSA develop and maintain national climate vulnerability assessment and mapping

- EDSA and EGTC should use GIS and other spatial mapping tools to create a geospatial map of their network and critical assets (such as sub-stations, control centers, power transformers, towers etc). Further an asset health study should be conducted to determine the health of the assets and their ability to handle climate change related natural disasters. The geospatial map, asset health index is then layered with climate layers to identify critical electrical assets vulnerable to climate related

events at present and in future. Based on this analysis specific adaptation measures such as relocation of assets, strengthening, upgrade of technical specifications etc can be developed.
- EGTC and EDSA should maintain vulnerability mapping data and conduct assessment periodically (once every 2-3 years). EGTC and EDSA should engage with donors for getting support in doing the first round of vulnerability mapping and then build their capacity for doing the studies on their own periodically.

Conduct capacity building on GHG inventory management and resilient infrastructure

- The existing GHG inventory has not adequately reflected the carbon intensity of the economy and is still a work in progress.
- A robust data collation tool is needed if Sierra Leone will successfully evaluate, monitor, and implement a GHG inventory in the energy sector.

Environmental, Health and Safety Management

Activities

Table 3-27: Strategic Initiative – Environmental, Health and Safety Management

Environmental and Safety Management	Lead	Timeframe
Establish EHS capacity and tools at EDSA and EGTC	EDSA, EGTC	Short-term
Develop sector EHS guidelines and coordination mechanisms	EWRC	Medium-term

Activity Description

Establish EHS capacity and tools at EDSA and EGTC

- Help establish an EHS Unit within EDSA and EGTC consisting of environmental /climate specialist, biodiversity specialist, community liaison specialist and social /gender/resettlement specialist. EDSA and EGTC will nominate 'EHS Champions' Champion is a person who is tasked by senior leadership of the utilities for leading efforts on the EHS aspects and building a team and related competencies.
- Develop and implement environmental and social management systems (ESMS) in EGTC and EDSA;
- Conduct health and safety audit of EDSA and EGTC against IFC EHS guidelines and take corrective actions;
- implementing H&S standards, regular monitoring and reporting on H&S issues.
- Roll out of EHS training within the EHS Unit

Develop sector EHS guidelines and coordination mechanisms

- Develop energy sector specific guidelines for EPA and facilitate EPA's coordination with EGTC

and EDSA.

- Development of environmental and social impact assessment (ESIA) guidelines for the distribution, transmission and generation sector.
- Develop an action plan to manage current and avoid future encroachment beneath transmission and distribution lines.
- Establish procedures for managing and disposing hazardous materials, specifically PCBs;
- Conduct an audit of EGTC waste management contractors for compliance
- Complete an audit/inventory of infrastructure with hazardous materials, particularly PCBs.
- Training of some champions/technical staff on climate change resilient infrastructure and new technologies.

EPA-SL Operations

Activities

Table 3-28: Strategic Initiative - EPA-SL Operations

EPA-SL Operations	Lead	Timeframe
Implement E&S training program	EPA-SL	Short-term
Establish E&S guidelines in-line with best practice	EPA-SL	Short-term
Establish and E&S audit system	EPA-SL	Medium-term
Develop a document describing the EIA thresholds for all energy sector projects	EPA-SL	Medium-term
Procure an on-line Integrated Biodiversity Assessment Tool to develop initial assessments of proposed projects	EPA-SL	Long-term
Procure environmental testing equipment	EPA-SL	Long-term

Activity Description

Implement E&S training program

- EPA needs a robust training program to enhance their capabilities to support power sector needs. Training topics should include:
  - ESIA good practice
  - International Standards (noise, air quality, EMF). Sessions on donor requirements and standards should also be included
  - Hydropower Impacts and Mitigation– key emphasis on e-flows, biodiversity and water users

- Biodiversity – Critical Habitat Assessment
- Transmission and Distribution Impacts and Mitigation
- Monitoring methods (observational & Instrumental)
- Hydropower Monitoring– construction and operational phase monitoring
- PCB Risks and Management
- Energy Efficiency Auditing
- Climate Change

Establish E&S guidelines in-line with best practice

- E&S Guidelines will be developed to support the training topics outlined under Intervention 1. Guidelines will be prepared based on international best practice requirements, including IFC and MCC and will provide case studies as support. Guidelines must be relevant to the country context. The guidelines will be prepared for internal use and also by EPA-SL for external guidance.

- Internal Guidelines
  - EIA Guidelines – including ESIA best practice methodologies
  - Hydropower Impact Identification and Mitigation.
  - Assessment of E-flows.
  - Critical Habitat Assessment
  - Transmission and Distribution Impact Identification and Mitigation.
  - Comparison and Interpretation of International E&S Standards –
  - Monitoring Methods (observational & Instrumental)
  - Hydropower Monitoring
  - Energy Efficiency Auditing
- External Guidelines
  - Sector Specific EIA Guidelines – primarily focusing on the ESIA steps for transmission, distribution and RE projects.
  - PCB Risks and Management
  - Asbestos risks and management
  - SF6 risks and management

- Guidelines will provide best practice references applicable to all physical interventions helping to improve the quality of ESIAs and methods to monitor projects.
- Guidelines will help EGTC and EDSA coordinate with the Agency and clearly understand their responsibilities.

Establish and E&S audit system

- Development of an updated audit system comprising the following:
  - Scheduling system to ensure that all projects with an EIA licensed are audited annually and that adequate resources (equipment and personnel) are available for the audits
  - Audit protocol describing what information is needed for the audit, what to take on the audit, what information to gather on the audit (e.g., the requirements of the EIA license), etc.
  - Audit checklists, specific to donor projects, e.g., hydropower, T&D and Solar. These checklists will include items that may go above and beyond those to be checked as part of

the EIA license, thereby allowing any new, or 'emerging' risks to be identified.
    - Set formats for audit reports to ensure consistency.
    - Updated procedure to ensure consistent method of conveying findings of the audit to the companies.
    - The updated system will be supplemented by a two-day training program for EPA-SL staff.
    - Prepare a set template for monitoring reports to be completed by project proponent. Supporting guidelines also prepared.
- Audits of MCC activities completed annually in a consistent and clear manner meaning that there will be no delays in obtaining EIA licenses.
- Provides clear understanding of what needs to be reported to EPA-SL as part of monitoring

obligations. Develop a document describing the EIA thresholds for all energy sector projects

- Preparation of a document describing the EIA thresholds for all energy sector projects.
- Minimize confusion over what type of project requires EIA.
- Transparent for all parties.
- Can be used my EPA-SL for all energy sector projects
- Could be expanded by EPA-SL to all sectors, e.g. extractives.

Procure an on-line Integrated Biodiversity Assessment Tool to develop initial assessments of proposed projects

- Procurement of Integrated Biodiversity Assessment Tool, an on-line biodiversity database which will allow EPA-SL to review proposed projects and make an initial assessment of the potential impacts of a project. Helps to identify potential critical habitat and the presence of special status species. This helps the EIA during screening and scoping of projects and ensures that key species and habitat are identified early in the EIA process and additional surveys and studies can be planned thereby reducing the risk of delays later in the EIA process.

Procure environmental testing equipment

- Procurement of additional equipment to test water quality, noise, air quality (via dispersion tubes), soil quality, PCBs, EMF
- Provide testing services as a regional center for PCB testing

Women in Energy

Activities

Table 3-29: Strategic Initiative – Women in Energy

Women in Energy	Lead	Timeframe
Conduct HR gender training for managers	EGTC, EDSA, EWRC, MOE	Short-term
Establish gender outreach and mentorship programs	EGTC, EDSA, EWRC, MOE	Short-term
Conduct gender policy audit and develop gender policy	EGTC, EDSA, EWRC, MOE	Medium-term

Develop employee gender manual, handbook, or code of ethics.	EGTC, EDSA, EWRC, MOE	Medium-term
Develop sexual harassment and gender-based violence (GBV) policy	EGTC, EDSA, EWRC, MOE	Medium-term
Establish Women in Energy Forum	MOE	Medium-term

Activity Description

Conduct HR gender training for managers

- Train HR Managers and Management on how to develop and implement best practices across the employee life cycle and develop skills for strategic planning on incorporating applicable practices to the specific business.
- Training will be provided to HR Managers and Senior Managers, rotation maybe a risk if they do not stay in their roles. Additionally, General Directors need to be committed as well, otherwise there is a risk that HR teams will not be supported therefore change is less likely to be achieved.

Establish gender outreach and mentorship programs

- Identify suitable educational institutions and develop partnerships to design outreach programs, internship and mentorship programs, career fairs, and networking events.
- Partner with actors such as the Sierra Leone Institute of Engineers (SLIE) is relevant to track internship results in the long term because entities like the SLIE maintain a career long contact with professionals.

Conduct gender policy audit and develop gender policy

- Develop Gender Policy and gender audit / deep dive into all policies and practices, focusing on compliance with Gender Equality and Women's Empowerment Act and the quality of the policies and effectiveness of implementation.

Develop employee gender manual, handbook, or code of ethics.

- Ensure that national gender laws and regulations, including the provisions of the Gender Equality and Women's Empowerment Act, as well as all other company policies, are communicated to employees in the employee manual, handbook, or Code of Ethics.

Develop sexual harassment and gender-based violence (GBV) policy

- Develop and implement a stand-alone sexual harassment and gender-based violence (GBV) policy that establishes a strong survivor-cantered grievance management process and post-sexual harassment support services. De-coupling this policy it from the gender equality policy is recommended.
- Developed policies need to be fully implemented to contribute to equality in the workforce. All the participant companies are short staffed, therefore there is a risk that once policies are developed,

they do not invest the time in creating mechanism to audit and improve the implementation of those policies.
Prioritizing the most urgent policies like GBVH prevention will be key to adequately distribute the limited human resources.

Establish Women in Energy Forum

- A Women in Energy forum will provide opportunities for power sector entities and private sector firms to exchange experience and learn best practices for increasing women participation in the sector.
- MOE should establish such a forum and solicit support from donors for its regular organization.

STRATEGIC THEME 5: PRIVATE SECTOR PARTICIPATION

Table 3-30: Strategic Objectives and KPIs – Private Sector Participation

Strategic objectives	KPIs
• Increase opportunities for private participation • Increase formality of sector roles	• Number of IPPs • New MW capacity • USD leveraged from private or public sources

Lack of enabling regulation and data. Private sector project developers looking at opportunities in generation or distribution lack access to transparent licensing and procurement processes that facilitate outside investment.
Furthermore, prospective developers lack sufficient data on the demand and potential for new generation sources to properly site and assess new projects. This roadmap recommends that licensing and procurement processes for new generation be formalized through transparent processes including auctions, feed-in tariffs, and provision for unsolicited proposals. It further recommends measures directed at improving the process for IRP development and the publication of resource and economic data. The IPP Frameworks for solicited as well as unsolicited proposals was developed under the THP. PPP Unit started using some of the standard templates developed during the THP but still deals mostly with the unsolicited proposals and there are over 167 legacy MOUs based on unsolicited proposals. The IPP framework needs to be updated and formally approved and adopted to enhance competitive private sector participation.

Incomplete unbundling of EGTC. After being spun off from NPA, EGTC retains assets and sector functions covering both generation and transmission. The incomplete unbundling of EGTC into separate generation and transmission functions complicates the independence of the transmission role with respect to generation dispatch and cross-border trade. An independent transmission system operator gives private sector confidence on equal access to transmission system for transactions. This roadmap recommends that first EGTC is restructured to create separate generation and transmission functional business units and then transitioned to full of EGTC unbundling starting with the development of an independent Transmission System Operator in long term if needed.

Lack of preparedness for cross border trade. The completion of the WAPP CLSG line in Sierra Leone opens the sector to a vast new source of low-cost power. To take full advantage of these new resources, the power sector must transform from a single-buyer market to a bilateral market that allows for wholesale bulk electricity delivery from WAPP. This roadmap lays out actions that further WAPP integration and prepares the sector for cross-border trade via a bilateral market.

PPP Support

Activities

Table 3-31: Strategic Initiative – PPP Support

PPP Support	Lead	Timeframe
Establish and staff a PPP Cell to build a pipeline of projects and implement and monitor IPP projects	MOE	Medium-term
Seed fund the Public Private Partnership Transaction Support Fund (P3TSF)	MOE	Long-term

Activity Description

Establish and staff a PPP Cell to build a pipeline of projects and implement and monitor IPP projects

- IPP Frameworks for solicited as well as unsolicited proposals was developed under the THP. The overall objective of the frameworks was to implement clear, fair, and transparent processes for attracting private sector participation.
- PPP Unit has started using some of the standard templates developed during the THP but still deals mostly with the unsolicited proposals and there are over 167 legacy MOUs based on unsolicited proposals.
- A National Investment Board (NIB) has just been formed bringing together Corporate Service Commission, PPP Unit and Sierra Leone Investment and Export Promotion Agency (SLIEPA) under one umbrella. The NIB would serve as a one-stop-shop (single window) for project investments and approvals.
- While it is understood that PPP Unit will still remain responsible for IPPs and project procurements in the electricity sector, its role under NIB will become more cross-sectoral and hence there is need for a complementary structure (PPP Cell) at MoE to focus on the PPP/IPP projects in power sector.
    - The key functions of the PPP Cell at MoE will be to: Facilitate approval and implementation of IPP Frameworks;
    - Conduct pre-feasibility/feasibility studies and create a project pipeline for power sector;
    - Facilitate project transactions including running a competitive bidding process for identified projects, manage negotiations and financial close;
    - Manage IPP inventory and ensure that contract provisions are enforced; and
    - Help develop a pipeline of projects; and
    - Provide transaction services for IPPs;
    - Provide other support as needed such as development of additional templates, and support for PPP Transaction Support Fund etc.
    - Ensure cross-sectoral coordination (contracting agency, PPP Unit, MoE, MoF, and NRA etc.) for implementation of power sector projects.
    -

Seed fund the Public Private Partnership Transaction Support Fund (P3TSF)

- The Transaction Support Fund (P3TSF) defined under the PPP Act has not been set up yet. The purpose of the fund is to help conduct independent studies on projects and prepare them for competitive bids.
- The PPP Unit is looking for seed funding for the P3TSF in the range of $4m-$8m and welcome the idea of stopping unsolicited projects (subject to certain caveats that can be worked out) and transitioning to the competitive framework.
- The fund is expected to be revolving in nature and some due diligence on its operational and governance framework has been done by the PPP Unit.
- The purpose of the P3TSF fund is to help conduct independent studies on projects and prepare them for competitive bids.
- MOE should work with donor partners to solicit seed funding for the P3STF ringfenced for power sector projects.

Procurement Systems and Rules

Activities

Table 3-32: Strategic Initiative – Procurement Systems and Rules

Procurement systems and rules	Lead	Timeframe
Develop procurement framework for solicited, unsolicited, and small-scale projects	MOE	Short-term
Develop technical standards for procurements	EWRC	Short-term
Publish pipeline resources	MOE	Short-term
Develop regulation for small capacity generation exempt from licensing	EWRC	Medium-term
Establish FiT for small scale RE	MOE	Medium-term
Establish and manage state guarantee instruments	MOF	Medium-term

Activity Description

Develop procurement framework for solicited, unsolicited, and small-scale projects

- IPP Frameworks for solicited as well as unsolicited proposals was developed under the THP. The overall objective of the frameworks was to implement clear, fair, and transparent processes for attracting private sector participation. Because of time constraints during THP the frameworks could not go through the final stages of development, review and GoSL approval. MOE should update the IPP framework if needed and approve it for adoption.
- Currently most power projects are procured through unsolicited arrangements.

- Solicited projects procured through competitive bidding are expected to lead to lower prices and an improved reliability of electricity supply through enhanced budget and capacity control.
- Competitive procurements face a limitation when a bilateral donor provides equipment on a grant basis that is linked to suppliers of the same nationality as the bilateral donor.
- Where auctioning is not appropriate, unsolicited projects would still be eligible through bilateral negotiations with preferred bidders, especially for large scale project sites over 50 MW.

Publish pipeline resources

- Publish generation statistics
- Publish map of available generation project sites
- Develop atlas of RE resources

Develop technical standards for Procurement

- The price of procured energy should never be above the long-term marginal generation cost of the grid as proposed by EWRC (using the IRP) and decided by the MOE.
- A premium may be granted for firm capacity supply (possibly for specific time bands) against a penalty for defaulting.

- There will be a cap on the maximum intermittent capacity that may be connected to the grid.
- Prices will be determined in hard currency (e.g., USD, GBP, EUR, or others) considering average conditions for local content costs.
- The price shall be fixed for a period equal to or exceeding the debt maturity of projects (12 to 15 years maximum).
- Technical default by an off-taker preventing sale to the grid shall be mitigated by a deemed energy compensation formula (i.e., similar to a take-or-pay obligation).
- The power purchase agreement for eligible projects shall be standardized.

Develop regulation for small capacity generation exempt from licensing

- The Electricity Act recognizes licensing as the only regulatory regime for all activities in the electricity sector.
- In-line with a feed-in-tariff policy, a threshold should be determined under which the strict conditions of a license (including reporting to the EWRC) does not apply.
- A progressive, light-handed regulation regime for small scale activities could include authorization of generators outside of the full licensing process for projects below a threshold (e.g., 10 kW).

Establish FiT for small scale RE

- Small scale projects (up to 3-5 MW) would be eligible for a renewable energy feed-in tariff (FIT) as outlined in a FIT policy.
- The EWRC will detail a feed-in tariff policy that will specify a maximum feed-in tariff for

specific technologies (e.g., hydro, solar PV, biomass), different capacity ranges between a minimum capacity (e.g., 500 kW) and a maximum capacity (e.g., 3–5 MW), and for grid-connected vs. off-grid systems.

Establish and manage state guarantee instruments

- The risk of payment default by an off-taker shall be mitigated by a guarantee instrument (excluding sovereign guarantee).

4.0 INSTITUTIONAL RESPONSIBILITIES

Ministry of Energy

The Ministry of Energy has the mandate to oversee, plan and coordinate the implementation of the Roadmap through the Steering Committee. The Ministry of Energy has a key ongoing role within the electricity sector to be the central driver of reform and to ensure that decisions and decision-making processes are aligned to and advance the roadmap.

Although the MOE is a centralized institution, not all work will be done centrally. Teams accountable for various aspects of implementation will be setup across the sector and the MOE will coordinate and monitor the work of these teams.

EDSA

The sustainable business model for EDSA is to provide electricity supply throughout the country especially in large towns where there is already sufficient generation capacity and a large customer base. EDSA devotes a considerable amount of its management's time, its meagre resources and capacity dealing with the challenges of operating the company on a day-to-day basis. This puts a lot of strain on EDSA in engaging in other essential operational activities aimed at boosting the overall financial, technical and sustainability of the Authority.

EGTC

The sustainable business model for EGTC is to own, maintain, operate and develop critical publicly owned (or controlled) assets in the generation (national scale) and transmission of electricity. Within EGTC, the senior executive team is the Director General, the Director for Planning (new directorate to be set up), the Director for Human Resources, the Director for Finance, the Director of legal affairs, the Director of technical operations and the Commercial Director. The next layer is the senior management team comprised of Heads of services. The leadership of EGTC has an essential role to embrace, demonstrate, and champion change.

EWRC

The sustainable institutional model for EWRC is based on its capacity to fulfil its functions and exercise its powers as specified in the EWRC Act, 2011 and the National Electricity Act, 2011 (and GVWC Act and the SALWACO Act also). Currently, the capacity at the EWRC to fulfil its regulatory functions in the areas of market, economics, technical and arbitrage is not yet at the desired level and capacity building measures will be put in place to improve its human, logistical and administrative capabilities.

Sector Steering Committee

Coordination of the Roadmap's implementation is a priority of the Steering Committee. This means supporting the public utilities with the appropriate resources, advocacy, advice, and priority setting, they need to be successful. It also means monitoring, probing, and holding the utilities' senior executive team accountable for real change.

The Steering Committee has already formally confirmed that the roadmap will be used to guide sector development, including performance goals and objectives that the utilities will measure and report to the Steering Committee.

EPA

The Environment Protection Agency Sierra Leone (EPA-SL) was established by the Environment Protection Act of 2008. The EPA-SL ensures the integration of environmental and social concerns in overall national planning by developing modalities and maintaining linkages or partnerships with relevant Government Ministries, Departments and Agencies. It is responsible for ensuring that national environmental and social requirements are adhered to in the planning and implementation of projects.

Key objectives of the Agency include:

- Reviews and approves environmental and social impact assessments (ESIA) submitted in accordance with the Environment Protection Agency Act 2008.
- Requires projects proponents to submit quarterly and annual environmental reports for the EPA-SL yearly projects audit.
- Review proponents report and undertake site visits to verify some E&S aspects.
- Renews the environmental license yearly based on the results of this audit.

5.0 IMPLEMENTATION STRATEGY

OVERSIGHT AND EXECUTION

Institutional Structure

Implementation of the Roadmap will be monitored and executed by teams comprised of leaders and experts representing all the main sector institutions.

Steering Committee –.

A SC was formed during the THP to support implementation of the Energy Sector Roadmap; however, it became inactive after the conclusion of the THP. Based on the lessons learned during the THP period, the SC has been reinstituted which now includes donor partners and establishment of various working groups. The SC will meet on quarterly basis to coordinate the actions and activities of all partners and its mandate will evolve based on sector needs and priorities. The SC will have overall oversight and governance on implementation of roadmap and one of its key priorities will be to resolve interdependencies and making resources available for implementation of the roadmap. The SC will also serve as a plat for GoSL to clearly articulate its priorities and ensure buy-in from development partners so that funding can be aligned with identified sector priorities.

The SC has set eight objectives to start with which will be reviewed and updated with time. These objectives include:

- reviewing technical advice for sector planning;
- coordinating investments to reduce losses;
- identification and implementation of key reforms to improve sectors financial outlook;
- reviewing and providing support for pipeline of generations projects;
- providing strategic direction for key development partner programs;
- setting annual electricity access targets;
- coordinating update of key sector studies; and
- coordinating the set-up, implementation and reporting of KPIs for the sector.

Technical Committee –

The SC will be supported by a technical committee (TC) drawn from SC member institutions (MoE, MOF, EDSA, EGTC, EWRC, Planning Unit and EPA-SL) and development partners (MCC, the WB, FCDO, EU, AfDB, JICA). The TC may be organized into sub-committees or working groups. The TC or a its sub-set is expected to act as PMO for the roadmap implementation discharging key functions such as:

- Communication and Stakeholder Management. Facilitate the development of communication strategy and proper stakeholder involvement

- Financial Management. Plan, track and manage the program budget, schedule, and benefits
- Project Planning. Maintain and enforce an integrated project plan. Identify, prioritize, track, and manage risks and issues
- Change Control Management. Manage all changes in existing actions, added activities, and schedule
- Strategic Theme Engagement. Enable collaboration within strategic themes through status reporting and integration issue management
- Working Group Management. Form WGs to support roadmap implementation as needed.
- Program Setup. Create a "Control Room" to act as a PMO control center.

The SC and TC will need assistance in establishing a proper structure for the PMO and establishing processes for its proper functioning. Technical assistance will also be needed on specific technical subjects to help the SC in decision making.

Working Groups – Responsible for implementation of specific strategic initiatives, activities, or workstreams.

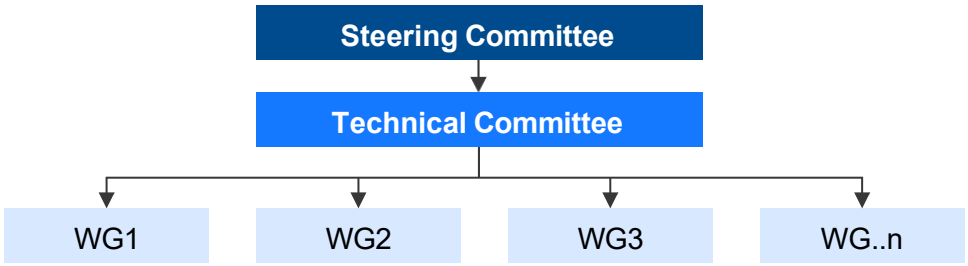


Figure 5-1: Reforms Roadmap Implementation and Oversight Structure

TC sub-committees or working groups can be formed along the thematic pillars of the reform's roadmap or around specific technical or management aspects. Some examples can be

- *Working group on sector financial model and roadmap* – this working group will consist of members from MOE (planning unit), PPP Unit, EDSA, EGTC, EWRC and MoF and supported by technical experts from development partners as needed. The working group will be responsible for monthly and quarterly reporting on sector financial model dashboard and monitoring progress on roadmap actions.
- *Working group on electricity access* – this working group will consist of members from MOE Energy Directorate, EDSA, MOE (planning unit), EWRC and development partners to assess reforms actions and key issues related to electricity access.
- *Working group on power sector financial health* – this working group comprising of members from MOE, MOF, PPP Unit, EDSA and EGTC will on behalf of SC will have oversight of the collection account and

will estimate investment requirements as well as subsidy burden on the sector. The working group will also have oversight of the loss reduction and other activities that have significant impact on sector financial health. The group will present quarterly report to the SC.

- *Working group on sector planning and coordination* – this working group drawn from MOE (planning unit), EDSA, EGTC and donors will have oversight of IRP and National Electrification Strategy studies and implementation. The working group will report on progress made on implementation as well as any significant deviations from the adopted planning studies.
- *Working group on regulatory and market transformation* – this working group drawn from MOE, MOF, and EWRC will have oversight of the transition to multi-year-tariff regime, cost of service studies, and changes in market structure from single buyer to multi-buyer etc.
- *Working group on private sector participation* – this working group drawn from MOE, PPP Unit, MOF and development partners will oversee adoption and implementation of IPP Frameworks for competitive procurement of energy projects and sector project pipeline.
- *Other working groups* – other working groups will be formed as needed and will be dissolved when the mandate is complete.

Project Management Office

The SC and TC should be provided assistance in establishing a proper Project Management Office (PMO) and establishing processes for its proper functioning.

A PMO is a unit within a project or program that comprises an agreed set of processes and tools providing control and transparency leading to successful delivery

A PMO is set up in most mid to large programs to ensure that multiple work streams and stakeholders are working together seamlessly, and that overall control and monitoring of activities and deliverables happens at a central level.

The benefits of a PMO include:

- Project control
  - Effective control of project costs and benefits
  - Management and integration of all the linkages and dependencies across all initiatives
- Project planning
  - Appropriate allocation of scarce resources and skills to deliver maximum business value
  - Ability to define structure and implementation sequencing of initiatives
  - Integrated program planning and progress control of the different initiatives that comprise the program
- Reporting and monitoring
  - Direct reporting to top management and transparent communication throughout different organizational levels
  - Proactive management of risks and critical issues
  - Constant coordination and communication across many functional entities (key in a complex enterprise transformation program)

The essential elements of a PMO are:

- Governance and processes
  - Assign roles, responsibilities and reporting relationships within the project
  - Maintain and enforce governing processes
- Communication and Stakeholder Management
  - Facilitate the development of communication strategy and proper stakeholder involvement
- Financial Management
  - Plan, track and manage the program budget, schedule, and benefits
- Project Planning
  - Maintain and enforce an integrated project plan (IPP)
  - Identify, prioritize, track, and manage risks and issues
- Change Control Management
  - Manage all changes in existing scope, added activities, and schedule
- Work stream Engagement
  - Enable collaboration within work streams through status reporting and integration issue management
- Program Setup
  - Create a “Control Room” to act as a PMO control center

KEY PERFORMANCE INDICATORS

The following key performance indicators provide a means to quantify, benchmark, and track Roadmap progress at a high level. Full indicator definitions are provided in Annex A

Table 5-1: Summary of KPIs

Theme	KPI	Description	Units measure	Disaggregation	Data sources
Electricity access	Electricity access rate	Characterizes the overall rate of access to electricity disaggregated by rural and urban zones. Useful for international benchmarks.	Percentage (%)	Urban, rural	EDSA customer database, sales and connection data from off-grid service providers
Electricity access	Circuit kilometers (ctkm) of transmission and distribution lines	Monitors the pace of extension of grid infrastructure	Kilometers (km)	Transmission, distribution	Asset data from EDSA and EGTC
Electricity access	Number of SHS systems sold/mini-grid connections	Monitors the state of the private off-grid sector	Number of systems, number of mini-grid connections	Urban, rural	Sales and connection data from off-grid service providers
Financial sustainability; Service delivery	System losses	High level view of the operational efficiency and financial health of the sector	Percentage (%)	NA	EDSA and EGTC generation and sales data used to determine technical and commercial

					losses
Financial sustainability	Cost of service	System level costs per kWh sold. Includes cost of generation, T&D, stakeholder margins, regulated fees, and system losses.	US Dollars/kWh	NA	EDSA and EGTC generation and sales data.
Theme	KPI	Description	Units measure	Disaggregation	Data sources
		Expressed as SLL or USD per kWh.			
Financial sustainability	Cost recovery ratio	The ratio of total revenue to total capital and operational costs.	Percentage (%)	NA	Sector-wide investment and operational cost data and EDSA sales data.
Service delivery	SAIFI, SAIDI	Measures of the frequency and duration of interruptions to electricity service	Number of interruptions, hours	NA	EDSA service data
Service delivery	Customer satisfaction score	A composite indicator that characterizes the frequency of customer complaints, the time to connect	Days to resolve complaints	Tariff class	EDSA customer data

		new customers, and customer feedback surveys			
Institutional capacity	Number of people trained	Monitors the pace of capacity building initiatives	Number of people	Men, women	Steering Committee and training contract data
Institutional capacity	Number of women in management	Characterizes the scope of opportunity for women working in the sector and impacts from the Women in Energy initiative	Number of managers	NA	HR data from all sector institutions
Institutional capacity	Number of sector policies	Monitors progress against the Roadmap's policy	Number of proposals,	NA	Official regulatory
Theme	KPI	Description	Units measure	Disaggregation	Data sources
	proposed and adopted	and regulatory reform agenda	official documents		documents or gazettes
Private sector participation	Number of IPPs	Number of private generation companies participating in the sector	Number of IPPs	Type, fuel and size	EDSA PPAs, EWRC licenses

Private sector participation	New MW capacity	Level of private sector participation in overall generation	Megawatt (MW)	Power generation source	EWRC licenses
Private sector participation	USD leveraged from private or public sources	Indicates the confidence of private investors and donors in the sector	US Dollars (USD)	NA	EDSA PPAs, MOE donor data

RISK ASSESSMENT

The following risk matrix outlines key risks for attention by sector leadership and treats high-level issues related to overall implementation of the roadmap.

Table 5-2: Risks and Mitigation Measures

Risks	Mitigation measures
Management and implementation capacity – Management staff across the sector's entities is responsible for both day to day operations and implementation of the reforms process. Concentrating responsibility on these key individuals risks underperformance in roadmap implementation.	Coordination and targeted advisory will promote efficient use of human resources and consistent focus on implementation. Measures include: • coordination of leadership through the Steering Committee and Technical Committee, including maintaining clear roles and responsibilities; • technical assistance through short-term and long-term management and advisory contracts; • recruiting reforms to attract and retain high quality in-house staff.

Staff retention – Highly trained and experienced staff working at sector institutions can often commander higher salaries by moving to the private sector. When key staff leave the sector, they take valuable institutional knowledge and disrupt the momentum of the reform workstreams that they're responsible to implement.	Investments in staff capacity should be safeguarded by promoting staff retention through contracts and organizational culture. Measures include: • bounding staff to minimum retention terms and continued support following training; • targeting training toward long-time, vested staff; • commitment to change management and organizational culture by top leadership; • developing the pipeline for talent by promoting the participation of women and through partnerships with professional associations.
Information sharing – Data flows and access between sector institutions is crucial to coordinated sector planning, supports consistent financial payments between sector institutions, and lends transparency to the private sector. Poor data management risks stunting progress on Roadmap reforms.	Data management systems and practices will support the knowledge base needed for sector coordination. Measures include: • establishing and maintaining GIS and IT systems for sector institutions; • regular technical, financial and regulatory auditing and reporting; • developing EDSA's customer management and care capabilities.
Reform dependencies – The technical, financial, and institutional challenges faced by the sector cannot be siloed. Reforms, investments, and organizational changes need to be driven in tandem. Failing to account for certain interdependencies between reforms and investments risks slowing or halting the pace of progress.	Sector leadership, through the Steering and Technical Committees, need to identify dependencies, trade-offs, and bottlenecks in the reform process. Measures include: • Regulatory support for importation of key equipment and materials; • early policy development to better coordinate reform and infrastructure development; • codification of technical standards and payment protocols to align technical and financial interests.

ANNEX A: KPI REFERENCE INFORMATION

THEME 1: ELECTRICITY ACCESS

Electricity access rate

Definition: Number of households that have legal connections to electricity service / Total number of households

Unit of measure: Percentage (%)

Disaggregation: Urban, rural

Data or calculated: Calculated

Primary Data Source: EDSA Quarterly Reports

Responsible Party: EDSA

Baseline: 29.5% (2022)

IMS will be able to provide this information: No

Calculation: This is the result of– "Households that have legal connections to electricity service by "Total number of households" and then multiplying the result by 100.

Circuit kilometers (ctkm) of transmission and distribution lines

Definition: The sum of linear kilometers of existing, new, reconstructed, rehabilitated, or upgraded transmission and distribution lines.

Unit of measure: Kilometers (km)

Disaggregation: Transmission, distribution

Data or calculated: Data

Primary Data Source: EGTC and EDSA Quarterly Reports

Responsible Party: EDSA, EGTC

Baseline: to be established

IMS will be able to provide this information: Yes

Number of SHS systems sold/mini-grid connections

Definition: Total number of off-grid connections, including new sales of standalone solar home systems and

new connections to mini-grids

Unit of measure: Number of systems, number of mini-grid connections

Disaggregation: Urban, rural

Data or calculated: Data

Primary Data Source: MOE

Responsible Party: MOE

Baseline: to be established

IMS will be able to provide this information: No

THEME 2: FINANCIAL SUSTAINABILITY

System losses – Aggregate technical and commercial losses (AT&C)

Definition: The amount of electricity generated or input to system (kWh) minus the amount in US$ for which payment is collected from customers converted to energy (kWh) divided by the amount of electricity generated or input to system (kWh) x 100

Unit of measure: Percentage (%)

Disaggregation: NA

Data or calculated: Calculated

Primary Data Source: EDSA and EGTC Quarterly Reports

Responsible Party: EDSA and EGTC

Baseline: 51% (2022)

IMS will be able to provide this information: Yes

Calculation:

$$Distribution\ Losses = \frac{(Energy\ Purchase - Energy\ Sales\ or\ billed)}{Energy\ Purchase}$$

$$Billing\ Efficiency\ (NB) = \frac{Energy\ Sales\ or\ billed}{Energy\ Purchase}$$

$$Collection\ Efficiency\ (NC) = \frac{Amount\ collected\ in\ \$}{Amount\ sales\ or\ billed\ in\ \$}$$

$$Aggregate\ Technical\ and\ Commercial\ Losses\ (AT\&C)\ or$$
$$Agregate\ Technical, Commercial\ and\ Collection\ Losses\ (ATC\&C)\ = 1 - N_B * N_c$$

Remarks: The total T&D losses do not capture the non-realization of payment, the Aggregate Technical and Commercial Losses (AT&C) are the actual measure of overall efficiency of the distribution business as it measures technical, commercial losses and the collection efficiency

Cost of service

Definition: Generation and operating costs divided by kWh sold, where operating expenses include at least fuel costs, O&M expenses, administrative expenses, and other expenses such as depreciation, interest, and foreign exchange gain/loss.

Unit of measure: US Dollars/kWh

Disaggregation: NA

Data or calculated: Calculated

Primary Data Source: EDSA and EGTC Quarterly Reports

Responsible Party: EDSA and EGTC

Baseline: to be established

IMS will be able to provide this information: Yes

Cost recovery ratio

Definition: Total revenue collected / Total operating cost. Total operating cost is defined as operating expenses plus depreciation.

Unit of measure: Percentage (%)

Disaggregation: NA

Data or calculated: Calculated

Primary Data Source: EDSA Quarterly Reports

Responsible Party: EDSA

Baseline: to be established

IMS will be able to provide this information: Yes

THEME 3: ELECTRICITY SERVICE DELIVERY

SAIFI

Definition: Sum of customer-interruptions in a quarter / Total number of customers connected to network in the same quarter.

The definition according to the standard of the **IEEE Guide for Electric Power Distribution Reliability Indices** (Std 1366) is: The system average interruption frequency index indicates how often the average customer experiences a sustained interruption over a predefined period of time.

Data or calculated: Calculated

Primary Data Source: EDSA Quarterly Reports

Responsible Party: EDSA

Baseline: To be established.

LEC IMS will be able to provide this information: No

Calculation: When an interruption occurs, number of customers connected to that particular feeder is divided by the total customer number. This gives contribution of that interruption into overall SAIFI.

SAIDI

Definition: Sum of durations, in customer-hours, of all customer interruptions in a quarter / Total number of customers connected to network in the same quarter.

The definition according to the standard of the *IEEE Guide for Electric Power Distribution Reliability Indices* (Std 1366) is: The System Average Interruption Duration Index indicates the total duration of interruption for the average customer during a predefined period of time. It is commonly measured in customer minutes or customer hours of interruption. Mathematically, this is given in the following equation:

Unit of measure: Hours

Data or calculated: Calculated

Primary Data Source: EDSA Quarterly Reports

Responsible Party: EDSA

Baseline: to be established

LEC IMS will be able to provide this information: No

Calculation: When an interruption occurs, the interruption time is taken in minutes and multiplied by the number of customers connected to this feeder. This is then divided by the total customer number, giving the

contribution of this interruption to overall SAIDI.

Customer satisfaction score

Definition: Time to resolve a claim about electric service.

Unit of measure: Days **Disaggregation:**

Tariff class, rural/urban **Data or**

calculated: Data

Primary Data Source: EDSA Quarterly Report

Responsible Party: EDSA

Baseline: to be established

IMS will be able to provide this information: Yes

THEME 4: INSTITUTIONAL CAPACITY

Number of people trained

Definition: Total number of people trained on sector-relevant expertise

Unit of measure: Number of people

Disaggregation: Male, Female, type of institution (public/private/NGO/NPO), position (entry level, mid-level, senior level)

Data or calculated: Data

Primary Data Source: MOE

Responsible Party: MOE

Baseline: to be established

IMS will be able to provide this information: No

Number of women in management

Definition: Total number of women working on management positions in the electricity sector

Unit of measure: Number of women

Disaggregation: NA

Data or calculated: Data

Primary Data Source: MOE

Responsible Party: MOE

Baseline: to be established

IMS will be able to provide this information: No

Number of sector policies proposed and adopted

Definition: Total number of policy proposals or policy enactments

Unit of measure: Number of proposals, official documents

Disaggregation: NA

Data or calculated: Data

Primary Data Source: MOE

Responsible Party: MOE

Baseline: to be established

IMS will be able to provide this information: No

THEME 5: PRIVATE SECTOR PARTICIPATION

Number of IPPs

Definition: It is a database of the main characteristics of IPPs, such as:

- Type of technology,
  - Renewable (Solar, Wind, Biomass, Hydro, Biofuel)
  - Non-renewable Thermal (Medium and High-Speed Diesel, Steam Turbines, Gas Turbines)
  - Nuclear
- Type of Fuel:
  - Diesel
  - HFO
  - LNG
  - Propane

Unit of measure: NA **Disaggregation:**

By type, fuel and size **Data or**

calculated: Data

Primary Data Source: EGTC **Responsible Party:** EGTC

Baseline: to be established

IMS will be able to provide this

information: No **Unit of measure:** NA

Disaggregation: By type, fuel and size

Data or calculated: Data

Primary Data Source: EGTC **Responsible Party:** EGTC

Baseline: to be established

IMS will be able to provide this information: No

New MW capacity procured through competitive procurement

Definition: Generation capacity added, measured in megawatts, resulting from construction of new generating capacity or reconstruction, rehabilitation, or upgrading of existing generating capacity.

Unit of measure: Megawatt (MW)

Disaggregation: Power generation source

Data or calculated: Data

Primary Data Source: EGTC Quarterly Reports

Responsible Party: EGTC

Baseline: to be established

IMS will be able to provide this information: Yes

USD leveraged from private or public sources

Definition: The value of all signed construction contracts for power infrastructure investments less the government contribution.

Unit of measure: US Dollars (USD)

Disaggregation: NA

Data or calculated: Data

Primary Data Source: MOE

Responsible Party: MOE

Baseline: to be established

IMS will be able to provide this information: Yes

Cost of generation (USD/kWh)

Definition: ratio of total cost of generation (capex, opex and financing etc.) and net electricity generated in kWh.

Unit of measure: US Dollars (USD) per kWh

Disaggregation: NA

Data or calculated: Data

Primary Data Source: MOE

Responsible Party: MOE

Baseline: to be established

IMS will be able to provide this information: No