ENUGU STATE ELECTRICITY PRIORITY PLAN AND IMPLEMENTATION ROADMAP

Nextier

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ABBREVIATIONS

AEI	Asteven Energy Institute
AFDB	African Development Bank
ASR	African School of Regulation
ATC&C	Aggregate Technical, Commercial & Collection
BESS	Battery Energy Storage System
BERAP	Business-Enabling Reform Action Plan
DER	Distributed Energy Resources
EERC	Enugu State Electricity Regulatory Commission
ENGIS	Enugu Geographic Information Systems
ESEA	Enugu State Electricity Agency
ESCPAP	Enugu State Climate Policy and Action Plan
ESWAMA	Enugu State Waste Management Authority
GDP	Gross Domestic Product
IPPs	Independent Power Producers
ISO	Independent System Operator
MoP	Ministry of Power
MPDC	Main Power Electricity Distribution Company
NAPTIN	National Power Training Institute of Nigeria
NERC	Nigerian Electricity Regulatory Commission
NESI	Nigeria Electricity Supply Industry
NESP	Nigerian Energy Support Programme
NETP	Nigeria Energy Transition Plan
PPA	Power Purchase Agreements
REMP	Renewable Energy Master Plan
SABER	State Action on Business Enabling Reforms
SEPP-IR	State Electricity Priority Plan and Implementation Roadmap
T&D	Transmission and Distribution
UNIDO	United Nations Industrial Development Organisation
UNECA	United Nations Economic Commission for Africa
UNN	University of Nigeria, Nsukka
WASH	Water, Sanitation, and Hygiene

Foreword

FOREWORD

We present the Enugu State Electricity Priority Plan and Implementation Roadmap (SEPP-IR) with immense pride and strategic optimism. This landmark document signals Enugu's commitment to establishing a modern, inclusive, and investor-friendly electricity market. This report has emerged at a crucial moment in the evolution of Nigeria's power sector, one characterised by the decentralisation of electricity regulation under the Electricity Act of 2023 and the constitutional amendments that empower subnational entities to take charge of and shape their energy futures.

Enugu State has embraced this responsibility with determination and vision. As one of the first states in Nigeria to establish an independent electricity regulatory framework, the State is leading the way in redefining energy governance, infrastructure planning, and attracting investment at the subnational level. The SEPP, developed through extensive research, stakeholder engagement, and data-driven analysis, lays the foundation for an integrated, resilient, and sustainable electricity system tailored to Enugu's unique needs.

This Plan sets forth our priorities for electricity market design, load demand planning, renewable energy integration, consumer clusterisation, and capacity building. It also outlines a pipeline of bankable projects and implementation strategies to guide policy decisions and foster private sector collaboration in the years ahead. Notably, the SEPP reflects our state's commitment to achieving universal access, promoting gender inclusion, and driving economic revitalisation through reliable and sustainable power.

We thank the African Development Bank (AfDB) for its support and the team at Nextier Capital Limited for their technical leadership. We applaud all public and private stakeholders, community representatives, and government institutions whose invaluable contributions have shaped this critical initiative and output. Our commendation will not be complete without a profound expression of gratitude to the Governor of Enugu State, His Excellency, Dr Peter Ndubuisi Mbah, whose visionary leadership mantra, 'Tomorrow is here', has set Enugu State on the path of innovation, greatness and excellence.

As we transition from planning to implementation, the Enugu State Electricity Regulatory Commission remains committed to regulatory excellence, transparency, and innovation. We invite investors, development partners, and the people of Enugu State to join us in achieving the objectives of this transformative plan.

Let there be light, and let it be accessible, reliable, affordable, and sustainable.

Mr. Chijioke Okonkwo

Chairman
Enugu State Electricity Regulatory Commission (EERC)

Executive Summary

The Enugu SEPP-IR is a document designed by the Enugu State Government, through the Enugu State Electricity Regulatory Commission (EERC), with funding support from the African Development Bank (AfDB) and technical implementation by Nextier. The SEPP provides a data-driven, participatory, and long-term framework for transforming Enugu State's power sector into a reliable, sustainable, and inclusive system that underpins the state's economic growth ambitions, particularly the goal of expanding the State's Gross Domestic Product (GDP) from $4.4 billion in 2023 to $30 billion by 2031.

The SEPP seeks to ensure energy security, affordability, environmental sustainability, and system reliability as the foundation for Enugu's transition into a productive and competitive economy. It aims to strengthen electricity access across urban and rural areas, reduce system losses, enhance regulatory effectiveness, and attract private-sector investment into power generation, transmission, and distribution.

The report provides a detailed review of Enugu State's electricity market design and distribution framework, including an

analysis of feeder performance data from the Main Power Electricity Distribution Company (MPEDC), a subsidiary of the Enugu Electricity Distribution Company (EEDC). Using a data-driven clustering approach, the SEPP segments consumers across urban, semi-urban, rural, commercial, and industrial zones to improve planning and service delivery.

Key performance indicators were analysed: billing efficiency, collection efficiency, aggregate technical, commercial, and collection losses, and metering density. Findings reveal overperforming and underperforming feeders, highlighting areas for infrastructure upgrades, improved data accuracy, and network optimisation. The SEPP recommends strategic interventions such as:

Construction of new feeders and substations to relieve overloaded networks, load balancing and reconfiguration across distribution lines, smart metering deployment and data quality assurance systems, targeted network upgrades, and capacity expansion in high-demand zones. These measures will enhance network efficiency, reduce outages, and improve service reliability for households, businesses, and industries.

As of 2023, Enugu State recorded 197,496 electricity customers and 940.76 GWh in annual energy consumption. The SEPP projects a rising demand driven by population growth, industrialisation, and urban expansion. It outlines a renewable energy plan to complement grid power through solar, mini-grid, and hybrid solutions, particularly for rural and underserved communities. This plan aligns with Nigeria's clean energy transition and Enugu's sustainability targets.

The SEPP proposes a comprehensive electrification strategy combining on-grid and off-grid solutions to achieve universal access. It serves as an investment guide for the private sector, identifying viable projects, financing models, and risk mitigation mechanisms that align with regulatory priorities and market opportunities.

Recognising the central role of EERC in driving implementation, the SEPP includes a Sustainable Capacity Building Framework based on an institutional assessment of 23 EERC staff. The findings reveal critical skill gaps in regulatory compliance, data analytics, policy development, and technical knowledge of power systems. Recommendations include:

- Technical and regulatory training (in collaboration with NAPTIN, UNN, PURC, ASR, and GIZ)
- Leadership and collaboration development programmes
- Gender-focused mentorship initiatives to increase women's participation in technical and leadership roles
- Establishment of a Learning and Development Unit within EERC to institutionalise continuous professional training

The SEPP provides a phased implementation roadmap:

- Short-term (3–6 months): Targeted skills enhancement, technical workshops, and mentorship programmes
- Medium-term (6–12 months): Study tours, advanced data analytics training, and leadership development
- Long-term (1–3 years): Institutional partnerships, creation of a knowledge-sharing platform, and annual performance evaluations to track progress

The SEPP represents a transformative step in Enugu State's pursuit of a sustainable, inclusive, and investor-friendly electricity market. Through evidence-based planning, stakeholder collaboration, and capacity enhancement, the plan establishes a clear pathway for powering Enugu's economic transformation and improving the quality of life for its citizens.

01

INTRODUCTION

Enugu State continues to set the pace in subnational electricity reform in Nigeria. Following the enactment of the Electricity Act, 2023, which decentralised electricity regulation, Enugu became one of the first states to establish its electricity regulatory framework. Through the Enugu State Electricity Regulatory Commission (EERC) leadership, the State is charting a new course in energy governance and infrastructure planning that aligns with global best practices while addressing local development priorities.

Driven by the vision to build a resilient, inclusive, and sustainable electricity sector that powers homes, businesses, and industries across the State, the Enugu State Government, through the EERC, initiated the development of the State Electricity Priority Plan and Implementation Roadmap. This plan provides a detailed roadmap for achieving universal electricity access by combining on-grid and off-grid solutions, integrating renewable energy, and improving the reliability and efficiency of the existing distribution network. The Plan also identifies bankable investment opportunities, outlines the enabling regulatory environment, and sets out actionable implementation strategies for the public and private sectors.

The SEPP is anchored on four core principles:

Energy security

Affordability

Environmental sustainability

System reliability

Beyond infrastructure and investment, the SEPP emphasises social inclusion, gender equality, and environmental stewardship, ensuring that the benefits of reliable electricity extend to all communities. Additionally, it provides a phased roadmap and project pipeline to translate the Enugu State Electricity Law into actionable outcomes. It sets the foundation upon which the State will build a modern electricity sector that delivers power that is accessible, reliable, affordable, and sustainable for every citizen.

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ENUGU STATE MARKET DESIGN

2.0 Review of the State Electricity Market Design

Enugu State has become a national leader in electricity market reform, being the first sub-national entity in Nigeria and Africa to exercise full regulatory autonomy over its electricity sector. The Enugu State electricity market design defines the regulatory and operational framework for managing electricity supply in the state. This section examines the legal, institutional, and policy frameworks shaping the Enugu electricity market, particularly concerning the state's objectives of enhancing service delivery and attracting private investment.

2.1 Legal and Policy Review

2.1.1 Analysis of the State Electricity Market Policy and Regulatory Framework

The United Nations Economic Commission for Africa (UNECA) and RES4Africa Foundation developed a custom methodology to assess policy, legislative, and regulatory frameworks concerning their ability to encourage the participation of private sector investors within the electricity sector. The approach encompasses the entire electricity supply industry value chain, covering the market's generation, transmission, distribution, and off-grid segments.

The review applies the UNECA and RES4Africa framework to assess how Enugu State's electricity law and policy support private sector participation. The methodology identifies three areas, called Dimensions, under which policy, legislative, and regulatory elements are clustered. These Dimensions are as follows.

I. **Openness** – or power sector structure and governance. This Dimension covers policies, laws, and regulations to define energy policy and strategy priorities, market entry, infrastructure planning, sector governance, market structures, and related considerations. These instruments combined provide an overall view of the openness of the electricity market to investors.

II. **Attractiveness** – or sector economics. This Dimension assesses policies, laws, and regulations that ensure the economic viability of electricity infrastructure investments and fair competition among market operators. A review of these instruments provides an overall synthesis of the attractiveness of the electricity market to private sector investors.

III. **Readiness** – or sector maturity. This Dimension investigates technical regulations designed to ensure the implementation, efficient integration and management of electricity infrastructure within the energy system. A review of these elements of the Dimension provides an overall picture of the readiness of the electricity market to investors along the value chain.

The methodology systematically evaluates Enugu's electricity market from broad frameworks to specific details to determine how open, attractive, and prepared they are for private sector investment.

Table 1: Overview of the criteria assessed within each Dimension

Openness	Attractiveness	Readiness
Energy Strategy	Contract regulation	Licensing and permitting
Power sector competition	Economic regulation	System planning
Power sector governance	Incentives	Grid Code/Access
Power sector framework	Credit enhancement	System quality and security standards
Procurement process		Access to data
Private sector participation		Off-grid system integration
Generation off taking options		

A Deep Dive into the Openness Dimension

The analysis examines how policies, regulations, and institutions influence the transparency and accessibility of the electricity market, highlighting its overall openness to investors.

Energy strategy	Enugu State has made substantial progress in energy regulation, guided by clear strategic documents. The State Electricity Policy sets targets for improved supply and renewable energy use, while the Climate Policy and Action Plan make Enugu the first subnational in Nigeria with a comprehensive long-term climate strategy.
Power sector governance	This refers to policies, institutions, regulations, and decision-making processes that shape how the electricity or broader energy sector is managed and governed. Enugu State has made substantial progress, showing excellent regulatory performance in power sector governance. The Enugu State Electricity Law provides a solid legal basis for a competitive market that promotes private participation in generation and distribution. However, transmission remains a future consideration, with plans for an Independent System Operator contingent on state approval.

Power sector framework	Enugu State's power sector is guided by the 2023 Electricity Law and the Electricity Policy, establishing a decentralised market structure that encourages private sector participation. The framework also supports off-grid and renewable energy solutions, aiming to expand electricity access in underserved areas. Overall, Enugu performs strongly in terms of its sector framework. The main gap lies in the lack of clarity around who owns and manages transmission assets. As the electricity market grows and matures, a dedicated transmission entity may need to be established. This could involve expanding the role of the MVDC to include transmission services or licensing a separate operator. While the law provides for creating a system operator, the regulatory commission will determine the appropriate approach through stakeholder consultations when the time is right.
Power sector competition	The National Competitiveness Council of Nigeria recognises Enugu as Nigeria's 5th most competitive state based on Human Capital, infrastructure, Economy and Institution. The Enugu State Electricity Market is structured to introduce competition by allowing multiple power generators- state-licensed (within Enugu) and NERC-licensed (outside the state)—to sell electricity directly to retail companies. This setup encourages market-based power trading, reducing dependency on a single source. As the state's distribution network expands, particularly the medium-voltage infrastructure, it will enable more competitive entry and supply, fostering a more dynamic and efficient electricity market.
Private sector participation	One of the defining features of a credible and modern electricity market is its alignment with the global shift toward decentralisation. Electricity is no longer confined to large, centralised systems; it is increasingly being generated, distributed, and managed at more localised levels. This trend, driven by technological advances, renewable energy integration, and changing consumer demands, is now widely acknowledged as irreversible and necessary. Within this context, the Enugu State Electricity Policy clearly embraces the principle that electricity, as a manufactured and tradable commodity, is most effectively delivered through a structured and well-regulated market, primarily operated by private sector entities.
Procurement process	The policy emphasises the need to establish a competitive and transparent energy procurement framework for Enugu State, which should be designed and managed by a neutral, designated entity under the oversight of the EERC. This framework is intended to ensure that energy procurement is carried out through fair, open, and non-discriminatory processes, enabling the selection of the most efficient and cost-effective suppliers or operators.
Generation off taking options	Generators in Enugu State have access to market routes for selling their electricity output primarily through licensed PPAs and off-take agreements approved by the Enugu State Electricity Regulatory Commission (EERC). The absence of a structured regional electricity market also limits broader off-taking opportunities, keeping generation market development at an early stage.

Table 2 Openness Dimension

Enugu's electricity market demonstrates strong foundations for openness, with a competitive legal framework, decentralised generation support, and power producers' market routes.

A Deep Dive into the Attractiveness Dimension

This analysis explores the Attractiveness dimension, focusing on how policy, legal, and regulatory instruments influence the appeal of the electricity market to private sector investors. By reviewing these frameworks, we understand how conducive the market is to investment, highlighting key factors such as risk, return potential, and ease of market entry.

Contracts regulation	All licensed operators in Enugu State's electricity market are mandated to operate under binding and enforceable contracts. Entities licensed in one service category must establish the necessary agreements with those in other categories to sell, purchase, or distribute electricity services. The analysis shows strong regulatory performance in contract management, with the market successfully attracting Independent Power Producers (IPPs) through long-term Power Purchase Agreements (PPAs). However, as these agreements were not publicly available for review, greater transparency through PPA disclosure is recommended to strengthen investor confidence.
Economic regulation	The State demonstrates strong performance in economic regulation, supported by the powers granted under Section 34 of the Enugu State Electricity Law, 2023, which strengthens the role of EERC in the tariff-setting process. The EERC is responsible for establishing the economic rules and formulas used to calculate electricity tariffs, subject to major and minor periodic reviews. These reviews must be approved by the Commission before implementation by any licensee. While significant progress has been made, it remains unclear whether the current tariff structure has fully achieved cost-reflectivity. However, consumer enumeration data suggests a general willingness of consumers to pay for electricity services.
Incentives	The State Electricity Policy encourages private sector investment in renewable energy development by supporting the State in developing incentives to promote renewable energy solutions and achieve renewable energy goals. Existing incentives are Pioneer status incentives, Rural investment allowance, Gas utilization investment allowance, VAT exemption on selected goods, Enhanced capital allowance (tax depreciation) regime, Exemption from minimum Corporate Tax, 95% accelerated capital allowance, 25% of income in convertible currencies exempted from tax, Generous Tax Holiday waiver on certain Business Levies and Taxes, Enhanced Land Acquisition Incentives, Waiver on Annual Ground Rent, Incentives for Broadband Deployment, Merit Based Investment Guarantees and Tax incentives for businesses operating within the free economic zones. Multiple incentives exist, but not specifically tailored for the electricity sector.

Table 3: Attractiveness Dimension

Credit Enhancement	Investors in Enugu State's power generation market may benefit from specific credit enhancement mechanisms. The Enugu State Electricity Policy includes guidance on establishing a Payment Guarantee Company to improve payment security within the electricity market. However, the policy does not explicitly provide for other instruments such as state government guarantees, concessional loans, or insurance schemes, which could further enhance investor confidence.

In addition, Executive Order 005 issued by the current administration in Enugu State prioritises the ease of doing business. To support this, the state recently inaugurated the Enugu State Ease of Doing Business Council, tasked with driving and coordinating reforms to make Enugu one of Nigeria's most attractive investment destinations. Overall, the Enugu electricity market reflects several foundational elements of a functioning power market. However, key institutional and transparency gaps remain, particularly the absence of well-defined arrangements for establishing an Independent System Operator (ISO) and limited public access to market data, which must be addressed to support efficient market development and investor confidence.

A Deep Dive into the Readiness Dimension

This analysis examines the Readiness Dimension, focusing on key factors determining how prepared the electricity market is to support investment across the entire value chain. By reviewing these elements, we comprehensively understand the market's capacity to accommodate and sustain private sector participation effectively.

Authorisations and permits	According to the World Bank, Enugu ranks third among Nigerian states for the efficiency of business startup procedures, considering the time, cost, and required steps. The state is also ranked ninth in the process of property registration. Most land areas within Enugu have been classified as urban areas. The procedures for obtaining access to land, water rights, construction permits, and environmental approvals are clearly established and available to private sector actors. However, they are not consolidated into a single document. Different laws assign specific institutions responsible for issuing each relevant permit and authorisation.
System planning	The national grid code adopted by the Enugu Electricity Regulatory Commission (EERC) offers a solid framework for electricity system planning in the state. It outlines a clear structure for planning activities across the entire electricity value chain and provides a basis for strong regulatory oversight. However, since an Independent System Operator (ISO) has not yet been established in Enugu despite the recognition of an ISO in the market design, there remains a lack of clarity regarding the entity responsible for network infrastructure planning, particularly concerning the transmission network.

Grid code	The National Grid Code, adopted by the EERC, defines system operation rules and grid connection rules, including rules on dispatch and ancillary services provision. The Grid Code is publicly accessible on the EERC website.
Grid Access	The National Grid Code adopted by EERC defines the procedure that grid users must follow to submit a Connection Application to enter into Connection Agreements. All connection rules and allocation of connection costs are governed by the Grid Code, providing clarity on grid access.
Access to Data	EERC provides its website with its regulations, codes, orders, and guidelines. However, other basic electricity market data and documents, such as PPAs, are not readily available, thus reducing the transparency and accessibility of relevant market data. Addressing data accessibility gaps will further improve market transparency to private actors.
System quality and standards	The National Grid Code adopted by EERC and other EERC regulations, provide clear guidance on the quality and security standards for planning and operating the network infrastructure.

Table 4:Readiness Dimension

Enugu's electricity market demonstrates strong investment potential, with a solid regulatory framework, entry of IPPs backed by long-term PPAs, and a wide range of business incentives. The lack of transparency around PPAs, uncertainty over tariff cost-reflectivity, limited access to data and the absence of sector-specific incentives pose challenges to full market attractiveness. However, it is well-positioned and shows strong progress toward meeting key investor requirements.

Main Findings / Strengths

Comprehensive Legal and Policy Framework	Enugu has enacted the 2023 Electricity Law and a supporting State Electricity Policy, which provide clear policy priorities and strategic direction for the energy sector. The framework encourages competition, private sector participation, off-grid electrification, and renewable energy deployment.
Support for Power Generation and Distribution	The legal and policy framework explicitly promotes generation and distribution activities, including the entry of Independent Power Producers (IPPs) with long-term PPAs to enhance competition and improve access.
Renewable Energy Integration	The State Electricity Policy sets quantitative targets for renewable energy. The state's electricity policy sets an ambitious target to achieve a generation capacity of 690 MW by 2030, with 20% of this capacity to be derived from renewable energy sources. While and offers

Incentives	General investment incentives that apply to clean energy technologies and power sector companies (e.g., tax holidays, VAT exemptions, and pioneer status incentives).
Private Sector Involvement and Market Structure	The market is structured for private sector-driven participation, with multiple off-take routes (centralised PPAs, private PPAs, and self-generation). Competitive procurement mechanisms are being established to ensure transparent and efficient supplier selection.
Electricity Access and Decentralisation	Strong focus on decentralised electricity models, including support for off-grid solutions in underserved areas. The policy reflects global best practices by promoting localised generation and distribution models.
Regulatory Oversight and Investor-Friendly Environment	The EERC has clear authority over tariff setting and enforcement, with oversight of contracts, procurement, and market conduct. Enugu is considered one of Nigeria's most competitive states for doing business (ranked 3rd in ease of starting a business).

Table 5:Summary of Key Findings and Strengths

Gaps / Limitations

This section outlines the main gaps and limitations identified in Enugu State's electricity market policy and regulatory framework. It highlights areas requiring further clarity, institutional development, and implementation to ensure a fully functional, inclusive, and investor-ready electricity market.

Lack of Transmission Market Clarity	Transmission is treated as a future option, the absence of well-defined arrangements for establishing an Independent System Operator (ISO) or clear ownership/management of existing infrastructure.
Tariff Cost-Reflectivity Unclear	Although a regulatory framework for tariff setting exists, there is no confirmation that current tariffs are cost-reflective, which may limit long-term investment viability and raise questions around affordability or subsidies.
Non-Specific Investment Incentives	Incentives offered are broad-based (covering all sectors) and not tailored to the electricity sector needs, particularly for renewable energy and rural electrification.
Inadequate Transparency of Market Data	Key documents like Power Purchase Agreements (PPAs) are not publicly disclosed, reducing market transparency and investor confidence.

Table 6: Summary of Gaps

2.2 Current Market Instruments and their Impact

The EERC has issued a set of market instruments to guide the development and regulation of the State Electricity Market. This section reviews the impact of these market instruments, focusing on their purpose and alignment with investment readiness.

Regulation	Strengths	Weaknesses	Recommendations
Captive Power Generation	Provides clarity on licensing requirements for captive generation >3MWh/day Recognises the need for surplus power sale	Excludes systems with a capacity below 3MWh/day, thereby limiting the inclusion of smaller actors. Lacks operational guidance for surplus power sales.	Provide registration guidelines for small-scale captive generation.
Licensing Regulations	Covers licenses for the entire electricity value chain, including integrated utilities and retail licenses. Provides clear application forms and procedures.	No clear provisions for license reviews or dispute resolution.	Conduct periodic license reviews every 2-3 years.
Customer Service Standards	Introduces enforceable customer service standards. Applies to all licensees, including mini-grid operators.	No investor protection against theft or non-payment. Enforcement mechanisms and penalties are still untested.	Develop energy theft protection mechanisms.
Tariff Methodologies Regulations	Adopts cost-reflective principles. Includes transparent methodology and revenue requirement structure.	No formal lifeline provisions. Limited guidance for setting off-grid or cooperative tariffs.	Incorporate lifeline & affordability tools.

Table 7: Regulatory Framework Assessment-Strengths, Weaknesses, and Recommendations

2.2.1 Other Market Instruments

In addition to its state-issued regulations, the EERC has adopted key regulatory instruments from the Nigerian Electricity Regulatory Commission (NERC), the national regulator for the Nigerian Electricity Supply Industry (NESI). These include:

- The Grid Code for the Nigerian Electricity Transmission System governs the transmission system's planning, development, operation, and maintenance.
- The Nigerian Electricity Health and Safety Standards Manual sets minimum safety requirements for all market participants.
- Wholesale Electricity Market Rules guide the operation of the electricity market, including dispatch, settlement, and scheduling.
- Uniform System of Accounts (USoA) – ensures consistent financial reporting and cost allocation across licensees.
- Tariff Models for the Generation, Distribution and Retail segments determine how electricity prices are calculated and approved by EERC.

EERC enhances regulatory coherence by integrating state and national instruments, ensuring market participants' compatibility. It also promotes investor confidence by applying established frameworks, which, combined with Enugu's state-specific instruments, provide a comprehensive regulatory foundation for a reliable, investable, and coordinated electricity market.

2.2.2 Impact of the Market Instruments

The effectiveness of the market instruments issued by EERC is measured by how conducive they are to attract investment and achieve the State's electrification goals. The following key market themes are used to assess their impact on the broader market:

Market Entry & Participation: EERC's regulations have clarified pathways for participation across the electricity value chain. These instruments provide certainty and outline requirements for new actors, including private retail suppliers, captive generators and other value chain players.
EERC has issued one interim electricity distribution license and two generation licenses to date. This marks a significant milestone in operationalising the state electricity market, signalling the functionality of the licensing framework. It also provides proof of concept for potential market participants and helps validate EERC's institutional readiness. However, limited provisions for mini-grids may constrain participation by distributed energy resources (DER) developers. The absence of permitting guidelines for this segment creates ambiguity for smaller, community-based, or renewable energy developers aiming to operate under the new market structure. Further enhancements in regulatory clarity and support structures are needed to encourage a more inclusive set of market participants.

Investment Friendliness: The regulations have improved the legal certainty and transparency necessary to attract private investment. Establishing cost-reflective tariff principles and a transparent licensing regime enhances predictability, which is a critical factor for building investor confidence and attracting long-term capital. These instruments reflect global good practices and clarify regulatory processes, helping to mitigate investment risk and improve the bankability of electricity projects in the state.

However, the absence of enforceable frameworks to mitigate non-technical losses (e.g., energy theft) and the limited regulatory reach over off-grid operators may constrain confidence among potential investors in decentralised energy solutions. Furthermore, mechanisms to ensure affordability for low-income consumers remain underdeveloped, which could impact the long-term sustainability of demand.

Consumer Protection & Inclusiveness: EERC has taken commendable steps to institutionalise customer rights and service standards through its Customer Service Standards and Protection Regulation. These provisions establish a baseline for reliability, transparency, and redress, which are essential for consumer trust and long-term sector growth. The regulation's applicability to all licensees reflects an inclusive approach to consumer protection. Enforcing these provisions consistently will ensure that all electricity consumers receive a standard level of service.

To build on this progress, introducing a social tariff or lifeline tariff framework will be essential to ensure affordability for low-income households. Such measures, alongside effective consumer education and proactive complaint resolution, can enhance inclusivity and protect vulnerable customers as the market evolves.

Implementation & Enforcement Capacity: EERC has demonstrated institutional readiness by issuing multiple licenses, operationalising its licensing framework, and developing key market instruments. These early milestones are critical signals of the Commission's operational capabilities and regulatory maturity. To ensure sustained success, continued capacity building will be essential. This includes equipping the Commission to undertake technical tariff reviews, manage data-intensive processes, and coordinate effectively with market participants. Building performance monitoring systems and refining enforcement protocols will also enable EERC to adapt dynamically to emerging market needs.
Overall, the Commission's progress to date reflects a strong platform that, with strategic support and stakeholder collaboration, can evolve into a best-practice model for sub-national electricity regulation.

2.2.3 Strategic Policy Recommendations

The table below summarises key gaps identified and corresponding regulatory recommendations to enhance the Enugu State Electricity Market framework.

Area	Key Gap Identified	Recommendations
Market Entry & Participation	No permitting framework for mini-grids. Ambiguity around small-scale captive power (<3MWh/day)	Adopt or adapt NERC's Mini-Grid Regulations as an interim framework. Develop a registration process or exemption guidelines for small-scale captive generation.
Investment Friendliness	No clear tools for investor revenue protection (e.g., energy theft)	Introduce Electricity Offences and Enforcement Regulations to deter theft and protect revenues
Consumer Protection & Inclusiveness	Lack of lifeline/social tariffs for low-income households	Introduce social tariff or lifeline tariff guidelines to ensure affordability
Implementation & Enforcement Capacity	Limited enforcement of service standards and penalties. No real-time performance tracking	Build technical capacity for monitoring, enforcement, and periodic performance reviews. Establish performance monitoring and data systems for licensee reporting and benchmarking.

Table 8: Summary of Identified Gaps and Recommendations

The current market instruments form a solid Enugu State Electricity Market foundation, aligning with global regulatory norms and the state's electrification objectives. Developing complementary regulations, particularly in decentralised energy, revenue protection, and affordability, is crucial to maximise their impact. It is important for EERC to monitor the utilisation and uptake of these regulations by market actors, as this can help identify areas where there is limited investor interest. Such insights could help identify regulatory bottlenecks, investor hesitation, or procedural burdens that may not be immediately visible through compliance audits alone.

Establishing mechanisms for continuous feedback and regulatory iteration, informed by investor behaviour, consumer responses, and market dynamics, will be key to ensuring that the Enugu State electricity market evolves in an investment-ready and inclusive way.

2.3 Enabling Policies from MDAs

Aside from EERC, other MDAs in Enugu State have developed or implemented frameworks and guidelines that support the electricity market. These include:

1. Enugu State Electrification Agency focuses on expanding electricity access, particularly in rural and underserved areas. The Agency is mandated to develop the State Electrification Strategy and Plan, and to submit quarterly progress reports to the Governor detailing electrification efforts, fund utilisation, and renewable energy deployment in unserved and underserved areas. However, no specific renewable energy targets or performance accountability measures have been assigned to the Agency. A practical solution would be introducing a policy directive establishing clear, measurable, and time-bound renewable energy targets for the Agency. These targets should be linked to performance-based budgeting, ensuring the agency receives full funding only upon demonstrating progress. Additionally, annual independent audits of renewable energy deployment should be conducted, with the results published publicly to enhance transparency and accountability.

2. The Ministry of Lands and Urban Development facilitates land access for electricity infrastructure. Its specific policies and guidelines include:

   Land Use Act (1978): Enforces the federal Land Use Act, vesting land ownership in the governor, who grants rights of occupancy for electricity projects like power plants, substations, and transmission lines.

   Enugu State Properties Protection Law (2024): Prevents land grabbing by ensuring that valid titleholders can claim ownership, reducing disputes, and facilitating land access for energy projects.

   Enugu State Land Use Regulation (2025): Introduces transparent procedures for land searches, title applications, and issuance of Certificates of Occupancy, minimizing corruption and hidden charges to streamline land acquisition for electricity infrastructure.

   Executive Order on Urban Area Designation (2025): Designates key areas as urban zones, simplifying land administration in rapidly developing regions to support electricity infrastructure deployment. Other relevant laws include: The Nigerian Urban and Regional Planning Law, The Enugu Geographic Information Systems (ENGIS) Law and The New Enugu City Law.

3. Enugu State Investment Development Authority offers incentives and

encourages public-private partnerships for renewable energy and grid expansion projects, creating a conducive business environment for electricity market growth. Its specific guidelines include:

SABER FY-2024 (State Action on Business Enabling Reforms): SABER FY-2024 is Enugu State's drive to improve the business climate by cutting red tape and streamlining approvals. It boosts the electricity market by making it easier for investors to secure land, permits, and partnerships for power projects.

BERAP (Business-Enabling Reform Action Plan): BERAP outlines clear, time-bound reforms that remove barriers to business. It directly supports Enugu's electricity sector by fast-tracking infrastructure approvals, simplifying land access, and attracting private investment.

These guidelines require state MDAs to clearly state and keep up to date with the formal process through which businesses are required to interact with the MDA in order to comply with a particular regulatory requirement. This will include grievance redress mechanism, information on fees, procedures and service delivery timelines related to a business regulatory process and publish same on the state website.

4. Other Supporting MDAs
   Ministry of Environment and Climate: The Enugu State Environmental and Climate Protection Law 2024 supports the state's electricity market by setting environmental standards for electricity infrastructure and encouraging eco-friendly practices.

Enugu State Waste Management Authority: The Enugu State Waste Management Authority (ESWAMA) Law (No. 8), 2004, primarily governs waste management but indirectly supports the electricity market by enabling waste-to-energy initiatives through its mandate to promote resource recovery and environmental sustainability.
Ministry of Water Resources: The Enugu State Water, Sanitation, and Hygiene (WASH) Policy 2025 focuses on improving water, sanitation, and hygiene services; it does not explicitly address or promote hydropower. The WASH Policy should be updated to include small and mini-hydropower development provisions, leveraging water infrastructure to enhance energy access and promote the synergy of the water–energy sector.

2.4 Way Forward

The review of Enugu State's electricity market design confirms the state's potential to build a decentralised, investor-friendly power sector rooted in strong regulatory foundations. Enugu has demonstrated both political will and institutional readiness to develop a modern electricity market aligned with its broader development goals.

Early achievements such as transparent licensing processes, private sector engagement, and the localisation of electricity distribution reflect meaningful progress toward a functional market. However, critical gaps remain.

As Enugu continues its electricity sector reforms, the focus must shift to deepening regulatory capacity, strengthening institutional coordination, and setting measurable performance targets. Priority should also be given to implementing the recommendations and action plans outlined in this chapter.

03

CUSTOMER CLUSTERISATION FOR INCREASED ELECTRICITY PENETRATION

The Enugu State customer clusterisation utilised a data-driven approach to segment electricity consumers in Enugu State using feeder performance data from Main Power Electricity Distribution Company (MPEDC), an Enugu Electricity Distribution Company (EEDC) subsidiary.

Aligning with the Enugu Electricity Regulatory Commission's (EERC) policies requires tackling performance gaps and infrastructure challenges. This involves engaging stakeholders, collecting data, conducting cluster analysis, and assessing infrastructure to create a comprehensive strategy for sustainable electrification.

3.1 Stakeholder Consultation and Data Gathering

Accurate, comprehensive data is essential for assessing feeder performance, understanding consumer needs, and designing interventions aligned with Enugu State's goal of expanding electricity access while meeting regulatory standards. MPEDC provided three years of feeder performance and consumer data for Enugu State's distribution network. Stakeholder consultations ensured alignment with the Enugu State Electricity Priority Plan, focusing on data quality, completeness, and relevance. Data from feeder logs, billing records, availability records, and energy sales were validated using industry best practices, yielding key metrics on technical performance, commercial efficiency, and consumer demographics to inform electrification analysis.

3.2 Cluster Analysis and Classification

Cluster Analysis

I. The cluster analysis groups Enugu State's distribution feeders by performance metrics and consumer characteristics to identify operational strengths and weaknesses, enabling targeted resource allocation to underperforming feeders and supporting more efficient electricity distribution and access.

Enugu State's distribution network is categorised by customer profile into:

I. 9 commercial feeders such as Coca-Cola 33kV, Kingsway Line 1 and 2 serving commercial hubs.
II. 3 industrial feeders, including Emene Industrial 1 and 2, 33kV, Nike Lake 11kV, serving manufacturing areas.
III. 9 rural feeders including NTA 11kV, Hill Top 33kV, Amechi 33kV serving remote areas.
IV. 3 semi-urban feeders such as Amaorji 11kV, Emene 11kV, Ugwogo 33kV serving mixed customer bases.
V. 39 urban feeders such as Chime Avenue 11kV, Golf 11kV, Government House 11kV serving urban locations.

Performance Metrics

Performance metrics are essential for evaluating the reliability, efficiency, quality, and economic performance of Enugu State's electricity distribution network, helping MPEDC and the Enugu Electricity Regulatory Commission monitor operations and improve service.

i. **Collection Efficiency:** Collection efficiency compares the revenue collected to the amount billed. High performers include New Haven 11kV (97.1%), Government House 33kV (93.6%), and Emene Industrial 1 33kV (92.5%). Poor performers include GRA Enugu 11kV (12%) and Independence Layout 33kV (53.4%). Outliers like Oji Waterworks (330%) and Oji River Township 11kV (267.3%) exceed 100%, suggesting data, billing anomalies or other issues.

ii. **Billing Efficiency:** Billing efficiency compares the billed Energy to the

received Energy. The average billing efficiency is unusually high at 156.8%, pointing to possible billing errors. Feeders near 100% include Independence Layout 33kV (96.8%), UNN 11kV (92.9%), and Oji Urban 11kV (97%). Low performers include Eha-Amufu 33kV (49.2%), Township Nsukka 11kV (51.5%), and New Haven 11kV (52.4%). Outliers like Nowas 11kV (234%), Golf 11kV (249%), and GRA Enugu 11kV (164%) require investigation for possible metering or billing errors.

iii. **T&D Loss:** Transmission and distribution (T&D) loss represents the loss of Energy between supply and consumer consumption. These losses include technical losses like heat in wires and commercial losses such as energy theft or unbilled energy usage. Feeders such as Udi 33kV (-166%), Golf 11kV (-149%) and Government House 11kV (-23%) recorded negative values, highlighting data reporting challenges.

iv. **ATC&C Loss:** ATC&C loss represents financial loss from technical and commercial inefficiencies. The average ATC&C loss is (–44.2%), with feeders like Oji Waterworks 33kV (–292.3%), Golf 11kV (–150%), and Udi 33kV (–180%) showing negative losses due to billing and collection errors. Addressing metering, theft, and illegal connections can reduce these losses.

v. **Metering Density:** Metering density indicates the share of customers with working meters, with an average of 60.3%. Fully metered feeders include Kingsway Line 2 33kV, Trans Ekulu 33kV, and Oji Waterworks 33kV. Low metered feeders include Udi 33kV (25%), Orba Nsukka, Top Land 11kV (43.5%), and Oji Urban 11kV (34.7%). Expanding meter coverage and checking for bypasses are critical to improving billing and loss metrics.

vi. **Feeder Percentage Loading:** Feeder percentage loading represents how close a feeder is to its capacity limit. Twenty-two feeders exceed 80% loading, seven at 33kV and fifteen at 11kV. These include Kingsway Line 1, Independence Layout, Prisons, Nowas, Maryland, and UNEC. Overloading feeders risks outages and equipment damage, and can be resolved through network upgrades or load redistribution solutions.

Data Quality Assurance

Data quality assurance ensures data is accurate, complete, consistent, and reliable for informed decision-making. It is critical for addressing anomalies in performance metrics such as billing efficiency, ATC&C loss, T&D loss, and collection efficiency, often caused by meter malfunctions, manual entry errors, or billing system issues. To improve data quality, the following measures are proposed:

i. Regular audits of billing and collection records to detect errors.
ii. Automated checks to flag values outside expected ranges.
iii. Routine meter calibration, particularly for outlier feeders like Nowas 11kV and Oji Waterworks 33kV.
iv. Staff training on accurate data recording and error identification.
v. These steps will enhance data reliability for feeder performance analysis, infrastructure planning, and monitoring.

Cluster Classification

Cluster classification groups Enugu State's distribution feeders into Categories A to D based on shared performance metrics: T&D loss, collection loss, ATC&C loss, and metering density. This approach enables targeted interventions to optimise the network, with Category A representing the best performance and Category D the worst.

i. **Category A:** Feeders with T&D loss <12%, collection loss <12%, ATC&C loss <35%, and metering density >60%.

These are high-performing, efficient, and profitable. Examples include Kingsway Line 1 33kV, Trans Ekulu 33kV, and UNN 11kV (partially meeting criteria). Recommendations: sustain performance through increased metering, regular maintenance, and deloading overloaded feeders.

ii. **Category B:** T&D loss 12–15%, collection loss 12–15%, ATC&C loss 35–50%, metering density 45–60%. These feeders are moderately performing and close to Category A. Examples: Onuiyi 11kV and Ugwuoye 11kV (partially meeting criteria).

Recommendations: deploy smart meters, enhance collection strategies, and adopt best practices from Category A.

iii. **Category C:** T&D loss 15–25%, collection loss 15–25%, ATC&C loss 50–65%, metering density 20–45%. These suffer high losses due to low metering and poor bill collection. Examples: Top Land 11kV and Orba Nsukka 33kV (partially meeting criteria). Recommendations: expand metering, strengthen collections, and increase energy theft monitoring.

iv. **Category D:** T&D loss >25% (up to 40%), collection loss >25% (up to 40%), ATC&C loss >65%, and metering density <20%. No feeders currently fall into this category, but it highlights the potential consequences of inaction and underscores the need for timely interventions in lower-performing categories.

Feeder Category	T&D Loss	Collection Loss	ATC&C Loss	Metering Density
Category A	Less than 12%	Less than 12%	Less than 35%	Greater than 60%
Category B	Greater than 12% but less than 15%	Greater than 12% but less than 15%	Greater than 35% but less than 50%	Less than 60% but greater than 45%
Category C	Greater than 15% but less than 25%	Greater than 15% but less than 25%	Greater than 50% but less than 65%	Less than 45% but greater than 20%
Category D	Greater than 25% but less than 40%	Greater than 25% but less than 40%	Greater than 65%	Less than 20%

Table 9: Feeder Category Classification

3.1 Energy Infrastructure Gaps and Recommendations

Energy demand assessment evaluates customer energy consumption and whether the existing infrastructure can meet that demand. It is essential to ensure a reliable supply, plan for future needs, reduce repair costs, and inform feeder cluster classification.

Infrastructure Gaps

Infrastructure gaps arise when the network cannot support current demand, leading to system overload when many customers use power simultaneously.

1. **Grid Overload:** Grid overload occurs when feeders carry more power than their design capacity, risking outages, equipment damage, and revenue

loss. Overloaded 33kV feeders include Kingsway Line 1 (20.16MW), Kingsway Line 2 (20.16MW), Independence Layout (18.8MW), Thinkers Corner (18.48MW), and UNN (18.6MW), all exceeding the standard 18MW limit. Overloaded 11kV feeders include Prisons (6.26MW), New Haven (5.25MW), and Maryland (5.71MW), surpassing the typical 6MW capacity.

S/N	Feeder Name	Annual Peak Load (MW)	Feeder Loading Status
1	KINGSWAY LINE 2, 33KV	20.16	OVERLOADED
2	PRISONS 11KV	6.26	OVERLOADED
3	NOWAS 11KV	6.35	OVERLOADED
4	AMECHI 33KV	15.42	OVERLOADED
5	GARIKI EAST 11KV	7.41	OVERLOADED
6	ARMY AWKUNANAW 11KV	6.07	OVERLOADED
7	SATELLITE 11KV	4.88	OVERLOADED
8	UGWUAJI GARIKKI 33KV	17.64	OVERLOADED
9	INDEPENDENCE LAYOUT 33KV	18.8	OVERLOADED
10	NEW HAVEN 11KV	5.25	OVERLOADED
11	UNEC 11KV	7.15	OVERLOADED
12	MARYLAND 11KV	5.71	OVERLOADED
13	KINGSWAY LINE 1, 33KV	20.16	OVERLOADED
14	COAL CAMP 11KV	5.41	OVERLOADED
15	THINKERS CORNER 33KV	18.48	OVERLOADED
16	EMENE 1, 11KV	6.34	OVERLOADED
17	ABAKPA 2, 11KV	6	OVERLOADED
18	ABAKPA 1, 11KV	7.07	OVERLOADED
19	UNN 33KV	18.6	OVERLOADED
20	ONUIYI 11KV	5.33	OVERLOADED
21	UNN 11KV	4.9	OVERLOADED
22	CHIME AVENUE 11KV	6.19	OVERLOADED

Table 10: Overloaded Grid Feeders

2. **Feeder Intervention:** Feeder Intervention is is needed when a 33kV feeder cannot supply sufficient power to its connected 11kV lines due to constraints like undersized wires, circuit breaker issues, meter faults, or transformer limits. These constraints affect MPEDC's ability to deliver power reliably. Feeders requiring intervention include Trans Ekulu (12.55MW), UNN (18.6MW), and New Haven (5.35MW).

Feeder Name	Annual Peak Load (MW)	Concurrent Feeder Peak Check
KINGSWAY LINE 2, 33KV	20.16	NEEDS INTERVENTION
TRANS EKULU 33KV	12.55	NEEDS INTERVENTION
UGWOGO 33KV	9.36	NEEDS INTERVENTION
ITUKU OZALLA 33KV	3.37	NEEDS INTERVENTION
INDEPENDENCE LAYOUT 33KV	18.8	NEEDS INTERVENTION
KINGSWAY LINE 1, 33KV	20.16	NEEDS INTERVENTION
THINKERS CORNER 33KV	18.48	NEEDS INTERVENTION
UNN 33KV	18.6	NEEDS INTERVENTION
NEW HAVEN 33KV	5.35	NEEDS INTERVENTION

Table 11: Grid Feeders for Intervention

Recommendations

Grid Overload Solutions

i. New Feeder Construction: Overloaded 33kV feeders, such as Kingsway Line 1 (20.16MW), Kingsway Line 2 (20.16MW), Independence Layout (18.8MW), Thinkers Corner (18.48MW), and UNN (18.6MW), exceed the standard 18MW capacity and require new 33kV feeders. A feasibility study is needed to determine optimal routes and whether distribution transformers should be relocated.

ii. Load Balancing and Reconfiguration: In the short term, reconfiguring the network can reduce load on overloaded feeders. For example, portions of Prisons 11kV (6.26MW) can be transferred to underutilised feeders like Onitsha Road 11kV (3.56MW) and Golf 11kV (3.01MW).

Feeder Intervention Measures

i. Detailed Assessment: Feeders such as Trans Ekulu (12.55MW), UNN (18.6MW), and New Haven (5.35MW) require thorough evaluation to identify root causes of constraints, including transformer limitations, meter malfunctions, circuit breaker issues, and undersized conductors.

ii. Targeted Network Upgrade: Based on assessment findings, upgrades may include installing smart meters to enhance load monitoring and billing accuracy; replacing undersized transformers to boost capacity; upgrading circuit breakers to modern, adjustable types to reduce outages; and reconductoring with higher-capacity cables where conductor size is a limiting factor.

Transmission Station	Feeder Name	Annual Peak Load (MW)	Intervention
NEW HAVEN	KINGSWAY LINE 2, 33KV	20.16	CONSTRUCTION OF NEW KINGSWAY LINE 3, 33KV TO RELIEVE OVERLOADED FEEDERS.
	KINGSWAY LINE 1, 33KV	20.16	
NEW HAVEN	THINKERS CORNER 33KV	18.48	CONSTRUCTION OF THINKERS CORNER 2, 33KV TO RELIEVE OVERLOADED FEEDER.
NEW HAVEN	TRANS EKULU 33KV	12.55	(I) INVESTIGATION OF METER FUNCTIONALITY THROUGH AUDIT CHECKS (II) PROPER ALIGNMENT OF FEEDER DISTRIBUTION TRANSFORMERS AND CUSTOMERS
NEW HAVEN	UGWOGO 33KV	9.36	(I) INVESTIGATION OF METER FUNCTIONALITY THROUGH AUDIT CHECKS (II) PROPER ALIGNMENT OF FEEDER DISTRIBUTION TRANSFORMERS AND CUSTOMERS
NEW HAVEN	ITUKU OZALLA 33KV	3.37	UTILISING EXISTING GARIKI WEST 11KV FEEDER TO RELIEVE GARIKI EAST 11KV AND ARMY AWKUNANAW 11KV FEEDERS
NEW HAVEN	INDEPENDENCE LAYOUT 33KV	18.8	(I) PROVIDE FEEDER RELIEF TO INDEPENDENCE LAYOUT 33KV BY MOVING NEW HAVEN 33KV AND PRESIDENTIAL 11KV FEEDERS TO GOVERNMENT HOUSE 33KV DUE TO PROXIMITY. (II) CONSTRUCTION OF A NEW 11KV FEEDER TO RELIEVE MARYLAND 11KV AND UNEC 11KV FEEDER
NRU	UNN 33KV	18.6	(I) UPGRADING 30MVA TRANSMISSION CAPACITY TO 60MVA (II) CONSTRUCTING NEW UNN 2, 33KV FEEDER TO RELIEVE OVERLOADED UNN 33KV FEEDER.
NEW HAVEN	NEW HAVEN 33KV	5.35	(I) INVESTIGATION OF METER FUNCTIONALITY THROUGH AUDIT CHECKS (II) PROPER ALIGNMENT OF FEEDER DISTRIBUTION TRANSFORMERS AND CUSTOMERS

Table 12: Feeder Interventions and Upgrade

04

LOAD DEMAND PLANNING IN ENUGU STATE

4.1. The Electricity Supply in Enugu State

The Main Power Electricity Distribution Company (MPEDC), a subsidiary of the Enugu Electricity Distribution Company (EEDC), is one of Nigeria's 13 Distribution Companies (DISCOs) and serves all 17 LGAs in Enugu State. EEDC also supplies power to parts of Anambra, Ebonyi, Imo, and Abia States. Electricity is generated outside Enugu State, transmitted via the national grid operated by the Transmission Company of Nigeria (TCN), and delivered to five transformation (sub)stations within Enugu State as of April 30, 2025. MPEDC distributes this power through 11 kV and 33 kV feeders. Additionally, the Ezillo 33 kV feeder from Nkalagu supplies customers in Ebonyi State.

4.2. Electricity Customers and Consumption

As of 2023, Enugu State had 197,496 electricity customers and a total annual energy consumption of 940.76 GWh. Historically, customers were billed under five tariff classes (residential, commercial, industrial, special, street lighting), further subdivided by connection type and voltage. Since September 1, 2020, the Nigerian Electricity Regulatory Commission (NERC) implemented a service-level-based tariff system with six bands based on daily supply duration:

- Lifeline: for low-consumption residential users only
- Bands A–E: for all customer categories, with minimum daily supply of 20, 16, 12, 8, and 4 hours, respectively

Band A includes four tariff classes (non-MD, MD1, MD2, Bilateral), while Bands B–E include three (non-MD, MD1, MD2), differentiated by connection type and voltage level.

4.3. Distribution System

MPEDC distributes electricity across Enugu State via 11 kV and 33 kV feeders from five transformation stations as of April 30, 2025. The system also supports cross-border supply to Ebonyi State through the Ezillo 33 kV feeder.

4.4. The Grid System

Enugu State's transmission infrastructure as of April 30, 2025, includes:

- One 330 kV transmission circuit (originating outside the State)
- Four 132 kV transmission circuits (all single circuit)
- One 330/132/33 kV transformer station that supplies other substations and directly feeds MPEDC's 33 kV network
- Four 132/33 kV transformer stations that directly supply MPEDC's 33 kV feeders

4.5. Load Demand Forecast

The load forecast covers only grid-connected customers served by the Main Power Electricity Distribution Company (MPEDC) in Enugu State. Off-grid systems (mini-grids, solar home systems) are excluded unless connected to the grid within the planning horizon (2024–2044). The forecast is based on energy sales data by customer class (Residential, Commercial, Industrial, Special, Street Lighting). It applies a consistent methodology across three scenarios: low, most likely, and high growth.

i. Residential Class: Forecast accounts for organic customer growth and a planned massive grid connection program. Grid access is projected to rise from approximately 35% in 2023 to 65–75% by 2044 (depending on scenario), with remaining households served off-grid. Energy sales per household are considered to have a 20% load suppression rate in 2023, which is removed from the forecast to reflect actual (unsuppressed) demand.

ii. Industrial & Commercial Classes: Forecasts use GDP-driven customer growth and energy sales per customer. Self-generation switching to the grid was considered in the methodology but excluded due to a lack of data.

iii. Special & Street Lighting Classes: Projected using customer growth and per-customer energy use, adjusted for load suppression.

iv. Energy received from TCN transformation stations:

$$Energy\ Received = \frac{Energy\ Sales}{1 - Distribution\ Loss}$$

v. Energy produced by power plants:

$$Energy\ Produced = \frac{Energy\ Received}{1 - Transmission\ Loss}$$

vi. System peak demand:

$$Peak\ Demand\ (MW) = \frac{Total\ Energy\ Produced\ (GWh)}{Load\ Factor * 8.76}$$

Key Assumptions and Parameters

i. Study area: MPEDC's service territory in Enugu State (17 LGAs).
ii. Reference year: 2023
iii. Base year: 2024
iv. Planning horizon: 2024–2044.
v. Household size: 4 persons.
vi. 2023 grid access: Approximately 35% of households.
vii. Load suppression rate: 20% in 2023, based on 2016 measurements.
viii. Loss assumptions:

- Distribution loss: 28% in 2024, declining by 2% annually and stopping at 12.5%.
- Transmission loss: 7.0% in 2024, declining by 0.25% annually to 6.5%.
- Load factor: Starts at 38%, increasing by 0.5% yearly.

Long-Term Load Forecast Results

Most Likely Scenario (2024 – 2044)

i. Total energy sales growth from 646 GWh (2024) to 2,571 GWh (2044).
ii. By 2044:

- Residential: 1,560.16 GWh
- Commercial: 566.92 GWh
- Industrial: 278.07 GWh
- Special: 161.36 GWh
- Street Lighting: 4.43 GWh

iii. Peak demand rises from 288 MW (2024) to 802 MW (2044).
iv. Total generation required: 3,142 GWh by 2044.
v. Distribution losses: 367 GWh; Transmission losses: 204 GWh.

Energy Data Projection Table (2023 - 2044)

Year	Sales (GWh)	Distribution Losses		DISCO (GWh)	Transmission Losses		Generation (GWh)	Load Factor (%)	Peak (MW)
		(%)	(GWh)		(%)	(GWh)			
2023	610.79	30.0	261.77	872.56	7.25	68.21	940.76	38.22	280.97
2024	646.12	28.0	251.27	897.38	7.0	67.55	964.93	38.22	288.18
2025	689.9	26.0	232.91	932.29	7.0	70.17	1002.46	38.22	299.4
2026	737.54	24.0	232.91	970.45	6.75	70.25	1040.7	38.22	310.81
2027	789.13	22.0	222.57	1011.7	6.5	70.33	1082.03	38.22	323.16
2028	844.71	20.0	211.18	1055.88	6.5	73.4	1129.29	38.22	337.27
2029	904.29	18.0	198.5	1102.8	6.5	76.67	1179.46	38.22	352.26
2030	971.43	16.0	185.04	1156.47	6.5	80.41	1236.87	38.22	369.4
2031	1046.09	14.0	170.29	1216.38	6.5	84.56	1300.94	38.22	388.54
2032	1121.77	12.5	160.25	1282.02	6.5	89.12	1371.15	38.72	404.22
2033	1204.28	12.5	172.04	1376.32	6.5	95.68	1472.0	39.22	428.42
2034	1293.55	12.5	184.79	1478.35	6.5	102.77	1581.12	39.72	454.38
2035	1389.64	12.5	198.52	1588.16	6.5	110.41	1698.57	40.22	482.07
2036	1492.57	12.5	213.22	1705.79	6.5	118.58	1824.37	40.72	511.42
2037	1602.42	12.5	228.91	1831.34	6.5	127.31	1958.65	41.22	542.4
2038	1719.18	12.5	245.6	1964.78	6.5	136.59	2101.37	41.72	574.94
2039	1842.92	12.5	263.27	2106.2	6.5	146.42	2252.62	42.22	609.04
2040	1973.75	12.5	281.96	2255.71	6.5	156.81	2412.52	42.72	644.63
2041	2111.85	12.5	301.69	2413.55	6.5	167.79	2581.33	43.22	681.76
2042	2257.31	12.5	322.47	2579.78	6.5	179.34	2759.13	43.72	720.38
2043	2410.28	12.5	344.33	2754.61	6.5	191.5	2946.1	44.22	760.5
2044	2569.72	12.5	366.78	2938.22	6.5	204.26	3142.48	44.72	802.1
Times	3.98		1.46	3.27		3.02	3.26		2.78
Increase (%)	297.91		46.17	227.42		202.41	225.67		178.34

Table 13:Energy Production and System Peak – Most Likely Growth Scenario

High Growth Scenario (2024 – 2044)

I. Energy sales: 3,476 GWh by 2044
II. Peak demand: 1,085 MW
III. Total generation: 4,249 GWh

Year	Sales (GWh)	Distribution Losses		DISCO (GWh)	Transmission Losses		Generation (GWh)	Load Factor (%)	Peak (MW)
		(%)	(GWh)		(%)	(GWh)			
2023	610.79	30.0	261.77	872.56	7.25	68.21	940.76	38.22	280.97
2024	647.8	28.0	251.27	899.73	7.0	67.72	967.45	38.22	288.94
2025	704.49	26.0	247.92	952.01	7.0	71.66	1023.66	38.22	305.73
2026	767.95	24.0	242.51	1010.45	6.75	73.14	1083.6	38.22	323.63
2027	838.33	22.0	236.45	1074.78	6.5	74.72	1149.5	38.22	343.31
2028	915.89	20.0	228.97	1144.87	6.5	79.59	1224.46	38.22	365.7
2029	1000.72	18.0	219.67	1220.4	6.5	84.84	1305.24	38.22	389.82
2030	1095.97	16.0	208.76	1304.72	6.5	90.7	1395.43	38.22	416.76
2031	1201.65	14.0	195.62	1397.27	6.5	97.14	1494.4	38.22	446.36
2032	1310.88	12.5	187.27	1498.15	6.5	104.15	1602.3	38.72	472.36
2033	1430.15	12.5	204.31	1634.46	6.5	113.63	1748.08	39.22	508.77
2034	1559.51	12.5	222.79	1782.3	6.5	123.9	1906.21	39.72	547.81
2035	1699.27	12.5	242.75	1942.02	6.5	135.01	2077.03	40.22	589.48
2036	1849.58	12.5	264.23	2113.8	6.5	146.95	2260.75	40.72	633.74
2037	2010.86	12.5	287.27	2298.13	6.5	159.76	2457.89	41.22	680.65
2038	2183.41	12.5	311.92	2495.32	6.5	173.47	2668.8	41.72	730.2
2039	2367.51	12.5	338.22	2705.72	6.5	188.1	2893.82	42.22	782.39
2040	2563.59	12.5	366.23	2929.82	6.5	203.68	3133.5	42.72	837.27
2041	2772.09	12.5	396.01	3168.11	6.5	220.24	3388.35	43.22	894.9
2042	2993.38	12.5	426.93	3421.01	6.5	237.63	3658.83	43.72	955.28
2043	3228.03	12.5	461.15	3689.17	6.5	256.47	3945.64	44.22	1018.52
2044	3476.44	12.5	496.63	3973.08	6.5	276.2	4249.28	44.72	1084.64
Times	5.37		1.97	4.42		4.08	4.39		3.59
Increase (%)	436.65		97.14	341.59		307.85	339.23		275.39

Table 14: Energy Production and System Peak – High Growth Scenario

Low Growth Scenario (2024 – 2044)

I. Energy sales: 1,924 GWh by 2044
II. Peak demand: 600 MW
III. Total generation: 2,351 GWh

Year	Sales (GWh)	Distribution Losses		DISCO (GWh)	Transmission Losses		Generation (GWh)	Load Factor (%)	Peak (MW)
		(%)	(GWh)		(%)	(GWh)			
2023	610.79	30.00	261.77	872.56	7.25	68.21	940.76	38.22	280.97
2024	641.64	28.00	249.52	891.16	7.00	67.08	958.24	38.22	286.19
2025	674.00	26.00	236.81	910.81	7.00	68.56	979.36	38.22	292.50
2026	708.67	24.00	223.79	932.46	6.75	67.50	999.96	38.22	298.65
2027	745.82	22.00	210.36	956.18	6.50	66.47	1,022.65	38.22	305.42
2028	785.31	20.00	196.33	981.64	6.50	68.24	1,049.88	38.22	313.56
2029	827.23	18.00	181.59	1,008.81	6.50	70.13	1,078.94	38.22	322.24
2030	874.26	16.00	166.53	1,040.79	6.50	72.35	1,113.14	38.22	332.45
2031	926.38	14.00	150.81	1,077.18	6.50	74.88	1,152.07	38.22	344.08
2032	977.79	12.50	139.68	1,117.47	6.50	77.69	1,195.16	38.72	352.34
2033	1,033.70	12.50	147.67	1,181.38	6.50	82.13	1,263.50	39.22	367.74
2034	1,093.94	12.50	156.28	1,250.21	6.50	86.91	1,337.13	39.72	384.27
2035	1,158.41	12.50	165.49	1,323.90	6.50	92.04	1,415.94	40.22	401.86
2036	1,227.10	12.50	175.30	1,402.40	6.50	97.49	1,499.89	40.72	420.46
2037	1,299.96	12.50	185.71	1,485.67	6.50	103.28	1,588.95	41.22	440.02
2038	1,376.95	12.50	196.71	1,573.65	6.50	109.40	1,683.05	41.72	460.49
2039	1,457.93	12.50	208.28	1,666.20	6.50	115.83	1,782.04	42.22	481.80
2040	1,543.01	12.50	220.43	1,763.44	6.50	122.59	1,886.03	42.72	503.95
2041	1,632.11	12.50	233.16	1,865.27	6.50	129.67	1,994.94	43.22	526.88
2042	1,725.30	12.50	246.37	1,971.77	6.50	137.00	2,108.85	43.72	550.60
2043	1,822.52	12.50	260.36	2,082.88	6.50	144.80	2,227.68	44.22	575.05
2044	1,923.74	12.50	274.82	2,197.58	6.50	152.84	2,315.40	44.72	600.20
Times	3.00		1.10	2.47		2.28	2.45		
Increase (%)	199.82		10.14	146.71		127.86	145.39		109.72

Table 15: Energy Production and System Peak – Low Growth Scenario

Comparison of Scenarios (2044)

I. The high scenario is approximately 35% higher than the most likely, and the low scenario is approximately 25% lower than the most likely.
II. Peak demand multiplier: High is 3.8x 2024 peak, Most Likely 2.8×, and Low 2.0×.

Electricity Consumption Per Capita (Most Likely Scenario)

I. Energy consumption per capita in 2044 is 1.8× that of 2024.
II. Average annual growth in per capita consumption: 3.1% (range: 0.7%–4.5%).
III. Similar 1.8× per capita increase in high scenario (average growth: 4.1%), 1.5× in low scenario (average growth: 2.1%).

05

RENEWABLE ENERGY PLAN FOR ENUGU STATE

5.1 Nigeria's Energy Transition Goals

A deep-seated crisis defines Nigeria's energy sector. Inadequate infrastructure, financial constraints, and inconsistent policies have resulted in approximately 80 million people lacking access to electricity, undermining economic development and the quality of life across the nation. To address this, the Federal Government has established ambitious national targets.

- Nigeria Energy Transition Plan (ETP) aims for universal energy access by 2030 and net-zero emissions by 2060. Supporting this is the
- Renewable Energy Master Plan (REMP) targets increasing the share of renewable electricity in the national generation mix to 23% by 2025 and 36% by 2030.

5.2 Enugu State's Regulatory Framework

While facing the same systemic challenges as the rest of the country, Enugu State has taken decisive and independent steps to forge its path toward energy sustainability. The State has become a first-mover in leveraging the 2023 constitutional amendment that removed restrictions on state-level involvement in electricity generation, transmission, and distribution.

This newfound regulatory autonomy has been swiftly operationalised through several key actions:

1. Enactment of State Electricity Law: Enugu promptly developed its legal framework to regulate an intra-state electricity market, empowering it to manage its energy future comprehensively.
2. Establishment of the EERC: The creation of the Enugu State Electricity Regulatory Commission provides a dedicated, independent body to oversee the sector, attract investment, and issue licenses for power generation and distribution.
3. Strategic Partnerships: The EERC actively engages with key partners, such as GIZ's Nigerian Energy Support Programme (NESP), to explore and implement renewable energy projects, particularly for rural and underserved communities.

Enugu State has laid the essential groundwork to attract private investment and execute its transformative energy vision by creating a stable and predictable regulatory environment, setting a new standard for subnational governance in Nigeria's power sector.

5.3 Enugu State's Renewable Energy Policies and Targets

Enugu State's commitment to a sustainable energy future is anchored by two complementary, forward-thinking policies that provide a clear and ambitious framework for its energy transition.

Enugu State Climate Policy and Action Plan (ESCPAP)

Approved in January 2025, the ESCPAP is a landmark policy, making Enugu the first subnational government in Nigeria to adopt a long-term, data-driven climate strategy. This comprehensive plan sets ambitious, multi-sectoral goals for 2060, demonstrating a long-term vision for decarbonisation and green growth.

Key ESCPAP Targets by 2060:

- **Energy:** Achieve 80% renewable energy usage across the State.
- **Transport:** Secure a 60% reduction in emissions from the transport sector.
- **Jobs:** Create 792,000 new jobs in renewable Energy, waste management, and reforestation.
- **Economic Growth:** Project a 25-fold increase in the State's GDP through sustained investments in green technology and sustainable agriculture.

Enugu State Electricity Policy 2023

This policy provides specific directives and measurable commitments to integrate renewable energy into the state's power mix. It translates the broad vision of the ESCPAP into concrete, near-term energy sector targets.

Key Electricity Policy Targets by 2030:

- **Generation Capacity:** Ensure that at least 20% of the State's 690MW target generation capacity is sourced from renewable Energy.
- **Universal Access:** Achieve universal access to a reliable electricity supply for all residents, focusing on unserved and underserved communities through distributed renewable energy solutions.
- **Economic Expansion:** Drive an increase in the State's GDP from $4.4 billion (2023) to $30 billion by 2031, primarily through clean energy investments.

Together, these policies create a robust and coherent strategy that aligns with Nigeria's national commitments and positions Enugu as a subnational climate action and sustainable development leader.

5.4 Assessment of Energy Resources

Enugu State possesses a diverse portfolio of energy resources, with a clear strategic pivot towards renewables and away from its carbon-intensive legacy fuels.

Potential Renewable Resources

- **Solar:** This is the State's most promising renewable resource. Enugu falls within a high irradiation zone, receiving 5.5-6.0 kWh/m²/day, indicating excellent potential for utility-scale solar farms and decentralised solutions like mini-grids and standalone systems. Numerous initiatives are underway, including a Solar PV Module Assembly Plant in Akpugo to foster local manufacturing, REA-commissioned mini-grids, and a joint EU-Enugu State "Solar for Health" project to power 25 health facilities.

- **Biomass:** With significant agricultural and forestry activity, the State has substantial biomass potential from crop residues, forest waste, and municipal solid waste. While 94% of households currently rely on traditional, unprocessed biomass for cooking, there is a significant opportunity to deploy modern waste-to-energy technologies and biogas digesters to provide stable power, manage waste, and reduce health hazards.

- **Hydropower:** The State's rivers and streams present viable opportunities for small and mini-hydro schemes, which are ideal for providing localised power to remote rural communities. While past projects have faced challenges, including the abandoned Ivo River Dam, successful pilot projects like the United Nations Industrial Development Organisation (UNIDO) commissioned station in Ezioha Mgbowo demonstrate the potential of this resource.

- **Wind:** The potential for wind generation exists, particularly in elevated areas like Nsukka and Udi, but it is less documented than solar. Further detailed wind resource mapping is required to identify suitable sites for development.

- **Natural Gas:** The State is connected to the national gas pipeline, but no

major gas-fired power plants are currently operational within Enugu. Challenges include supply reliability and the contradiction with long-term decarbonisation goals.

- **Coal:** Though historically known as "Coal City," the future of coal for power generation is doubtful. Environmental concerns, global and national commitments to net-zero, and the high cost of new plants make cleaner alternatives the only viable path forward.

5.5 Current State of Energy Access

Energy access in Enugu State is severely limited, posing a significant barrier to socio-economic development. Key challenges include:

- **Low Grid Reliability:** Only about 47% of households have access to grid electricity, which is often inconsistent and insufficient.
- **Pervasive Self-Generation:** The unreliable grid forces widespread reliance on costly and polluting diesel and petrol generators.
- **Economic Impact:** Unreliable power hinders business productivity and negatively affects the welfare of the population.

5.6 Data-Driven Project Categorisation

To address these challenges systematically, the plan proposes a data-driven categorisation of towns for targeted energy access projects based on population, existing grid access, and current energy demand. This ensures that interventions are appropriate for the specific needs of each community.

1. **Grid Reinforcement:**

a. Target Towns: Communities with moderate but unreliable grid access (over 8 hours/day), such as Oji River Town and parts of Nsukka.
b. Intervention: Improve infrastructure reliability by expanding transformer capacity, upgrading feeders, and rehabilitating lines.

2. **Off-Grid Mini-Grids:**

a. **Target Towns:** Communities with populations over 200, moderate energy demand (e.g., for refrigerators, small businesses), and a willingness to pay for reliable power, such as Obollo-Afor and Ugbawka.
b. **Intervention:** Deploy centralised, renewable-based mini-grid systems (e.g., solar hybrid) to power homes, clinics, schools, and local businesses efficiently.

3. **Solar Home Systems (SHS):**

a. **Target Towns:** Sparsely populated or scattered settlements with poor or no grid access and low power needs (e.g., for lights, radios), such as Ikem and Edem.
b. **Intervention:** Rapidly deploy a standalone SHS to improve household-level Energy

4. **Interconnected Minigrid:**

a. **Target Towns:** Communities with an existing but weak and unreliable grid connection, a medium-to-high population, and high generator usage.
b. **Intervention:** Deploy a local minigrid using renewables (like solar, wind, or hydro) to supplement and stabilise the existing weak grid connection.

Criteria	Grid Reinforcement	Mini-Grid	SHS
Avg. Electricity Hours	> 8 hrs	4–8 hrs	< 4 hrs
Generator Ownership	High	Medium	Low
Population	High	> 200	< 200
Appliance Use	High-wattage	Refrigerators, TVs	Basic (lights, fans)
Existing Grid	Existing but poor	Absent or unreliable	Absent

Table 16: Project Allocation Table

5.7 Strategic Implementation Recommendations

The report outlines a series of clear, actionable next steps to translate the energy plan into tangible outcomes. Successful implementation requires a coordinated approach focused on technical feasibility, community engagement, and strategic planning.

Key Recommendations:

1. **Prioritise High-Impact Projects:** Focus initial investments on high-return areas by prioritising upgrades in key Local Government Areas (LGAs) like Oji River and Nsukka for grid reinforcement and targeting productive-use nodes (markets, health centres) for mini-grids.

2. **Conduct Detailed Feasibility Studies:** Before large-scale deployment, conduct detailed technical designs, load studies, and economic analyses for proposed mini-grid projects to ensure their long-term viability and scalability.

3. **Cluster Projects for Efficiency:** Group towns with similar needs (e.g., all SHS-designated communities) into larger clusters for procurement and rollout. This approach will streamline logistics, reduce costs, and accelerate implementation.

4. **Drive Community Engagement and Sensitisation:** Proactively engage with communities slated for mini-grid and SHS projects to build trust, prepare residents for new payment models, and provide education on system maintenance and energy conservation.

5. **Harmonise with National Agencies:** Validate and align the State's project categorisation and implementation plans with existing national programs managed by the Rural Electrification Agency (REA) to avoid duplication of effort and maximise synergy.

6. **Leverage Innovative Technologies and Financing:** Consider smart meters to improve efficiency for grid reinforcement. For SHS deployment, utilise results-based financing models to incentivise private sector participation and ensure accountability.

Enugu State has established itself as a vanguard of energy sector reform in Nigeria. Through the combination of bold regulatory autonomy with a clear, ambitious vision for renewable Energy, the State has created a strong foundation to attract investment and drive sustainable development. This plan's strategic framework, grounded in a realistic assessment of resources and a data-driven approach to energy access, provides a clear and viable roadmap.

With sustained political commitment and effective implementation of the recommendations outlined, Enugu State is not only on a path to achieving a reliable, 24/7 power supply for its citizens but is also poised to serve as an influential model for other states seeking to build a resilient and prosperous energy future. The continued momentum of these reforms is critical to transforming this potential into a reality that benefits all residents of the State.

06

ELECTRIFICATION SOLUTIONS FOR ENUGU STATE

To achieve universal access and reliable electricity supply across Enugu State, the following electrification solutions are recommended to ensure that the unserved and underserved customers are reached in a sustainable and scalable manner.

- Utility-Led Electrification: This model relies on the provision of electricity services through the Medium Voltage Distribution Company (MVDC) and the Electricity Retail Companies (ERCs), licensed by the EERC.

- Mini-Grids: This model enables licensed operators to provide reliable electricity supply to unserved and underserved communities through isolated or interconnected mini-grids of smaller capacities. Mini-grids are expected to play a key role in delivering affordable and sustainable electricity in areas where grid extension is technically or economically unviable.

- Electricity Co-operatives: This model supports community-led participation in electrification delivery, particularly in rural areas where community mobilisation and local financing can enhance project viability and sustainability. In the Enugu context, cooperatives are expected to play a partnership role, supporting service delivery through structured agreements with licensed operators, rather than holding full electricity licences themselves. The model is particularly well-suited for rural areas, where community mobilization can significantly enhance project sustainability.

- Solar Home Systems: This model enables households and small businesses to access reliable off-grid electricity services through individual solar solutions. The SHS model is particularly suited for dispersed rural communities where grid extension or mini-grid development is not economically viable.

- Public-Private Partnerships (PPP) with the State Electrification Agency: This model leverages Enugu State facilitation and private sector investment to deliver electrification solutions in priority areas, primarily where market conditions do not fully support commercial service delivery. PPPs are particularly suited for public infrastructure zones, multi-village projects, and strategic rural electrification clusters.

An overview of these models is provided below:

Electrification Model	Market Structure	Roles & Interface	Revenue Streams	Regulatory Framework	Best-Fit Areas
1. Utility-Led Electrification	Operates under an unbundled market framework. The MVDC acts as the medium-voltage network operator (33/66 kV) and common carrier. Electricity Retail Companies (ERCs) manage low-voltage (11 kV/415 V) networks and end-user delivery.	ERCs procure power from licensed Gencos via PPAs and pay Distribution Use of System (DUOS) charges to MVDC. Interface occurs at 33 kV/11 kV substations where ERCs handle downstream metering, billing, and customer service.	MVDC earns DUOS fees from ERCs. ERCs earn through retail tariffs, connection fees, and approved value-added services.	Governed by DUOS Agreements between MVDC and ERCs under EERC oversight. EERC regulates licensing, tariffs, and performance standards.	Peri-urban and urban clusters where grid extension or reinforcement is feasible and demand is concentrated.
2. Mini-Grids	Licensed entities operate isolated or interconnected systems under a forthcoming Mini-Grid Licensing Framework. May be developer-led or implemented as PPPs with the State Electrification Agency (SEA).	Operators manage generation, distribution, and retail within defined service areas. Interconnected mini-grids link to MVDC at agreed points under Interconnection Agreements; isolated mini-grids function independently.	Retail tariffs from end-users (EERC-approved. Grants and RBF payments from national programs (e.g., DARES).	Mini-Grid Licensing Regulations (TBD); Interconnection Guidelines to govern grid-linked systems; tariffs approved by EERC.	Rural and peri-urban settlements beyond grid economic reach, with strong productive-use potential.
3. Electricity Co-operatives	Community-led governance entities operate under Community Service Agreements (CSAs) with licensed ERCs, mini-grid operators, or PPP developers. Not full licensees initially.	Cooperatives mobilize communities, support billing and collections, and may co-invest in distribution assets. Interface with licensed operators for O&M, service quality, and grievance resolution.	Service fees or revenue share via CSAs. Community equity funds or donor project participation.	Operate under CSAs supervised by EERC through partner operator's license; may later seek full or partial licensing per EERC Licensing Regulations.	Rural communities with strong social cohesion and willingness to co-invest; areas requiring high community engagement and ownership.

4. Solar Home Systems (SHS)	Delivered by private PAYGO or direct-sale companies; operate off-grid without interconnection. Providers register with EERC for technical compliance and consumer protection.	SHS providers handle procurement, installation, maintenance, and customer service. No interface with grid operators (standalone model).	Monthly PAYGO payments or upfront sales. RBF grants/ subsidies from SEF or donor programs.	Light-touch regulation under EERC registration to enforce technical standards, warranties, and after-sales support.	Dispersed rural or remote communities; low-income households; small-scale public institutions (schools, clinics).
5. Public-Private Partnerships (PPP)	SEA leads project preparation and procurement; private partners (licensed utilities or mini-grid developers) deliver electrification under PPP contracts. State may provide capital subsidies or grants through the State Electrification Fund (SEF).	Private partners design, build, finance, and operate systems. Interface with SEA for performance monitoring and, where applicable, with MVDC for interconnection.	Retail tariffs and anchor load revenues. Availability payments or performance-based subsidies. Concessional finance or donor grants.	Governed by State PPP Regulations, EERC licensing, and SEA oversight on service standards.	Public infrastructure clusters (schools, health centers), social-priority rural zones, and multi-village projects needing blended finance.

Table 17: Electrification Models

6.1 Electrification Pilot Projects

The following pilot projects are proposed to demonstrate and scale the delivery models outlined above. The pilots are designed to address priority electrification gaps across three regions of Enugu State, while testing innovative structuring approaches and building institutional capacity. The selection of electrification models for each Regional Pilot Project has been guided by standard decision logic commonly applied in off-grid and grid-based electrification planning frameworks3. Three projects were selected across the three senatorial zones in Enugu - Enugu East, Enugu North, and Enugu South.

Enugu Town

Enugu Town has been selected as the pilot site for a utility-led electrification model aimed at improving electricity reliability in one of the state's most populous and commercially active urban corridors. The pilot area is currently served by the Thinkers Corner 33 kV feeder, which supplies several downstream 11 kV feeders, including Abakpa 1, Abakpa 2, Abakpa 3, Nowas, and GRA Enugu. Due to increasing demand and limited distribution capacity, the Thinkers Corner feeder frequently experiences voltage drops, transformer overloads, and service interruptions across its network. To address these challenges, the pilot proposes the construction of a new 33 kV feeder to de-load the existing

Thinkers Corner feeder, thereby improving power quality and reliability for the communities it serves.

Recognizing the liquidity constraints of the incumbent utility, the pilot further proposes that improved 11 kV feeders be assigned to Electricity Retail Companies (ERCs) operating under a retail service model. Under this arrangement, ERCs would be responsible for financing or co-financing the infrastructure upgrades, and operating the feeders on a commercial basis, including metering, billing, and revenue collection under a license issued EERC.

Capital Requirements

The capital requirements are high-level estimates and will need to be validated as part of a detailed feasibility study.

Item	Description	Estimated Cost (NGN Million)	Assumptions1
New 33 kV Feeder Construction	40 – 45km of 33 kV line with poles, conductors, protection & switching gear	1,001	Assumes the maximum length of 33KV at a cost of N22 million per km based on BEME[1] cost
New 11 kV Feeder Construction	15 – 20km of 11 kV line with poles, conductors, protection & switching gear	373	Assumes the maximum length of 11kV at a cost of of N19 million per km based on BEME[2] cost
Procurement and Installation of Customer Metering	Estimated metering gap on Abakpa 11kV feeders	1,468	Based on the metering gap provided by EERC and applying 1:3 ratio to cater for illegal connections. NERC-approved prices of N136,029.04 for 1 phase meters and N226, 766 for 3 Phase meters as of March 2025. 60:40 ratio for 1 Phase to 3 Phase based on historic customer consumption.
TOTAL		2,842	

Table 18: Capital Requirements for Utility-led Project in Enugu

Nsukka

Nsukka has been selected as the second pilot region based on the presence of the University of Nigeria, Nsukka (UNN), one of Nigeria's foremost higher education institutions. UNN serves as a stable and high-demand anchor load, surrounded by a vibrant ecosystem of students, academic institutions, health facilities, and small businesses with increasing energy needs.

[1]Cost assumptions are drawn from internal BEME estimates prepared for similar grid extension projects in Nigeria as of April 2024.

Figure 1:Photo of University of Nsukka, Nigeria

The pilot proposes the development of an interconnected mini-grid anchored around UNN and its environs. Despite improvements in the existing grid infrastructure, Nsukka continues to experience power outages and unstable supply due to transmission bottlenecks and limited distribution capacity. This has resulted in UNN and surrounding institutions relying on costly and polluting diesel generation to supplement electricity needs.

To address this, the proposed solution envisions the deployment of a university-anchored, interconnected mini-grid (IMG) that combines solar PV and grid interconnection through the existing 11 kV distribution network. The project will ensure stable and reliable electricity to UNN while enabling power delivery to nearby clusters, including residences and commercial centers.

The presence of UNN also creates an opportunity to coordinate with the Energising Education Programme (EEP) managed by the Rural Electrification Agency (REA).

Capital Requirements

The capital requirements for the 1MW Nsukka IMG will need to be validated through detailed feasibility studies. However, a high-level estimate based on benchmark data from a report utility-enabled DER projects. is presented below:

Component	Cost (USD)	Cost (₦ Million)
Solar PV (1 MW @ $600/kW)	600,000	963,000
Battery Storage (1.5 MWh @ $450/kW)	675,000	1,083,375
Distribution Network Upgrades (~35%)	456,000	731,880
Project Development Costs (~9%)	114,750	184,174
Contingency	184,575	296,242
Total Estimated Project CapEx	2,030,325	3,258,672

Table 19:Capital Requirements for Nsukka IMG

2Cost assumptions are drawn from internal BEME estimates prepared for similar grid extension projects in Nigeria as of April 2024.

Awgu Cluster Electrification Project

Awgu has been selected as the third pilot region under the State Electricity Market due to the potential for clustering off-grid and underserved rural communities, making it well-suited for a phased mini-grid electrification strategy. The area is characterized by challenging terrain, low grid penetration, and dispersed but dense rural settlements, which collectively limit the feasibility of traditional grid extension.

The proposed electrification model for Awgu is a cluster-based mini-grid approach, designed to deliver economies of scale by pooling procurement, construction, and operational resources across multiple sites. By focusing on productive use clusters, such as smallholder farming hubs and local markets, the project aims to drive rural development, reduce energy poverty, and create a replicable model for other rural LGAs in the State.

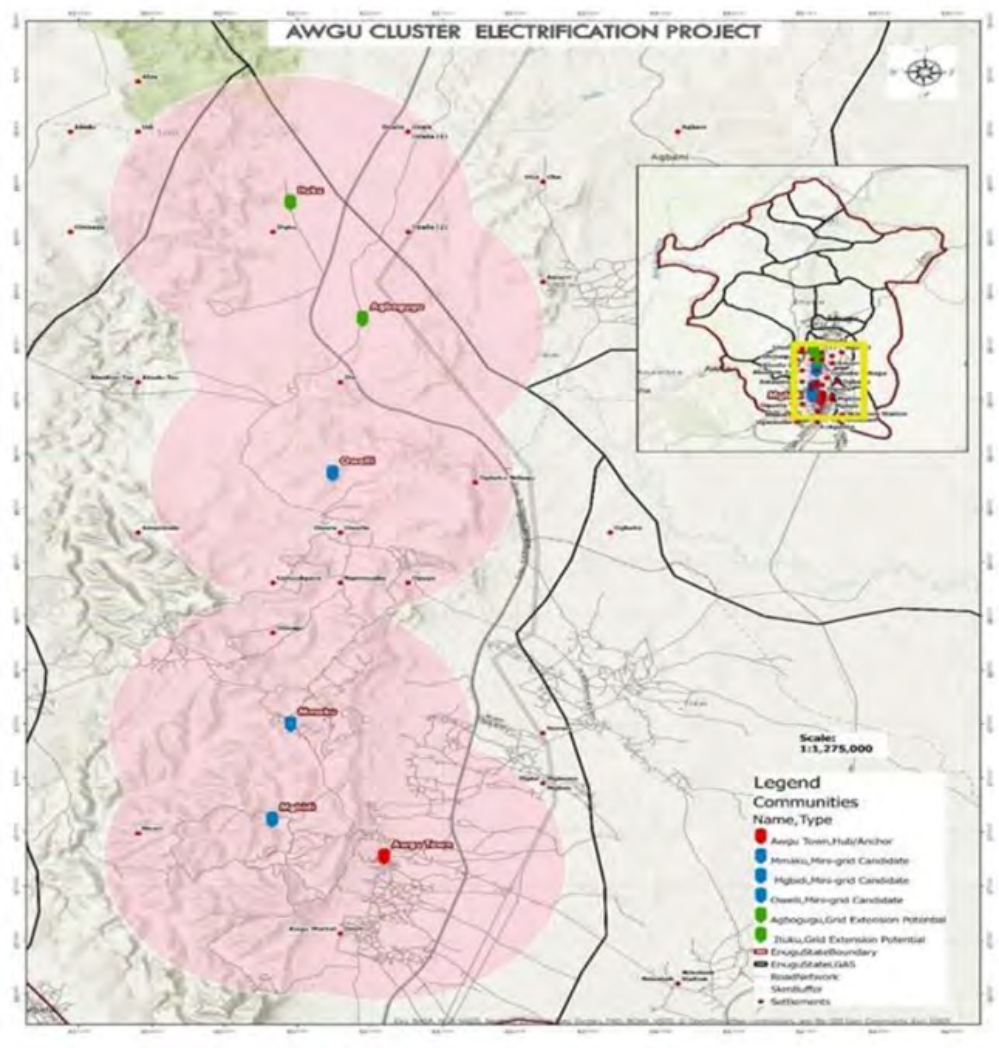


Figure 2:Map of Awgu Cluster Electrification Project

The map illustrates the spatial layout of the Awgu cluster electrification pilot, showing the geographic distribution of communities and their proposed electrification pathways. The project adopts a phased, clustered mini-grid model. Key features include:

- Awgu Town (Red) designated as the administrative hub and anchor load.
- Four mini-grid candidate communities: Mmaku, Mgbidi, Owelli, and Agbogugu.
- Two grid extension potentials: Agbogugu and Ituku, identified for potential connection to existing infrastructure.

Capital Requirements

This table presents the estimated capital requirements for five mini-grids planned across Awgu LGA. Each of the communities, except Awgu Town, will host a 300 kW mini-grid, while Awgu Town will host a larger 500 kW system, reflecting its role as the central hub. The sizing of the mini-grid is based on projects deployed in communities with similar load profiles. The total number of connections is also estimated at 11,000 based on similar communities. Capital expenditure includes solar PV, battery storage, distribution network, and soft costs and is based on RMI benchmark data. A detailed feasibility study is required to validate the number of connections, proposed system size, and associated costs.

Community	Mini-Grid Size (kW)	Base CAPEX (USD)	Base CAPEX (₦ '000)
Awgu Town	500	756,000	1,213,380
Mmaku	300	453,600	728,028
Mgbidi	300	453,600	728,028
Owelli	300	453,600	728,028
Agbogugu	300	453,600	728,028
Contingency (10%)	-	257,040	412,549
Total Estimated CAPEX	-	2,827,440	4,538,041

Table 20:CAPEX for Awgu Cluster Project

6.2 Key Recommendations

The following recommendations are proposed to successfully scale electrification in Enugu State and achieve the objectives of the 2024 State Electricity Policy:

- Strengthen the capacity of EERC to function effectively as an independent regulator.
- Fast-track the finalization of EERC's mini-grid regulations, including guidelines for interconnected systems, to provide market certainty to developers and investors.
- Institutionalise the State Electrification Agency and build its capacity to function as an implementing institution.
- Pursue co-financing opportunities through national programmes such as REA's DARES and Energizing Education, especially for the Nsukka and Awgu pilots.
- Engage transaction advisors to support financial structuring, legal agreements, and stakeholder negotiation of pilot projects.
- Document and share lessons from the pilot phase, to guide future project design and refine regulatory and financing mechanisms.

Implementation of the recommendations outlined will require coordinated action across SEA , EERC and the State Government.

07

SUSTAINABLE CAPACITY BUILDING FRAMEWORK FOR ENUGU STATE

The sustainable capacity building framework provides a strategic and coordinated approach to enhancing the Enugu Electricity Regulatory Commission's (EERC) capabilities in effectively regulating the growing Enugu State Electricity Market.

7.1. Capacity Needs Assessment

The goal of the institutional capacity needs assessment is to identify gaps in the Enugu State Electricity Regulatory Commission's (EERC) capacity relative to what is required to fulfil its regulatory mandate. It evaluates the EERC's collective knowledge, skills, systems, and operational methods to pinpoint areas needing improvement or development. This assessment supports effective capacity building, targeted resource allocation, and the creation of a more effective, adaptive, and inclusive institution.

7.2. Stakeholder Engagement and Data Collection

Questionnaires were developed to assess gaps in EERC's institutional capacity, focusing on staff skill levels, operational systems, and inter-departmental coordination. They included questions on institutional strengths, weaknesses, stakeholder suggestions, organisational roles, cross-departmental challenges, and systemic issues.

The questionnaires were distributed via an online Google Form to 23 EERC members. All 23 responded, yielding 22 unique responses and one duplicate. Twenty-two unique responses (95.65% response rate) were analysed, and the duplicates were excluded to ensure data accuracy.

7.3. Data Finding and Analysis

Analysis of the 22 unique questionnaire responses identified critical institutional skill gaps and priority areas for capacity building within the Enugu State Electricity Regulatory Commission (EERC). The assessment combined quantitative evaluation using self-rated skill levels on a 1–5 scale (1 = low, 5 = high), with qualitative insights on departmental roles, priorities, and recommendations. Data sets were grouped by department and position to reveal institutional patterns and differences.

Competency Skill Gaps

I. Understanding of Electricity Regulations:

- Average self-rated skill: 2.86
- Average job importance rating: 4.04
- Indicates a poor knowledge of electricity regulations despite high job relevance.

The three departments below include Legal, Market Operations, Organisational Support, and Customer Care.

II Regulatory Compliance and En forcement

- Average self-rated skill: 2.72
- Average job importance rating: 4.00
- Shows weak grasp of enforcement mechanisms. Departments below 3 include Organisational Support, HR Admin, Engineering Services, Engineering HSE, and Customer Care.

III. Policy Analysis and Development

- Average self-rated skill: 2.72
- Average job importance rating: 4.00
- Shows weak grasp of enforcement mechanisms. Departments below 3 include Organisational Support, HR Admin, Engineering Services, Engineering HSE, and Customer Care.

IV. Data Analysis and Reporting

- Average self-rated skill: 2.54
- Average importance rating: 3.81
- Reflects a poor understanding of

policy creation and evaluation. Low-performing departments include Organisational Support, Customer Service, and Engineering Services.

V. Technical Knowledge of Power Systems

- Average self-rated skill: 2.50
- Average importance rating: 4.10
- Highlights a significant deficit in analytical capabilities essential for planning and monitoring. Departments affected include Organisational Support, Legal, Engineering Services, and Market Operations.

These findings emphasise the need for targeted training and capacity-building interventions across core regulatory competencies.

Department Priority Areas

Respondents identified key departmental gaps during data collection, with mini-grid regulation (13%) and project monitoring and evaluation (13%) most frequently identified primarily by Legal, Market Operations, and Customer Care staff. Additional gaps included electrification planning (12%), customer protection (11%), and licensing and tariff setting (11%).

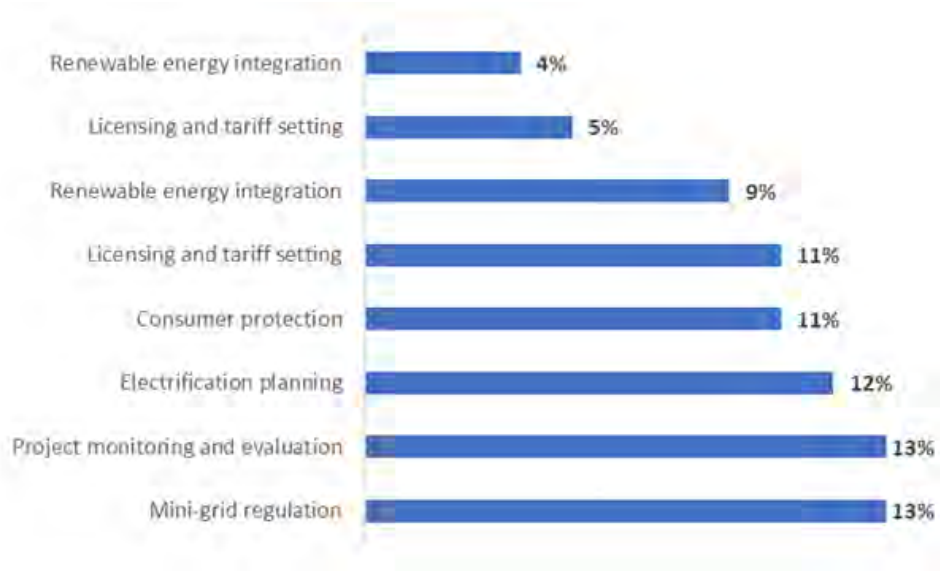


Figure 3: Current institution priority needs

Gender Balance and Inclusion

Four (4) out of the twenty-two (22) unique data entries were females, accounting for 18% of the EERC's employees. 68% of respondents indicated that gender-focused training and mentorship would be welcomed, while noting barriers to women's involvement in technical or leadership roles, such as lack of mentorship (25%), work assignment bias (25%) and inflexible work environment (25%).

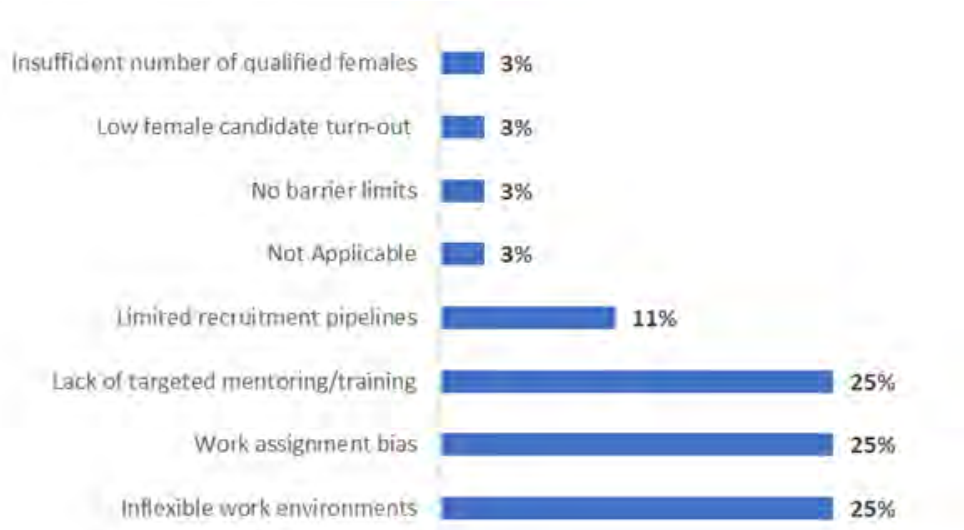


Figure 4: Barriers limiting women's involvement in leadership or technical roles

Training Preference

63% of respondents preferred study tours or exchange programs, in-person technical workshops (21%), and policy and regulatory bootcamps (8%). 77% of respondents preferred collaboration with academic or vocational institutes for the training, such as the University of Nigeria, Nsukka (UNN), and the National Power Training Institute of Nigeria (NAPTIN).

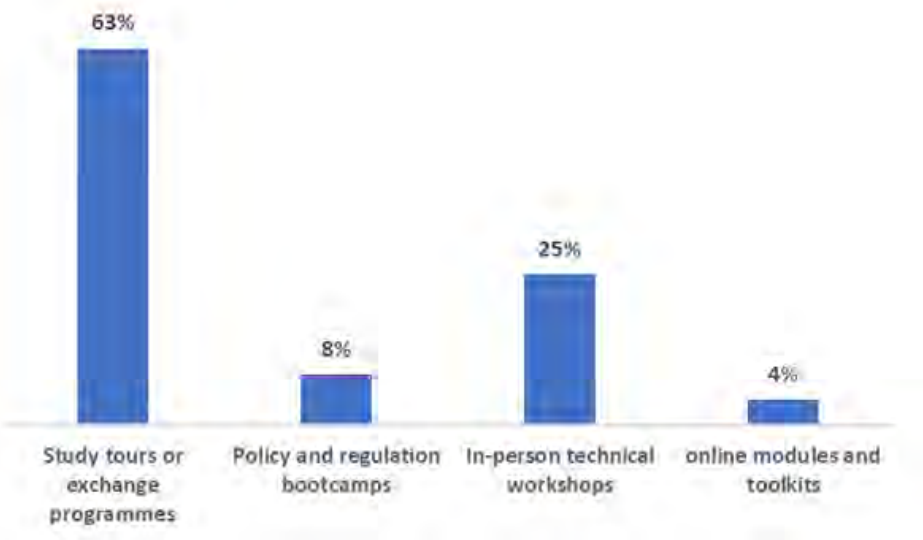


Figure 5: Capacity-building training preference

7.4 Recommendations for Capacity Building

Based on the identified skill gaps and departmental priorities, specific recommendations are made to strengthen the EERC's capacity to meet its regulatory objectives in Enugu State's electricity sector.

I. Technical Training Programs

Given the low average self-rating (2.54) in technical knowledge of power systems, EERC should implement training on on-grid systems, battery energy storage systems (BESS), and solar PV design. Programs should engage Engineering Services and Engineering HSE, Organisational Support (average 2.0), and Accounts and Budget (average 3.0). Partner with institutions such as NAPTIN, Renewable Energy Training Institute (RETTI), and Asteven Energy Institute (AEI), which offer certified courses to track progress and incentivise participation.

II. Data Analysis Training

With an average data analysis skill score of 2.5, EERC needs training in tools like Excel, SQL, Python, and Power BI, which are critical for tariff modelling, electrification planning, and trend analysis. Departments with the lowest scores include Organisational Support (2.0), Legal (2.0), and Customer Care (2.5). Recommended providers include ALX Africa, PWC's Data Analytics Academy, and Lagos Data School.

III. Regulatory and Compliance Capacity Building

The low self-rated understanding of electricity regulations (2.86), despite high perceived importance, calls for the following interventions:

- Policy and regulation bootcamps on mini-grid licensing, tariff design, and enforcement, using Nigerian and international case studies.
- Development of internal compliance manuals and quick-reference guides for Legal, Customer Care, Market Operations, and Organisational Support.
- One-month study tours with international partners like the Public Utilities Regulatory Commission (PURC) and the African School of Regulation (ASR), as suggested by respondents.

IV. Leadership and Collaboration Development

Low self-ratings in leadership and collaboration ratings from support staff (2.67), technical staff (2.50), and especially support staff on job role importance (2.33) indicate a need for the following approach:

- A 6-month leadership program covering team management, conflict resolution, and strategic decision-making.
- An internal mentorship program pairing junior and senior staff with monthly goal-setting sessions.
- Partnerships with institutions like Lagos Business School to deliver workshops on inter-agency coordination, a gap noted by 12% of respondents.

V. Gender Focused Initiatives

While 95% of respondents acknowledge gender-balance policies, 75% cite barriers such as inflexible work environments, assignment bias, and lack of mentorship. Recommended actions include:

- Targeted technical training for women in power systems and regulation, in collaboration with women-in-energy networks.
- A Women in Energy Mentorship Program linking female staff with senior leaders.
- Implementing gender-sensitive policies (e.g., flexible work, anti-discrimination protocols) and unconscious bias training.
- ·Setting measurable targets to increase female representation in technical and

leadership roles, monitored through recruitment and promotion data.

VI. Collaboration with Institutions

With 63% of respondents expressing interest in study tours and 25% in technical workshops, EERC should implement the following:

- Form formal partnerships with UNN, NAPTIN, GIZ, and the United Nations Development Program (UNDP) to develop modular courses in regulation, renewables, BESS, and solar PV.
- Create a joint curriculum committee with UNN and NAPTIN to align training with Enugu's market needs.
- Collaborate with ASR and PURC (Ghana) to exchange knowledge on renewable energy regulation, electrification frameworks, and tariff design.
- Aim for at least 50% staff participation in collaborative training within 18 months, tracked via participation records.

7.4. Implementation Roadmap

The implementation roadmap presents a structured, three-phase plan to address institutional capacity gaps at the Enugu State Electricity Regulatory Commission (EERC), aligned with assessment findings and stakeholder preferences. It leverages partnerships with institutions like NAPTIN, UNN, PURC, ASR, GIZ, and UNDP to build a skilled, inclusive, and adaptive workforce capable of advancing regulatory excellence and equity in Nigeria's energy transition.

Figure 6: Capacity building implementation roadmap

- **Phase 1: Short-term (3-6 months)**

Phase 1 focuses on urgent skill gaps (self-rated below 3 in key areas) through foundational actions:

- **Training Needs Refinement:** Departmental heads will prioritise competencies such as regulations and data analysis and co-develop tailored curricula with UNN and NAPTIN, incorporating case studies and simulations in multiple languages.
- **Technical Workshops:** Hands-on training with NAPTIN on power systems and regulatory tools, including site visits to mini-grids, addressing the 13% gap in mini-grid regulation, especially for low-scoring departments like Organisational Support (1.75) and Accounts and Budget (2.3).
- **Women in Energy Mentorship:** Launch a mentorship program pairing senior leaders with female technical and mid-level staff to tackle barriers like lack of training and assignment bias, supporting EERC's 18% female representation and 68% staff support for gender initiatives.
-

Phase 2: Medium Term (6-12 months)

This Phase builds on Phase 1 by expanding regulatory, analytical, and leadership capacity:

- **Study Tours:** Month-long tours for Legal and Market Operations staff with PURC and ASR to learn global best practices in mini-grid licensing, tariff design, and compliance enforcement, including site visits and incorporating post-tour reports for internal knowledge sharing.

- **Data Analysis Training:** Six-month program with ALX Africa, PwC, and Lagos Data School for 50% of staff, featuring weekly virtual sessions, biweekly labs, and access to platforms like Coursera to strengthen skills in Excel, Python, SQL, and GIS, addressing the 2.5 average rating and 15% gap in data analysis.

- **Leadership Development:** Six-month program with Lagos Business School for support and technical staff, including role-playing, case studies, applied projects, and a diversity module to improve team collaboration (rated 2.5–2.67) and address the 12% inter-agency coordination gap.

Phase 3: Long Term (1-3 years)

Phase 3 ensures sustainability, institutionalisation, and gender equity:

- **Institutional Partnerships:** Formal MOUs with UNN, NAPTIN, GIZ, and UNDP to co-design courses on regulatory oversight, BESS, and solar PV, develop a 5-year training roadmap, and establish a knowledge exchange network with PURC and ASR.

- **Learning and Development Unit:** Create a dedicated unit with three full-time staff under Organisational Support to manage an annual training calendar, offer NAPTIN/UNN-certified courses, and host materials on an internal intranet platform.

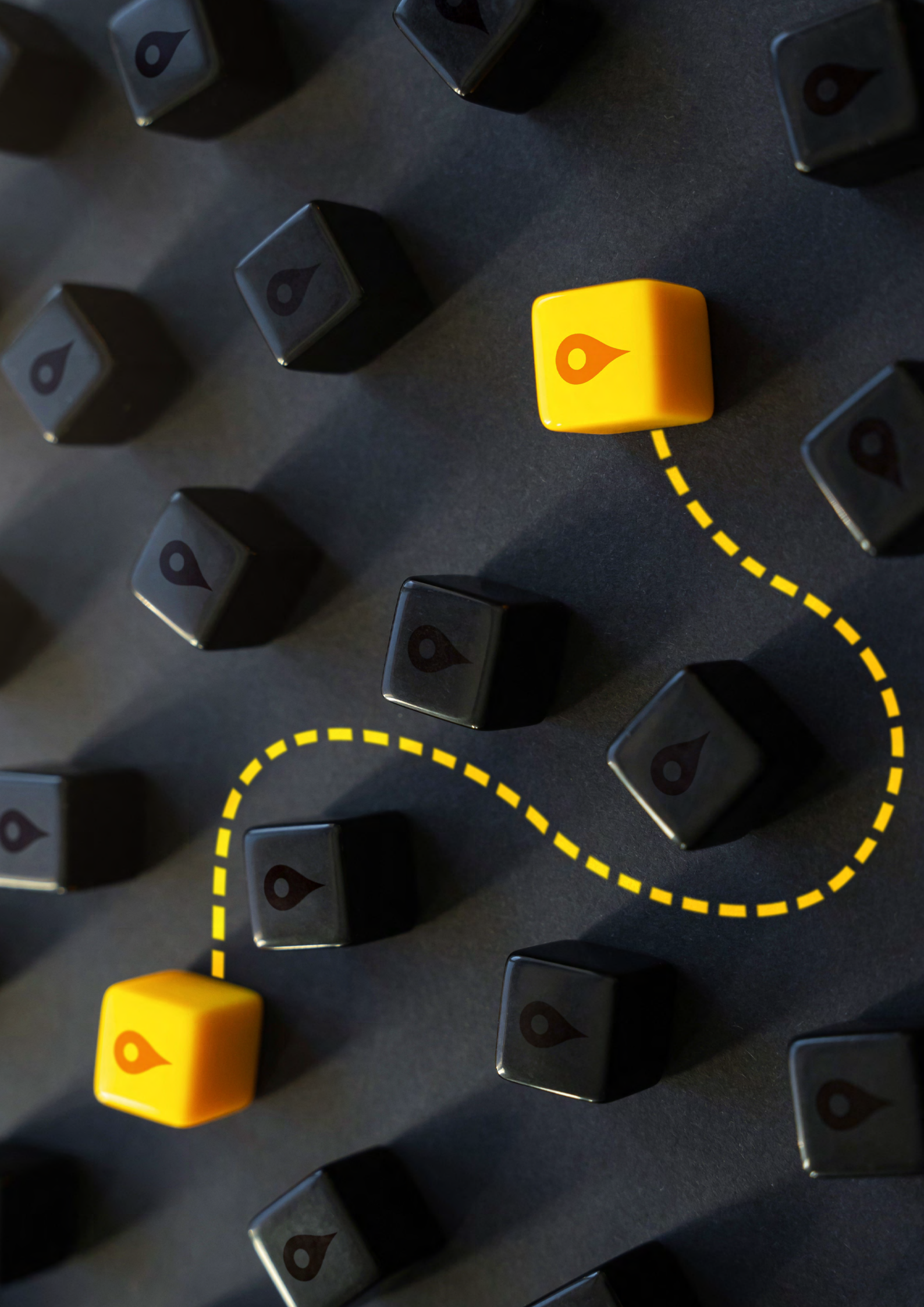
- **Annual Assessments:** Conduct yearly evaluations via surveys, focus groups, and performance reviews to monitor progress, update training, and maintain relevance.

- **Gender Equity Advancement:** Expand the Women in Energy Mentorship Program with external mentors, host an annual conference, and set measurable yearly targets to increase female representation in technical and leadership roles through inclusive recruitment and promotion practices.

This phased approach ensures measurable, scalable progress toward a competent, equitable, and future-ready regulatory institution.

08

IMPLEMENTATION ROADMAP



1

Phase 1: Foundation and Capacity Building (2026 – 2027)

Objective: Establish a credible evidence base and strengthen institutional capacity for targeted interventions.

- Launch a foundational EERC training programme in collaboration with Nigerian Universities and professional institutions, focused on identified skill gaps from the self-reported capacity assessment.
- Validate and quality-assure 2024 MPEDC feeder performance data, including energy audits, loss segmentation (technical vs. commercial), and consumer categorisation (residential, commercial, industrial).
- Finalise feeder cluster classification based on parameters like T&D losses and metering density to prioritise intervention zones.
- Roll out stakeholder consultations with MPEDC for data alignment with Enugu State Electricity Priority Plan.

Lead Entities: EERC, MPEDC, Universities, Learning Institutions

2

Phase 2: Renewables Integration (2027 – 2028)

Objective: Identify viable renewable energy options and prepare technical and regulatory groundwork for integration.

- Map renewable targets to state clusters, prioritising small-hydro to align with the Nigerian Renewable Energy Master Plan (REMP) 2,000 MW national target and solar PV for semi-urban and rural areas.
- Engage the Renewable Energy Association of Nigeria (REAN) and Enugu State Electrification Agency (ESEA) to support resource mapping and stakeholder mobilisation.
- Assess biomass and wind targets progress, adapting to Enugu's infrastructure challenges.
- Pilot renewable data collection aligned with Nigeria Energy Transition Plan (ETP) for net-zero by 2060.
- Initiate grid interconnection readiness studies for priority renewable injection points, ensuring alignment with MPEDC's network capacity and NERC's technical standards.

Lead Entities: EERC, FmoP, ESEA and REAN

3

Phase 3: Electrification Model Deployment and Pilots (2028 – 2030)

Launch utility-led electrification in urban clusters such as Enugu Town pilot and grid extensions for high metering density areas.

- Deploy mini-grids and solar home systems in semi-urban and rural segments.
- Create electricity co-operatives in commercial and industrial areas per the proposed business models.
- Conduct a detailed comparative assessment of the various electrification models for deployment.
- Expand pilots state-wide, prioritising high T&D loss feeders.
- Integrate renewable sources such as solar PV in co-operatives with EERC oversight.

Lead Entities: EERC, ESEA and MPEDC

4

Phase 4: Scaling, Evaluation, and Sustainability (2030 – 2031+)

- Evaluate the pilot model's impact utilising feeder metrics such as billing efficiency and T&D loss in a "before Vs after" comparative analysis.
- Scale top-performing electrification model deployment based on comparative assessment.
- Update EERC capacity building to account for emerging regulatory knowledge gaps.
- Achieve full renewable energy integration consistent with SDG 7 (universal access) by 2030.
- Annual review of market design for private investment and funding models.

Lead Entities: EERC and ESEA

APPENDIX

Capacity Building Needs Assessment Questionnaire

Enugu State Electricity Regulatory Commission (EERC) & Enugu State Electrification Agency (ESEA)

Objective: To support the development of a comprehensive framework and roadmap for sustainable capacity building in Enugu State's power sector.
Required Skills and Experience for Capacity Needs Assessment

1. Market Operations

a. Bachelor's or higher degree in business, economics, finance, or related disciplines
b. Experience in market analysis, energy trading, or market operations within the energy sector
c. Knowledge of electricity market structures, pricing mechanisms, and regulatory frameworks
d. Experience with market forecasting tools and data analysis software
e. Strong analytical and problem-solving skills (f) Familiarity with risk management in energy markets (g) Fluency in English

2. Organizational Support

a. Bachelor's or higher degree in business administration, management, or related disciplines
b. Experience in organisational development, process improvement, or administrative support
c. Proficiency in project coordination and change management
d. Experience with workflow optimisation and documentation (e) Strong interpersonal and communication skills f) Familiarity with office management software and tools (g) Fluency in English

3. Engineering Services (a) Bachelor's or higher degree in mechanical, electrical, or civil engineering, or related disciplines (b) Experience in engineering design, project execution, or maintenance in the energy sector (c) Proficiency in engineering software (e.g., AutoCAD, MATLAB, or similar) (d) Knowledge of power generation, transmission, or distribution systems (e) Experience with project management and quality assurance (f) Familiarity with industry standards and regulations (g) Fluency in English

4. Account and Audit (a) Bachelor's or higher degree in accounting, finance, or related disciplines (b) Experience in financial planning, budgeting, or accounting (c) Proficiency in financial software (e.g., SAP, QuickBooks, or similar) (d) Experience with cost control and financial reporting (e) Knowledge of regulatory compliance and auditing processes (f) Strong analytical and organizational skills (g) Fluency in English

5. Engineering HSE (Health, Safety, and Environment) (a) Bachelor's or higher degree in environmental engineering, occupational health, or related disciplines (b) Experience in health, safety, and environmental management in engineering projects (c) Knowledge of HSE regulations, standards, and best (d) Experience with risk assessments and incident investigations (e) Proficiency in developing and implementing HSE policies (f) Strong training and communication skills (g) Fluency in English

6. Analyst IT, Engineering (Network) (a) Bachelor's or higher degree in computer science, information technology, or electrical engineering (b) Experience in network engineering, IT infrastructure, or systems analysis (c) Proficiency in network protocols, cybersecurity, and network management tools (d) Experience with network design, troubleshooting, and optimization (e) Knowledge of energy management systems is a plus (g) Fluency in English

7. Customer Care (a) Bachelor's or higher degree in business, communications, or related disciplines (b) Experience in customer service or client relations in the energy sector (c) Strong interpersonal and conflict resolution skills (d) Experience with CRM software and customer feedback systems (e) Knowledge of billing processes and customer inquiry resolution (f) Fluency in English

8. HR/Admin (a) Bachelor's or higher degree in human resources, business administration, or related disciplines (b) Experience in HR management, recruitment, or administrative operations (c) Experience with talent acquisition, employee relations, and performance management (d) Knowledge of labor laws and compliance requirements (f) Strong organizational and multitasking skills (g) Fluency in English

9. Legal (a) Bachelor's or higher degree in law (b) Experience in corporate law, energy law, or regulatory compliance (c) Expertise in drafting, reviewing, and negotiating contracts and legal agreements (d) Experience with litigation management and legal risk assessment (e) Knowledge of energy sector regulations and compliance requirements (f) Strong analytical and problem-solving skills (g) Fluency in English

10. Licensing (a) Bachelor's or higher degree in law, engineering, environmental science, or related disciplines (b) Experience in regulatory affairs, permitting, or licensing in the energy sector (c) Proficiency in navigating government and regulatory processes for permits and licenses (d) Experience coordinating with regulatory bodies and preparing compliance documentation (e) Strong organizational and detail-oriented skills g) Fluency in English

11. Communications (a) Bachelor's or higher degree in communications, journalism, public relations, or related disciplines b) Experience in corporate communications, media relations, or public relations c) Expertise in crafting press releases, stakeholder communications, and crisis communication plans d) Experience managing media relationships and public perception e) Familiarity with energy sector issues for effective communication of technical topics f) Strong written and verbal communication skills g) Fluency in English

Section A: Respondent Information

1. Name: _____

2. Agency:
- Enugu State Electricity Regulatory Commission (ESERC)

3. Department/Unit:
- Market Operations
- Organizational Support
- Engineering Services
- Account and Budget
- Engineering HSE

- Analyst, IT
- Customer Care
- HR Admin
- Legal
- Licensing
- Communications

4. Position/Title: _____

5. Level:
- Senior Management
- Middle Management
- Technical/Professional Staff
- Support Staff

6. Gender:
- Male
- Female

7. Years of experience in the energy/power sector: _____

8. Highest level of education:
- OND
- HND/BSc
- MSc
- PhD

Section B: Institutional Mandate and Capacity Needs

9. Briefly describe your department's role in the electricity sector in 2-3 sentences.

10. What are your department's current priority areas (check all that apply)?
- Mini-grid regulation
- Renewable energy integration
- Licensing and tariff setting
- Electrification planning
- Project monitoring and evaluation
- Consumer protection
- Others: _____

11. What capacity gaps exist within your department (check all that apply)?
- Data collection and analysis for planning
- Licensing and permitting of DERs/mini-grids
- Tariff design and cost-reflectivity
- Inter-agency coordination
- Project development and appraisal
- Public-private partnership (PPP) structuring
- Renewable energy system design or oversight
- Monitoring and compliance enforcement
- Others: _____

12. Has your department conducted a similar needs assessment exercise before?
- Yes
- No

Section C: Gender-Responsive Capacity Assessment

14. What barriers limit women's involvement in technical or leadership roles?
- Limited recruitment pipelines
- Work assignment bias
- Lack of targeted mentoring/training
- Inflexible work environments
- Others: _____

15. Would gender-focused training or mentorship initiatives be welcomed within your agency?
- Yes
- No
- Not sure

16. Are existing policies ensuring a balanced gender composition in the commission?
- Yes
- No

17. Recommend initiatives to improve workplace gender balance in 2 – 3 sentences?

Section D: Training Priorities and Delivery

18. Which areas should be prioritised in future capacity-building programmes? (Rate 1–5)
- Regulatory oversight of renewable energy projects
- Electrification strategy and geospatial planning
- Mini-grid licensing and enforcement
- Tariff modelling and affordability analysis
- Power purchase agreement (PPA) review and design
- Battery Energy Storage Systems (BESS) applications
- Solar PV system design and inspection
- Energy access monitoring and reporting
- Others_____

19 What training formats are most suitable for your department?
- In-person technical workshops
- Policy and regulation bootcamps
- Online modules and toolkits
- Study tours or exchange programmes
- Short-term academic certificates
- Others_____

20. Would your agency collaborate with academic or vocational institutions to co-design and co-deliver such training?
- Yes
- No
- Maybe

Section E: Self-Assessment of Core Competencies (Tick 1-5 for both options)

Rate each competency's importance to your role and current skill level (1 = low, 5 = high). Be honest to help identify accurate training needs.

Example: Understanding of electricity regulations: Importance = 5, Skill Level = 3

- Understanding of electricity regulations
- Regulatory compliance and enforcement
- Policy analysis and development
- Data analysis and reporting
- Technical knowledge of power systems
- Legal and regulatory framework
- Use of digital tools and software
- Report writing and documentation
- Public communication and engagement
- Team collaboration and leadership

Section F: Roadmap Development and Partnerships

21. Which institutions (universities, training centres, consultancies) should be involved in Enugu's capacity development roadmap?

22. Additional comments or recommendations for developing a sustainable and inclusive energy workforce in the commission?

23. Would you be willing to participate in follow-up interviews or focus groups to discuss capacity needs further?

- Yes
- No

Nextier