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Assessment Of Abuja Electricity Distribution Company's Grid Modernisation And Renewable Energy Integration In Nigeria

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ABSTRACT
This study assesses the efficiency and sustainability of the Abuja Electricity Distribution Company's (AEDC) services, with a particular focus on its initiatives for grid modernisation and the integration of renewable energy. The research addresses the persistent issues in Nigeria's power sector, including outdated infrastructure and high energy losses, which hinder socioeconomic development. Employing a mixed-methods approach, the study surveyed 276 AEDC customers to gather quantitative data, while also incorporating qualitative insights from various stakeholders. Findings reveal significant customer dissatisfaction across key service areas. The majority of respondents reported an irregular power supply, frequent outages, and voltage instability. Customer service was also rated poorly, with most complaints left unresolved, indicating a breakdown in trust. Despite a strong public willingness to adopt renewable energy, the study found that most customers are unaware of any AEDC initiatives in this area. This highlights a critical communication gap and a missed opportunity to leverage public support for a sustainable energy transition. The study concludes that AEDC must urgently modernise its grid, improve customer relations, and transparently integrate renewable sources to enhance its efficiency and contribute to Nigeria's sustainable development goals.
Keywords: AEDC, Electricity Distribution, Grid Modernisation, Renewable Energy, Customer Satisfaction, Nigeria**.**

1.0 INTRODUCTION

The provision of efficient and sustainable electricity is a cornerstone of socioeconomic progress, particularly in rapidly growing urban centres (Suleiman et al., 2025), such as Nigeria's Federal Capital Territory (FCT). A stable power supply fuels industrial growth (Magaji, 2004), education (Gabdo et al.,

2025), healthcare (Ijoko et al., 2021), and overall economic activity (Magaji et al., 2023). However, Nigeria has been hindered by persistent challenges like inadequate distribution infrastructure, high energy losses, and system inefficiencies (Adenikinju, 2020). The Abuja Electricity Distribution Company (AEDC), which serves the FCT and surrounding states, is a key player in ensuring that households, businesses, and industries get sustainable energy services (Okafor & Eze, 2021).

Despite various reforms aimed at improving the efficiency of Nigeria's electricity sector, distribution companies (DisCos), such as AEDC, still face significant operational and structural issues. These include poor metering, electricity theft, and financial instability (Ogunleye, 2017). Such problems not only prevent a stable power supply but also raise questions about the long-term viability of the existing distribution framework. Given Abuja's status as Nigeria's political and administrative capital, evaluating AEDC's performance is especially important for informing policy and advancing a sustainable energy transition (Olayemi & Bello, 2022).

The global push for sustainable development and climate action underscores the need for DisCos to adopt environmentally friendly, socially inclusive, and economically viable practices (United Nations, 2015). Sustainable energy distribution involves minimising technical and non-technical losses, boosting customer satisfaction, and ensuring equitable access to electricity. Since Nigeria is committed to achieving Sustainable Development Goal (SDG) 7, which calls for universal access to affordable, reliable, and sustainable energy, AEDC's performance offers a glimpse into the broader Nigerian power sector's strengths and weaknesses (Akinyemi, 2019).

Numerous studies have emphasised the role of distribution efficiency in closing the gap between electricity demand and supply. For example, Adeoye and Omolade (2020) found that, despite improvements in Nigeria's electricity generation capacity, distribution bottlenecks continue to be a significant barrier to reliable electricity access. Therefore, AEDC's operational performance is crucial for ensuring that improvements in generation and transmission actually benefit end-users. This raises important questions about how well AEDC is fulfilling its mission to provide efficient and sustainable energy distribution.

This study aims to evaluate AEDC's efficiency and sustainability in electricity distribution within its service areas. By examining the company's operational challenges, customer experiences, and strategic measures, this research aims to provide insights into how distribution efficiency can be enhanced in alignment with global sustainability standards. The findings are expected to contribute to the ongoing discussion on improving Nigeria's power sector and helping DisCos, particularly AEDC, play a transformative role in achieving sustainable energy development.

2.0 Literature Review and Theoretical Framework

2.1 Conceptual Review

2.1.1 Energy Distribution Efficiency

Energy distribution efficiency refers to a DisCo's ability to deliver electricity to end-users with minimal losses, optimal resource use, and reliable service. This includes technical efficiency, which involves utilising modern infrastructure to minimise transmission and distribution losses, as well as operational efficiency, which encompasses effective metering, billing, and customer service (Adenikinju, 2020). In developing countries like Nigeria, inefficiencies are often due to outdated infrastructure, electricity theft, and a lack of investment in grid modernisation. This results in high system losses and an unreliable supply (Adeoye & Omolade, 2020). Improving distribution efficiency is crucial for enhancing energy access, reducing costs, and promoting sustainable development (Okafor & Eze, 2021).

2.1.2 Sustainable Energy Distribution

Sustainable energy distribution is the process of delivering electricity in a manner that is environmentally sound, socially equitable, and economically viable in the long term. This approach extends beyond simply supplying power by integrating renewable energy sources, reducing carbon emissions, and enhancing energy efficiency in distribution networks (Akinyemi, 2019). A sustainable distribution system ensures reliable access to affordable electricity while minimising losses, tackling energy poverty (Ologbonori et

al., 2025), and meeting the needs of both current and future generations (United Nations, 2015). In Nigeria, achieving SDG 7, which promotes universal access to clean and reliable energy, is vital (Olayemi & Bello, 2022).

2.1.3 Poverty and Renewable Energy

Poverty and renewable energy are deeply interconnected, as access to affordable, reliable, and sustainable energy plays a critical role in breaking cycles of deprivation. For poor households, high dependence on traditional biomass, such as firewood and charcoal, not only worsens health outcomes through indoor air pollution but also reinforces economic marginalisation due to low productivity and the time spent collecting fuel (Odenu et al., 2025). Renewable energy, along with exceptionally decentralised solutions such as solar home systems, mini-grids, and clean cookstoves, offers opportunities to improve living conditions (Tanko et al., 2025), enhance educational outcomes (Gabdo & Magaji, 2025), Promotes general human capital development (Magaji et al, 2025) and expand economic activities and creating employment (Adekoya et al.., 2025) However, the initial costs of renewable technologies, weak policy support, and limited financing mechanisms often restrict access for people with low incomes, potentially deepening inequality if not addressed. Therefore, integrating renewable energy into poverty reduction strategies is vital to ensure inclusive and sustainable development.

2.2 Theoretical Review

2.2.1 Systems Theory

Systems Theory is a framework that sees an organisation as a collection of interconnected parts working together toward a common objective. Developed by Ludwig von Bertalanffy, the theory posits that no part of a system can be understood in isolation; instead, the system's overall behaviour arises from the dynamic interactions of its components (Bertalanffy, 1968). For electricity distribution, systems theory shows how generation, transmission, and distribution are linked and how problems in one area can disrupt the entire power sector (Ogunleye, 2017). Applying this theory helps in analysing and improving the operations of DisCos, such as AEDC, by highlighting the importance of coordinating infrastructure, technology, policies, and stakeholders to ensure efficient and sustainable electricity delivery (Okafor & Eze, 2021).

2.3 Empirical Review

Adebayo, Musa, and Ibrahim (2020) examined the impact of grid modernisation on electricity distribution efficiency in Nigeria. Using a quantitative research design, they collected operational and technical data from selected Nigerian Distribution Companies (DisCos) between 2010 and 2018. The study employed econometric modelling and regression analysis to assess the impact of advanced grid technologies, including advanced metering infrastructure (AMI) and distribution automation, on technical losses, service reliability, and customer satisfaction. Their findings showed that modernisation significantly reduced distribution losses and improved reliability, concluding that DisCos must prioritise large-scale investments in grid technology to enhance efficiency and sustainability.

Okoye and Ezenwa (2021) explored the integration of renewable energy into Nigeria's grid. Their study employed a mixed-methods approach, combining simulation modelling of solar and wind energy potentials with policy analysis of Nigeria's energy framework. Data were obtained from the Nigerian Electricity Regulatory Commission (NERC), solar radiation maps, and international energy databases. The results demonstrated that integrating renewable energy into the existing grid is technically feasible and economically viable, particularly in reducing reliance on fossil fuels. The study emphasised the need for grid upgrades and supportive policies, such as feed-in tariffs, tax incentives, and investment subsidies, to enable the penetration of renewable energy.

Smith (2019) investigated the financial sustainability of electricity distribution companies (DisCos) in developing countries. Employing a case study approach with secondary financial data analysis, the research examined revenue collection patterns, metering efficiency, and billing practices across several African and Asian Distribution Companies (DisCos). The study employed descriptive statistics and correlation analysis to establish a link between high revenue losses and inefficient metering systems, billing errors, and electricity theft. The findings recommended the adoption of prepaid meters, smart

metering technologies, and stricter monitoring systems to reduce leakages, ensure cost recovery, and enable DisCos to finance infrastructure upgrades.

Johnson (2022) assessed customer satisfaction in urban electricity distribution. The study used a survey-based quantitative methodology, collecting responses from 1,200 urban electricity consumers across major Nigerian cities. A Likert-scale questionnaire was used to capture customer perceptions of service quality, outage frequency, and complaint handling. Factor analysis and regression models were employed to interpret satisfaction levels. The study revealed that frequent outages, a lack of transparency in billing, and inadequate complaint resolution mechanisms were the primary causes of dissatisfaction among customers. Johnson recommended that DisCos improve customer communication, establish efficient grievance redress mechanisms, and enhance transparency in billing processes.

Chen (2023) conducted a comparative analysis of electricity distribution systems in developed versus developing nations. Using a comparative research design, the study drew on secondary datasets from 15 developed and 15 developing countries, encompassing infrastructure investment, grid performance indicators, and renewable energy integration. Through cross-country regression and cluster analysis, Chen demonstrated that developed nations have successfully implemented grid modernisation and renewable energy policies, leading to high system reliability and lower emissions. Conversely, developing countries were found to struggle with outdated infrastructure, limited private-sector participation, and inadequate financing. The research underscored the importance of adopting global best practices and context-specific reforms in developing nations like Nigeria.

Garcia (2021) examined how regulatory frameworks influence the distribution of sustainable energy. This study employed a qualitative research approach, involving the analysis of regulatory policies, energy laws, and government reports from over 20 countries. Additionally, Garcia conducted semi-structured interviews with regulators, policymakers, and energy sector experts to assess how regulatory structures influence the investment decisions of DisCos. The findings revealed that transparent and consistent regulatory environments encourage DisCos to adopt renewable energy, invest in infrastructure, and improve customer service. Garcia concluded that well-designed regulations—particularly those ensuring tariff stability, investor protection, and incentives for renewable energy—are crucial for achieving sustainability and efficiency in the distribution sector.

Literature Gap

Several studies provide valuable insights into electricity distribution efficiency, renewable energy integration, financial sustainability, customer satisfaction, comparative best practices, and regulatory frameworks. However, there are still important gaps:

i. Context-specific evidence for Nigeria's DisCos: While Adebayo et al. (2020) and Okoye & Ezenwa (2021) addressed modernisation and renewable integration, few studies comprehensively examine how these strategies can be jointly applied within the operational and financial realities of Nigerian DisCos, particularly the Abuja Electricity Distribution Company (AEDC).
ii. Limited consumer-focused studies: Johnson (2022) highlighted urban consumer dissatisfaction, but there is little research on rural and peri-urban customers, who constitute a significant portion of AEDC's service base.
iii. Financial and regulatory interactions: Smith (2019) and Garcia (2021) separately explored financial sustainability and regulatory frameworks. However, limited studies integrate these two dimensions to show how policy environments directly affect DisCos' financial health and capacity for modernisation.
iv. Comparative analysis gaps: Chen (2023) provided a broad developed vs. developing country comparison, but did not delve into intra-regional comparisons within Africa, which could provide more relevant lessons for AEDC.

Thus, while existing literature lays a foundation, there is a gap in holistic, empirical research that simultaneously considers modernisation, renewable integration, financial sustainability, consumer

experience, and regulatory structures in the specific context of AEDC and Nigeria's power distribution landscape.

3.0 METHODOLOGY

This study will use a mixed-methods research design, combining quantitative and qualitative approaches. The quantitative part will involve surveys and statistical analysis of AEDC's performance. In contrast, the qualitative part will use in-depth interviews, focus group discussions, and document analysis to gather stakeholder perspectives.

This mixed-methods approach will provide a comprehensive understanding of AEDC's efficiency and sustainability. Quantitative data will provide statistical evidence of the company's performance, while qualitative data will offer contextual insights into the factors influencing its operations.

3.2 Study Area

The study was conducted within the operational area of the Abuja Electricity Distribution Company (AEDC), including the Federal Capital Territory (FCT), which includes both urban and rural areas. The focus will be on selected locations within these areas to ensure a broad view of AEDC's operations and customer segments.

3.3 Population of the Study

The study population includes:

i. AEDC Customers: Residential, commercial, and industrial customers.
ii. AEDC Employees: Staff from management, technical, and customer service.
iii. Government Officials: Representatives from regulatory bodies and ministries.
iv. Industry Experts: Consultants, researchers, and professionals in energy distribution.

3.4 Sample Size and Sampling Technique

The sample size will be determined using statistical formulas to ensure it adequately represents the population. The sampling techniques will include:

- Stratified Random Sampling: To select a representative sample of customers from different segments and locations.
- Purposive Sampling: To select government officials, industry experts, and AEDC employees with relevant expertise.
- Convenience Sampling: To gather quick feedback from readily available AEDC customers.

3.5 Sampling Procedure

The sampling procedure will involve:

1. Identification of Sampling Frame: Creating a list of AEDC customers, employees, government officials, and industry experts.
2. Stratification: Dividing the customer population by segment (residential, commercial, industrial) and location.
3. Random Selection: Using random number generators to select customers from each stratum.
4. Purposive Selection: Identifying and selecting key stakeholders based on their expertise.
5. Convenience Sampling: Administering surveys to available customers at service centres.

3.6 Sources of Data

The study will use both primary and secondary data.

i. Primary Data: Surveys, in-depth interviews, focus group discussions, and direct observations.
ii. Secondary Data: AEDC's operational and financial reports, regulatory documents, academic journals, and industry publications.

3.7 Instrument of Data Collection

The tools for data collection will be:

i. Questionnaires: Structured questionnaires for customers to assess service quality, satisfaction, and perceptions.
ii. Interview Guides: Semi-structured guides for interviews with officials and experts, focusing on regulatory frameworks and operational challenges.

iii. Focus Group Discussion Guides: Guides for discussions with customers and employees on service delivery and community engagement.
iv. Observation Checklists: Checklists to document observations of AEDC's operations and service centres.

3.8 Validity and Reliability of Instruments

To ensure validity and reliability, the study will:

- Content Validity: Use expert review to ensure instruments cover relevant topics.
- Pilot Testing: Conduct pilot tests with a small sample to identify and fix any inconsistencies.
- Internal Consistency: Use Cronbach's alpha to assess the internal consistency of questionnaire items.
- Triangulation: Use multiple data sources and methods to cross-validate findings.

3.9 Technique of Data Analysis

The data analysis will include:

- Quantitative Data Analysis: Descriptive statistics (frequency distribution) and statistical software (SPSS, R) for data visualisation and analysis.

3.10 Ethical Considerations

The study will adhere to ethical principles by:

i. Informed Consent: Obtaining consent from all participants.
ii. Confidentiality and Anonymity: Ensuring participant responses are confidential.
iii. Voluntary Participation: Allowing participants to withdraw at any time.
iv. Data Security: Protecting the privacy and security of collected data.
v. Transparency and Integrity: Maintaining transparency in all research and reporting.

4.0 DATA ANALYSIS, PRESENTATION, AND DISCUSSION OF FINDINGS

This chapter presents and analyses data collected from the field.

4.1 Demographic Characteristics of the Respondents

Serial Number	Characteristics	Frequency	Percentage
1	**Gender**		
	Male	156	56.52
	Female	112	40.58
	Prefer not to say	8	2.90
	Total	**276**	**100**
2	**Age**		
	18-20	12	4.35
	21-30	74	26.81
	31-40	93	33.70
	41-50	61	22.10
	Above 50	36	13.04
	Total	**276**	**100**
3	**Occupation**		
	Civil Servant	81	29.35
	Private Sector	58	21.01
	Self-employed	65	23.55
	Students	42	15.22
	Unemployed	30	10.87
	Total	**276**	**100**

Source: Fieldwork, 2025

Table 4.1 shows that the majority of respondents were **male (56.52%)** and in the **31-40 age group (33.70%)**. This reflects a sample of economically active individuals who are highly concerned with power reliability. The most common occupations were **civil servants (29.35%)** and the **self-employed (23.55%)**, which highlights the strong presence of working-class consumers in the study.

Serial Number	Type	Frequency	Percentage
1	Residential	178	64.49
2	Commercial	46	16.67
3	Industrial	18	6.52
4	Governmental	34	12.32
	Total	**276**	**100**

Source: Fieldwork, 2025

Table 4.2 confirms that **residential users (64.49%)** comprise the most significant portion of the sample, underscoring the importance of a stable power supply for households in Abuja.

4.3 Electricity Supply and Quality

Serial Number	Responds	Frequency	Percentage
1	**Electricity Supply Regularity**		
	Very regular	24	8.70
	Irregular	108	39.13
	Very poor	46	16.67
	Total	**276**	**100**
2	**Hours of Supply**		
	Less than 4 hours	38	13.52
	4–8 hours	87	31.52
	9–15 hours	103	37.32
	Above 15 hours	48	17.39
	Total	**276**	**100**
3	**Satisfaction with Supply Quality**		
	Very satisfied	18	6.52
	Satisfied	71	25.72
	Dissatisfied	122	44.20
	Very dissatisfied	65	23.55

Source: Fieldwork, 2025

Table 4.3 reveals significant dissatisfaction with the electricity supply. A majority of respondents (39.13%) reported irregular supply. Only 8.70% reported very regular power. Regarding the hours of supply, only 37.32% received electricity for 9-15 hours daily, while a small fraction (17.39%) enjoyed more than 15 hours. Most concerning is the widespread dissatisfaction with quality, with 67.75% of respondents expressing dissatisfaction or being very dissatisfied.

4.4 Fault Response and Perceived Fairness

Serial Number	Responses	Frequency	Percentage
1	**Faults**		
	Very prompt	22	7.97
	Prompt	88	31.88
	Delayed	104	37.68
	Very poor	62	22.46
	Total	**276**	**100**
2	**Experience with a power surge**		
	Yes	207	75.00
	No	69	25
	Total	**276**	**100**
3	**Perceived Fairness Distribution**		
	Yes	78	28.26
	No	124	44.93
	Not sure	74	26.81

Source: Fieldwork, 2025

Table 4.4 shows that 60.14% of customers reported delayed or feeble responses to fault reports, indicating a significant weakness in AEDC's maintenance services. A worrying 75% of respondents had experienced power surges, highlighting significant issues with voltage stability. Furthermore, nearly 45% believed the distribution of power was unfair, suggesting potential biases in service delivery.

4.5 Billing and Customer Service

Serial Number	Responds	Frequency	Percentage
1	**Types of Billing**		
	Prepaid meter	121	43.84
	Postpaid billing	79	28.62
	Estimated billing	76	27.54
	Total	**276**	**100**
2	**Satisfaction with Billing Accuracy**		
	Yes	67	24.28
	No	123	44.57
	Sometimes	86	31.16
	Total	**276**	**100**

Source: Fieldwork, 2025

Table 4.5 shows that while prepaid meters are the most common billing method (43.84%), a significant number of customers still use postpaid and estimated billing. This is compounded by the fact that nearly half of all respondents (44.57%) were not satisfied with their billing accuracy, which suggests a deep-seated distrust in the billing system.

Serial Number	Rating	Frequency	Percentage
1	Excellent	22	7.97
2	Good	88	31.88
3	Poor	96	34.78
4	Very poor	70	25.36
	Total	**276**	**100**

Source: Fieldwork, 2025

Table 4.6 indicates that customer service is a significant weakness, with **60.14%** of respondents rating it as poor or very poor. Only a small fraction **(7.97%)** rated it as excellent, highlighting a substantial area for improvement.

Serial Number	Complaint resolution	Frequency	Percentage
1	Yes resolved	82	29.71
2	Yes, but unresolved	91	32.97
3	No	103	37.32
	Total	**276**	**100**

Source: Fieldwork, 2025

Table 4.7 shows that only **29.71%** of complaints were resolved satisfactorily. The majority of respondents either had their complaints unresolved or did not report them, which demonstrates low confidence in AEDC's complaint mechanisms.

4.6 Perception of Sustainability

Serial Number	Perceptions	Frequency	Percentage
1	Strongly agree	17	6.16
2	Agree	86	31.13
3	Disagree	108	39.13
4	Strongly disagree	65	23.55
	Total	**276**	**100**

Source: Fieldwork, 2025

Table 4.8 reveals that only **37.32%** believe AEDC is committed to sustainable energy, while **62.68%** disagree or strongly disagree. This suggests widespread scepticism about the company's long-term planning and environmental responsibility.

Serial Number	Responds	Frequency	Percentage
1	Yes	98	35.51
2	No	178	64.49
	Total	**276**	**100**

Source: Fieldwork, 2025

Table 4.9 indicates that awareness of AEDC's renewable energy initiatives is low, with nearly two-thirds of respondents (64.49%) being unaware of these efforts. This points to a lack of effective communication and public engagement.

Serial Number	Responds	Frequency	Percentage
1	Yes	203	73.55
2	No	42	15.22
3	Insufficient	31	11.23
	Total	**276**	**100**

Source: Fieldwork, 2025

Table 4.10 illustrates strong public support for renewable energy, with a large majority (73.55%) in favour of increased investment in this area. This indicates a readiness for a transition to sustainable alternatives.

Serial Number	Responds	Frequency	Percentage
1	Very willing	114	41.30
2	Willing	95	34.42
3	Not willing	67	24.28
	Total	**276**	**100**

Source: Fieldwork, 2025

Table 4.11 reveals that over **75%** of respondents are willing or very willing to adopt alternative energy sources, such as solar power, which signals a strong readiness for transition, provided the necessary support and infrastructure are available.

4.2 DISCUSSION OF FINDINGS

The demographic analysis reveals that the study sample is predominantly composed of economically active male residents of Abuja, with the majority being either civil servants or self-employed individuals. Since most respondents were residential customers, the findings primarily reflect household-level electricity usage and concerns.

The data reveal widespread dissatisfaction with AEDC's service. The supply is primarily seen as irregular, with most customers experiencing less than 15 hours of power per day. A significant majority are dissatisfied with the quality of power, citing frequent interruptions and voltage instability, as evidenced by the high number of reported power surges. This aligns with findings from Johnson (2022), which linked frequent outages to low customer satisfaction.

Customer service is another major weakness. The majority of respondents rated AEDC's service as poor or very poor, and most complaints went unresolved. This suggests a significant gap in the company's ability to address customer issues effectively and build trust. The findings also suggest an underlying distrust in billing, particularly with estimated and postpaid methods, which aligns with Smith's (2019) study on the financial sustainability of DisCos.

In terms of sustainability and renewable energy, the study found a high level of public support for investing in alternative energy sources, as noted by Okoye and Ezenwa (2021). However, despite this public willingness, a large majority of respondents are unaware of any AEDC-led renewable energy initiatives. This suggests a significant lack of communication on AEDC's part and a missed opportunity to engage the public and promote a sustainable energy transition. The pervasive scepticism about AEDC's commitment to sustainability further confirms this disconnect.

The survey findings confirm inefficiencies in AEDC's operations, highlighting the need for grid modernisation and improved customer relations. The persistent issues with power quality, fault response, and billing accuracy align with the problems identified in the broader empirical literature. The strong public support for renewables presents a significant opportunity for AEDC to modernise its grid, integrate renewable sources, and ultimately enhance its efficiency and sustainability.

5.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the study's findings, the Abuja Electricity Distribution Company (AEDC) faces significant challenges in providing efficient and sustainable electricity distribution to its service areas. Widespread customer dissatisfaction, stemming from irregular power supply, poor power quality, and inadequate customer service, indicates a fundamental disconnect between the company's operational goals and the public's needs. The persistent issues with fault response, billing accuracy, and complaint resolution highlight the urgent need for a systemic overhaul of AEDC's operational framework. Furthermore, despite a strong public appetite for a shift towards sustainable energy, the company's efforts in renewable energy integration are unknown primarily to its customers, suggesting a significant communication failure and a

missed opportunity to build a more resilient and sustainable energy future. The current state of AEDC's services undermines the socioeconomic progress of the FCT and reflects the broader inefficiencies within Nigeria's power sector.

To address these critical issues, this study provides a series of recommendations. First, AEDC must prioritise and fast-track investments in grid modernisation, including the deployment of smart metering technologies and distribution automation, to reduce both technical and non-technical losses and improve service reliability. Second, the company should implement a comprehensive customer service improvement plan aimed at enhancing communication, establishing transparent complaint resolution mechanisms, and building trust with its customer base. Third, AEDC must proactively engage in the integration of renewable energy sources, such as solar and wind power, and effectively communicate these initiatives to the public. By leveraging public support and adopting a more sustainable and transparent business model, AEDC can not only enhance its operational efficiency but also play a transformative role in achieving Nigeria's sustainable development goals.

REFERENCES

Adebayo, T., Musa, A., & Ibrahim, K. (2020). Grid Modernisation and Electricity Distribution Efficiency in Nigeria. *Journal of Energy Policy and Management, 5*(2), 101–118.

Adekoya, A. A., Magaji, S., & Ismail, Y. (2025). Empirical analysis of the impact of unemployment on economic growth in Nigeria. *International Journal of Innovative Finance and Economics Research, 13*(2), 63–80. https://doi.org/10.5281/zenodo.15311427

Adenikinju, A. (2020). Energy poverty and the challenges of electricity distribution in Nigeria. *Energy Policy, 142,* 111127. https://doi.org/10.1016/j.enpol.2020.111127

Adeoye, B. W., & Omolade, A. (2020). Electricity Distribution Challenges in Nigeria: Implications for Sustainable Development. *Journal of Energy Studies, 12*(3), 44–59.

Akinyemi, O. (2019). Sustainable electricity distribution and the attainment of SDG 7 in Nigeria. *African Journal of Sustainable Development, 8*(2), 73–86.

Bertalanffy, L. von. (1968). *General system theory: Foundations, development, applications.* George Braziller.

Chen, L. (2023). Comparative analysis of electricity distribution in developed and developing nations. *International Journal of Energy Systems, 29*(1), 55–72.

Gabdo, A. L., & Magaji, S. (2025). Examining the relationship between urban sustainable development and quality education in FCT Abuja, Nigeria. *African Journal of Environment and Sustainable Development, 3*(2), 2718.

Gabdo, A. L., Magaji, S., & Yakubu, J. (2025). Impact of government policies on educational quality in FCT Abuja, Nigeria. *OSR Journal of Humanities and Social Science (IOSR-JHSS), 30*(6), 07–14.

García, M. (2021). Regulatory frameworks and sustainable energy distribution: A global perspective. *Energy Regulation Review, 14*(3), 77–95.

Ijoko, A. O., Magaji, S., & Gombe, B. M. (2021, December 8–9). Impact of public health expenditure on health infrastructure in primary health care centres in FCT. *1st International Conference on Socio-economic and Health Shocks: Policy uncertainty and the need for Institutional Reforms.* Department of Economics, Faculty of Arts and Social Sciences, Gombe State University.

Johnson, R. (2022). Customer Satisfaction in Electricity Distribution in Urban Areas. *Journal of Consumer Energy Studies, 8*(4), 32–47.

Kafor, C., & Eze, E. (2021). Power Sector Reforms and Electricity Distribution Efficiency in Nigeria. *Nigerian Journal of Energy Economics, 4*(1), 15–27.

Magaji, S. (2004). *Introduction to project evaluation.* Sanitex Press.

Magaji, S., Ismail, Y., & Musa, I. (2025). Impact of Institutional Quality on Human Capital Development in Nigeria. *MSI Journal of Economics and Business Management, 2*(2), 21–26. https://doi.org/10.5281/zenodo.14936039

Magaji, S., Musa, I., & Dogo, S. S. (2023). Analysis of the Impact of Banking Sector Credits on the Real Sector in Nigeria. *International Journal of Management and Business Applied, 2*(1), 12–20.

Odenu, I. E., Shuaibu, M., & Magaji, S. (2025). From fuelwood and fossil fuels to the future: An economic exploration of cooking energy choices in Delta State, Nigeria. *The Journal of Environment and Development.* SAGE. https://doi.org/10.1177/10704965251324461

Ogunleye, E. K. (2017). Political Economy of Nigerian Power Sector Reforms. *World Bank Policy Research Working Paper, 8149.* https://doi.org/10.1596/1813-9450-8149

Okafor, C., & Eze, E. (2021). Power Sector Reforms and Electricity Distribution Efficiency in Nigeria. *Nigerian Journal of Energy Economics, 4*(1), 15–27.

Okoye, U., & Ezenwa, C. (2021). Renewable Energy Integration and Electricity Grid Sustainability in Nigeria. *African Journal of Renewable Energy, 12*(1), 89–104.

Olayemi, T., & Bello, R. (2022). Electricity distribution and sustainable development: A review of Abuja Electricity Distribution Company's operations. *Journal of Sustainable Energy, 14*(2), 101–115.

Ologbonori, S. T., Magaji, S., & Musa, I. (2025). Assessing the Critical Needs Driving Rural Development in Nigeria: Implications for Sustainable National Development. *MRS Journal of Accounting and Business Management, 2*(7), 1–10.

Smith, J. (2019). Revenue Collection Challenges and Financial Sustainability of Electricity Distribution Companies in Developing Countries. *Energy Economics and Policy, 11*(2), 142–159.

Suleiman, H., Magaji, S., & Musa, I. (2025). Assessing the effect of green loans and carbon finance on sustainable cities and community development in Nigeria: An analysis of urban sustainability indices. *International Journal of Innovative Science and Research Technology, 10*(5).

Tanko, Y., Magaji, S., & Musa, I. (2025). Effect of Green Finance on Climate Change Mitigation in Nigeria. *International Journal of Economic Perspectives, 19*(7), 1–22.

United Nations. (2015). *Transforming our world: The 2030 agenda for sustainable development.* United Nations. https://sdgs.un.org/2030agenda