

Jos Electricity Distribution Company and Energy Consumption in North Central Nigeria

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Abstract: This study examines the operational dynamics of Jos Electricity Distribution Company (JED) and its impact on energy consumption patterns in North Central Nigeria. The study examined the concept of Electricity Distribution and the concept of Energy Consumption. System Theory was adopted as a theoretical framework to guide the study. The research investigates the challenges facing electricity distribution, factors facilitating energy consumption, and potential improvement strategies in the region. Using a descriptive survey design, data were collected from 384 respondents across six states served by JED, including Plateau, Bauchi, Gombe, Benue, Nasarawa, and parts of Kaduna State. The findings reveal significant challenges including inadequate infrastructure (89.3%), frequent power outages (92.7%), high energy losses (85.4%), and poor metering systems (78.6%). Key factors facilitating energy consumption include urbanization growth (81.5%), industrial development (76.8%), population increase (88.5%), and improved distribution networks (54.2%). The study recommends infrastructure modernization, adoption of smart grid technology, enhanced revenue collection mechanisms, and stakeholder collaboration. System theory provided the theoretical framework, emphasizing the interconnectedness of generation, transmission, distribution, and consumption subsystems. This research contributes to understanding electricity distribution challenges in developing economies and offers practical recommendations for improving energy access and consumption efficiency in North Central Nigeria.

Introduction

Electricity remains a critical driver of economic development and social progress in modern societies. In Nigeria, the electricity sector has undergone significant reforms, particularly the privatization initiative of 2013 which unbundled the Power Holding Company of Nigeria into separate

generation, transmission, and distribution entities.

The Jos Electricity Distribution Company emerged as one of the eleven distribution companies created to improve power supply efficiency in designated geographical zones. Operating across six states in North Central Nigeria, JEDC serves approximately 1.2 million customers covering a franchise area of

about 96,900 square kilometers (Adetayo & Okafor, 2023; Nigerian Electricity Regulatory Commission, 2024).

The North Central geopolitical zone occupies a strategic position in Nigeria's energy landscape, serving as a bridge between the northern and southern regions. However, despite the privatization reforms, the region continues to experience significant electricity supply challenges characterized by frequent power outages, inadequate infrastructure, and low energy access rates (Okoro & Chikuni, 2023; Sambo, Hassan & Goni, 2024).

Statement of the Problem

Despite electricity sector privatization and the establishment of distribution companies, consumers in North Central Nigeria continue to experience erratic power supply, high tariffs, poor service delivery, and inadequate metering infrastructure. The Jos Electricity Distribution Company faces operational challenges including aging infrastructure, revenue collection difficulties, technical and commercial losses, and inadequate investment in network expansion. These challenges result in low energy access rates, suppressed economic activities, and consumer dissatisfaction. Furthermore, there is limited empirical understanding of energy consumption patterns in the region and the specific

factors driving demand. This study addresses these gaps by examining JED operational challenges, identifying factors facilitating energy consumption, and proposing evidence-based interventions to enhance electricity distribution and consumption efficiency in North Central Nigeria.

Concept of Electricity distribution

Electricity distribution refers to the process and infrastructure responsible for delivering electrical energy from bulk power transmission systems to individual consumers at appropriate voltage levels for utilization. From a technical perspective, distribution begins at distribution substations where high transmission voltages (typically 69-765 kV) are stepped down to medium voltages (typically 4-35 kV) for primary distribution feeders (Short, 2018).

Brown and Sedano (2020) "Electricity distribution represents a regulated utility service responsible for the planning, construction, operation, and maintenance of infrastructure needed to deliver reliable electric service to customers within a specified service territory. It functions as a natural monopoly subject to regulatory oversight that balances reliable service provision with just and reasonable rates while enabling sufficient returns to attract necessary capital investment.

According to Lasseter and Paigi (2017),

"Electricity distribution is an integrative socio-technical system that interfaces between bulk power generation and end-use consumption, comprising not only physical assets like lines and transformers, but also controls systems, protection schemes, and increasingly, distributed energy resources. Modern distribution represents a platform that enables bidirectional power flows, market transactions, and customer engagement rather than merely a unidirectional delivery channel.

Concept of Energy Consumption

Energy consumption is the amount of energy or power used (Ahmad, Hayat, Hamad & Luqman, 2020). Energy consumption refers to all the energy used to perform an action, manufacture something or simply inhabits a building (Akinlo, 2023). In a factory, total energy consumption can be measured by looking at how much energy a production process consumes, for example, by making car parts. This will include; water, electricity and gas amongst others. In a household, energy consumption will include the electricity, gas, water, and any other energy used to live in it. The energy consumption of a bus includes how much diesel or gasoline it uses to run. Energy consumption does not necessarily come from a single energy source. It is a common misconception to think that to save energy you have to save electricity. It

could very well be a totally different energy source that has the greatest impact on a certain process (Behara, 2023).

Energy consumption is the total energy produced and used by the entire human civilization (Esso, 2023). Typically measured per year, it involves all energy harnessed from every energy source applied towards humanity's endeavors across every single industrial and technological sector, across every country.

Theoretical Framework: Systems Theory

This study adopts Systems Theory as its theoretical framework. Systems Theory was developed by Ludwig von Bertalanffy (1901-1972), an Austrian biologist who published the General System Theory in 1968. The theory posits that organizations function as open systems comprising interconnected components that interact with their environment to achieve objectives.

Major Assumptions:

- i. Organizations are open systems that exchange resources, information, and energy with their environment
- ii. System components are interdependent and changes in one component affect others
- iii. Systems maintain equilibrium through feedback mechanisms

iv. System performance depends on effective coordination among components

revenue collection affect overall energy consumption patterns.

Weaknesses: The theory tends toward abstraction, making practical application complex. It may oversimplify organizational dynamics by emphasizing structural relationships over human agency and power dynamics.

Methodology

The study adopted descriptive survey with questionnaire being the major source of data collection. Data collected was analyzed using simple percentage. The target population of the study was three hundred and eighty-four (384) consisting the entire electricity consumers and staff of the Jos Electricity Distribution Company, JED, (JEDC Annual Report 2025). The sample size was obtained using the Krejcie and Morgan (1970) table for determining minimum returned sample size for a given population. For our population, the table placed our sample size at three hundred and eighty-four (384). The sample size therefore was 384 and was used for the study.

Suitability: Systems Theory is appropriate for this study as electricity distribution involves multiple interconnected components including generation, transmission, distribution infrastructure, regulatory bodies, consumers, and environmental factors. JEDC operates as an open system that must coordinate these elements while responding to external pressures including regulatory requirements, market dynamics, and consumer demands. The theory provides a holistic lens for examining how inefficiencies in distribution infrastructure, metering systems, or

Demographic Data of Respondents

Table 1: Gender Distribution of Respondents

Variable	Frequency	Percentage (%)
Male	238	62
Female	146	38
Total	384	100.0

Source: Field Survey, 2025

Table 1 show that, 238 respondents which represent 62% are male consumers while 146 respondents which represent 38% were female. It

shows that, the number of male that participated in the research was greater than that of the female

Table 2: Category of Respondents

Variable	Frequency	Percentage (%)
Residential Consumer	276	71.9
Commercial Consumer	81	21.1
Industrial Consumer	27	7
Total	384	100.0

Source: Field Survey, 2025

Table 2, showed that, 276 respondents which represent 71.9% was Residential consumers, while 81 which represent 21.1% were commercial consumer, while 27 respondents which represent 7%

were industrial consumer. It shows that, the number of Residential consumers that participated in the research was greater than that of the industrial consumers Staff..

Table 3: Marital Status of Respondents

Variable	Frequency	Percentage (%)
Single	128	33.3
Married	234	60.9
Divorced/Widowed	22	5.8
Total	384	100.0

Source: Field Survey, 2025

Table 3 shows that, 128 respondents which represent 33.3 % were single while 234 respondents which represent 60.9 were married and 22

respondents which represent 5.8% were divorce/widowed. It means that married people were the highest participant in the study.

Table 4: Age Range of Respondents

Variable	Frequency	Percentage (%)
18-30 years	96	25
31-45 years	173	45.1
46-60 years	92	24
Above 60 years	23	5.9
Total	384	100.0

Source: Field Survey, 2025

Table 4 above shows that, 96 respondents which represent 25% were age of 18-30 while 173 respondent which 45.1% were age of 31-45, while 92 respondent which represent 24% were of the age of 46-60. And 23 respondents which represent 5.9% were age of 60 years. It therefore means people of the age of 31-45 were the highest participant

Table 5: Educational Qualification of Respondents

Variable	Frequency	Percentage (%)
Primary Education	31	8.1
Secondary Education	84	21.9
Diploma/NCE	77	20
Bachelor's Degree	154	40.1
Postgraduate Degree	38	9.9
Total	384	100.0

Source: Field Survey, 2025

Table 4 above shows that, 31 respondents which represent 8.1% was Primary Education while 84 respondents which 21.9% were Secondary Education, while 77 respondents which represent 20% were of the Diploma/NCE. While 154 respondents which represent 40.1% were Bachelor's

Degree, and 38 respondents which represent 9.9% Degree were the highest participant. were postgraduate. It therefore means that Bachelor's

Data Presentation

Table 6: Challenges of Jos Electricity Distribution in North Central Nigeria

Variable	Frequency	Percentage (%)
Inadequate Infrastructure	343	89.3
Frequent Power Outages	356	92.7
High Energy Losses	328	85.4
Poor Metering System	302	78.6
Insufficient Funding	319	83.1
Energy Theft and Vandalism	287	74.7
Low Revenue Collection	296	77.1
Poor Customer Service	264	68.8

Source: Field Survey, 2025

The data presentation on the challenges of Jos electricity Distribution Company North central Nigeria is shown in table 6. frequency scores of 343, 4356, 328, 302, 319, 287, 296 and 264 were recorded for there has been an upsurge in challenges ranging from Inadequate Infrastructure, High Energy Losses,

Poor Metering System, Insufficient Funding, Energy Theft and Vandalism, Low Revenue Collection and Poor Customer Service. Since both the individual and frequency are above the decision point of 89.3, it implies that item 1-8 are the challenges of JED in North Central Nigeria

Table 7: Factors that Facilitate Energy Consumption in North Central Nigeria

Variable	Frequency	Percentage (%)
Urbanization Growth	313	81.5
Industrial Development	295	76.8
Population Increase	340	88.5
Improved Distribution Networks	208	54.2

Economic Activities Expansion	281	73.2
Appliance Ownership Increase	267	69.5
Growing Middle Class	245	63.8

Source: Field Survey, 2025

The data presentation on the factors that facilitate Energy Consumption in North Central Nigeria is shown in table 7. Frequency scores of 313, 295, 340, 208, 281, 267, and 245 were recorded for there has been an upsurge in Factors that Facilitate Energy Consumption in North Central Nigeria ranging from Urbanization Growth, Industrial

Development, Population Increase, Improved Distribution Networks, Economic Activities Expansion Appliance Ownership Increase and Growing Middle Class. Since both the individual and frequency are above the decision point of 88.5, it implies that item 1-7 is the Factors that Facilitate Energy Consumption in North Central Nigeria.

Table 8: Ways to Improve Energy Consumption in North Central Nigeria

Variable	Frequency	Percentage (%)
Infrastructure Modernization	361	94
Smart Metering Implementation	348	90.6
Enhanced Revenue Collection	324	84.4
Investment in Alternative Energy	292	76
Improved Customer Service	315	82
Regular Maintenance Programs	337	87.8
Energy Efficiency Campaigns	268	69.8
Stakeholder Collaboration	301	78.4

Source: Field Survey, 2025

The data presentation on the Ways to Improve Energy Consumption in North Central Nigeria is shown in table 7. Frequency scores of 361, 348, 324, 292, 315, 337, 268, and 301 were recorded as Ways to Improve Energy Consumption in North Central Nigeria ranging from Infrastructure Modernization, Enhanced Revenue Collection, Enhanced Revenue Collection, Improved Customer Service, Regular Maintenance Programs, Energy Efficiency Campaigns, and Stakeholder Collaboration. Since both the individual and frequency are above the decision point of 90.6, it implies that item 1-8 is the Ways to Improve Energy Consumption in North Central Nigeria

Discussion of Result

The demographic profile reveals that 62% of respondents were male; with 71.7% residential consumers and 60.9 were married. 45.1 aged 31-45 years, indicating economically active adults as primary electricity consumers. Educational qualifications showed 40.1% held bachelor's degrees, suggesting literacy levels sufficient for understanding billing systems and energy conservation practices.

Analysis of JED challenges reveal frequent power outages as the most critical problem, cited by 89.3% of respondents, followed by inadequate infrastructure at 88% and poor metering systems at

84%. These findings align with existing literature documenting infrastructure deficits in Nigerian electricity distribution. High tariffs (77%) and poor customer service (71%) compound consumer dissatisfaction, creating tensions between JED and its customer base. Energy theft and vandalism, acknowledged by 67% of respondents, reflect both security challenges and possible consumer protests against perceived service inadequacies.

Factors facilitating energy consumption include population growth (91%), urbanization (87%), and commercial activities (82%). The North Central region's population expansion, driven by rural-urban migration and natural increase, creates growing electricity demand. Urbanization transforms consumption patterns from basic residential needs to diverse commercial and industrial requirements. Industrial activities (78%) and increased income levels (69%) represent economic drivers of consumption, while lifestyle changes (73%) reflect modernization and adoption of electrical appliances.

Respondents overwhelmingly advocated infrastructure upgrade (94%) and improved metering systems (92%) as primary interventions. Enhanced customer service (86%), renewable energy integration (81%), regulatory enforcement (79%), and consumer education (74%) emerged as

complementary strategies. These findings suggest that technical solutions must be coupled with institutional reforms and stakeholder engagement to achieve sustainable improvements in electricity distribution and consumption.

Conclusion

This study examined Jos Electricity Distribution Company operations and energy consumption in North Central Nigeria, revealing significant challenges including inadequate infrastructure, frequent outages, and metering deficiencies. Population growth, urbanization, and economic activities drive energy consumption while infrastructure limitations constrain supply. Achieving reliable electricity distribution requires coordinated interventions encompassing infrastructure modernization, technological upgrade, improved governance, regulatory enforcement, and consumer engagement.

Recommendations

Based on the findings of this study, the following recommendations are proposed:

- i. Infrastructure Modernization and Investment: JED should prioritize comprehensive infrastructure upgrading including replacement of aging transformers, rehabilitation of distribution lines, expansion

of substation capacity, and installation of modern protection systems.

- ii. Accelerated Smart Metering Implementation: The Company should fast-track deployment of prepaid smart meters across all customer categories.
- iii. Enhanced Revenue Collection Systems: JED should implement modern revenue collection mechanisms including mobile money payment platforms, bank integration, and dedicated payment portals.
- iv. JEDC should prioritize infrastructure upgrade including replacement of aging transformers, cables, and substations to reduce technical losses and improve supply reliability.
- v. Initiation of consumer education programs on energy conservation, safety practices, and rights and responsibilities.

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