SIAR-Global Journal of Engineering & Agricultural Review (GJEAR)
www.siarpublications.org ISSN: 3121-9896
info@siarpublications.org Vol. 1 Issue 1 Sept.-Oct. 2025

Consequences and Solutions of Electrical Power Outages in Selected Federal Universities in Niger Delta Region, Bayelsa State

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ABSTRACT

The aim of the study is to evaluate the consequences and solutions of electrical power outages in Federal Universities in Niger Delta region, Nigeria. The study was guided by four research objectives which is to determine the power outage rate and duration in Federal universities in Niger Delta region, Nigeria, to determine the reliability indices of the feeders in Federal universities in Niger Delta region, Nigeria to find out the effects of power outage in Federal universities in Niger Delta region, Nigeria, and to determine the solution to power outage in Federal universities in Niger Delta region, Nigeria. The data for this study was sourced and gathered from the independent system operation (IS0) unit of the Transmission Company of Nigeria (TCN) Regional Headquarters in Bayelsa State in the months of January to December, 2024. The data obtained for analysis were collected on monthly basis and were further classified as thus; Monthly fault frequency, Monthly fault Duration, Total Annual fault Frequency, Scheduled Outage, Forced Outage. Reliability assessment of the various components has to do with the evaluation of the activities of the power system in Federal universities in Niger Delta region, Nigeria based on power distribution with a view to capturing the feeder network that is under pressure, overstressed and experiencing outage as a result of overload. It was recommended that there should be Intensive funding of researches by Government and other corporate organizations on the best alternative sources of power supply for example solar energy and wind energy. There is also need for Private entrepreneurs, dedicated government agencies and local communities to start developing micro-hydropower stations and solar home systems at lower prices such that there will be competition to PHED Power supply and others.

Keywords: consequences, solutions, electrical power outages, Federal Universities, Niger Delta region.

INTRODUCTION

Power is widely acknowledged as the foundation of any economy and the engine of growth, with all sectors relying on it to operate efficiently. As a result, clear plans and strategies that may guide the economy toward sustainable development are necessary for its development, management, and improvement (Aderemi et al., 2009).

According to Awah and Okoro (2010), Nigerian households and businesses continue to use energy inefficiently. The majority of electrical energy is used inefficiently (Otegbulu, 2011), and significant waste results from the fact that homes, businesses, governmental institutions, and private offices use significantly more energy than is truly required to meet their needs (CREDC, 2009).

One of the biggest problems Nigerian institutions face is undoubtedly an inadequate supply of electricity. Up to ten times a week, power outages or voltage fluctuations occur in most institutions; these episodes last roughly two hours and frequently happen without warning. Due to idle labor, output loss, equipment damage, and startup costs, this circumstance places a heavy financial burden on colleges. All things considered, an unstable power supply increases operational uncertainty, lowers returns on investment, erodes the possibilities for national economic growth, and makes Nigeria less attractive to foreign investors.

The public utility in charge of providing power in the nation is the Power Holding Company of Nigeria (PHCN). However, PHCN has continuously failed to provide enough and dependable power despite enormous investments totaling billions of naira. Because of this failure, the public's trust has been severely damaged, to the point where customers mockingly reinterpret the PHCN name as the "Power Holders Commission of Nigeria."

The economy is heavily burdened by PHCN's inefficiencies. The World Bank calculated that PHCN's inefficiencies caused economic losses of about ₦1 billion as early as 1990. Relocation, factor substitution, private power generation, changes in corporate operations, and production reduction are the five main ways that businesses usually react to an unstable electrical supply. All of these solutions are clear across Nigerian colleges, however the most common approach is still private power generating.

Electricity users, including individuals and businesses, have increasingly turned to self-generation of power as a result of PHCN's subpar performance. Particularly at universities, the cost of generators is frequently included in capital and operating expenses, which raises running costs considerably. According to Lee and Anas (1991), self-generated electricity can account for as much as 25% of a university's overall running expenses. The national electrical monopoly loses money as a result of this circumstance, which also restricts viable investment prospects, raises manufacturing costs, and lowers the competitiveness of local produce.

Strictly speaking, electricity is not a private good. Due to economies of scale and large initial capital requirements, the sector's number of viable manufacturers is necessarily constrained. However, commercial operators are virtually barred from entering the market by the PHCN Act, which prevents agreements like satellite operations, pooled supplies, or collaborative production that might reduce costs and improve reliability. Because of this, certain big companies who have more power than they need are legally prohibited from selling it to other companies.

One essential tool for energy management is power load auditing. In addition to lowering energy usage, these audits increase the lifespan of systems and equipment and enhance indoor environmental quality by spotting areas for increased energy conservation and efficiency. These advantages result in financial savings and possible increases in production. Additionally, using less energy results in using less fossil fuels, which lowers pollution emissions and promotes sustainable development and environmental preservation. Furthermore, examining the expenses related to power outages can help measure PHCN's inefficiencies, reveal important information about consumers' willingness to pay for dependable electricity, and give a solid foundation for changing the public electricity monopoly.

Statement of problem

Rapid urbanization, population increase, and poor individual and governmental planning have made power supply more complicated. Due in large part to failed privatization attempts, repeated fuel price hikes, pervasive corruption, and a lack of public investment in power infrastructure, Nigeria's economy has continued to face significant issues in the energy sector. These issues have led to frequent and ongoing power outages, which have seriously affected economic activity, especially in the transportation, commercial, and industrial sectors. The availability and dependability of energy at a reasonable price are crucial for sustainable economic growth and national development, which runs counter to the basic function of an efficient power supply system. However, power outages frequently happen without warning in Nigeria, which raises grave questions about the dependability of the country's electrical supply system.

The Federal Government of Nigeria has occasionally implemented a number of reform efforts in response to the ongoing energy problem and in an attempt to increase power system reliability. Among these, the National Electric Power Authority (NEPA) was formed in 1972 by the merging of the Electricity Corporation of Nigeria (ECN) and the Niger Dams Authority (NDA). In order to improve efficiency, accountability, and operational effectiveness, NEPA was renamed the Power Holding Company of Nigeria (PHCN) in 2005. In 2012, the company was reorganized, unbundled, and privatized into eighteen (18) distinct firms.

The availability and dependability of power supply, which continues to be a major concern for consumers, appear to have improved little or not at all as a result of government interventions, according to the current state of electricity supply in establishments like the Federal University, Otuoke. Many electrical users have thus lost faith in the power grid, especially primary consumers. Public unhappiness has increased due to the deteriorating status of power generation, and as a result, electricity users have been voicing their grievances and demonstrations on numerous social media sites.

Due to a number of enduring obstacles, power access in federal colleges in the Niger Delta region is still below economically acceptable norms and hasn't improved much in recent years. Inadequate data, regulatory bottlenecks, weak institutional frameworks, poor grid infrastructure, aging and deteriorated transmission and distribution networks, low system efficiency and performance, trouble sourcing diesel for alternative power generation, lack of continuity in power policies and projects, and inadequate financial investment are some of these issues. In light of this, the current study aims to investigate the consequences of electrical power outages and potential ways to enhance the availability of electricity in federal institutions located in Nigeria's Niger Delta.

Aim and Objectives

The main objective of the study is to investigate the consequences and solutions of electrical power outages in Federal universities in Niger Delta region, Nigeria. The specific objectives of the study include the following:

1. To compute the Power System Reliability Indices of Federal universities in Niger Delta region, Nigeria.
2. To determine the reliability indices of the feeders in Federal universities in Niger Delta region, Nigeria.
3. To find out the Customer Index (Jan-Dec, 2024) in Federal University, Otuok

LITERATURE REVIEW

Overview of Outage Intensity in Nigeria

In Nigeria, power interruptions continue to be a major hindrance to commercial activities. Many businesses have been forced to close as a result of the ongoing unpredictability of the power supply, and enterprises have also been pushed to relocate to neighboring West African countries where electricity is more reliable. Figure 2, which shows the average monthly outage intensity for certain enterprises across Nigeria's six geopolitical zones, further highlights the severity of inadequate energy supply. With an average of almost

122.025 outages each month, the South-East has the highest outage intensity, followed by the North-Central (34.314), North-West (34.042), North-East (30.753), South-West (30.047), and South-South (25.744). Cumulative statistics show that the South-East had outage levels of almost 2,000, which was significantly higher than those in the North-Central (1,000), North-West (630), South-West (372), North-East (200), and South-South (100).

Nigeria's Electricity Market Structure

The Rural Electrification Board (REB), licensed private power producers, self-generators, and the Power Holding Company of Nigeria (PHCN) are the four primary players in the Nigerian electricity market. Decree No. 24 of 1972 created the National Electric Power Authority (NEPA), which subsequently changed its name to PHCN, to handle the production, transmission, and distribution of power across the country. Operating on a cost-recovery basis was mandated under the decree. NEPA was then included on the list of public businesses targeted for commercialization under Decree No. 25 of 1988, the Privatization and Commercialization Decree.

The public monopoly has persisted in functioning under difficult circumstances in spite of its commercialized status. Efficiency has been limited by strict government regulation and the idea that providing electricity is a social duty. Nigeria's installed generating capacity in 1996 was 5,876 MW, or around one-fifth of South Africa's 31,000 MW capacity. Ironically, at the time, Nigeria's highest electricity demand of 2,452 MW was nearly doubled by this added capacity. However, national reliability levels were reported to be below 50%, indicating that the electrical supply remained extremely erratic. According to available data, only roughly 34% of Nigerians have access to public electricity, and the country's per capita energy consumption was just 161 kWh, which is hardly enough to run ten 40-watt bulbs for an hour every day of the year (Vision 2010).

Three primary factors contribute to Nigeria's suppressed demand for electricity: households and businesses without access to public supply (roughly 66% of the population), those that augment public supply with private generation, and consumers who, even though they are grid-connected, depend on private power sources because of worries about quality and dependability. Only roughly 45 of the 80 generating units that PHCN operates are ever fully operational. The low quality of the electrical supply is caused by a number of problems, such as outdated hydro and thermal facilities that urgently require rehabilitation, diminishing investment in the power sector, restrictions in generating capacity, and insufficient growth to meet expanding demand. The significant need for system refurbishment is highlighted by the fact that approximately 36 percent of installed capacity is over 20 years old, 48 percent is over 15 years old, and approximately 80 percent is over 10 years old

About 15,000 substations and 80,000 km of 33 kV and 11 kV overhead lines make up Nigeria's electrical distribution network, which serves about 2.6 million customers. Approximately 3.4 million residential users, 640,000 business customers, 53,000 industrial consumers, and roughly 5,000 street-lighting connections made up the total registered customer base as of December 31, 2009. As a result, the majority of electricity produced is intended for domestic usage. Despite producing almost 52% of the electricity, residential customers only make up 27% of overall revenue, while commercial and industrial users generate 32.9 and 33.3 percent, respectively. Just 0.28 percent of revenue comes from street lighting.

ECN, now known as PHCN, was given a wide range of powers by Ordinance No. 15 of 1950, including the ability to produce, transmit, distribute, and sell electricity across the country; purchase and sell land for operational use; and halt the supply of electricity for testing, inspections, repairs, or new connections.

Customers are not legally entitled to reimbursement during such disruptions, which has frequently exempted PHCN from liability for inefficiently caused service interruptions.

Additionally, the ordinance permitted state governments, private companies, and people to generate, distribute, and sell power, contingent upon federal approval and PHCN recommendations. In order to join to PHCN's network, applicants had to prove that their locations were too far away. In actuality, PHCN was frequently hesitant to suggest licenses for substitute suppliers, so restricting the involvement of the private sector. However, a few organizations were given licenses, such as the Ajaokuta Steel and Rolling Mill, the Shell Petroleum Development Company in Bonny and parts of the Delta, African Timber and Plywood Limited in Sapele, and the Nigerian Electricity Supply Company (NESCO), which operated in parts of the former Northern Region. Even though PHCN supplies over 97% of Nigeria's energy, privately held businesses with extra generating capacity have periodically added modest amounts to the output of PHCN. However, as Table 1 illustrates, the percentage of these alternative providers has remained minor, falling from over 17% in 1999 to less than 2% by 2008.

Table 1: PHCN energy output, 2009

Type	**Output generated (MW)**	**% of generation**
PHCN :		
Hydro		
Kainji	760	0.122
Jebba	578.4	0.093
Shiroro	600	0.096
Thermal		
Orji	30	0.005
Delta	900	0.144
Ijora	60	0.010
Sapele	1020	0.164
Afam	969	0.155
Egbin	1320	0.212
Total	6237.4	

Source: PHCN Annual Report (2009).

Since the Third National Development Plan period (1975–1980), state governments have also been involved in the provision of energy, even though the Power Holding Company of Nigeria (PHCN) continues to be the principal supplier of public electricity. Through the creation of Rural Electrification Boards (REBs), their involvement has mostly been restricted to rural areas that are not connected to the PHCN grid. With the hope of eventually being incorporated into the national grid when circumstances allowed, these isolated power schemes—which are primarily dependent on fossil fuels were created as short-term fixes. But because state governments have found it difficult to handle the high operating and maintenance costs of tiny, standalone diesel-powered generating units, the performance of many REBs has been mainly subpar.

As a result, the only communities and consumers who have benefited from the availability of energy for comparatively longer periods of time each day are those who are lucky enough to be connected to the national grid. Although PHCN was given the authority to generate energy in Nigeria by the legislation that established it, the organization's incapacity to provide adequate and dependable power has caused reality to diverge dramatically. Due to this ongoing underperformance, the private sector has become increasingly dependent on producing its own electricity. The desire to lessen the significant financial losses brought on by frequent power outages, such as lost productivity, damaged equipment, and idle labor, has strengthened this unofficial but pervasive move toward private power supply.

Almost all large new businesses, whether privately held, publicly owned, or independently run, have invested heavily in self-generated electricity in recent years. Although this tactic lessens the impact of power outages, it has also increased production costs and reduced the competitiveness of Nigerian products and services in both local and foreign markets.

Relocating operations, switching production factors, investing in a private power source, shifting business emphasis, or lowering output are the five solutions that companies typically use in reaction to inadequate infrastructure. Although private power provision is by far the most prevalent, Nigerian enterprises exhibit evidence of all five responses. Businesses have been forced to look for alternate power arrangements in order to lessen their reliance on public supply and minimize losses resulting from intermittent electricity due to PHCN's incredibly bad performance.

Businesses respond to unreliable public infrastructure in four primary ways, according to Lee and Anas (1991). The first is self-sufficiency, in which a business produces all of its own electricity without depending on the public supply. The second is backup private provision, where businesses keep private facilities and transition to them when the quality or dependability of public energy declines. In the third approach, businesses rely mostly on private generation and then transition to public energy when it becomes reasonably dependable. When businesses continue to rely entirely on public electricity despite its unreliability, the last tactic, captivity, takes place.

Alternative systems including satellite supply agreements, shared generation, and collaborative production have not been adopted in Nigeria due to regulatory limitations over the trade and delivery of infrastructure services. Because of PHCN's ongoing unreliability, most manufacturers are now forced to pay extra for private power sources. As a result, the market for generators has grown quickly, and there are now a lot of tiny gas-powered generating sets in use, most of which are made by Chinese and Japanese companies including Elemax, Sumac, Honda, Suzuki, and Yamaha. Some of these generators are assembled locally, such as Yamaha generators put together by Holt Engineering Limited, but the majority are imported.

Furthermore, because locally made generating sets are far less expensive than imported ones, many small-scale industrial operators now prefer them. Even though all energy generators utilized in the nation must be registered by the Federal Ministry of Mines, Power, and Steel, user compliance with this rule is still extremely low.

Empirical Studies

Research on electricity outages, corruption, and corporate performance has garnered significant attention in the domains of energy and industrial economics in recent years, according to an assessment of empirical studies. The association between power outages and firm performance has been the subject of numerous research, both cross-country and single-country, with generally consistent results. For example, Adenikinju (2005) used Nigeria as a case study to examine the consequences of power outages in emerging countries and discovered that frequent power outages have a negative influence on company operations, with small and medium-sized businesses (SMEs) being the most severely affected. Similarly, Arlet (2017) examined the effects of energy pricing and power outages on firm performance using firm-level survey data from 190 countries. He found that power outages considerably lower firm performance globally, with SMEs being disproportionately impacted. Electrical outages have a negative impact on business performance and productivity, according to other empirical studies (e.g., Eifert et al., 2008; Steinbuks & Foster, 2010; Rud, 2011; Alby et al., 2012; Alam, 2013; Cissokho & Seck, 2013; Allcott, 2014; Doe & Emmanuel, 2014; Fisher-Vanden et al., 2014; Abeberese, 2016; Abotsi, 2016; Mensah, 2016).

On the other hand, there is conflicting empirical data regarding the connection between corporate performance and corruption. According to a number of research (e.g., Jisman & Svensson, 2007; Wu, 2008; Lee et al., 2010; De Rosa et al., 2010; Abudu, 2017; Okafor, 2017; Johnson et al., 2000), corruption has a detrimental impact on business performance in both cross-country and country-specific assessments. On the other hand, Vial and Hanoteau (2010) discovered that corruption can improve business performance in their investigation of Indonesia. Their results provide credence to the "grease-the-wheels" theory, which postulates that companies that provide larger informal payments might perform better by avoiding bureaucratic inefficiencies.

There is still little and recent empirical evidence that corruption and the availability of power are directly related. To the best of our knowledge, Pless and Fell (2017) are among the few studies that have looked at the impact of bribery on the reliability of electricity. According to their research, companies are much more likely to bribe utility officials when there are frequent power disruptions. In particular, it was discovered that the likelihood of bribery for an electricity connection was linked to an increase in monthly power outages of about 14. The study also showed that frequent power outages had a significant detrimental effect on business sales income, with average global revenue losses from frequent outages estimated at roughly 22%.

In a relevant Nigerian setting, TEEGA and Ahiakwo (2019) evaluated Port Harcourt's electrical power failures by examining operational and outage data gathered from the city's two main transmission centers. The study assessed the performance of chosen feeders over a five-year period (2012–2016) using reliability and customer indicators such mean time after failure (MTBF), mean time to failure (MTTF), and system availability. The results demonstrated that the most common failures were circuit breaker trips, which were mostly brought on by overloads, short circuits, and ground faults. Transformer and transmission line faults were next. The study also showed that feeder overloading caused by rapid population expansion resulted in low power availability per user. All things considered, the investigation offered insightful information and well-informed suggestions meant to enhance and maintain a dependable supply of energy for Port Harcourt consumers..

METHODOLOGY

The data for this study was sourced and gathered from the independent system operation (IS0) unit of the Transmission Company of Nigeria (TCN) Regional Headquarters in Bayelsa State in the months of January to December, 2024. While collecting the data, verbal interviews were conducted with students to extract more information on outages. Data records from operational daily Log book were collated. The result was further grouped into monthly data.

The data obtained for analysis were collected on monthly basis and were further classified as thus; Monthly fault frequency, Monthly fault Duration, Total Annual fault Frequency, Scheduled Outage, Forced Outage:

Analysis of Data to Determine MTTR and MTBF

Reliability assessments of the feeders were carried out to ascertain the quality of electrical power delivered to the school. The assessment was performed with the 2024 power outage data collected from the Transmission Company/PHED Plc.

$$\textbf{MTBF} = \frac{1}{\lambda} = \frac{Total\ \text{Operating time}}{No\ \text{of failures}} \qquad (3.1)$$

Mean Time To Repair (MTTR) or Mean Down Time (MDT): This is the average of time that a fault takes to recover from downtime to uptime.

$$\textbf{MTTR} = \frac{1}{\mu} = \frac{Total\ \text{outage time}}{No\ \text{of failure}} \qquad (3.2)$$

Availability,(A): This is a measure of the presence of electrical power to the school. It is a ratio.

$$\textbf{Availability, A} = \frac{MTBF}{MTBF + MTTR} = \frac{Uptime}{Uptime - \text{downtime}} \qquad (3.3)$$

Unavailability (B): This is the opposite of availability. It indicates the measure of the absence of electrical power to a customer.

B= 1 – A (3.4)

This means that availability and unavailability together equals 1 as shown below.

B + A = 1 (3.5)

Failure Rate,(λ): This is a measure that expresses the frequency of fault occurrences in a network to the time of operation. It is defined as expressed in the equation below.

Therefore,

$$\lambda = \sum \frac{F}{T} \qquad (3.6)$$

Where, F = Frequency of faults, and T = Total time of Operation.

Failure and Failure Modes

The failures that occur on a power system network in Port Harcourt were identified to be caused majorly by the following modes as outlined in table 3.1 below. The degree of its frequency is allotted in percentages.

Determination of Failure Rates and Duration on Feeder Lines

In examining the feeder lines outage rates and duration, records were taking for both the forced ad scheduled outage data. The information gathered was fitted into the equations below. *Ft*

$$\lambda_t = \sum \frac{F_t}{T_t}$$

$$\mu_t = \sum T_t$$

Where λ_t= total failure rate for both forced ad scheduled outages ;

F_t = total failure for both forced ad scheduled outages ;

μ_t= total failure duration for both forced ad scheduled outages T_t= total outage time for both forced ad scheduled outages.

Determination of Reliability Indices

Electricity supply is primarily meant to satisfy the system load requirement with continuity to its customers. In this evaluation work, serious attention was given to the level of satisfaction that public electricity users in Port Harcourt derive. Basic indices of measurement were considered in this required. They include;

(1) **SAIDI** (System average interruption duration index): This is defined by the total outage duration to the number of customers to be supplied power.

$$SAIDI = \frac{\textit{Total Duration in Hours}}{\textit{Number of Customers Supplied}}$$

(2) **SAIFI** (System average interruption frequency): This expresses the relationship between the frequencies of power outages to the number of customers supplied.

$$SAIFI = \frac{\textit{Frequency of Outages}}{\textit{Number of Customers Supplied}}$$

(3) **CAIDI** (Customer average interruption duration index): It measures the total average of power outage time to the number of customers that are affected by the outage.

$$CAIDI = \frac{\textit{Total Duration in Hours}}{\textit{Number of Customers Affected}}$$

(4) **ASAI** (Average service availability index): It is a measure of the availability of power to the customers that are actually in demand at that time.

$$ASAI = \frac{\textit{Customer Service Availability}}{\textit{Customers Service Demand}}$$

(5) **ASUI** (Average service unavailability index): It shows the duration of power outage to the total time in demand.

$$ASUI = \frac{\textit{Duration of Outages}}{\textit{Total Demand}}$$

RESULTS AND DISCUSSIONS

Computation of Power System Reliability Indices

The average failures in 2024 were evaluated with information from the calculations in methodology. The equipment's primary causes of power network failures were determined, as shown in Table 3.1. Tables 4.1–4.3 give the detailed results of the analysis of the data collected for the different feeder lines. In order to show the frequency of outages and their lengths for the January–December period, Table 4.1 summarized the feeders' results. Additionally, customer and reliability indices were computed. Microsoft computer software was used to create bar charts that displayed annual outage trends and customer power supply availability.

Table 2: Summary of Frequency and Duration of Outages in Federal universities in Niger Delta region, Nigeria

MONTHS	SCHEDULED OUTAGE		FORCED OUTAGE		TOTAL OUTAGE	
	Frequency	Duration	Frequency	Duration	Frequency	Duration
Jan	92	72.15	47	103.01	139	175.16
Feb.	88	280	32	40.2	133	320.2

Mar.	120	225.6	41	93.4	204	319
Apr.	101	272.04	43	90.7	168	362.07
May	118	196.07	51	169	169	299.07
Jun.	77	230.5	50	184.1	127	414.6
Jul.	81	265.15	32	53.5	113	318.65
Aug.	120	250.09	53	62.3	173	312.39
Sept.	111	210.1	47	83.2	158	293.3
Oct.	83	96.8	43	85.3	126	182.1
Nov.	82	190.01	34	70.6	116	260.61
Dec.	93	220	52	80.9	145	300.9

Source: Researchers Computation, 2025

Compared to the second quarter of the year under review, the outage data show a relative improvement in the power supply. An average improvement of almost 40% was seen based on the results shown above. Due in significant part to the fact that the majority of material requests that were submitted in December 2024 were still pending, the first quarter's performance was lower and the feeders' major maintenance tasks were postponed until early 2024. However, necessary supplies including fuses, cables, and circuit breakers became accessible starting in the second quarter, especially around June 2024. This advancement made maintenance tasks more efficient, which in turn resulted in a discernible decrease in feeder outages.

Table 3: Reliability Outage Parameters, Jan – Dec, 2024, Federal universities in Niger Delta region, Nigeria

Months	Freq.	Outages (Hrs)	Total	Failure in Hrs	MTBF	MTTR	Avail.
Jan	139	175.16	744	0.187	5.353	1.260	0.765
Feb.	133	320.20	672	0.198	5.053	2.408	0.523
Mar.	204	319.00	744	0.274	3.647	1.564	0.571
Apr.	168	362.74	720	0.233	4.402	2.159	0.496
May	169	299.07	744	0.227	4.402	1.770	0.598
Jun.	127	414.60	720	0.176	5.670	3.265	0.424
Jul.	113	318.65	744	0.152	6.584	2.820	0.572
Aug.	173	312.39	744	0.233	4.301	1.806	0.580
Sept.	158	293.30	720	0.219	4.557	1.856	0.593
Oct.	126	182.10	744	0.169	5.905	1.445	0.755
Nov.	116	260.61	720	0.161	6.207	2.247	0.638
Dec.	145	300.90	744	0.195	5.131	2.075	0.596

Source: Researchers Computation, 2025.

The feeder's failure rate shows that, in spite of the apparent improvement, the frequency of outages continued to be erratic. Because of this, it was hard to forecast how long the power supply would last on any given day. The analysis showed that unauthorized connections, which commonly resulted in sporadic line tripping, were the main cause of these variations. Despite the constant use of security agencies to apprehend and prosecute criminals, the supply authority has been unable to fully control this issue.

Table 4: Customer Index (Jan-Dec, 2024) in Federal University, Otuoke

Month	Freq	Outage	Hours	SAIFI	SAIDI	CAID	ASAI	ASUI
Jan	139	175.16	744	0.028	0.035	1.131	0.765	0.235

Feb.	133	320.20	672	0.027	0.064	2.408	0.524	0.476
Mar.	204	319.00	744	0.041	0.064	1.564	0.571	0.429
Apr.	168	362.74	720	0.034	0.073	2.159	0.496	0.504
May	169	299.07	744	0.034	0.060	1.770	0.598	0.402
Jun.	127	414.60	720	0.026	0.083	3.265	0.424	0.576
Jul.	113	318.65	744	0.023	0.064	2.820	0.572	0.428
Aug.	173	312.39	744	0.035	0.063	1.806	0.580	0.420
Sept.	158	293.30	720	0.032	0.059	1.856	0.593	0.407
Oct.	126	182.10	744	0.025	0.037	1.445	0.755	0.245
Nov.	116	260.61	720	0.023	0.052	2.247	0.638	0.362
Dec.	145	300.90	744	0.029	0.061	2.075	0.596	0.404

Source: Researchers Computations, 2025.

The findings show that during the reviewed time, this feeder's power usage stayed largely consistent. Due to inadequate generation capacity, the supply authority was forced to contemplate load rationing even though electrical consumers connected to the feeder wanted more supply and longer service hours.

CONCLUSION AND RECOMMENDATIONS

In order to determine which feeders are under stress, overstressed, or experiencing outages as a result of overload, reliability assessment of the various power system components in Federal universities in Nigeria's Niger Delta region entails analyzing the distribution network's performance. Among the assessment's main findings are:

1. Every year, the number of facilities at universities grows. As the population grows, this expansion puts more strain on the power system, and because the current power installations haven't been updated in a while, system overload results.
2. Short circuits, which can happen on overhead wires owing to excessive sagging or on underground lines during construction, excavation, or inadequate routing, account for more than 20% of problems.
3. Aging equipment is a contributing factor to malfunctions and installation difficulties.
4. Both natural and human factors are involved; thunderstorms are frequently the source of campus power outages.

Power outages have serious negative economic effects on a city's or institution's development and expansion. Because electrical power infrastructures are essential to industrialization and technological growth, governments around the world make significant investments in them. Effective policy execution, regulatory framework acceptance, and supply dependability all work together to ensure a safe, sustainable, and reasonably priced energy supply.

The following suggestions are put out in light of the assessment of power interruptions at Federal colleges in the Niger Delta region:

1. To provide dependable and sustainable electricity options, governments and businesses should heavily invest in research into alternative power sources like solar and wind.
2. To increase competition for public electricity suppliers like PHED and improve access and dependability, private companies, governmental organizations, and local communities should develop solar household systems and micro-hydropower stations at cheaper rates.

3. The "National Grid" should not be the only focus of national electricity policy; instead, states with the capacity to produce electricity should be permitted to distribute it independently within their borders.
4. Committees for energy audits should be formed by universities, with representation in each dorm. These representatives should encourage energy-saving measures in common spaces including kitchens, restrooms, and common rooms. They may be selected from current porters or security guards to avoid hiring more workers..

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