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ELECTRICITY CONSUMERS AND ELECTRICITY THEFT IN EDO STATE, NIGERIA: IMPLICATION FOR EFFICIENT POWER DISTRIBUTION

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Abstract

Over the years, Nigeria has faced the challenges of inadequate generation, supply, and distribution of power. There is growing concern about the pervasiveness of electricity theft in the country, suggested to be among the chief factors inhibiting electricity sector efficiencies. The present study aimed to ascertain the trend of electricity theft among electricity consumers in Edo state, Nigeria. The study adopted a survey method to examine the prevalence of electricity theft among households in randomly selected towns in Edo state, Nigeria. The study population comprised electricity consumers under the residential category described by the BEDC. A convenient sample of 217 residential consumers and BEDC officials completed the research questionnaires. The finding shows that 32.7% of the electricity consumers indicated they never participated in energy theft, while 67.3% showed high involvement. A linear regression analysis was conducted to answer whether electricity theft affects efficient power distribution in Edo state. The result demonstrated a statistically significant effect of electricity theft on efficient power distribution in Edo state F (1, 12), 21.36 P< .05. Also, the R^2 indicated that electricity theft contributed about 54.4% of the inefficiencies in power distribution in Edo state. Thus, it is concluded that the trend of electricity theft is high in the area of study and significantly affects the efficient distribution of electricity. The result provides valuable data to the government and electricity regulators.

Keywords: *electricity theft, consumers, BEDC, power distribution*

INTRODUCTION

The ever-increasing demand for electricity in Nigeria, coupled with a limited supply, has led to many transformations in the electricity ecosystem. Significant changes have been made to how the electricity industry operates in Nigeria. The National Electric Power Authority (NEPA) was first transformed into the Power Holding Company of Nigeria (PHCN) to mark the beginning of the privatization process inside the power industry. The purpose of the unbundling was to make the transfer from the government monopoly to the private companies as seamless as possible. Subsequently, the PHCN was divided up into the Transmission Company of Nigeria (TCN), six generating firms, and eleven distribution businesses (Adedeji, 2017). Thus, the transformation in the electricity industry created a competitive electricity market under a unified regulatory body.

Consequently, the electricity reforms in Nigeria have undoubtedly been adjudged unsuccessful by most stakeholders (Arowolo & Perez, 2020). The issue of erratic and epileptic power supply in Nigeria has been a significant concern not just to the citizen but to the Federal Government and companies under various industries (Jimah et al., 2019). The widespread consensus among Nigerians is that the country's energy supply is currently unreliable and in poor condition. The power supply is characterized by low accessibility, epileptic and poor transmission (Ebhota & Tabakov, 2018), and has affected the economic development of the nation (Amuta et al., 2018). Indeed, numerous factors have been identified as challenges in the electricity sector. For instance, poor policy initiative, non-existent asset protection mechanism, poor maintenance culture, insufficient gas supply, vandals sabotaging pipelines, inadequate gas supply, poor town, and urban planning make it difficult to control power distribution, poor staffing, water mismanagement affecting national grid, and poor transmission are all contributing factors (Amadi, 2015; Emem, 2015; Garba et al., 2014; Jimah et al., 2019; Nwachukwu, 2014; Ogunyemi & Adetona, 2019; Okafor, 2008; Okorie & Abdu, 2015; Olaosebikan Aremu, 2019; Oluwole et al., 2012). In addition, electricity theft has been a growing concern in the electricity industry relative to its effect on power distribution.

Electricity theft is a challenge for developing countries (Arkorful, 2022). Theft in the electricity sector has been a significant concern to the secure operation of power systems and the interests of power companies (Lin et al., 2021). Electricity theft is a problem that plagues many developing countries, including Nigeria. As a result, the capacity of the country's power companies to generate revenue and efficiently distribute power is being negatively impacted. Electricity theft is one of the most critical sources of non-technical losses in the electricity sector, of which the citizens are significant perpetrators (Adongo et al., 2021). Accordingly, the trend not only decreases electricity revenues but portends risks to power usage's safety, which has been increasingly challenging nowadays (Feng et al., 2020)

Electricity theft can be fraud, such as meter tampering, illegal connections, billing irregularities, and unpaid bills (Smith, 2004). The behavior of electricity theft is a violation that harms many parties (Hardianto & Akbar, 2021). Electricity theft entails a non-technical loss (NTL) in transmitting electrical energy that has been difficult for power companies to detect and combat. Thus, the inability of the power companies to sufficiently detect and prevent electricity theft has resulted in an enormous loss of income (Adil et al., 2020; Arango et al., 2017; Arif et al., 2021; Aslam et al., 2020; de Oliveira Ventura et al., 2020; Khan et al., 2020; Khonjelwayo & Nthakheni, 2021; Yakubu et al., 2018) and disruption in power supply (Jain & Bagree, 2011; Lavanya et al., 2020; Naik & Patil, 2020). Indeed, there are indications that energy worth 21 billion is stolen annually in Nigeria (Osigwe, 2018). The costs are routinely passed on to the customers directly in the form of high tariff rates and indirectly through poor quality of service.

Theft is quite common in many African countries electricity distribution systems and has been implicated in the widely reported power crisis. For instance, Louw and Bokoro (2019) noted that electricity theft and illegal connection by ground surface conductors are pervasive problems in South Africa. Accordingly, Kambule and Nwulu (2021) stated that despite the roll-out of prepaid meters in Tanzania and Kenya, the prepaid electricity sectors still suffer from challenges of electricity thefts, including meter bypassing and illegal connection. Research from Ghana indicates that the two utility companies, the Electricity Company of Ghana (ECG) and the Northern Electricity Distribution Company of the Volta River Authority (NEDco-VRA), deployed prepaid smart energy meters to curb the escalating non-technical losses perpetrated by consumers who take advantage and tamper with meters to hide their actual consumption (Yakubu et al., 2018). There is a growing concern that the failure to quickly combat the trend of electricity theft will throw utility companies into immense debt and trigger more inefficiencies in their operations. Similarly, numerous authors have underscored the trend of electricity theft in Nigeria (Ekere et al., 2019; Josephine & Nathan, 2016; Kambule & Nwulu, 2021; Komolafe & Udofia, 2020; Odje et al., 2021; Ogu et al., 2016; Umar et al., 2022). The menace of electricity theft in many states of Nigeria, including Edo State, is unreported. Thus, the present paper aims to bring the pervasiveness of power theft in Edo State to record.

Electricity Consumers and Electricity Theft in Edo State

Edo state is in southern Nigeria and was formed in 1991 from the northern portion of Bendel state. The state is bounded by the states of Kogi to the northeast and east, Anambra to the east, Delta to the southeast and south, and Ondo to the west and northwest. Benin City is the state capital and largest urban center. The Edo state lies 500 feet (150m) in the south and more than 1,800 feet (550 m) north. The Benin Electricity Distribution Company (BEDC) is among the utility distribution companies in Nigeria responsible for electricity distribution in Edo, Delta, Ekiti, and Ondo states. The BEDC maintains an estimated coverage of 55,770 square kilometers. Initially, many of the company's customers were unmetered or had

obsolete meters. This was a significant challenge as it made energy accountability difficult and encouraged using estimated billing, leading to over and under-billing. Consequently, many consumers resorted to various activities relating to electricity theft.

Although, the report suggests that many households indulge in different forms of electricity theft and illegal tampering with electric metering devices (Dike et al., 2015). Observation of the trend of electricity theft in Edo state indicates that electricity tapping was the most common form of energy theft. In a report, the BEDC complained of overwhelming energy theft through meter bypass and tampering. Most electricity consumers engaging in energy theft considered it a rational response to overbilling and the inefficiency of the BEDC. A significant challenge faced by BEDC is the high incidence of electricity theft through meter bypass. According to its website, the company's network had been plagued with illegal connections. It also acknowledges that enforcing disconnection orders had been less than practical, often subverted by illegal reconnections. Notably, the menace of energy theft is a global phenomenon and has increased in Nigeria. Consequently, numerous research has underscored the trend in several states in Nigeria. However, data on energy theft in Edo state has not been researched much. Thus, the present paper aims to answer the question:

a. *Does electricity consumers in Edo state involve in electricity theft?*
b. *Does electricity theft affect efficient power distribution in Edo state?*

Method

This study adopted a survey method to examine the prevalence of electricity theft among households in Edo, Nigeria, and to determine whether electricity theft affects power distribution in the state. The study population comprised the BEDC staff and electricity consumers under the residential category of the BEDC. Five towns in Edo state, including Benin City, Uromi, Auchi, and Ekpoma, were randomly chosen as the study area. However, about two hundred and sixty-three households from the selected towns and BEDC main office in Benin City were approached between December 2022 and February 2023 and asked to participate in the study to ascertain problems related to power distribution in the area. Two questionnaires were used in the study. Notably, one questionnaire was designed to elicit information relating to electricity theft involvement from the consumers, and the other questionnaire was aimed at gathering data concerning the effect of theft on efficient power distribution in the area of study from the staff of BEDC. Those who consented (n=237) were given the study questionnaire to fill out on the spot. Consequently, two hundred and seventeen (n=217) of the questionnaires distributed were appropriately filled and returned. Thus, they were subjected to further analysis.

Table 1: showing the distribution of the respondents

Source	*N*	*m*	*f*
Benin City	63	48	15
Uromi	41	29	12
Auchi	38	22	16
Ekpoma	31	28	3
BEDC staff	14	9	5
Total	217	136	51

N= Number of participants; M=male; f= females

The table above shows that the majority of the electricity consumers were drawn from Benin City (63), while others were sampled from Uromi (41), Auchi (38), and Ekpoma (31). The table indicates that 136 samples were male, while 51 represented females.

Result

This study sought to estimate the size of the households' electricity end-users who had been directly involved in the incidence of electricity theft and the effect of electricity theft on power supply in the area using a self-structured questionnaire. The scale was designed to assess the consumer's level of involvement in electricity theft. Statements for the questionnaire were intended to assess the electricity user's previous and present participation in energy-related theft. The statements were empirically selected to test two areas of electricity theft, including meter bypassing and illegal reconnection. The Likert-type scale contains questions ranging from "can you bypass the meter if you have the opportunity" to "have you made any illegal connections." A higher score indicates high electricity theft. The scale recorded a Cronbach alpha of 0.96 following a pilot study. Similarly, data relating to the effect of electricity theft on the efficient power supply was determined by a questionnaire distributed to the fourteen (n=14) staff of BEDC. Data from the respondents were computed using the statistical package for social science SPSS Version 23. As shown in the table below, a frequency model was used to analyze the prevalence of electricity theft in Edo State.

Table 2: shows the frequency of electricity theft in Edo State

Response	N	%
No	67	32.7
Yes	141	67.3
Total	203	100

The table above shows the frequency score of the respondents on electricity theft in Edo State. The result indicates the prevalence of electricity theft in Edo State. The table shows that 32.7% of the respondents indicated that they never participated in energy theft, while 67.3% showed high involvement in electricity theft.

Table 3: shows the linear regression for electricity theft and efficient power distribution in Edo state.

	B	SEB	β	t	R^2	Sig
Power Distribution	.67	.066	.67	12.16	544	.000

*Note: B = Unstandardized regression coefficient; SEB = Standardized error of the Coefficient; β = Standardized coefficient; R^2 = Coefficient of determination. *P<.000.*

A linear regression analysis was conducted to answer whether electricity theft affects efficient power distribution in Edo state. The analysis performed on the data demonstrated a statistically significant effect of electricity theft on efficient power distribution in Edo state F (1, 12), 21.36 P< .05 with an R^2 of 544.

Discussion

The current study investigated the prevalence of electricity theft in Edo State. The study focused on concerns about data relating to energy theft in Edo state. Two hundred and seventeen electricity end-users in five towns of the state participated in the study. The result indicated a high percentage (67%) of electricity theft in the present context. More so, a linear regression analysis was conducted to answer whether electricity theft affects efficient power distribution in Edo state. The result demonstrated a statistically significant effect of electricity theft on efficient power distribution in Edo state F (1, 15), 21.36 P< .05. Also, the R^2 indicated that electricity theft contributed about 54.4% of the inefficiencies in power distribution in Edo state. Thus, the result offered evidence of the pervasiveness of electricity theft in Edo State, especially in Benin City, Uromi, Auchi, Ekpoma, and Ugboha. The present finding entails that consumers who scored high on the electricity theft scale are most likely to tamper with the electricity meter and engage in illegal reconnections. Generally, electricity theft in this direction ensures that the quest for efficient electricity distribution is never attained. Consumers who have resorted to energy theft due to the inadequate power supply and big bills are likely the problem of BEDC's poor performance. This assertion is reflected in the reinforced state of energy sabotage in Edo state, such that the inability of the utility company to combat the trend could worsen electricity theft and impair power distribution in the area.

Similarly, the result indicates that electricity consumers in the state are more likely to experience poor power supply due to theft-related activities. The result showed that many electricity consumers in the selected towns display more readiness to sabotage electricity distribution. Therefore, it would appear that the electricity consumers are not satisfied with the power supply system. However, they resort to increasing the inefficiencies in power distribution. Thus, the finding provides insight into the lack of awareness relative to the consequences of electricity sabotage among the consumers in Edo state.

Limitations, strengths, and future directions

Because of the small sample size and homogeneousness, it becomes imperative to caution about generalizing the present research result. Despite the practical limitations, the present study makes a first step towards better understanding the phenomenon of electricity theft by giving a frequent view of the seriousness of the trend in Edo state. Thus, the result broadens our knowledge about the electricity consumer's poor knowledge of the dangers of electricity theft. Moreover, it is observed that no study has attempted to investigate the incidence of energy theft in Edo state, hence, justifying the current research. Future researchers should endeavor to utilize data from more inclusive sources and establish a cause-effect relationship.

Conclusion

The frequency analysis conducted on the study data suggested an increasing concern about electricity theft in the state, especially in the study parameters. Indeed, the result of the study offered answers to the research questions. Therefore, it is concluded that electricity theft is a critical predictive variable in the ineptitudes and inefficiencies of the utility company in the state. The finding can provide valuable data to the Government, Electricity regulators, and Discos in achieving their various purposes relating to electricity supply in the country. Also, the result has implications for developing measures relative to theft management in the electricity domain. For instance, identifying the existence of electricity theft would lead to a solution that might limit the proliferation of the phenomenon.

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