FACTORS INFLUENCING ENERGY THEFT IN LAGOS STATE, NIGERIA

A Research Paper Design

by:

AFOLABI FUNMILAYO ABIODUN

683210FA

NIGERIA

MASTER OF ARTS IN DEVELOPMENT STUDIES

Major:

ECONOMICS OF DEVELOPMENT

Proposed Supervisor:

Elissaios Papyrakis (Dr)

Proposed Second Reader:

Dr. John Cruzatti C

The Hague, The Netherlands

November 2024

Disclaimer:

This document represents part of the author's study programme while at the International Institute of Social Studies. The views stated therein are those of the author and not necessarily those of the Institute.

Inquires:

International Institute of Social Studies

P.O. BOX 29776

2502 LT The Hague

The Netherlands

t: +31 70 426 0460

e: info@iss.nl

w: www.iss.nl

fb: http://.facebook.com/iss.nl

twitter: @issnl

Location:

Kortenaekade 12

2518 AX The Hague

The Netherlands

Keywords:

Factors, Influencing, Energy, Theft, Energy Sector, Energy security, Nigeria

Acknowledgement

I want to thank the Author and finisher of my faith who has strengthened me throughout the study. My sincere appreciation goes to my supervisor, Dr. Ellissaios Papyrakis, for his guidance, support, mentorship, and timely responses and feedback throughout this research. I would also like to thank my second reader, Dr. John Cruzatti C, for his valuable contributions and suggestions. Also, my sincere gratitude goes to my wonderful mother, Deborah, and the Adegoke Family for the love, moral, spiritual, and support that has encouraged me throughout this journey. I would also love to thank all my participants for sparing their busy schedules to provide information for this study. May God Bless You All!

TABLE OF CONTENTS

List of Figures

List of Tables

Abstract

Energy theft is prevalent in all countries, however, developing nations are worst hit due to weak legal and regulatory frameworks, poverty and corruption. This study was undertaken to understand the factors influencing energy theft in Lagos state, Nigeria. Using data captured from questionnaires and interviews, energy theft is perpetrated by men, especially those of working age. It is more common among low-income earners, including the unemployed and self-employed, who are struggling financially and do not understand the legal consequences of their actions. These people engage in energy theft mainly due to high energy prices, rewards and risk perception, severity of penalties, moral values, inequitable billing and metering issues, and corruption. Policies formulated to reduce energy theft should take into account provision of subsidies for low-income households, communicating the cost of electricity theft to consumers and improving metering and billing systems. Also, community leaders should be engaged to spread anti-theft messages so that people get to know the dangers of energy theft. The government should intensify grid surveillance and have the offenders charged and sentenced before courts to minimise energy theft.

Keywords:

Factors, Influencing, Energy, Theft, Energy Sector, Energy security, Nigeria

Justification and Relevance

Access to affordable energy is important for socio-economic development and poverty alleviation (Asghar et al., 2022). Energy is a fundamental input for economic activities and productivity. Addressing energy theft and unaffordability is essential for promoting inclusive growth by ensuring that all segments of society have access to the energy resources necessary for economic participation (Singh & Inglesi-Lotz, 2021). However, a number of developing countries in sub-Sahara Africa have reported huge losses through energy theft. Hundreds of millions of US dollars are lost to electricity theft annually (Acharya & Sadath, 2019). Thus, studying the determinants of energy theft and unaffordability is important to inform policy on community empowerment by designing policies and interven-

tions that create sustainable solutions. Energy is a fundamental input for economic activities and productivity (Singh & Inglesi-Lotz, 2021). The study will identify challenges to energy access and inform policies to promote inclusive energy development creating equitable economic opportunities for all residents.

This study is justified by the need to address the rising issue of energy theft in Lagos State, Nigeria, which has huge economic, social, and infrastructural impacts. Despite the global prevalence of energy theft, the problem is particularly severe in developing nations, where weak legal and regulatory frameworks, poverty, and corruption exacerbate the situation. As Nigeria's most populous urban center, Lagos State faces energy distribution challenges, making it an important area for this research. While there is growing academic interest in energy theft, much of the existing literature does not explore the drivers in Lagos State. This study fills that gap by examining factors such as rewards and risk perception, inequitable billing, metering issues, corruption, and the role of moral values in influencing energy theft. Thus, this research improves knowledge of energy theft in urban settings. The findings of this research have implications for improving energy management, reducing financial losses, and promoting equitable access to electricity in Lagos. The strategies informed by the findings contribute to strengthening the energy sector in Nigeria including building a sustainable power system.

Chapter 1

1.1 Introduction

Energy theft is a major global power sector issue (Adeniran, 2018). It raises costs for customers, reduces safety, and causes an unfair distribution of costs among suppliers, which harms competition and the smooth running of the market (Amadi et al., 2016). When energy theft happens, the cost of buying electricity from Generating Companies (GENCOs) through the Transmission Company of Nigeria (TCN) is higher than the money collected from customers because some use electricity without paying. This leaves Distribution Companies (DISCOs) with large debts, making it hard to pay GENCOs. As a result, they often refuse electricity and fall further into debt (Amadi et al., 2013). This cycle of debt also affects GENCOs, reducing their income and making it harder for them to pay gas suppliers, which limits their ability to generate electricity. For example, in 2014, Ikeja Electricity Distribution Company (IKEDC) found that 43,000 out of 134,000 prepaid meters had been tampered with (IKEDC, 2014). In 2017, Port Harcourt Electricity Distribution Company (PHED) lost about 30% of its expected income due to energy theft (Daniel, 2017). The Enugu Electricity Distribution Company (EEDC) reported losing 43% of its monthly revenue to energy theft (Uzodinma, 2017). 2018 Eko Electricity Distribution Company (EKEDC) lost over $1.58 million monthly to energy theft and other commercial losses (PM News, 2018). Therefore, the study investigates the factors influencing energy theft in Lagos State, Nigeria.

1.2 Research Problem

Globally, energy is an important component of economic inclusion, social prosperity, productivity, domestic necessity and for these reasons, it should be accessible, available, reliable and affordable for everyone (Kingsley, 2022). When electricity is affordable, people are most likely to meet their energy need, however, when energy is very expensive and people cannot afford it, they resort to furtive behaviours such as energy theft. Energy theft is not isolated to any particular region, continent, or country, rather it is a global issue from developed nations

to the least developed ones. According to Briseno and Rojas (2020), the average energy losses due to theft in 141 nations ranges from 1 percent to 30 percent. Also, Babar et al. (2022) energy theft is prevalent in all countries, however, developing nations are worst hit due to weak legal and regulatory frameworks, poverty and corruption. The energy theft ratios in developed nations and that of developing countries differ, for example in the US and Europe, the rate of theft is between 1-2percent. However, in developing countries its higher ranging from 5percent and above (Xia et al., 2022).

Just like from other countries, theft of energy is a problem in Nigeria resulting into losses an estimated $124.36 million in first three months of 2021 for the power Distribution Companies [DisCos] (Association of Nigerian Electricity Distributors report, 2022). Over 25 percent of the total energy wheeled is lost to theft, vandalism, meter bypass, and unpaid electricity bills by consumers (Fidelis et al., 2017). Globally, energy theft costs hundreds of millions of dollars annualy to energy distribution companies. In Ghana, almost 30 percent of energy supplied by utility companies is lost through theft and related illegal activities (Yakubu et al., 2018). Uganda also faces similar problems resulting in annual losses of over $30million for UMEME-the main energy distribution company (Ssekika, 2013). In Turkey, out of the 4.8million subscribers, over 196,000 were using energy illegally (Tasdoven et al., 2012).

The government of Nigeria is urged to regulate the energy tariffs so that all Nigerians can access it. Majority of people in rural areas cannot afford to pay for energy and the initial connection fee to the power grid is quite high for some people to afford. Such concerns are some of the key determinants creating the illegal energy connections in the country. A study by Wesonga (2020) attribute energy theft to high tariffs, high initial connection fee, lack of incentives to those that snitch on energy thieves and delays in connecting to the grid. Lewis (2015) argued that illegal connections pose a great risk to the utility infrastructure because it causes system overload. Saini (2017) established that the major determinants influencing energy theft include corruption, high tariff rate, low income, low literacy level, population growth rate, and many others. To address the energy theft vice, DisCos implemented a customer outreach campaign to sensitise the citizenry about the dangers of energy theft. However, no substantial results

have been registered, given the current prevalence of the energy theft in the country. Thus, my study sought to establish the reasons for the increased in energy theft in Lagos state.

1.3 Contextual Background

Energy remains one of the basic infrastructures that serve as a major tool for industrialisation (Sahoo & Sethi, 2020), increase in productivity, aggregate demand and Gross Domestic product – which are a country's growth indicators as well as quality of life (Guo et al., 2020). Energy is needed by majority of the population in Nigeria, though there is imbalance in energy access and usage (Shabalov et al., 2021). In sub-Sahara Africa, energy distribution companies are suffering the impact of energy theft causing billions of dollars in losses. Energy theft makes it difficult for the companies to plan for the grid resulting in power black outs (Hock, 2020). The irregularity of power as a result of unstable grid slows down the economy as businesses and industries cannot operate profitably and public services such as health, transport and telecommunication may not function normally. Developed counties also experience energy theft although it is on a small scale compared to developing countries in Asia and sub-Sahara Africa (Gregory & Sovacool, 2019; Nduhuura et al., 2021). Nigeria being a developing nation struggle with this vise which hampers growth of energy sector (Daggash & Mac Dowell, 2021). A big number of energy meters in Nigeria are postpaid; they are read monthly by the staff and subcontractors of distribution companies for billing. This process of consumer energy accountability is riddled with sharp practices such as meter shunting, recalibration etc to reduce consumption already calculated by the meter.

End-users who use prepaid meters engage more in energy theft compared to those with postpaid meters. For prepaid meter users, when energy units is low, they tamper with the meter to have the energy reconnected or run a direct connection to their homes to bypass the meter especially where access to vending centers that sell units is possible at the time (Nduhuura et al., 2021). The distribution companies loose 30 percent of supplied energy to theft. In some instances, human lives have been lost through fire outbreaks or electrocution

due to illegal connections to steal energy. It is therefore, important to understand the underlying factors that serve as motivation for energy theft so that to suggest remedies to prevent such thefts. A study by Yakubu et al. (2018) indicate that most of the arrests reported of energy theft involved churches, businesses and domestic consumers. This shows that there are different categories of people engaged in energy theft. Monyei et al. (2018) high energy theft rate in developing economies leads one to believe that poverty is the main cause, however, in China energy theft is low yet the poverty rate is high (Lin & Okyere, 2022).

Energy theft is a complex phenomenon which requires thorough study. In this study, I will present factors influencing energy theft from Lagos state, Nigeria and make some recommendations. In Nigeria, there have been media campaigns through television, radio, social media, billboards, and all sorts of adverts encouraging people to desist from stealing energy and report suspects, but little has been achieved. Discos have made concerted efforts at influencing the enactment of laws and punishment for energy theft. They have tried to tightened loosed ends and coupled with installation of prepaid meters and aerial bundled conductors. Some of the laws and regulations include; Section 94(3) of the Electric Power Sector Reform provides that,

> *"Any person who destroys wilfully, injures or removes equipment of a licensee commits an offence and such, is liable on conviction to imprisonment for a period of not less than five years and not more than seven years."*

Also, Section 94 of Miscellaneous Offenses Act provides that,

> *"Any person who disconnects, removes, tampers, damages, meddles with or in any way interferes with any plant, cables, works, wire or assembly of wires used for transforming energy shall be guilty of an offence and liable on conviction to be sentenced to imprisonment for life."*

In addition, a person who engaged in energy theft is guilty under Sections 286(2) of the Penal Code, Sections 383 and 400 of the Criminal Code, and Section 1 of the Regulation.

All the above laws and regulations have been provided to eradicate energy theft, however, the vice is still prevalent in Lagos Nigeria and given that the

factors influencing energy theft are complex, Jamil and Ahmad (2019) recommends that the problem be understood before any action is taken against energy theft. This research was undertaken to understand the reasons why individuals in Lagos state engage in energy theft and therefore suggest approaches to curb it.

1.4 Research Objectives and Questions

To understand the factors influencing energy theft in Lagos state, Nigeria, this research will give answers to the following questions:

1.4.1 Main question:

- Why is there an increase in energy theft in Lagos State, Nigeria?

1.4.2 Sub-Questions:

To achieve this, my study will seek to provide answers to the following questions:

1. What is the prevalence of energy theft in Lagos State from 2020 to 2023?
2. What are the motivating factors behind energy theft activities in Lagos State?
3. How much percentage of Nigeria's GDP that energy theft shares for the year 2020 – 2023?
4. What strategies should be implemented to reduce the prevalence of energy theft in Lagos state?

1.5 Research Paper Outline

The rest of paper is organised as follows: in section 1, I highlighted the research problem. Section 2 mentioned related works and the literature gaps highlighted, section 3 of this paper explained the study methods while section 4 and 5 presented the study findings including discussions by relating my findings with existing literature. Section 6 contained the conclusions and recommendations.

Chapter 2

2.1 Theoretical Review

My research is grounded on Becker's (1968) theoretical research on economics of crimes. The theory states that a criminal is a utility maximiser who weighs subjective costs and gains from a crime and that the imposition of penalties help to reduce crime rate. Therefore, economics of crime is concerned with a cost and gains of limiting a non-violent crime. The costs involved include payments of rewards, increased surveillance expenses of utilities and incentives to monitors (van Velthoven et al., 2016). The gains are associated with improved quality of services to customers and increase in revenues of utilities (Becker, 1968). Becker explains that individuals are rational and make decisions by weighing the benefits against the costs. An individual will commit a crime if they believe benefits such as financial gain are greater than the costs such as the chance of being caught and punished. This is similar to how people make choices in legal activities.

In this theory, deterrence is important because if punishment is severe, it will prevent crime. This tells why people may steal energy especially when facing economic challenges and weak law enforcement in Lagos State. I find this theory relevant to the study because it predicts changes in crime rates based on economic conditions, law enforcement and punishment policies (Levitt, 2017). For Becker, it is important to understand the economic pressures such high electricity costs and low income that make people consider stealing energy. Evaluating the current enforcement measures is important to see if punishments are effective and if the chances of getting caught are high enough to deter theft.

Different factors should be studied to understand what determines criminal behaviour, for example incentives – the greater the potential reward from stealing energy, the more likely someone might do it. Penalties or the severity of punishment act as a deterrent – if the punishment is harsh, it raises the cost of the crime (Miceli, 2018). The risk of being caught creates a scenario where a higher chance of detection makes the crime less attractive. In addition, a person's

willingness to take risks, economic situation and moral values also influence the decision to commit a crime (Becker, 1968).

If an energy consumer is risk averse and connected to energy grid and he or she has an option of extracting energy from grid illegally through either by-passing the meter of the utility or meter-tampering. The decision of such a person bases on the expected gains and risks (Hokamp, 2022). An energy consumer faces a choice of whether to commit energy theft or pay in full the energy consumed. What the individual gains depends on random factors, some of which are assumed to be known by him before making the decision. The probability of detection is assumed to depend on surveillance expenses. The fines imposed on the offender depends on the harm to community due to the offense (Becker, 1968). When the consumer has been detected, he or she has to pay a fine assumed to exceed the value of energy theft, while if a consumer hides his crime and does not get caught, the value of illegally consumed energy is a pecuniary benefit (Becker, 1968).

Smith (2004) showed that countries with low levels of corruption usually have smaller energy losses (under 6%), while those with high corruption often have larger losses (over 30%). Few studies look at how corruption affects efficiency in the energy sector. Bò and Rossi (2007) found that corruption causes managers to spend time on dishonest activities, which makes businesses need more resources. Energy is made at power stations, which are far from where people use it. It is then sent to users through a network of wires and transformers. Some energy is lost during this process, known as transmission and distribution losses. These losses are technical (due to physical issues) or non-technical (caused by illegal activities like energy theft). Non-technical losses are referred to as energy theft (Badr et al., 2023). Energy companies charge users based on meter readings, and stealing energy is a crime around the world. Utility workers have tasks like maintenance, selling energy, and catching theft. Because these workers interact directly with consumers, they are involved in corruption. For example, employees take bribes to help customers hide their real energy use, benefiting both the employee and the consumer. This type of energy theft is summed up by improper recording, underreporting, and illegal sharing of profits (Nadeem & Arshad, 2021). Research on how individuals act when it comes to

crime and corruption, especially with energy theft, is limited. This study introduces explains that combines crime, risk and socio-economic variables such as corruption in the energy sector. What makes this study special is its focus on energy theft helping to show how economic, social, and governance factors are connected and providing ideas for policy changes. In Lagos State, understanding these factors is key to addressing the motivations behind energy theft and developing deterrence strategies.

2.1.1. Personal behaviour towards energy theft

The usual way to understand how a consumer decides to steal energy is based on economic decision-making under risk, with the idea that the person wants to maximise their benefit (Jamil & Ahmad, 2019). We assume the consumer is risk-averse and connected to the power grid. They might steal energy by tampering with the meter or bypassing it altogether. The decision of the consumer depends on comparing the expected benefits with the risks and costs involved. Paying for energy is like choosing a safe option while stealing energy is like choosing a risky option. This decision-making can be compared to picking a mix of investments, following the rules of the Von Neumann-Morgenstern theory for choices under uncertainty (Handy, 1983).

The consumer must decide whether to pay for energy or steal it. The gains from stealing depend on various factors, some of which the consumer knows before making a decision (Hokamp, 2022). If the average energy price is λ and the consumer uses C units, then the total cost is $R = \lambda.C$, which is the amount they should pay. However, if the consumer steals an amount T (where $T = C - X$), they only pay for X units, while T units are lost to the utility as distribution losses. The consumer is charged $r = \lambda.X$ and gains $G = \lambda.T$, a portion of what they would have paid. Since the amount of stolen energy T depends on various factors, it is hard to calculate the exact gain. To clarify this, we use a fixed amount of stolen energy, Ť, the maximum a consumer could steal. For simplicity, we assume the energy price λ stays the same and do not consider how multi-tiered pricing (where the price goes up as more energy is used) affects theft (Handy, 1983).

The consumer's choice is between paying fully for their energy or choosing to steal it. Becker (1968) argues that this decision-making process leads to energy theft because consumers weigh the potential financial gains against the risks and penalties. When consumers perceive that the benefits of stealing energy such as reduced costs outweigh the possible consequences, they engage in theft. If the penalties or chances of being caught are low or enforcement is weak, the "risky" choice becomes more attractive. This situation is further increased by economic pressures or mistrust in the utility system. The more consumers feel they can profit from theft without huge risk, the more likely they will bypass or tamper with meters. This behaviour adds to non-technical losses for utility companies and contributes to widespread energy theft (Naik & Patil, 2020).

2.1.2 Principal-agent-client model of energy theft

In the three-layered principal-agent-client model of energy theft involving corruption, the main players are the consumer (client), the utility employee (agent), and the utility or government (principal). The agent works for the principal and directly interacts with the consumer (Yusof et al., 2024). This relationship is where we focus on potential corruption, as the agent's discretionary power in energy services can lead to unauthorised dealings for personal benefit. Corruption is seen as any unauthorised agreement between the agent and the client or the misuse of power for personal gain (Jain, 1998). For utility officials, energy represents a huge opportunity for rent-seeking. However, the principal influences the agent's actions by setting rules and monitoring them, although close oversight is costly and complete control is difficult.

The level of corruption depends on how precise the rules are and the expense of monitoring employees. While the principal might know the overall revenue loss and the amount of energy stolen, it cannot tell which consumers are honest or corrupt unless the agent identifies and reports theft (Yusof et al., 2024). An agent can collude with consumers, sharing bribes with supervisors or peers to lower the chance of detection, making their net gain a portion of the total bribe (Obafemi, 2021). If a meter reader is assigned to record energy usage, a consumer may pay a small bribe (b) to avoid paying the full charge. The decision to engage in corruption depends on the cost and benefit analysis of doing

so. The financial gain of the consumer from theft after paying the bribe is represented as G−b. Bribe payments reduce deterrence by lowering the probability of detection. If the consumer is caught, they must pay a fine *f*, where f > (G−b) > 0.

The financial advantage motivates the agent to accept the bribe for reporting reduced energy usage for the client. The agent's report would indicate X units of electricity, which is less than the actual consumption. Since utility billing depends on these meter readings, small-scale corruption increases and becomes recurring (Mushtaq & Mirza, 2023). The principal (utility) detects electricity theft with a probability *p*. If an agent is caught and proven to have accepted a bribe, they face dismissal and a penalty η (where $\eta > 0$). Similarly, a convicted consumer must pay a fine *f* (where *f* > 0). For deterrence to be effective, the penalty for the agent (η) and the fine for the consumer (*f*) should be huge but less than their total wealth.

The profit of the consumer from stealing energy is G−b while the agent's profit is the bribe amount *b*. The financial loss for the principal equals G, which also leads to a social cost that impacts other consumers. The client's decision to steal depends on the perceived probability of getting caught (Becker, 1968). The consumer will give a bribe if their expected gain from theft exceeds the cost of paying for the electricity honestly, i.e., if *G*−*pf* is positive. The expected utility for the consumer, considering wealth *Y* and risk ϱ, can be represented as:

$$(1-p)\, U(Y+G-b-\varrho) + pU(Y-f-\varrho)(1 - p)$$

where (1−p) is the probability of not getting caught and *p* is the probability of detection.

Consumers choose to steal if the expected gain outweighs the risk and cost of fines (Becker, 1968). Utility employees may accept bribes for personal profit, worsening the problem. Weak monitoring and enforcement by the utility enable this corruption to continue, leading to huge financial losses and higher social costs for honest consumers (Mushtaq & Mirza, 2023).

2.2. Energy Theft

Energy theft is an illicit activity that results in heavy financial losses for utility companies and affects the reliability of the electricity supply. The growing prevalence of electricity theft is attributed to socio-economic, institutional, and legal factors, which differ from country to country. Babar et al. (2022) revealed that corruption and frequent power outages are the primary reasons people commit electricity theft. Unlike Ghana, where electricity tariffs are seen as a major issue, Babar et al. found that the cost of electricity had little impact on theft decisions. Instead, unreliable power supply and widespread corruption were huge drivers. Yakubu et al. (2019) noted that the Public Utilities Regulatory Commission's failure to protect consumers encouraged electricity theft. The study also identified poverty, unemployment, illiteracy, and negative attitudes toward utility companies as additional factors driving electricity theft in Ghana. The socio-economic conditions in the country make it difficult for many individuals to afford electricity. Similarly, Wabukala et al. (2023) found that electricity theft and the high cost of electricity were major problems in rural areas, where many households cannot afford the initial connection fees or ongoing costs of legal electricity consumption. The socio-economic divide contributes to electricity theft as rural communities rely on illegal connections due to financial constraints. Gupta et al. (2022) identified that existing detection systems in India have not been effective.

2.2.1 Prevalence of energy theft globally

Theft in the energy sector has been a big concern to the secure operation of power systems and the interests of power companies (Lin et al., 2021). Energy theft is a problem that plagues many developing countries. As a result, the capacity of the nation's power companies to generate revenue and distribute energy is being negatively impacted. It is one of the most important sources of non-technical losses in the energy sector, of which the citizens are major perpetrators (Adongo et al., 2021). The trend decreases energy revenues and portends risks to power usage's safety (Feng et al., 2020). Energy theft is fraud through illegal connections, meter tampering, unpaid bills, and billing irregularities

(Smith, 2004). The behaviuor of energy theft is a violation that harms many parties (Hardianto & Akbar, 2021). Energy theft entails a non-technical loss 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 energy theft has resulted in an enormous loss of income (Arif et al., 2021) and disruption in power supply (Naik & Patil, 2020). There are indications that energy worth 21 billion is stolen annually in Nigeria. The costs are routinely passed on to the customers directly through high tariff rates and indirectly through poor quality of service (Osigwe, 2018).

Energy theft is widespread across several African countries and has been linked to the region's persistent power challenges. For example, Louw and Bokoro (2019) observed that South Africa faces major issues with energy theft and unauthorised connections via surface conductors. Likewise, Kambule and Nwulu (2021) noted that even with the implementation of prepaid meters in Tanzania and Kenya, these nations still contend with energy theft issues such as meter bypassing and unauthorised connections. In Ghana, studies indicate that utility providers introduced prepaid smart meters to address non-technical losses, as some consumers manipulate meters to underreport usage (Yakubu et al., 2018). There is an increasing concern that if energy theft remains unchecked, it may plunge utility companies into financial distress and operational inefficiencies. Similar challenges with energy theft have been documented in Pakistan (Jamil, 2018).

2.2.2 Energy theft in Nigeria

Akabuiro and Umeobika (2020) revealed that Nigeria produces less than 30% of the electricity required to meet national demand. Over 50% of this production is lost due to technical and non-technical factors, with rural areas experiencing the highest losses from electricity theft. The study also found that urban areas collect more revenue due to the higher number of legally connected households and greater consumption per household. Komolafe and Udofia (2020) developed a method to detect and locate energy theft in low voltage power distribution systems using network analysis. The method was applied to a real Ekong Uko Street, Eket, Nigeria network. It achieved high accuracy in detecting power

theft with an accuracy range of 96% to 100%, depending on the location of the theft and network conditions. The method could detect theft as low as 10 to 260 watts.

In addition, Osadebamwen (2023) investigated the relationship between energy theft and power supply quality in Edo State, Nigeria. It found a moderate positive correlation ($r = 0.41$) between energy theft and the quality of power supply. Their results showed that energy theft accounts for about 11.6% of the variation in power supply quality, showing that theft affects electricity reliability and quality. Obafemi (2021) in Lagos State identified that 68.8% of households are involved in electricity theft, while 31.2% are not. The key factors driving electricity theft include corruption, low-income levels, lack of punishment for previous offenders, presence of micro-businesses in residential areas, frequent power outages, high electricity tariffs, and weak enforcement of anti-theft laws. The study found that electricity theft leads to various problems such as damage to equipment (64.4%), challenges in service planning (68.2%), increased self-power generation costs (51.6%), damage to household appliances (61.4%), unreliable power supply (72.4%), and reduced revenue for utilities (82.0%).

David (2018) discusses how widespread energy theft disrupts the generation and distribution of electricity, contributing to frequent blackouts. This has forced many users to rely on diesel and petrol generators, increasing greenhouse gas emissions. The inefficiency caused by energy theft also reduces revenue for power distribution companies, undermining their ability to invest in the sector and meet the rising electricity demand. Olaoluwa (2017) identifies technical and non-technical losses in Nigeria's power system, with electricity theft being a significant non-technical loss. The regulatory framework established by the Nigerian Electricity Regulation Council in 2013 aimed to reduce theft, but its impact has been limited. Forms of theft include meter tampering, illegal connections, and billing irregularities. Such practices increase costs for compliant consumers and impede capital investments necessary for power sector improvements. Ojedokun et al (2021) examines the social context of energy theft in Lagos and Ibadan, where electricity tapping is widespread. Many consumers justify theft as a response to the perceived inefficiency and high costs imposed by distribution companies. Otuoze et al. (2019) emphasise that smart grid infrastructure could

improve theft detection by using smart meters and advanced data analysis to proactively monitor and address theft. However, they also note that energy theft remains a considerable risk for smart city planning and energy efficiency efforts. Energy theft is also a problem in several states, although it often goes unreported. This study seeks to document the extent of energy theft in Nigeria.

2.3 Factors influencing energy theft

Energy theft is a global issue influenced by various economic, social, and institutional factors. Among the major contributors are high energy prices, unreliable power supply, corruption, and inadequate enforcement of anti-theft laws. In regions with high energy prices, such as areas with low energy subsidies or low-income levels, people are more likely to resort to illegal connections to avoid paying for energy. This is especially true in communities where poverty and unemployment rates are high, as individuals and households struggling to afford basic needs prioritise access to energy through illegal means to improve their living conditions. In many developing countries, energy supply is inconsistent, marked by frequent blackouts, voltage fluctuations, and sometimes prolonged outages. This unreliable power supply frustrates consumers who rely on energy for daily activities, business operations, and essential services. People in areas with a poor quality power supply feel justified in bypassing the official channels, especially when they perceive utility providers as failing to deliver reliable service. For instance, a study by Obafemi et al. (2021) on Lagos State, Nigeria found that an unreliable power supply coupled with inadequate enforcement of anti-theft laws led many households to opt for illegal connections to secure stable energy access.

In addition, when utility officials or public regulators are involved in corrupt practices, they ignore illegal connections or tampered meters in exchange for bribes. This normalises energy theft within certain communities. In the Islamabad and Rawalpindi regions, Babar et al. (2022) showed that corruption and inconsistent power supply were major drivers of energy theft among younger populations who view illegal connections as justifiable in institutional inefficiency. This trend illustrates how corruption deepen socio-economic divides by allowing

wealthier individuals to bypass regulations through bribery, while poorer communities = engage in theft out of necessity.

Another factor is the insufficient enforcement of anti-theft laws, which allows energy theft to continue unchecked. Obafemi et al. (2021) found that inadequate law enforcement in Lagos State contributed to widespread household-level energy theft. People often perceive the consequences of getting caught as minimal, making the benefits of free access to energy more appealing than the risks associated with theft. In many areas, regulatory bodies such as the Public Utilities Regulatory Commission are limited in monitoring, preventing, and penalizing theft effectively. Without strong enforcement mechanisms, there is little deterrent against engaging in illegal connections.

In Uganda, Wabukala et al. (2023) found that high connection costs in rural areas prevent legal access to energy. The lack of affordable, accessible options for legitimate connections drives people in underserved areas to take matters into their own hands, perpetuating the cycle of energy theft. In communities with high poverty rates, many people cannot afford to pay for basic utilities, leading them to resort to illegal methods to meet their energy needs. Low literacy levels also contribute to misunderstandings or mistrust of billing systems, making some individuals more likely to bypass official channels. Also, negative perceptions of utility providers and a lack of consumer protection further fuel energy theft. When customers feel that they are not receiving adequate service or that their complaints are not addressed, it can lead to frustration and resentment toward utility companies. This dissatisfaction reduces individuals' willingness to pay for energy, especially if they perceive utility providers as exploitative or unresponsive to their needs. In such cases, energy theft is seen as a way of balancing perceived injustices or a means of self-compensation for inadequate service (Arango et al., 2017).

When energy prices go up, honest customers cut back on their energy use, while the number of people attempting to steal energy could increase (Adongo, 2021). Employees who might be open to corruption could also start charging higher bribes while working harder to catch those stealing without paying them off, allowing them to profit more (Jamil & Ahmad, 2019). This creates a situation where higher prices result in less revenue. The drop in revenue cannot be due to

lower demand but because more people are stealing energy. The outcome is more energy use by dishonest customers, more money made from corrupt staff bribes, and less utility income (Ikejemba & Schuur, (2018). In addition, the trust level between customers and the energy provider affects the impact of higher tariffs. If customers feel the bills are not fair, they turn to theft. Different tariff rates across customer groups, such as in different sectors, also increase energy theft. Some sectors find theft profitable due to these price differences created for social, economic, or political reasons (Yakubu et al., 2018).

To add on, wages paid to utility employees are important for reducing petty corruption and stopping energy theft (Razavi & Fleury, 2019). The idea of efficiency wages from Becker and Stigler (1974) suggests that if workers earn enough, they avoid taking bribes, as the risk of losing a good-paying job outweighs the benefit of corrupt earnings. This efficiency wage includes the regular wage plus a premium for the effectiveness of corruption monitoring. The higher the chance of getting caught for bribes, the smaller this premium must be. High wages raise the cost of job loss and discourage corruption (Jamil & Ahmad, 2019). However, Carr and Murray (2022) note that such wages reduce motivation for workers to monitor for theft. When wages are low, employees feel justified in accepting bribes to compensate for low pay (Benito et al., 2018). Low wages and temporary contracts for junior staff further encourage corruption. However, simply raising wages may not solve corruption on its own without strong monitoring and enforcement. A complete analysis is required to see if low wages lead to lower utility revenue (after wage costs) than efficiency wages (Jamil & Ahmad, 2019).

In addition, there is less when these detection chances and penalties are increased, the expected benefits from theft decrease. Crime analysis looks at arrest rates and penalties to measure the risk of punishment; similarly, fines for caught energy thieves act as a strong deterrent. The effectiveness of deterrence and detection depends on the number of monitoring staff and their efforts to find theft cases. Although hiring more monitoring staff may seem straightforward, it is not that simple. If some staff are open to corruption, adding more can not reduce theft. Many utility companies have surveillance teams that regularly check on customers and employees, inspecting meters and distribution lines for

theft and corruption. This overlap in monitoring makes it harder for corrupt employees and customers to work together, increasing the chances of detection (Xia et al., 2022). Another determinant is that when someone is caught, they must pay a fine, which is a deterrent, especially if fines are high (Obafemi, 2021). People respond strongly to higher fines, which discourage theft across different groups. For energy thieves, the fine and the possibility of getting caught work together to reduce theft (Jamil & Ahmad, 2019). Even if fines are not perfectly set, increasing them helps counteract any issues with corruption that might reduce deterrence (Saini, 2018).

2.4 Economic impact of energy theft

Globally, energy theft results in major revenue losses for utility companies, causing increased operational costs, decreased profitability, and reduced funds available for maintenance and upgrades (Arango et al., 2017). When customers bypass meters or manipulate billing systems, utility companies lose huge revenue, which is impactful in countries where electricity consumption heavily relies on a subsidised or publicly funded grid (Gaur & Gupta, 2016). Energy theft accounts for about 10–20% of electricity distributed in developing regions, creating serious financial strain on utilities. Billions of dollars are lost annually worldwide due to energy theft, which affects the utility sector's ability to invest in improved infrastructure and the reliability of power supply (Venkatachary et al., 2017). In addition, utility companies pass down these losses to paying customers. In response to reduced revenue, utilities are forced to raise energy rates to maintain financial stability (Yurtseven, 2015). As a result, honest customers bear the financial burden through higher electricity bills, paying for their own consumption, and the shortfall energy thieves create. This price increase contributes to energy poverty, especially for low-income households struggling with energy affordability (Hu et al., 2020). In extreme cases, the rising cost of electricity pushes more individuals to resort to illegal connections, increasing the cycle of theft and financial strain on the energy sector (Jamil & Ahmad, 2019).

Energy theft hinders economic growth by discouraging investment in energy infrastructure and innovation (Shokoya & Raji, 2019). Utility companies

facing continuous revenue losses are less likely to invest in new technology, renewable energy projects, or grid modernisation initiatives (Razavi & Fleury, 2019). Without sufficient funds, utilities cannot implement smart meters, improve grid security, or expand access to energy in underserved areas, limiting economic development and social progress. This is detrimental in developing economies with insufficient energy infrastructure to meet demand. When utility companies struggle to provide reliable power, industries reliant on a consistent energy supply suffer, and business expansion is stunted due to unreliable electricity (Arango et al., 2016).

Energy theft also strains government resources, as funds initially allocated for public services are diverted to subsidise struggling utility companies or cover losses from stolen power (Katiyar, 2005). To compensate, governments increase taxes or reallocate budgetary resources, leading to underfunding other essential services like education, healthcare, or public infrastructure. In countries where energy distribution is publicly funded, the government loses revenue that could otherwise contribute to economic growth initiatives (Razavi & Fleury, 2019). Furthermore, if energy theft becomes pervasive, it discourages foreign investment as investors perceive the country's energy sector as unstable or high-risk. Thus, the prevalence of energy theft impacts a nation's global economic standing and ability to attract and retain foreign investment (Smith, 2004).

Many countries, especially those heavily reliant on fossil fuels, produce extra energy to account for stolen energy, which increases emissions and strains natural resources (White, 2024). Additional power generation leads to increased pollution and increases climate change, creating economic costs associated with environmental harm, such as healthcare expenses due to pollution-related illnesses or the costs of climate adaptation. Energy theft hampers efforts to transition to cleaner energy sources due to increasing inefficient energy use and limiting the funds for green energy initiatives (Cantarero, 2020).

Energy is a foundational requirement for nearly all modern industries and services, from manufacturing and agriculture to education and healthcare. When energy theft becomes prevalent, it reduces the revenues of utility companies, discourages investment in the energy sector, and drives up costs, which, in turn, impacts a country's overall productivity and economic output (Salite et al., 2021).

The losses incurred by energy theft run into billions of dollars, and the economic consequences influence key GDP components such as industrial productivity, infrastructure development, and household consumption (Arango et al., 2017).

One way energy theft impacts GDP is its effect on industrial and commercial productivity. Manufacturing, processing, and other high-energy industries rely on a steady, reliable power supply to operate efficiently (Razavi & Fleury, 2019). Energy theft results in power shortages, blackouts, or fluctuations in developing economies where the power grid is already fragile (Jamil, 2013). These disruptions limit companies' ability to meet production targets, reduce output, and increase operation costs. If manufacturers and service providers are forced to invest in alternative power sources, such as generators, production costs increase, reducing profitability and discouraging expansion. Lower industrial output translates directly to lower GDP, reducing the goods and services produced within the country (Venkatachary et al., 2017).

On a larger scale, the instability caused by energy theft deter domestic and foreign investment in the energy sector and other industries. Investors are attracted to countries with stable infrastructure, as it ensures lower risks and a higher return on investment. However, pervasive energy theft signals weak regulatory control and operational inefficiencies in the energy sector, making investors wary of the reliability of the country's infrastructure. Reduced investment in the energy sector affects the quality and quantity of energy supply (Munawar et al., 2022). Also, it limits the development of innovative technologies and renewable energy sources that could make energy use efficient. With lower investment in these important areas, a country's growth potential is constrained, affecting long-term GDP growth (Katiyar, 2005). Furthermore, energy theft leads to higher operational costs for utility companies, passing these costs to consumers through increased electricity rates (Arango, 2016). Higher energy costs reduce household disposable income, as a greater portion of income is allocated to energy bills (Chester,2013). This reduction in disposable income lowers household consumption, a key component of GDP. As consumer spending declines, so does demand for goods and services, affecting businesses, employ-

ment, and economic output. In countries where energy theft is high, this reduction in consumption has a measurable impact on GDP, especially if energy theft continues to drive up utility costs over time (Bohlmann & Inglesi-Lotz, 2021).

Energy theft also affects government budgets, as governments have to allocate additional resources to subsidise burdened utilities. In publicly funded energy systems, energy theft results in a huge loss of revenue that would otherwise contribute to public spending, infrastructure development, and economic initiatives (Bohlmann & Inglesi-Lotz, 2021). When resources are redirected to cover these losses, funds for other sectors such as healthcare, education, and transportation are limited, impacting the nation's development and GDP growth. In addition, some governments need to increase taxes to compensate for these losses, further burdening businesses and reducing economic competitiveness (Wang et al., 2016). In response to energy theft, power providers generate additional electricity to meet demand, leading to increased use of fossil fuels and higher emissions. The environmental degradation resulting from higher emissions has economic repercussions, including increased healthcare costs and lower productivity due to pollution-related illnesses. These indirect costs affect national productivity, thus impacting GDP in the long run. Furthermore, as global demand for sustainable practices rises, countries with high levels of energy theft and associated emissions face barriers to trade and investment (Ahmad et al., 2018).

Chapter 3

3.0 Methodology and Methods

I presented the methods that will be used to collect and analyse data for the study.

3.1 Study design

This study adopts a mixed-methods approach where both quantitative and qualitative approach of data collection and analysis was used. The use of a mixed-methods approach enabled integration of statistical data with the rich experiences from key informants (Dawadi et al., 2021). The qualitative component uses a phenomenological design to explore participants' lived experiences with energy theft. This approach is suitable for understanding the personal and community-level dynamics that drive energy theft, as it focuses on how individuals perceive and interpret their own experiences (Schoch, 2020). The qualitative data was gathered through in-depth interviews with community members, focusing on their direct and indirect experiences with energy theft. Phenomenological design emphasises capturing both the "what" (description of experiences) and the "how" (interpretation of experiences) aspects of the phenomenon (Qutoshi, 2018). The quantitative component complements the qualitative data by providing statistical evidence on the prevalence and impact of energy theft in Lagos State. A questionnaire was administered to gather data on the socioeconomic characteristics of community members, their experiences with energy theft, and their perceptions of its impact on the local economy. This data was analysed to quantify trends such as the demographic characteristics of those most likely to engage in energy theft, and the severity of energy theft within the community. In the analysis phase, qualitative data from interviews was transcribed and coded to identify relevant themes. These themes were further synthesised into organised categories that reflect the underlying motivations associated with energy theft. Quantitative data was analysed using descriptive statistics to provide frequencies and percentages.

3.2 Study participants

I selected purposively participants who were knowledgeable about energy theft in Lagos State. The participants included officials from the Ikeja Electricity Distribution Company (IKEDC) working in customer service, field operations and security departments because they possessed experience with patterns of energy theft. In addition, I involved community leaders as they are well-acquainted with local practices. Government leaders from Nigerian Electricity Regulatory Commission (NERC) were also included to provide knowledge on regulatory and enforcement aspects of energy theft. I intended to select researchers and academicians who had studied energy theft, energy policy, and related socioeconomic issues to offer academic findings on the study (Ojedokun et al., 2021; Obafemi et al., 2021 and Akabuiro & Umeobika, 2020). Informants in a qualitative study are critical to its success as such persons provide insights into matters and also give access to interviewees who may have contrary evidence (Yin, 2018).

Twelve (12) Participants were selected using a purposive sampling technique appropriate for ensuring that selected individuals had the knowledge and experience relevant to the study. For the IKEDC officials, the study targeted those departments involved with customer interactions and field operations. Community leaders were identified through local government offices in Lagos state. Top administrators from NERC were selected based on their roles and involvement in energy regulation and policy implementation. Academicians and researchers were chosen based on their previous work related to energy theft. Six (6) community members were approached in their neighborhoods where they were invited to participate in the study. The questionnaires were administered in a face-to-face format to improve response accuracy and provide an opportunity for clarification on any questions. The research assistant asked participants to complete the questionnaires at their own pace, ensuring they felt comfortable providing honest responses. After the questionnaire administration, the researcher conducted follow-up interviews with a subset of participants who expressed willingness. This purposive sampling approach ensured that the study gathered rich and relevant perspectives from different actors. According to Yin (2018), in-depth interviews are valid when researchers know that the people being interviewed are representatives of the majority of people that are actually facing the

problem. In other words, researchers needed to show that the people they are interviewing were knowledgeable of what is going on. In this way, a potential bias picture was minimised.

3.3 Data collection methods

The study used questionnaires to collect data from community members while interviews to collect data from key informants. Structured questionnaires were distributed to community members to obtain information on demographics, economic status, employment history and beliefs related to energy theft. On the other hand, interviews helped by suggesting explanations of key events as well as findings reflecting participants' relative perspectives (Yin, 2018). The interview guide directed the topics of interest but the participant and the interviewer were free to explore ideas as they arise. Participants were asked to indicate the common methods of energy theft, describe what motivates individuals to engage energy theft practices, explaining the risks involved in identifying and addressing the vise while also suggesting the likely remedies to energy theft in Lagos state. This helped to move discussions into specific examples and details relevant to the participant's experiences. The flexibility of interviews allowed for more elaboration of questions and will help to sort questions in themes (Roberts, 2020). The interview was done online through phone calls, Whatsapp calls and zoom and each lasted 30-45minutes and was digitally recorded for transcription. The recording was started upon getting consent from participants to do so. Yin (2018) emphasises that 'using recording is a matter of personal preference'. The audio recordings provide a more accurate interpretation of any interview than taking notes. He further notes that recording should not be used when a participant refuses, appears uncomfortable, the recording distracts the process or acts as substitute for "listening".

3.3.1 Secondary data

The researcher gathered data from government reports, industry publications, and statistical databases. Key documents included reports from the Nigerian Electricity Regulatory Commission (NERC) and publications from the Ikeja Electricity Distribution Company that gave data on the prevalence of energy

theft statistics. Also, economic reports from the National Bureau of Statistics provided Nigeria's GDP for 2020 to 2023. The researcher also reviewed reports from international organisations such as the World Bank and the International Energy Agency (IEA) to understand energy theft in Nigeria and other similar economies. Data from the National Bureau of Statistics and the Central Bank of Nigeria were analysed to estimate the percentage of Nigeria's GDP affected by energy theft. This secondary data helped quantify the financial losses attributed to energy theft. The literature review incorporated existing research studies by scholars such as Ojedokun et al. (2021) and Obafemi et al. (2021), who have explored energy theft patterns and socioeconomic factors influencing the vice.

3.4 Data Analysis

Descriptive statistics (percentages and trends) were used to show the year-on-year changes in the prevalence of energy theft from 2020 to 2023. To estimate how much energy theft affected Nigeria's GDP from 2020 to 2023, the researcher calculated the financial losses due to energy theft as a proportion of the country's total GDP. Thematic analysis was conducted to analyse the transcribed data. Thematic analysis allows interpretation of rich data and is useful when summarising key features of a large data. The researcher started by familiarising with all the data and journaling to make note of the comments of participants. According to Braun and Clarke (2006) notes that researchers should first familiarise with the depth of the data. The transcripts were read several times to allow myself understand each participant's lived perspective of energy theft. After familiarising with the data, I did open coding where a list of codes was grouped into categorises to identify relationships by colour coding with different colours to distinguish each easily. Codes were then combined to generate themes. The generated themes and subthemes were named and defined.

3.5 Limitation of research and possible practical problems

Some participants refused to give information, but to ensure that the study was successful, the researcher explained to them study purpose and assuring them that whatever information they share would be kept confidential. In addition,

the time needed to conduct this research was not enough since it was basing on a qualitative approach. I minimised this by considering a small sample size and followed work schedule that was drafted to meet deadlines. Despite, sample size being limited to a few interviews due to time constraints, in-depth analysis of interviews and an extensive literature review were still beneficial to answer research questions.

3.6 Research ethics

The researcher upheld ethical standards throughout all study stages since the process could bring harm to the individuals involved in the process. Before conducting interviews, the scope of the research and its limitations were explained to the informants. It was highlighted that they could refuse to answer any question as well as withdraw at any point without any consequences. They were also asked if they had any questions which they would want to add. I ensured that I create an open conversation with participants so that they speak their perceptions. In addition, I considered not revealing any details about the participants and I included as many direct quotes as possible since it was difficult to represent others.

Chapter 4

4.1 Prevalence of energy theft

The study examines the extent of energy theft in Lagos State. The prevalence of energy theft impacts the efficiency and financial stability of the power sector. The estimated losses due to energy theft in monetary terms, alongside the perception of community members.

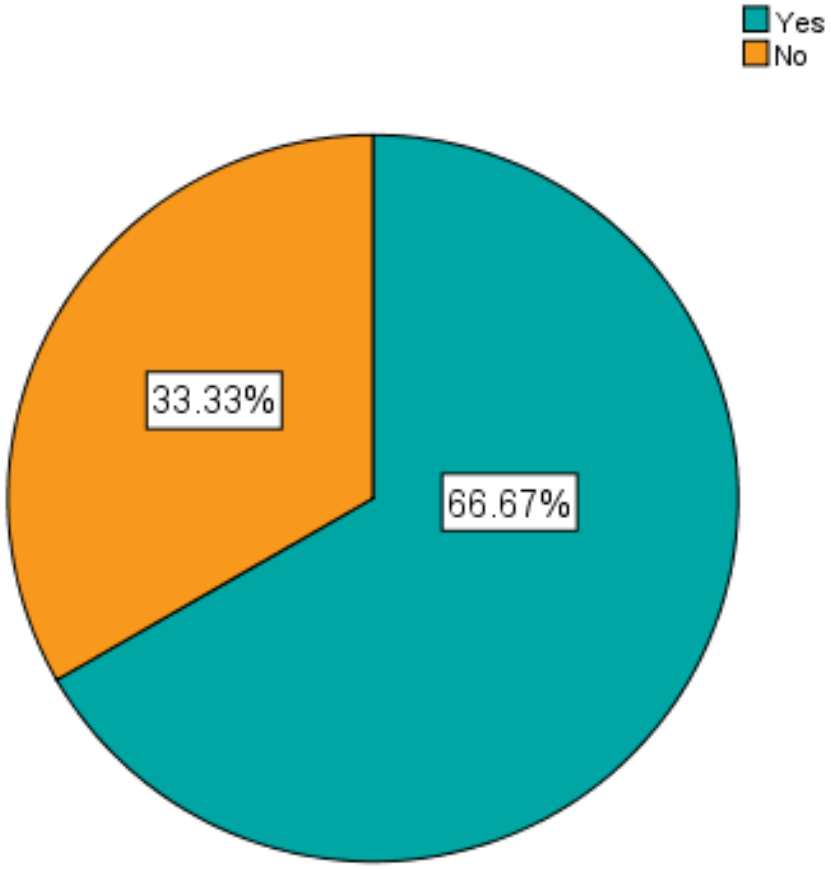

Figure 4.1 Experience of energy theft in Lagos State

Figure 4.1 reveals that 66.7 percent of community members or their family members have engaged in energy theft, while 33.3 percent have not. This indicates that energy theft is a common response to certain challenges faced by residents.

Furthermore, the researcher asked the community members on a scale of 1-5 to rate how serious energy theft is in Lagos state. The results are presented in Table 4.1.

Table 4.1 Perception on level of energy theft by community members

Category	*Frequency*	*Percentage*	*Gender (f)*
1 (Not serious at all)	0	0%	-
2 (Slightly serious)	0	0%	-
3 (Moderately serious)	1	16.7%	Female
4 (Very serious)	2	33.3%	1 Female, 1Male
5 (Extremely serious)	3	50%	2 Male, 1Female
Total	6		

When asked to rate the seriousness of energy theft in Lagos State, 50 percent rated it as "extremely serious" (5 on a scale of 1-5), while 33.3 percent rated it as a 4, and 16.7 percent rated it as a 3. Out of the extremely serious, 2 were male aged between 26years and 45years and one female aged between 26-36years. This implies that most community members see energy theft as a major issue in their area.

Source: Shokoya and Raji (2019)

Picture showing an example of meter tampered by bypassing a meter in a residential building in Ikorodu, a suburb of Lagos State. The supply line leading to the first energy meter (*on the left*) is diverted. The picture also shows another method of tampering with the meter involves reversing the input and output terminals to prevent the meter from recording energy usage accurately.

4.2. Percentage share of energy theft in GDP for 2020-2023

This section examines the impact of energy theft on Nigeria's economic performance by analysing the percentage share of energy theft losses in the country's GDP growth from 2020 to 2023. Energy theft represents a huge challenge for Nigeria causing financial losses for utility companies and the economy.

Table 4.2 Descriptive Statistics of Energy loss and its percentage share in GDP from 2020-2023

Variable	Obs	Mean	Std. Dev.	Min	Max
Estimated Loss (million USD)	4	50.11	21.19472	31.72	79.05
Percentage share of GDP (%)	4	11.75929	4.689755	6.711523	17.93168

Source: National Bureau of Statistics (2020, 2023) and NERC quarterly reports for 2020 to 2023

The table indicates that on average, the losses due to energy theft each year were approximately 50.1 million dollars from 2020 to 2023. The standard deviation of 21.19 suggests that there is a significant variation in the losses over the years. A higher standard deviation indicates that the yearly losses have fluctuated, reflecting changes in the rate of energy theft. The minimum loss recorded during this period was 31.72 million dollars, while the maximum reached 79.05 million dollars.

Table 4.2 indicates that, on average, the losses due to energy theft account for 11.76 percent of Nigeria's GDP. The standard deviation of 4.69 percent indicates variability in the percentage share across the years, suggesting fluctuations in the extent of losses relative to GDP. The minimum percentage share observed was around 6.71 percent, while the maximum reached approximately 17.93 percent. This range implies that the impact of energy theft on the GDP is different over the analysed period.

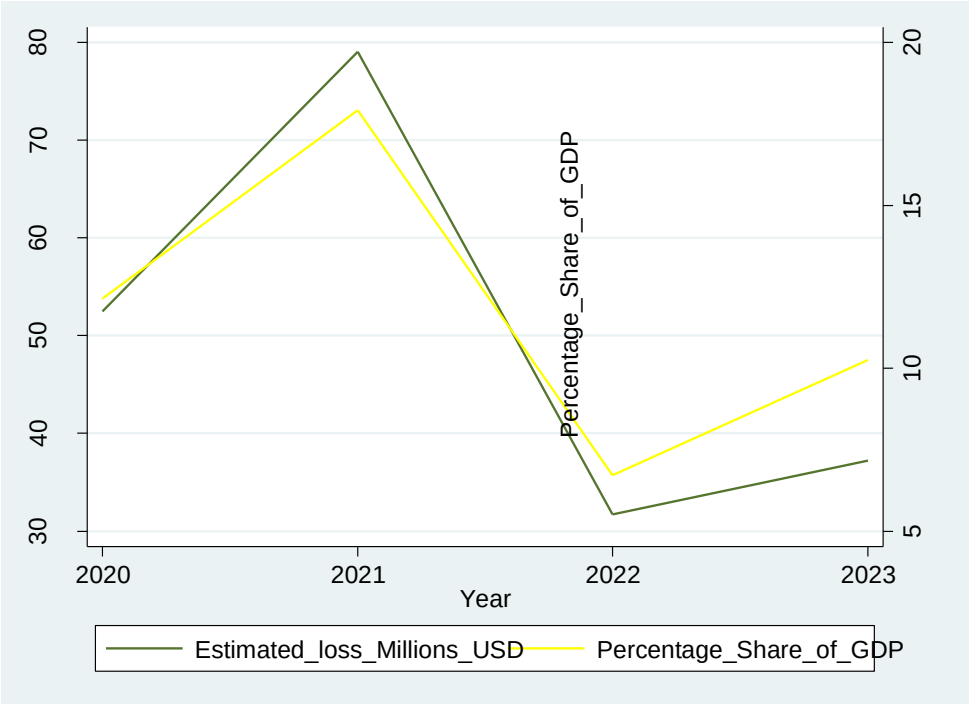

Figure 4.2 Energy loss and its percentage share in GDP from 2020-2023

Figure 4.4 shows that in 2020, losses were estimated at 52.46 million USD and this increased to a peak of 79.05 million USD in 2021, suggesting that energy theft activities were at their highest during this time. However, in 2022, losses dropped to 31.72 million USD, which indicate better enforcement and anti-theft measures. In 2023, losses rose to 37.21 million USD, indicating that challenges remained in controlling theft.

In 2020, energy theft made up 12.14% of economic losses. This number increases to 17.93% in 2021, marking a peak that strained financial resources and slowed growth. By 2022, the share fell to 6.71%, indicating possible improvements in energy management that eased some of the economic burden. However, in 2023, the share rose again to 10.26%. Therefore, persistent energy theft disrupts revenue for utility companies, limits public investments, and slows GDP growth.

4.3 Motivating factors behind energy theft activities in Lagos State

Energy theft in developing countries have been studied before (e.g. Yakubu et al., 2018; Monyei et al., 2018 and Lin & Okyere, 2022). However, this chapter relies on data generated from the field together with secondary data on the motivating factors influencing energy theft activities in Lagos State. The reasons for energy theft are presented in Figure 4.3.

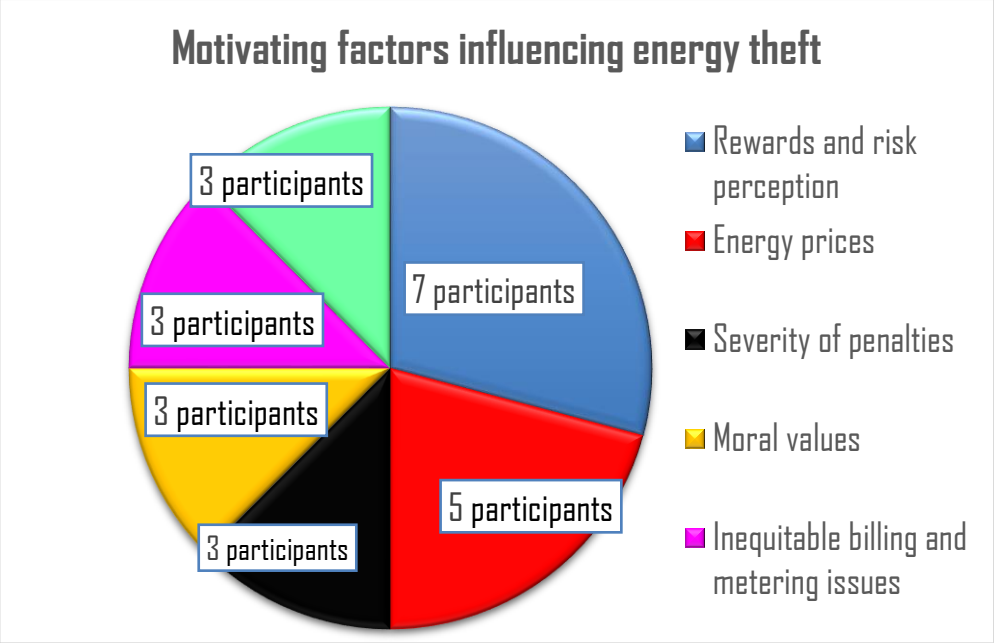

Figure 4.3 Motivating factors influencing energy theft

Figure 4.3 showed that most of the respondents indicated that low risk of being caught is the dominant reason that account for stealing the energy. High energy prices were also identified as a key issue causing energy theft by 5 participants. This implies that when energy costs rise, individuals are more inclined to steal to save money. Other factors, each cited by 3 participants, include enforcement of penalties, moral values implying that weaker ethical considerations contribute to such behaviour, billing and metering discrepancies creating feelings of unfairness and corruption, where people feel justified in stealing energy due to lack of trust in institutions. These imply that energy theft is influenced by both economic factors (like costs and risks) and perceptions of fairness and ethics (such as corruption and billing inequities).

High energy prices

Five respondents mentioned the sharp rise in energy tariffs as a key driver behind energy theft, indicating that many consumers feel burdened by the high cost of electricity. In low-income areas such as Ajegunle, many people live on small daily incomes; energy costs take up a large part of their budget. Some residents illegally bypass meters or connect to power lines because they believe they are unfairly charged. In addition, small business owners in places like Alaba markets also face high bills, and some turn to illegal connections to reduce their costs. The tariff structure for energy is organised into service bands implemented by the power distribution companies, areas with better service quality in higher bands like Band A or B, where residents receive between 16 to 20 hours of electricity per day. While this ensures a more stable supply for these areas, it also comes with higher tariffs, which many urban consumers in Lagos find challenging to afford. As a result, some urban residents cannot keep up with the high energy costs, so they turn to energy theft to reduce their monthly energy bills. Ginald, an Assistant General Manager at NERC, observed,

> "In Lagos energy is more reliable but expensive, some residents thus resort to electricity theft to avoid paying high bills."

This indicates a challenge of balancing reliable supply with affordability for urban consumers. Another participant, Bayo – an energy sales manager at Ikeja Electric, explained that high energy costs exert financial pressure on consumers, prompting some to seek illegal connections to lower their expenses. Energy theft spikes tend to align with price hikes, indicating that rising tariffs push people to look for alternatives when they become unaffordable. Drimo, a senior manager, shared similar views, suggesting that economic hardship drives consumers toward energy theft when faced with unaffordable prices. Akomo, an energy sales supervisor, added that irregular and unexpected price increases lead to frustration, motivating some to tamper with meters or bypass connections altogether.

From the community perspective, Igu, CDA chairman said that residents perceive the price hikes as unjust causing some to bypass the system to balance out perceived inequities. From these narratives, I believe that high energy prices create economic strain and shape perceptions of fairness among consumers.

When the energy cost is seen as disproportionate to the service received when the price increases, it triggers financial injustice that fuels energy theft. This agrees with findings from Ghana where widespread frustration toward utility companies grew due to sharp increases in tariffs and inadequate services. In some cases, this frustration led community members to vandalise the offices and equipment of these companies, expressing their anger over what they perceive as excessively high bills (Myjoyonline News, 2017).

Rewards and risk perception

The second cluster of factors that motivate people to engage in energy theft is perceived rewards and risks. Participants in this study established that people are always going to assess and make decisions to engage in such illegal activities basing on the likelihood of benefits accrued. One participant said, "In this area, the gain from stealing electricity is high, especially for those struggling with high utility bills." [Atima, Specialist in Abu Dhabi on the Asia Electric, Ikeja Electric] Atima's observation indicates that when people are burdened with high utility bills, they resort to energy theft. Atim explained that a local small business owner facing severe electricity bills found that stealing power gave him immediate financial relief, outweighing the potential consequences. The weak enforcement of regulations in the State further increases the theft as people see the likelihood of getting caught as minimal. This agrees with Becke,r's (1968) economic theory of crime who posits that individuals are more likely to commit crimes when the expected benefits outweigh the perceived risks.

Another interviewee remarked:

> "People are motivated to steal energy when they see increased savings and believe the risk of detection is minimal." [Phen, Revenue Protection Energy Vigilance, Ikeja Electric]

People's motivation stems from weak enforcement in Lagos, for example, residents in informal settlements feel that their chances of detection are low due to the limited presence of enforcement officers in their areas. In addition, Asimo said that, "The temptation to steal energy increases with low-risk perception." [Asimo, Researcher, Energy and Regulatory Consultant, Nigerian Power Sector].

This shows that if local authorities implemented inspections, individuals reassess the risks associated with theft.

Rewards are also assessed on the financial pressures, as a participant put it that,

> "Many households here experience differences between their actual power usage and what's reported. This discrepancy makes theft seem more beneficial as the perceived risk of getting caught is low compared to the benefits of free electricity." [Drimo, Senior Manager, Ikeja Electric]

This shows that the reported power usage creates an environment conducive to theft. One household with irregular power meter readings see theft as a viable way to avoid paying for what they perceive as inflated bills. In addition, another participant explains that economic hardship increases the motivation for theft where a low-income family struggling to make ends meet views energy theft as a necessary option to manage their financial situation, even if it involves some risk.

> "For many dwellers in Lagos, stealing electricity is seen as a necessary measure to balance the scales, outweighing the risks of detection." [Phen, Revenue Protection Energy Vigilance, Ikeja Electric]

To add on this, Drimo explained a scenario that, "a worker who has lost their job might turn to energy theft as a temporary solution to their financial problems, weighing the short-term relief against the long-term risks" [Drimo, Senior Manager, Ikeja Electric]. This confirms that economic strain influences the decision to engage in theft. Individuals under financial stress view theft as a necessary means to alleviate their economic burdens, when they perceive enforcement as insufficient. For many people, "energy theft is considered as a necessary risk to manage their financial situations. Their willingness to engage in theft is closely linked to their economic conditions." [Wole, Researcher, Academia]

From data, the high rewards associated with energy theft in Lagos State combined with weak enforcement create an environment where theft is seen as a low-risk, high-reward activity. Miceli (2018) noted that economic incentives and risk perceptions drive criminal behavior, with weak enforcement lowering

the perceived risk of detection. Similarly, van Velthoven et al. (2016) find that a lower perceived risk increases the likelihood of criminal activities.

Severity of penalties

In Lagos State, the success of penalties in stopping energy theft depends on how harsh and regularly they are enforced. Three participants shared their views on this theme. One participant explained that strict penalties are important but lose their impact if not enforced regularly. He explained, *"In Lagos State, severe penalties are important to deter energy theft. However, their effectiveness depends on how frequently they are applied across different neighborhoods."* [Ginald, an Assistant General Manager at NERC]. This shows that people in Lagos State feel more comfortable stealing energy, assuming they do not face serious consequences.

Another participant, Van, pointed out that in some cases, the penalties in Lagos State are too mild to act as good deterrents. He said,

> *"In Lagos State, some penalties for energy theft are not severe enough to deter offenders. When penalties are perceived as insufficient, they fail to prevent theft effectively."* [Van, NERC]

This suggests that if the punishment is not strong enough compared to the gains from stealing energy, people continue with theft, believing the risk is worth it. Bayo added that penalties must be both high and consistently enforced to work. He noted,

> *"In Lagos, the effect of penalties is low because enforcement is inconsistent."* [Bayo, an Energy Sales Manager at Ikeja Electric]

Bayo's comment explains that even tough penalties should be applied evenly across all areas to prevent theft. In other States where enforcement is strong, theft rates are lower. These findings support Becker's (1968) economic theory of crime, which suggests that people weigh the benefits of illegal activities against the risks of getting caught. According to this theory, higher penalties and a greater chance of being caught reduce the likelihood of committing crimes. This study supports Becker's idea, showing that strict penalties and consistent enforcement can prevent energy theft. However, Van's observation about weak penalties agrees with Tasdoven et al (2012) argument that people's economic incentives and risk perceptions drive criminal behavior. When penalties do not

outweigh the financial benefits of theft, they fail to stop the crime. This is evident in Lagos, where lighter penalties have contributed to ongoing theft because the risk of facing serious consequences is low. In addition, Wesonga (2020) found inconsistent enforcement increases criminal activity.

Moral values

Study participants established that energy theft is normalised in some parts of Lagos State supported by views from three participants. Neka, an Energy Sales Coordinator at Ikeja Electric, observed that in some areas of Lagos, energy theft is seen as a minor offense. Neka stated,

> *"In some neighborhoods of Lagos State, energy theft is seen as a common practice. This normalisation weakens the moral barriers to theft, making it more prevalent."*

This suggests that in some parts of Lagos, residents experience irregular billing, theft has become acceptable. People view it as a practical solution to inadequate service rather than a crime, which diminishes the moral resistance to theft and makes it more likely. In addition, Igu, supported this by noting that when theft becomes normalised, people's moral judgments weaken. He said, *"In Lagos, energy theft is somehow normalised, the moral judgment against it weakens. People in these areas are more inclined to commit theft because it is seen as less of a crime."* Residents see it necessary, especially if their peers are also engaging in it. As a result, even those new to the area or struggling financially adopt the practice, seeing it as acceptable.

Asimo, a researcher and Energy Regulatory Consultant, explained that social norms are key to shaping attitudes toward theft. He stated, *"The social norms in some parts of Lagos State make energy theft seem like a minor offense. When theft is seen as common and accepted, individuals' moral resistance to committing such acts is reduced."* In neighborhoods where theft is prevalent, people tend to view it as a normal behavior rather than a serious crime. This social acceptance weakens moral values and leads to higher rates of theft. This data agrees with Singh and Inglesi-Lotz's (2021) argument that social norms influence criminal behavior. When theft becomes accepted within a community, it lowers the moral barriers that would prevent such actions. This also connects with Saini's (2017) strain theory, which

suggests that when social norms are weak or in conflict, individuals turn to criminal activities, such as theft, to achieve their goals. In Lagos, where theft is normalised, residents see it as a valid response to economic or service issues. The data also supports Miceli's (2018) research, which indicated that moral values which are weak increase the likelihood of criminal behavior. As shown in Lagos, the social acceptance of energy theft reduces moral objections, resulting in higher rates of theft across communities where these behaviors are normalised.

Inequitable billing and metering issues

This is another cluster of factors where errors and inefficiencies in the billing and metering systems contribute to energy theft in the State. Participants viewed that faulty meters, incorrect billing, and poor maintenance create frustrations for residents leading some to see theft as a reasonable response to what they see as unfair utility charges. Neka, an Energy Sales Coordinator at Ikeja Electric, explained that faulty and poorly calibrated meters are a common issue in Lagos. She noted,

> *"In Lagos State, faulty and poorly calibrated meters are common and this makes it easy for people to bypass billing and engage in energy theft without much concern."*

This shows that when some household experience inaccurate meter readings that do not reflect their actual energy usage, as such they see theft as a way to avoid inflated bills. In these cases, residents are less likely to feel guilt or fear of being caught, as they perceive the billing system to be flawed in the first place.

Another participant, Adahim, Principal Manager at the Customer Service Standards Unit of NERC, added that inaccurate billing and poor meter maintenance create conditions where energy theft is seen as a rational choice. He said,

> *"Lagos faces serious problems with inaccurate billing and meter maintenance and these create an environment where energy theft becomes a choice for those who feel they are being unfairly charged."*

It was established that in some instances when households receive bills much higher than their actual energy consumption, due to faulty meters, they feel justified in bypassing the system to avoid paying for electricity they did not use. This feeling of unfair treatment lead people to view energy theft as a logical response to the problem.

Akomo, from IKEDC, noted that inconsistent meter readings and high utility charges drive consumers to theft. He explained,

> *"Consumers in Lagos turn to energy theft due to inconsistent meter readings and high utility charges. The unreliable metering systems here push people towards bypassing the system entirely."*

In this case, when meters give unreliable readings and electricity costs are perceived as too high, residents resort to theft as a way of escaping what they see as unfair pricing. The frustration with inaccurate metering systems fuels this behavior, making energy theft more common. The view from participants is consistent with Yakubu et al (2018) who found that errors in billing systems lead to theft, as people try to correct what they see as unfair charges. Similarly, Obafemi et al's (2021) study showed that people are more likely to steal when they feel they are being overcharged. The problems described in Lagos state also agree with Ojedokun et al. (2021), who found that poor meter management and billing inaccuracies create opportunities for theft by weakening monitoring and enforcement. When the system is unreliable, individuals are more likely to exploit these weaknesses.

Corruption

Corrupt practices such as bribery and collusion lower the risks associated with theft and make it easier for individuals to engage in illegal activities without facing consequences. Asimo, a researcher and Energy and Regulatory Consultant stated, *"In this state, bribes are given to alter meter readings."* This observation explains that utility workers accept bribes to alter meter readings and enable residents to avoid paying for the actual amount of energy they use. This makes energy theft easier and reduces the fear of being caught. A person bribed a worker to report a lower energy usage and shows they are essentially stealing energy, where the bribe ensures there are no consequences for the theft.

Ginald, Assistant General Manager at NERC, noted that collusion within the utility sector allows energy theft to thrive. He noted, *"In Lagos, collusion among some utility personnel enables energy theft to flourish. This internal corruption simplifies stealing electricity and reduces the likelihood of getting caught."* This shows that some utility employees work together to cover up illegal activities, which makes energy theft much easier. He narrated that some workers collaborate to provide false meter

readings; as such, people steal electricity without fear of detection. This kind of corruption acts as a shield for those engaging in theft, making it more common.

Wole, a researcher in academia, pointed out that,

> *"Corrupt practices within Lagos's utility companies create an environment where energy theft is not only possible but also appears justified due to weak laws."*

Wole narrative suggests that weak enforcement makes individuals see energy theft as an acceptable response. He said officials ignore some illegal connections; thus, people feel that theft is justified because there is no real threat of punishment. This perception of impunity encourages more theft and supports a culture where it is seen as rational. Xia et al (2022) found that corruption in public services increases opportunities for illegal activities. In Lagos, corruption in the utility sector reduces the risks associated with energy theft, making it more attractive to residents. Similarly, Nduhuura et al (2021) argued that corruption weakens the effectiveness of institutions and their ability to enforce regulations. In Lagos, corruption helps people steal electricity and undermines efforts to prevent it. When utility employees are involved in corrupt practices, enforcement becomes less effective, and energy theft increases. Jamil and Ahmad (2019) also noted that corruption leads to weaker public administration and less effective enforcement of laws. Their research supports the view that states with high corruption are more likely to experience problems like energy theft because the law is compromised.

4.4 Strategies to reduce the prevalence of energy theft in Lagos state

This chapter examines the strategies to reduce the prevalence of energy theft in Lagos State. Energy theft is a big challenge to the distribution and consumption of energy, causing heavy financial losses for utility companies and unreliable power supply for consumers. Drawing on interview data, the chapter is structured around four key strategies: communicating the cost of electricity theft to consumers, improved metering and billing, and community education.

Provision of subsidies for low-income households

This strategy focuses on providing financial support to low-income households to reduce the incidence of energy theft in Lagos State. Many low-income families struggle to pay for electricity, making them more susceptible to the temptation of engaging in theft. Interview participants suggest subsidies as a means to alleviate this burden. One participant noted:

> When low-income households receive financial assistance for their electricity bills, they are less likely to resort to theft as a way to cope with their energy costs. [Ginald, Assistant General Manager, NERC]

Implementing subsidies reduces the financial strain on these households. This support would help families pay for their electricity and also promote legal consumption. Adahim remarked, "By providing financial aid, we can help vulnerable communities access energy without resorting to illegal means, leading to improved relationships between utility companies and consumers."

In addition, subsidies with educational programs that inform households about responsible energy use would be a good move. As participants suggested, "Combining subsidies with information on energy conservation empowers low-income families to use energy well, further reducing the likelihood of theft." [Neka, Energy Sales Coordinator, Ikeja Electric] Research shows that when households have a clearer understanding of their energy consumption and the benefits of legal access, they are more likely to stay within legal bounds (Babar et al., 2022). In addition, utility companies could collaborate with local governments and non-governmental organisations to identify and assist eligible households. By establishing a transparent application process, these partnerships ensure that the subsidies reach those who need them most. Asghar et al. (2022) noted that communities with strong support systems in place tend to have lower theft rates, as financial assistance creates a sense of stability and trust in the system.

Intensified grid surveillance and legal action against offenders

Another cluster of strategies is improving grid surveillance and implementing strict legal measures against energy theft in Lagos State. Energy theft poses a big

challenge to the power distribution system, and addressing it requires a strong enforcement framework. One participant stated:

> "We can quickly identify and apprehend offenders by strengthening surveillance on the grid, sending a strong message that theft will not be tolerated." [Neka, Energy Sales Coordinator, Ikeja Electric]

They suggested the implementation of advanced surveillance technologies like smart meters and drones to provide utility companies with data on energy usage and theft activities. Adahim noted, "Modern monitoring systems allow us to detect irregular consumption patterns, making it easier to pinpoint areas where theft is prevalent." Using this approach, he added that we could identify offenders and minimise the economic losses caused by theft. In addition, offenders should face charges and legal consequences to create a deterrent effect. Ginald stated, "When individuals know that there are strong penalties for stealing electricity, they are less likely to engage in such activities." Thus, establishing a clear legal framework that includes swift prosecution of offenders strengthens the seriousness of the issue. Participants suggested that utility companies and the government should conduct awareness campaigns to inform the public about the consequences of theft. This concurs with Asghar et al. (2022) who argued that communities with visible enforcement of laws experience lower theft rates, as individuals are more cautious when they know penalties are enforced.

Communicating the cost of energy theft to consumers

Utility companies should communicate the financial implications of theft to consumers. They need to convey how theft affects electricity tariffs to motivate consumers to report theft and participate in preventive measures. A participant observed: *"… When people understand that theft leads to higher costs for everyone, they become more motivated to report suspicious activities."* [Neka, Energy Sales Coordinator, Ikeja Electric]

Consumers are likely to recognise the direct benefits of reporting theft; when they understand that theft drives up their electricity costs and diminishes service quality for all, they become more inclined to take action against theft. Adahim added:

> *"If consumers receive notifications about how energy theft drives up their electricity tariffs, they will be more likely to engage in theft prevention measures. Transparency about the financial burden caused by theft increases public support for reporting and reducing theft."* [Adahim, Principal Manager, Customer Service Standards Unit, NERC]

This shows that SMS or app notifications to inform consumers about how theft affects their electricity tariffs encourage consumers to support theft prevention efforts and report illegal activities. When consumers are informed about the costs associated with their energy usage, they tend to adopt more energy-efficient behaviors and engage in conservation efforts (Babar et al, 2022). Fidelis et al (2017) demonstrated that feedback on energy consumption leads to reductions in energy use.

Improved metering and billing

This cluster of strategies explains that meters reduce the temptation to steal energy when properly calibrated and billing is accurate. One participant noted:

> *In most areas around Lagos State, faulty and poorly calibrated meters are common, making it easy for people to bypass billing and engage in energy theft without much concern."* [Neka, Energy Sales Coordinator, Ikeja Electric]

In Lagos, the inadequacy of metering systems increases the appeal of theft as Adahim, Principal Manager at the Customer Service Standards Unit of NERC, added: *"Lagos faces serious problems with inaccurate billing causing energy theft to become an easy choice for those who feel they are being unfairly charged."* [Adahim, Principal Manager, Customer Service Standards Unit, NERC] When consumers receive incorrect bills due to faulty meters, they feel justified in bypassing the metering system to avoid paying for what they believe is an overcharge. Asghar et al. (2022) found that when metering systems are reliable, consumers are less likely to engage in theft as the risk of detection increases and the incentive to bypass the system diminishes.

Community education

Participants mentioned that creating awareness about energy theft empowers individuals to participate in prevention efforts. One participant said, "…. When residents understand how energy theft affects them directly through increased

tariffs, they are more likely to participate in prevention efforts. Initiatives like local workshops and informational campaigns make a big difference." [Neka, Energy Sales Coordinator, Ikeja Electric]

I suggest that utility companies in Lagos state carry out local workshops to demonstrate how theft leads to increased electricity tariffs and motivate community members to report theft and engage in preventive measures. Another participant supported this by arguing that,

> "… community outreach programs that include information on how theft affects local infrastructure and services help to create a more informed public that is less tolerant of theft." [Ginald, Assistant General Manager, NERC]

Through community outreach programs, residents learn how theft undermines local infrastructure and disrupts services, leading to resistance against such activities. I suggest community meetings to inform residents about how bad theft is and tell them to be vigilant to one another. More so, we need to engage community leaders to spread anti-theft messages that amplify the reach of educational efforts and create a community-wide commitment to reducing theft." [Phen, Revenue Protection Energy Vigilance, Ikeja Electric] Jamil and Ahmad (2019) found that community-based educational interventions decreased theft rates by raising awareness about theft's financial and legal consequences. Similarly, Hokamp (2022) collaborations with trusted community figures improved the reach and impact of educational campaigns. On the other hand, Akabuiro and Umeobika (2020) noted that initial educational efforts could lose effectiveness over time without continuous follow-up. This calls for education initiatives that include regular updates and continuous engagement.

Chapter 5

5.1 Conclusion

Energy theft in Lagos State has reached alarming levels and requires immediate attention. It was important to understand key motivating factors that motivate consumers to engage in energy theft. This will result in establishing measures to track and curb the vice. In this study, men were more involved in energy theft than women, while urban residents show higher engagement in illegal electricity connections due to increased demand and challenges in monitoring. The findings also indicate that those in the working-age group are more implicated, and a lower level of education appears to contribute to reduced awareness of the legal repercussions of energy theft. In addition, I study established that low-income earners and those facing financial instability, especially the unemployed and self-employed, are more likely to engage in energy theft to reduce costs. Most residents had no family ties to energy companies, meaning economic motivations rather than insider influence made them participate in energy theft.

I found that increasing energy costs push more people to steal, as they struggle to pay for legal access of energy. People in Lagos State also engage in energy theft due to rewards and risk perception, severity of penalties, moral values, inequitable billing and metering issues, and corruption. The rewards and risk perception surrounding energy theft make individuals weigh the potential benefits of accessing free electricity against the perceived low risks of being caught. Becker's (1968) theory on the economics of crime is useful here, as it explains how individuals make rational choices based on a cost-benefit analysis. In Lagos, the perceived benefits of theft such as free electricity are seen to outweigh the risks, especially when enforcement is weak. Also, weak legal frameworks fail to provide a strong deterrent while when theft is normalised, individuals view it as acceptable, which Becker's theory also addresses, as societal values shift what is perceived as rational or acceptable behavior. The study established that inequitable billing and metering issues contribute to energy theft by creating dissatisfaction among consumers. The theory of economics of crime explained that when consumers perceive the system as unfair, they are more likely to act in their own economic interest even if it means breaking the law. Corruption facilitates

theft by creating an environment where individuals exploit loopholes without consequences. Corruption diminishes the likelihood of punishment, the cost of theft decreases, encouraging more individuals to engage in it.

Energy theft has affected Nigeria's GDP growth by reducing revenue for electricity companies and limiting government spending. From 2020 to 2023, energy theft made up about 11.76% of GDP losses, peaking at 17.93% in 2021. This peak shows that widespread theft put a lot of pressure on the economy, diverting money that could have been used for development projects.

5.2 Recommendations

Policies formulated to reduce energy theft should include provision of subsidies for low-income households. Also, communicating the cost of electricity theft to consumers through tools like SMS alerts and apps could raise awareness about the financial impact of theft, thereby encouraging consumers to take ownership of reporting theft. In addition, improving metering and billing systems would reduce the opportunities for theft by ensuring fair billing practices, making it harder for individuals to justify non-compliance. More so, community education programs would help shift social norms by discouraging theft. In addition, community leaders should be engaged to spread anti-theft messages so that people get to know the dangers of energy theft. The government should intensify grid surveillance and have the offenders charged and sentenced before courts to minimise energy theft. Research should explore the behavioral responses of consumers to increased penalties or community-based monitoring.

References

Acharya, R.H. and Sadath, A.C. (2019) 'Energy poverty and economic development: Household-level evidence from India,' *Energy and Buildings*, 183, pp. 785-791.

Adeniran, A. (2018) Mitigating Electricity Theft in Nigeria. [online] Available at: http://cpparesearch.org/nu-en-pl/mitigating-electricity-theft-nigeria/ [Accessed 1 September 2024].

Adongo, C.A., Taale, F., Bukari, S., Suleman, S., and Amadu, I. (2021) 'Electricity theft whistleblowing feasibility in commercial accommodation facilities,' *Energy Policy*, 155. https://doi.org/10.1016/j.enpol.2021.112347

Ahmad, T., Chen, H., Wang, J., and Guo, Y. (2018) 'Review of various modeling techniques for the detection of electricity theft in smart grid environment,' *Renewable and Sustainable Energy Reviews*, 82, pp. 2916-2933.

Akabuiro, D.O., and Umeobika, C.Q. (2020) 'Energy Security and Energy Related Offences in Nigeria: The Challenges of Enforcement,' *AJLHR*, 4, pp. 181.

Amadi, H.N., Okafor, E.N.C., and Izuegbunam, F.I. (2016) 'Assessment of energy losses and cost implications in the Nigerian distribution network,' *American Journal of Electrical and Electronic Engineering*, 4(5), pp. 125-132.

Arango, L.G., Deccache, E., Bonatto, B.D., Arango, H., and Pamplona, E.O. (2017) 'Study of electricity theft impact on the economy of a regulated electricity company,' *Journal of Control, Automation, and Electrical Systems*, 28(4).

Arango, L.G., Deccache, E., Bonatto, B.D., Arango, H., Ribeiro, P.F., and Silveira, P.M. (2016) 'Impact of electricity theft on power quality,' *17th International Conference on Harmonics and Quality of Power (ICHQP)*, IEEE, pp. 557-562.

Asghar, N., Amjad, M.A., Ur Rehman, H., Munir, M., and Alhajj, R. (2022) 'Achieving sustainable development resilience: Poverty reduction through affordable access to electricity in developing economies,' *Journal of Cleaner Production*, 376, 134040.

Association of Nigerian Electricity Distributors (ANED) (2022) *Annual Report on Electricity Distribution in Nigeria*.

Babar, Z., Jamil, F., and Haq, W. (2022) 'Consumer's perception towards electricity theft: A case study of Islamabad and Rawalpindi using a path analysis,' *Energy Policy*, 169, 113189.

Badr, M.M., Mahmoud, M.M., Abdulaal, M., Aljohani, A.J., Alsolami, F., and Balamsh, A. (2023) 'A novel evasion attack against global electricity theft detectors and a countermeasure,' *IEEE Internet of Things Journal*, 10(12), pp. 11038-11053.

Becker, G. (1968) 'Crime and punishment: an economic approach,' *Journal of Political Economy*, 76, pp. 169-217.
Becker, G.S. and Stigler, G.J. (1974) 'Law Enforcement, Malfeasance and Compensation of Enforcers,' *Journal of Legal Studies*, 3, pp. 1–18.

Benito, B., Guillamón, M.D., Ríos, A.M., and Bastida, F. (2018) 'Can salaries and re-election prevent political corruption? An empirical evidence,' *Revista de contabilidad*, 21(1), pp. 19-27.

Bohlmann, J.A. and Inglesi-Lotz, R. (2021) 'Examining the determinants of electricity demand by South African households per income level,' *Energy Policy*, 148, 111901.

Braun, V. and Clarke, V. (2006) 'Using thematic analysis in psychology,' *Qualitative Research in Psychology*, 3(2), pp. 77-101.

Briseno, H. and Rojas, O. (2020) 'Factors associated with electricity losses: A panel data perspective,' *International Journal of Energy Economics and Policy*, 10(5), pp. 281-286.

Cantarero, M.M.V. (2020) 'Of renewable energy, energy democracy, and sustainable development: A roadmap to accelerate the energy transition in developing countries,' *Energy Research & Social Science*, 70, 101716.

Carr, D. and Thomson, M. (2022) 'Non-technical electricity losses,' *Energies*, 15(6), 2218.

Chester, L. (2013) 'The impacts and consequences for low-income Australian households of rising energy prices.' International Association for Energy Economics, pp. 23-27.

Daggash, H.A. and Mac Dowell, N. (2021) 'Delivering low-carbon electricity systems in sub-Saharan Africa: insights from Nigeria,' *Energy & Environmental Science*, 14(7), pp. 4018-4037.

Dal Bó, E. and Rossi, M.A. (2007) 'Corruption and inefficiency: Theory and evidence from electric utilities,' *Journal of Public Economics*, 91(5-6), pp. 939-962.

aniel, S. (2017) 'Energy theft: PHED moves against perpetrators,' *Vanguard Newspaper*. [online] Available at: https://www.vanguard-ngr.com/2017/08/energy-theft-phed-moves-perpetrators/ [Accessed 8 September 2024].

David, N. (2018) 'The Effects of Energy Theft on Climate Change and Its Possible Prevention Using Smart Meters: Case Study Nigeria,' *International Journal of Science and Engineering Research*, 9, pp. 1775.

Dawadi, S., Shrestha, S., and Giri, R.A. (2021) 'Mixed-methods research: A discussion on its types, challenges, and criticisms,' *Journal of Practical Studies in Education*, 2(2), pp. 25-36.

Federal Republic of Nigeria (1973) *Regulation of Electric Power Offences Act*. Section 1.

Federal Republic of Nigeria (1990) *Criminal Code Act*. Sections 383 and 400.

Federal Republic of Nigeria (2000) *Electric Power Sector Reform Act*. Section 94(3).

Feng, X., Hui, H., Liang, Z., Guo, W., Que, H., Feng, H., Yao, Y., Ye, C., and Ding, Y. (2020) 'A novel electricity theft detection scheme based on text convolutional neural networks,' *Energies*, 13(21).

Fidelis, C., Chukwuemeka, J., and Onyinye, A.H. (2017) 'Controlling electricity theft, a smart meter approach: case study Nigeria,' pp. 1-16.

Gaur, V. and Gupta, E. (2016) 'The determinants of electricity theft: An empirical analysis of Indian states,' *Energy Policy*, 93, pp. 127-136.

Gregory, J. and Sovacool, B.K. (2019) 'Rethinking the governance of energy poverty in sub-Saharan Africa: Reviewing three academic perspectives on electricity infrastructure investment,' *Renewable and Sustainable Energy Reviews*, 111, pp. 344-354.

Guo, Y., Tian, J., and Chen, L. (2020) 'Managing energy infrastructure to decarbonize industrial parks in China,' *Nature Communications*, 11(1), 981.

Gupta, A.K., Routray, A., and Naikan, V.A. (2022) 'Detection of power theft in low voltage distribution systems: A review from the Indian perspective,' *IETE Journal of Research*, 68(6), pp. 4180-4197.

Handa, J. (1983) 'Decisions under imperfect knowledge: The certainty equivalence theory as an alternative to the von Neumann-Morgenstern theory of uncertainty,' *Erkenntnis*, 20(3), pp. 295-328.

Hardianto, H. and Akbar, A. (2021) 'Study the Form of Electricity Theft in Area X,' *International Journal of MultiDiscipline Science (IJ-MDS)*, 4(2).

Hock, D. (2020) *Detecting Energy Theft and Anomalous Power Usage in Smart Meter Data.* (Doctoral dissertation, University of Plymouth).

Hokamp, S. (2022) 'How to Build Utility Functions for Becker's Economics-of-Crime Theory: Allingham-Sandmo's Example of Tax Evasion and Non-Compliance Extended,' *Journal of Computations & Modelling*, 12(2), pp. 17-28.

Hu, W., Yang, Y., Wang, J., Huang, X., and Cheng, Z. (2020) 'Understanding electricity-theft behavior via multi-source data,' In *Proceedings of The Web Conference 2020*, pp. 2264-2274.

Ikeja Electricity Distribution Company (IKEDC) (2014) '43,000 installed prepaid meters already tampered with,' *Nigeria Electricity Hub*. [online] Available at: http://www.nigeriaelectricityhub.com/tag/electricity-theft/ [Accessed 10 July 2024].

Ikejemba, E.C. and Schuur, P.C. (2018) 'Analyzing the impact of theft and vandalism in relation to the sustainability of renewable energy development projects in Sub-Saharan Africa,' *Sustainability*, 10(3), 814.

Jain, A.K. (1998) 'Models of corruption,' In *Economics of corruption* (pp. 13-34). Boston, MA: Springer US.

Jamil, F. (2013) 'On the electricity shortage, price and electricity theft nexus,' *Energy Policy*, 54, pp. 267-272.

Jamil, F. and Ahmad, E. (2019) 'Policy considerations for limiting electricity theft in the developing countries,' *Energy Policy*, 129, pp. 452-458.

Kambule, N. and Nwulu, N. (2021) 'Rationale Part II: A Misdiagnosis of Non-payment and Electricity Theft,' In *Lecture Notes in Electrical Engineering*, Vol. 759.

Katiyar, S.K. (2005) 'Political economy of electricity theft in rural areas: A case study from Rajasthan,' *Economic and Political Weekly*, pp. 644-648.

Kingsley, J. (2022) 'Energy theft registry will reduce electricity challenges in Nigeria', *The Guardian*. Available at: https://guardian.ng/energy/energy-theft-registry-will-reduce-electricity-challenges-in-nigeria/ (Accessed: 17 March 2024).

Levitt, S.D. (2017) 'The economics of crime.' *Journal of Political Economy*, 125(6), pp. 1920-1925.

Lewis, F.B. (2015) 'Costly 'throw-ups': electricity theft and power disruptions', *Electricity Journal*, 28(7), pp. 118-135.

Lin, B. and Okyere, M.A. (2022) 'Haunted by the past: exploring the micro-level effects of childhood economic shocks on energy poverty in developing countries,' *Energy Research & Social Science*, 93, p. 102854.

Louw, Q. and Bokoro, P. (2019) 'An alternative technique for detecting and mitigating electricity theft in South Africa', *SAIEE Africa Research Journal*, 110(4).

McLaughlin, S., Podkuiko, D. and McDaniel, P. (2010) 'Energy theft in the advanced metering infrastructure', In *Critical Information Infrastructures Security: 4th International Workshop, CRITIS 2009, Bonn, Germany, September 30-October 2, 2009. Revised Papers 4*, pp. 176-187. Springer Berlin Heidelberg.

Miceli, T.J. (2018) 'On proportionality of punishments and the economic theory of crime', *European Journal of Law and Economics*, 46, pp. 303-314.

Miscellaneous Offences Act. Section 94. Federal Government of Nigeria.

Monyei, C.G., Adewumi, A.O., Obolo, M.O. and Sajou, B. (2018) 'Nigeria's energy poverty: Insights and implications for smart policies and framework towards a smart Nigeria electricity network', *Renewable and Sustainable Energy Reviews*, 81, pp. 1582-1601.

Munawar, S. et al. (2022) 'Novel FDIs-based data manipulation and its detection in smart meters' electricity theft scenarios', *Frontiers in Energy Research*, 10, p. 1043593.

Mushtaq, I. and Mirza, F.M. (2023) 'The Impact of Services Quality on Electricity Theft Reduction: An Empirical Analysis of Electricity Distribution Utilities in Pakistan', *The Lahore Journal of Economics*, 28(1), pp. 89A-114.

Myjoyonline News (2017) 'Photos: ECG under attack over "extremely outrageous" bills'. Available at: https://www.myjoyonline.com/photos-ecg-under-attack-over-extremely-outrageous-bills/.

Nadeem, A. and Arshad, N. (2021) 'A data-driven approach to reduce electricity theft in developing countries', *Utilities Policy*, 73, p. 101304.

Naik, S. and Patil, S. (2020) 'Smart electricity measuring system', *2020 International Conference for Emerging Technology, INCET 2020*.

Nduhuura, P., Garschagen, M. and Zerga, A. (2021) 'Impacts of electricity outages in urban households in developing countries: A case of Accra, Ghana', *Energies*, 14(12), p. 3676.

Obafemi, M.O. (2021) 'Determinants, prevalence and effects of electricity theft among households in Lagos State' (Doctoral dissertation).

Obafemi, M.O. et al. (2021) 'Prevalence of electricity theft among households in Lagos State, Nigeria', *Nigerian Journal of Technology*, 40(5), pp. 872-881.

Ojedokun, U.A., Dinne, C.E. and Buhari, M.T. (2021) 'Social context of energy theft among electricity consumers in Lagos and Ibadan Metropolis, Nigeria', *Security Journal*, 34, pp. 802-819.

Olaoluwa, O.G. (2017) 'Electricity theft and power quality in Nigeria', *International Journal of Engineering Research & Technology*, 6(6), pp. 1180-1184.

Osigwe, A. (2018) 'Electricity Theft in Nigeria: How Effective Are the Existing Laws?' *Journal of Energy Technologies and Policy*, 8(8).

Otuoze, A.O. et al. (2019) 'Electricity theft detection by sources of threats for smart city planning', *IET Smart Cities*, 1(2), pp. 52-60.

Penal Code Act. Section 286(2). Federal Government of Nigeria.

Qutoshi, S.B. (2018) 'Phenomenology: A philosophy and method of inquiry', *Journal of Education and Educational Development*, 5(1), pp. 215-222. Razavi, R. and Fleury, M. (2019) 'Socio-economic predictors of electricity theft in developing countries: An Indian case study', *Energy for Sustainable Development*, 49, pp. 1-10.

Roberts, R.E. (2020) 'Qualitative Interview Questions: Guidance for Novice Researchers', *Qualitative Report*, 25(9).

Sahoo, M. and Sethi, N. (2020) 'Impact of industrialization, urbanization, and financial development on energy consumption: Empirical evidence from India', *Journal of Public Affairs*, 20(3), p. e2089.

Saini, S. (2017) 'Social and behavioral aspects of electricity theft: an explorative review', *International Journal of Research in Economics and Social Sciences*, 7(6), pp. 26–37.

Saini, S. (2018) 'Electricity Theft–A primary cause of high distribution losses in Indian State', *International Research Journal of Management and Commerce*, 8(1), pp. 163-175.

Salite, D. et al. (2021) 'Electricity access in Mozambique: A critical policy analysis of investment, service reliability and social sustainability', *Energy Research & Social Science*, 78, p. 102123.

Schoch, K. (2020) *Case study research. Research design and methods: An applied guide for the scholar-practitioner*, pp. 245-258.

Shabalov, M.Y. et al. (2021) 'The influence of technological changes in energy efficiency on the infrastructure deterioration in the energy sector', *Energy Reports*, 7, pp. 2664-2680.

Shokoya, N.O. and Raji, A.K. (2019) 'Electricity theft mitigation in the Nigerian power sector', *International Journal of Engineering & Technology*.

Singh, K. and Inglesi-Lotz, R. (2021) 'The role of energy poverty on economic growth in sub-Saharan African countries'.

Smith, T.B. (2004) 'Electricity theft: A comparative analysis', *Energy Policy*, 32(18).

Ssekika, E. (2013) 'Uganda loses Shs 76bn annually to power theft', *The Observer*, Kampala, Uganda.

Tasdoven, H.B., Fiedler, A. and Garayev, V. (2012) 'Improving electricity efficiency in Turkey by addressing illegal electricity consumption: A governance approach', *Energy Policy*, 43, pp. 226-234.

Uzodinma, E. (2017) 'Energy theft: EEDC introduces whistle blowing', *Daily Post*. Available at: http://dailypost.ng/2017/10/06/energy-theft-eedc-introduces-whistle-blowing/ (Accessed: 8 July 2028).

van Velthoven, B. and van Wijck, P. (2016) 'Becker's theory on crime and punishment, a useful guide for law enforcement policy in The Netherlands', *Recht der Werkelijkheid*, 37(1), pp. 6-31.

Venkatachary, S.K., Prasad, J. and Samikannu, R. (2017) 'Economic impacts of cyber security in energy sector: A review', *International Journal of Energy Economics and Policy*, 7(5), pp. 250-262.

Wang, Z., Han, B. and Lu, M. (2016) 'Measurement of energy rebound effect in households: Evidence from residential electricity consumption in Beijing, China', *Renewable and Sustainable Energy Reviews*, 58, pp. 852-861.

Wesonga, N. (2020) 'Electricity illegal connections are dangerous'. Available at: https://observer.ug/businessnews/68897-electricity-illegal-connections-are-dangerous (Accessed: 18 March 2024).

White, J.K. (2024) *The Truth about Energy: Our Fossil-fuel Addiction and the Transition to Renewables*. Cambridge University Press.

Xia, X., Xiao, Y., Liang, W. and Cui, J. (2022) 'Detection methods in smart meters for electricity thefts: A survey', *Proceedings of the IEEE*, 110(2), pp.

Yakubu, O., Babu, N. and Adjei, O. (2018) 'Electricity theft: Analysis of the underlying contributory factors in Ghana', *Energy Policy*, 123, pp. 611-618.

Yin, R.K. (2018) *Case study research and applications* (Vol. 6). Thousand Oaks, CA: Sage.

Yurtseven, Ç. (2015) 'The causes of electricity theft: An econometric analysis of the case of Turkey', *Utilities Policy*, 37, pp. 70-78.

Yusof, H.M., Yusof, D.M. and Adnan, N.M. (2024) 'The role of the Principal-Agent-Client Model in understanding corruption in the public procurement sector in Malaysia', *Intellectual Discourse*, 32(1).

Appendices

Appendix A: Consent Form

International Institute of Social Studies

International Institute of Social Stud

Consent to Participate in a Research Study

Working title: Factors influencing energy theft in Lagos State, Nigeria

Investigator: Afolabi Funmilayo Abiodun

University: Erasmus University (ISS), Rotterdam, Netherlands

This research aims to understand the factors influencing energy theft in Lagos state, Nigeria. The main research question is, "Why is there an increase in energy theft in Lagos State, Nigeria?"

The discussion will be conducted by Afolabi Funmilayo Abiodun, as part of master's research at the International Institute of Social Sciences. Please note that there are no right, or wrong answers and it will last about 30-45minutes.

I would like to let you know that I will be recording the interview sessions and audio recordings will be kept anonymous you can leave the interview session at any time. The response you will give will not be traced back to you. I will ask you to sign below to indicate that you will keep all comments made during the interview session confidential and not discuss what happened during the interview session outside the meeting.

By signing below, I agree:

- To maintain confidentiality of the information shared in the interview.
- To have the interview session recorded.
- To participate in the study.
- that I have received a copy of this information letter

Name of researcher	Date	Signature
Abdulsalam A M	22nd July 2024	Abdulsalam
Name of participant	Date	Signature

To invoke your rights, if you have any concerns or questions about this research, please send an email either to 683210fa@student.eur.nl

International Institute of Social Studies

International Institute of Social Studies

Internatior Institute of Social Stud
Erasmu

Consent to Participate in a Research Study

Working title: Factors influencing energy theft in Lagos State, Nigeria

Investigator: Afolabi Funmilayo Abiodun

University: Erasmus University (ISS), Rotterdam, Netherlands

This research aims to understand the factors influencing energy theft in Lagos state, Nigeria. The main research question is, "Why is there an increase in energy theft in Lagos State, Nigeria?"

The discussion will be conducted by Afolabi Funmilayo Abiodun, as part of master's research at the International Institute of Social Sciences. Please note that there are no right, or wrong answers and it will last about 30-45minutes.

I would like to let you know that I will be recording the interview sessions and audio recordings will be kept anonymous you can leave the interview session at any time. The response you will give will not be traced back to you. I will ask you to sign below to indicate that you will keep all comments made during the interview session confidential and not discuss what happened during the interview session outside the meeting.

By signing below, I agree:

- To maintain confidentiality of the information shared in the interview.
- To have the interview session recorded.
- To participate in the study.
- that I have received a copy of this information letter

Name of researcher	Date	Signature
Nneka Sylvia Uzuegbu	23/07/2024	Uzuegbu
Name of participant	Date	Signature

To invoke your rights, if you have any concerns or questions about this research, please send an email either to 683210fa@student.eur.nl

Appendix B: Interview Guide Protocol for IKEDC Officials

Dear participant,

My name is Afolabi Funmilayo Abiodun, I am carrying out a study on "factors influencing energy theft in Lagos State, Nigeria," in partial fulfillment of the requirements for the award of the Master degree of Arts in Development Studies. You have been chosen as one of my participants to provide information for my study. The information you provide will only be used solely for the purpose of this research and will be treated with confidentiality. This interview will take not more than 30-45 minutes.

1. Please tell me about yourself?
2. Describe your role at Ikeja Electricity Distribution Company?
3. What are the most common methods of energy theft you encounter in Lagos State?
4. In your opinion, what motivates individuals to engage in energy theft?
5. How has this impacted the company's operations?
6. What measures does IKEDC currently implement to prevent energy theft?
7. What challenges do you face in identifying and addressing energy theft?
8. In your experience, what measures do you believe are necessary to effectively combat energy theft in this area?

Thank you for your time

Appendix C: Interview Guide Protocol for Community Leaders

1. Please tell me about yourself?
2. Describe your role and responsibilities as a community leader?
3. How prevalent is energy theft in your community?
4. What are the main reasons people in your community engage in energy theft?
5. How does energy theft affect the daily lives of people in your community?
6. What are the common methods used for energy theft in your area?
7. As a community leader, what role play in reducing energy theft?
8. What challenges do you face when trying to address energy theft in your community?
9. As a leader, what measures do you suggest to reduce energy theft in your community?

Thank you for your time

Appendix D: Interview Guide Protocol for Top administrators at NERC

1. Please tell me about yourself?
2. Describe your role and responsibilities in NERC?
3. How does NERC currently address the issue of energy theft?
4. What policies are in place to combat energy theft?
5. In your experience, what motivates individuals to engage in energy theft?
6. In your opinion, what are the main challenges NERC face in enforcing laws against energy theft?
7. How does energy theft affect the energy sector and economy of this country?
8. As a Government worker, what measures do you believe are necessary to reduce energy theft in Lagos State?

Thank you for your time

Appendix E: Interview Guide Protocol for Researchers and Academics

1. Please tell me about yourself?
2. Please describe what you researched about?
3. Based on your research, what are the key factors contributing to the increase in energy theft in Lagos State?
4. What are the common methods of energy theft observed in your research?
5. What role can academic research play in developing strategies to reduce energy theft?
6. What policy recommendations would you make to the government and IKEDC to address energy theft more effectively?

Thank you for your time

Appendix F: Questionnaire for Community Members

Dear participant,

My name is Afolabi Funmilayo Abiodun, I am carrying out a study on "factors influencing energy theft in Lagos State, Nigeria," in partial fulfillment of the requirements for the award of the Master degree of Arts in Development Studies. You have been chosen as one of my participants to provide information for my study. The information you provide will only be used solely for the purpose of this research and will be treated with confidentiality. This questionnaire will take not more than 30-45 minutes.

1) Gender

a) Male ☐ b) Female ☐

2) Age

a) Below 18 ☐ b) 18 – 25 ☐ c) 26 – 35 ☐ d) 36 – 45 ☐

e) 46 – 55 ☐ f) Above 55 ☐

3) Educational Level

a) No formal education ☐ b) Primary education ☐

c) Secondary education ☐ Tertiary education ☐

4) Living area:

a) Urban ☐ b) Rural ☐

5) Employment status

a) Employed ☐ b) Self-employed ☐ c) Unemployed

d) Retired ☐ e) Student ☐

6) Do you or a family member currently work or have ever worked for an electricity company?

a) Yes ☐ d) No ☐

7) What is your average monthly household income?

a) Below ₦30.5 ☐ ₦30.5 - ₦61.0 ☐

c) ₦61.0 - ₦122.0 ☐ d) ₦122.0 - ₦305.0

e) Above ₦305.0 ☐

8) How often do you receive income?

a) Weekly ☐ b) Monthly ☐ c) Quarterly ☐

d) Yearly ☐ e) Irregular ☐

9) Have you or any of your family members ever engaged in energy theft (e.g. tampering with meters, illegal connections)?

a) Yes ☐ d) No ☐

10) If yes, what were the main reasons for engaging in energy theft? (You may select more than one)

a) High electricity bills ☐ b) Dissatisfaction with billing systems ☐

c) Perceived low risk of being caught ☐ d) Corruption and bribery ☐

e) Economic hardship ☐ f) Common in the community ☐

g) Other (please specify) ……

11) If no, what do you think or have heard are the reasons people engage in energy theft? (You may select more than one)

a) High electricity bills ☐ b) Dissatisfaction with billing systems ☐

c) Perceived low risk of being caught d) Corruption and bribery ☐

e) Economic hardship ☐ f) Common in the community ☐

g) Other (please specify) ……

12) Which of the following strategies do you think would be most effective in reducing energy theft in Lagos State? (You may select more than one)

a) Improved metering and billing systems ☐

b) Community education programs about the effects of energy theft ☐

c) Stronger penalties against offenders ☐

d) Corruption control measures among staff ☐

e) Use of technology (SMS alerts, mobile apps) for reporting theft ☐

f) Community-based reporting systems ☐

Thank you for your time

Appendix G: Key informants

No.	*Pseudoname*	*Position*	*Gender*	*Institution*
1	Bayo	Energy sales manager	Male	Ikeja Electric
2	Igu	CDA's chairman	Male	Local government
3	Neka	Energy sales coordinator	Male	Ikeja Electric
4	Akomo	Energy sales supervisor	Male	Ikeja Electric
5	Drimo	Senior manager	Male	Ikeja Electric
6	Atima	Specialist in Abu Dhabi on the Asia Electric	Male	Ikeja Electric
7	Phen	Revenue Protection Energy vigilance	Male	Ikeja Electric
8	Adahim	Principal manager (customer service standards unit)	Male	NERC
9	Asimo	Researcher (Energy and Regulatory Consultant)	Female	Nigerian power sector
10	Van	Consumer Affairs division	Female	NERC
11	Ginald	Assistant general manager	Male	NERC
12	Wole	Researcher academia	Female	Researcher

Appendix H: Prevalence of energy theft and Nigeria's GDP

Year	Estimated Loss (million USD)	Nigeria's GDP (billion USD)	Percentage share
2020	52.46	432.20	12.1379
2021	79.05	440.84	17.93168
2022	31.72	472.62	6.711523
2023	37.21	362.81	10.25606

Appendix I: Demographic and socioeconomic characteristics

Table 4.1 Demographic information of respondents

	Category	Frequency	Percent
Gender	Male	4	66.7
	Female	2	33.3
Age	18 - 25	1	16.7
	26 - 35	2	33.3
	36 - 45	2	33.3
	46 - 55	1	16.7
Educational level	Secondary	4	66.7
	Tertiary	2	33.3
Living area	Urban	5	83.3
	Rural	1	16.7
Employment status	Employed	3	50.0
	Self-employed	2	33.3
	Unemployed	1	16.7
A family member works or have ever worked for an electricity company	Yes	1	16.7
	No	5	83.3

Table 4.1 indicates that most respondents were male (66.7 percent), with females making up 33.3 percent. This suggests that men have an interest in discussing energy theft. In addition, highest proportions of participants were aged 26-35 and 36-45 (33.3 percent). This indicates that people in their working years might be more engaged in or impacted by energy theft. Among the 6 community members, 66.7 percent had secondary education and only 33.3% were reached tertiary level. The presence of less-educated individuals imply that lower educational levels could be linked to limited awareness of the legal implications of energy theft. Table 4.1 shows that majority of respondents lived in urban areas (83.3 percent), with only 16.7 percent from rural areas. This implies that energy theft is more prevalent in urban settings, possibly due to higher electricity demand and denser populations where detection is more challenging.

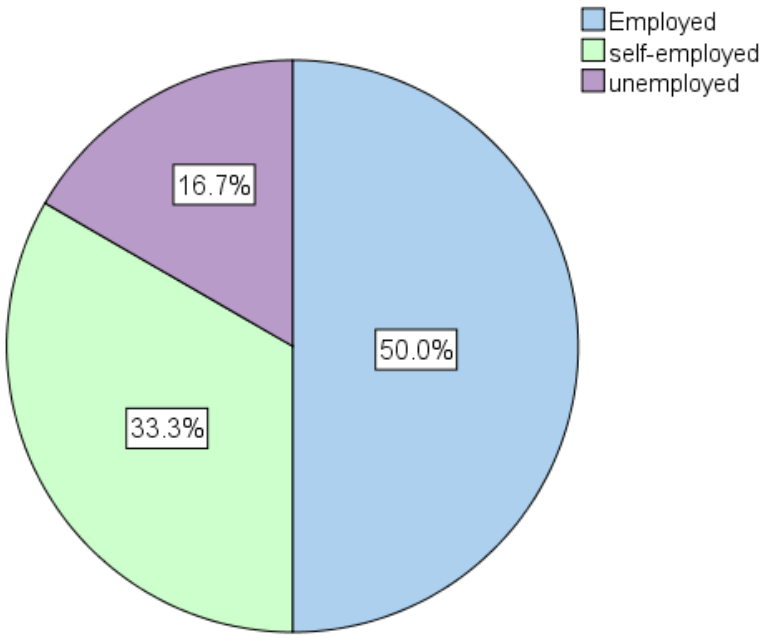

Figure 4.1. Employment status

Table 4.1 and Figure 4.1 reveal that 50 percent were employe while 33.3 percent were self-employed, and 16.7 percent were unemployed. Economic pressure among the unemployed and self-employed could drive some individuals towards energy theft as a means of reducing costs.

Table 4.1 indicate that 83.3 percent did not have family connections to electricity companies. This shows that community engagement in energy theft is likely driven by general economic conditions rather than insider influence.

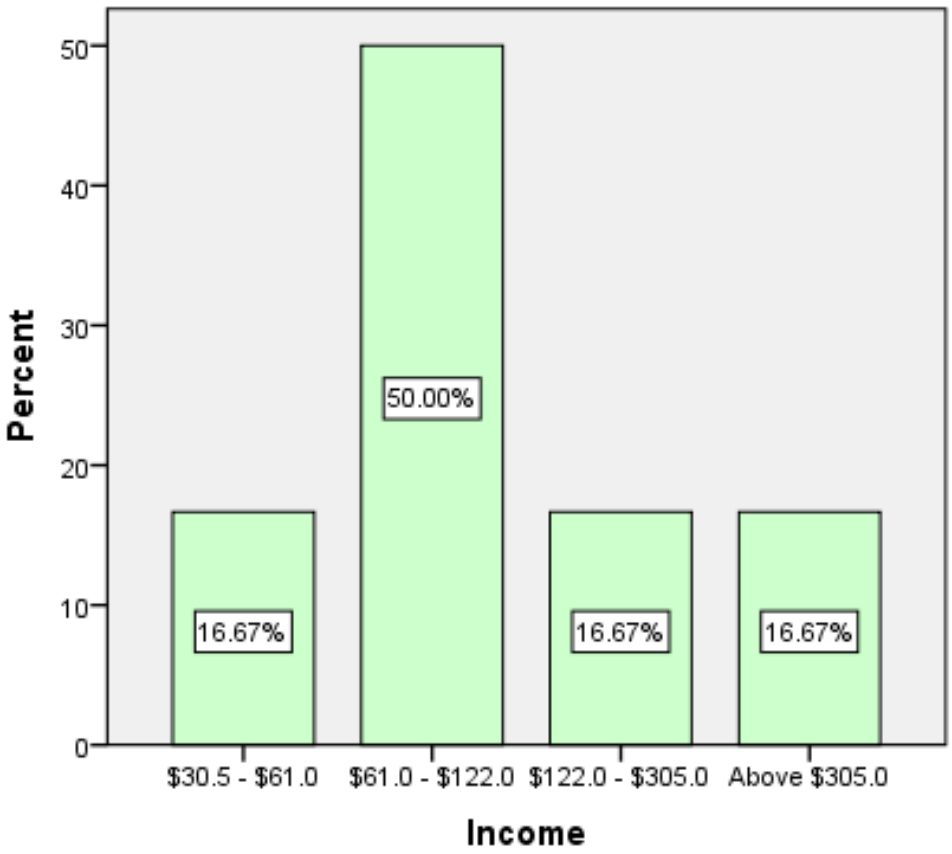

Figure 4.2 Monthly income of community members

Figure 4.2 shows that most respondents (50 percent) have a monthly income between $61.0 and $122.0. A smaller number of respondents fall into other income ranges: 16.7 percent earn between $30.5 and $61.0; another 16.7 percent earn between $122.0 and $305.0, and the remaining 16.7 percent earn above $305.0. Majority of respondents with lower incomes suggest that financial challenges push some community members towards energy theft, as they might look for ways to cut down on expenses, like electricity bills. This indicates that economic difficulties could be a key reason for illegal connections. The few respondents with higher incomes suggest that energy theft is limited to those struggling financially and also involve people from various income levels.

Table 4.2. Frequency of receiving income

Frequency of receiving income	*Frequency*	*Percent*
Daily	1	16.7
Weekly	3	50.0
Monthly	1	16.7

Irregular	1	16.7
Total	*6*	*100.0*

Table 4.2 indicates that 50 percent of respondents earn their income weekly, while 16.7 percent each earn their income daily, monthly, or at irregular intervals. The majority of respondents with weekly income might have modest, cash flow making them sensitive to monthly utility costs like electricity bills. Those with irregular or monthly income face challenges in managing consistent expenses, which could lead them to seek alternative means to reduce costs, such as engaging in energy theft. The different income frequency suggests that economic stability influence the motivations behind illegal connections.