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The Effects of Electricity Theft on Eskom Distribution in KwaZulu Natal Operating Unit

By

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Abstract

Electricity theft is becoming an increasing problem with a significant impact on the overall economy. Power utilities around the world are losing billions annually; this translates to reduced sales, resulting in revenue loss that could be invested in other critical developmental projects. In developing countries, electricity theft poses a serious threat to the sustainability of power utilities, economic growth, security and quality of supply, as well as the delivery of “electricity for all” universal access programme. To address this challenge, power utilities tend to focus on technical techniques, neglecting the socio economic challenges which are motivating factors behind the theft of electricity. This study has been undertaken to investigate and assess the effects of electricity theft on the operations of Eskom Distribution business in KwaZulu-Natal. The study aims to identify the factors contributing to electricity theft and the effects thereof, that will assist in the creation of an effective sustainable solution.

A combination of qualitative and quantitative reseach design methodology was employed to establish the factors and effects of electricty theft on the operations of Eskom Distribution business. The research is of a mixed method, entailing a research methodology based on semi structured interviews and close-ended survey questionnaires.The target population of this research was Eskom employees selected from Eskom Distribution, KwaZulu Natal Operating Unit and households (Eskom customers), selected from Edendale area, Pietretmaritzburg.

The major findings of the study identified socio economic factors, affordability, lawlessness, culture of entitlement and slow delivery of electricity access, as the main contributors to theft. The effects of theft leads to revenue loss, increased operational cost, power outages, increased electricity tarrifs, loss of life and electrocution injuries. The study found that electricity theft is a multifaceted socio economic problem which requires a multi-pronged approach. The issue of electricity theft cannot be addressed by looking at technical solutions only, it requires a multi-pronged strategy consisting of political, social, economic and technical solution. Based on these findings, the study recommends that Eskom formulates holistic strategies that includes communities, government and private sector considering the factors contributing to electricity theft.

Electricity theft can be minimised through an extensive community awareness programmes with a stronger emphasis on the impact of electricity theft. Eskom needs to improve internal control measures and deliver services timeous “just in time”.

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Chapter 1 : Introduction

1.1 Background to the study

Eskom is a state-owned organisation with a mandate of providing electricity in an efficient and sustainable manner, to service South African's economy, society and the region. The financial sustainability and competitiveness of Eskom is dependent on its financial viability, which in turn depends on its ability to increase revenue resources. However, Eskom, just like many electricity distribution utilities around the world, is faced with the challenge of revenue loss due to electricity theft.

Energy utilities in developing countries are struggling to manage the increasing losses due to electricity theft. Electricity theft is a silent crime that rarely makes the headlines, but poses a serious threat to the overall country's economy, reliability of energy, security of supply and government electrification programmes (Landie, 2011). In South Africa, electricity theft is a major problem with negative impact which often leads to devastating and tragic consequences, such as grave injury, loss of life, electrical fires, power outages and damage to essential infrastructure, inconvenience to communities and has a huge impact on the overall economy.

Electricity theft is not a new phenomenon; it is a practise that is acknowledged by utilities and communities. It has been a problem for energy utilities for decades all around the world. Its sharp increase, disruptive effects on businesses and the impact on the cost of electricity to consumers over years, have become an area of interest for many utilities and authorities (Steadman, 2009). Many people view electricity theft as a victimless or silent crime and unlike other forms of theft, legislation and regulatory measures hardly carry strict penalties to those who commit crimes such as stealing electricity (Parbhoo et al., 2009; Steadman, 2009). However, Eskom and other organisations have been calling for tougher laws which will enforce stringent penalties and enable the effective prosecution of offenders (BruynIt, 2010). It is not clear whether the implementation of tougher regulations will combat electricity theft. South Africa is known for having good legislative frameworks on paper, but lacks proper enforcement.

Electricity theft occurs in various forms and is caused by fraudulent activities deliberately performed by consumers in order to evade payments for the electricity

used to the utility (Chauhan and Rajvanshi, 2013; Lewis, 2015) Electricity theft is a problem shared by all utilities and accounts for 1% of all electricity consumed globally (Khanyisa, 2013). In South Africa, Eskom and municipalities are currently losing an estimated R7.5 billion a year as a result of electricity theft (IOL, 2016). In India, more than 20% of the electricity generated is lost to thefts (Gaur and Gupta, 2016) and according to the World Bank, it accounts for 1.5% of countries' GDP and estimated at $30 billion a year in annual theft (Smith, 2012). Kenya reported a loss of Sh17.5 billion, which equates to more than R2.6 billion in non-technical losses annually (Chumo, 2015). Electricity theft does not only affect developing countries, developed countries are not immune to this act. In United States of America, theft costs approximately $6 billion annually (Battaglia, 2013).

Despite the known facts contributing to electricity theft and technical measures put in place to minimize the losses, it continues to be on the upward trend. It is therefore essential to understand the underlying factors contributing to electricity theft, as it will assist in the creation of an effective sustainable solution.

1.2 Problem Statement

In South Africa, Eskom is the primary energy supplier, generating approximately 90 % of the country's electricity and provides approximately 40% of the electricity used in Africa (Eskom, 2017). Eskom generates, transmits and distributes electricity to industrial, mining, commercial, agricultural and residential customer. Eskom directly provides 45% of electricity to its end user and the other 55% is resold by redistributors including municipalities and metros, which in turn redistribute electricity under licence to businesses and households within their areas (Eskom, 2015).

Eskom's mandate is to ensure the security of supply to service the South African economy and society. However, electricity theft threatens energy security and hampers the economy. Non-technical losses (NTL) on the distribution networks, which include non-payments, illegal prepaid power vending ("ghost vending"), cable and infrastructure theft, illegal connections, meter bypassing and tampering, are increasingly becoming a challenge for the utility. In Eskom for the year 2014/2015, non-technical losses were estimated at approximately R 4.7 billion, in year

2015/2016, the losses were sitting at R4.8 billion and for the year 2016/2017, non-technical losses were R5.4 billion (Eskom, 2015; Eskom, 2017). Electricity theft and non-payment are considered to be the common form of non-technical losses and accounts for most, if not all NTL in the power system (Suriyamongkol, 2002; Gaur and Gupta, 2016). Many researchers agree that electricity theft is the most prominent form of, and the main driver NTL (Joseph, 2010; Gaur and Gupta, 2016). Despite numerous educational campaigns on the illegal use of electricity, electricity theft is an increasing problem in the residential, business and commercial sector.

The role of Eskom Distribution is to manage the distribution of assets by building, operating and maintaining the network. As part of Eskom Distribution, KwaZulu Natal Operating Unit has a mandate to operate, provide services, deliver safe and ensure reliable electricity to customers by building, operating and maintaining distribution assets, whilst enhancing stakeholder relations. However, electricity theft, particularly in the form of illegal connections, not only has technical and financial impact on Eskom, but innocent lives are lost every year, as a consequence of illegal connections.

1.3 Purpose of the study

Electricity theft is increasing in South Africa and most regions in the world (Khanyisa, 2013; Winther, 2012; Agalab, 2009). It threatens the sustainability of power utilities with the huge impact on the overall economy. To address this challenge, power utilities tend to focus on technical techniques neglecting socio economic factors which maybe as a result of both government and power utilitity adopted policies. The study is premised on the need for a holistic, sustainable solution to address and manage electricity theft in South Africa. The purpose of this study is to identify factors contributing to electricity theft and explore the extent to which it impacts the operations of Eskom Distribution business from the supplier and consumer perspective. On successful completion, this study might assist and serve as a guideline for effective strategy formulation and management of electricity theft in Eskom and municipalities. On the other hand, it might contribute to the growing body of literature on electricity theft and its impact in developing countries.

1.4 Research Objectives

One of Eskom's Distribution strategic imperative is to reduce energy losses in order to sustain network performance within target and deliver on its mandate. To assist in finding an effective solution to the growing trend of illegal connections and meter tampering, the study's main objectives include the following:

- identifying the factors contributing to electricity theft,
- assessing the impact of electricity theft on the operations of Eskom Distribution in KwaZulu-Natal Operating Unit
- identifying the strategies employed to address the problem.
- exploring employee's perceptions and attitude towards Eskom strategies in minimising electricity theft.

It is hoped that understanding the contributing factors, perceptions and attitudes towards the strategies intended to minimise electricity theft, is vital towards finding a holistic approach to electricity theft.

1.5 Research Questions

The study seeks to answer the following questions

- What are the key factors contributing to electricity theft in KwaZulu-Natal Operating Unit?
- How does electricity theft affect the operations of Eskom Distribution in KwaZulu-Natal Operating Unit?
    - How does electricity theft affect the technical and financial sustainability of Eskom?
- What are the strategies employed by Eskom Distribution to minimise electricity theft?
- What are the employee's perception and attitude towards Eskom strategies in minimising electricity theft?

1.6 Significance of the study

The research study might assist in identifying the underlying factors contributing to electricity theft. These factors will be identified by both Eskom employees and Eskom customers (consumers of electricity). Through this study, management or decision makers will become aware of the motivating factors behind theft of

electricity and the effects thereof. It is hoped that understanding the factors and effects of electricity theft would assist in formulating and improving the strategies that deal with the reduction of electricity theft. The research study intends to contribute to the growing body of literature on electricity theft and its impact on developing countries. The study could also assist government and Eskom decision makers, pertaining to strategy formulation and management of electricity theft.

1.7 Methodology

This research adopted the mixed method approach, comprising the qualitative and quantitative methodology. The study seeks to best understand the issue of electricity theft by comparing different perspectives, but complementary data drawn from qualitative and quantitative instruments. The researcher gathered both qualitative and quantitative data via semi-structured interviews with selected Eskom employees, as well as administered questionnaires to electricity consumers 'Eskom customers' serviced by Eskom in the Edendale area, Pietermaritzburg.

1.8 Limitations of the study

The study targeted the Edendale area serviced by Eskom Edendale CNC, which has 44 577 registered customers, dominated by the residential sector. In the Edendale area, non-technical losses are the highest, as compare to other areas in Eskom Distribution, KwaZulu Natal Operating Unit. The area is a township, whose population is mainly the Black people. According to (Statistics SA, 2013), within the Eskom boundaries, Edendale area has over 500 000 households and therefore the target population was 381, according to Krejcie and Morgan's table for finite population. Due to time and resource constraints, only 71 respondents were used for the study. Most targeted respondents (customers) were reluctant to participate due to the sensitivity of the subject investigated. The key participants for the quantitative component were electricity consumers (Eskom customers) per household over the age of 18 years. The qualitative dimension of the study interviewed 9 Eskom employees based on their experience with electricity theft and no distinction was made between Eskom management and bargaining unit staff.

A key limitation of the study is that the factors contributing to electricity theft are vast and that addressing the strategies within Eskom to improve or minimise the losses

does not necessarily solve the problem. The issue of electricity theft is imbedded in the socio-economic conditions. Whilst the study has identified measures to minimise electricity theft, there are no guarantees of their effectiveness.

1.9 Overview of the dissertation

Chapter 1

The introductory chapter provides the framework for the study and presents the background information to the topic investigated. This chapter outlines the problem statement and the study objectives, as well as the research questions. An overview of each individual chapter for this study is briefly discussed.

Chapter 2

This chapter locates and summarises the studies related to the research questions. Literature review is structured according to the study objectives. A review of literature is carried out to understand and present the theoretical development on the subject of electricity theft. The chapter reviews the factors contributing to electricity theft in Eskom Distribution. It aims to provide a context to the effects of electricity theft and examines the measures put in place to minimise electricity theft.

Chapter 3

This chapter outlines the research methodology and data collection strategies utilised for the current research. The research methodology chosen is best suited in providing answers to the research objectives and questions. The combination of quantitative and qualitative contributed to a substantial understanding of the research problem being investigated. The procedures used to gather the qualitative and quantitative data are discussed. These include the location of the study and its participants sampling, research instruments, data collection strategies, ethical considerations and data analysis. Data gathered from the research instruments formed part of the primary data needed for the study.

Chapter 4

This chapter analyses, interprets and presents the data gathered for this study. The relevance of the findings will be discussed in this chapter, in line with the objectives of the study. The chapter presents the findings of the study.

Chapter 5

This chapter provides a discussion of the research findings from the data gathered and presented in Chapter 4. The findings for each research objective are discussed, interpreted and explained in conjunction with the literature reviewed in Chapter 2, with a view to establish the similarities and differences on the subject matter.

Chapter 6

This chapter presents the recommendations and conclusions of the investigation into the effects of electricity theft on Eskom Distribution in KwaZulu Natal Operating Unit. The chapter details whether the study objectives were achieved and brings the study to a close. The limitations and implications of this research are also detailed in this chapter.

1.10 Summary

This chapter provided the back ground and motivation of the study. It outlined study objectives and research questions pertaining to the study. This chapter also includes a brief overview of the methodology adopted for the research and study limitations. The next chapter reviews literature relating to the factors contributing to theft, effects and measures to minimise electricity theft.

Chapter 2 : Literature Review

2.1 Introduction

This chapter aims to provide a context to the effects of electricity theft in Eskom Distribution. To understand and gain a clearer perspective to the concept and the effects of electricity theft, this chapter examines and reviews the factors contributing to electricity theft. This aspect is important to provide direction and an understanding of what other scholars have uncovered relating to electricity theft.

Electricity theft, which constitutes non-technical losses, appears to have not been studied adequately and there is limited published evidence of electricity theft in South Africa's electricity industry. This study therefore seeks to identify and describe the factors and effects of electricity theft to Eskom and the consumers. Furthermore, its seeks to identify the measures and strategies that can be employed by utilities to minimise electricity theft and provide an understanding of what other researchers have discovered. This chapter therefore provides the definitions to the concept of electricity theft. The factors and effects of electricity theft are examined, as well as the measures to minimise electricity theft.

2.2 Definition of terms

Electricity theft is defined as an act of using electricity without a formal contract with the utility, by tapping into overhead lines or underground cables illegally, tampering with meters and buying tokens from illegal vendors (Depuru et al., 2010; Oni, 2013). Agalab (2009) defines it "as a conscience attempt by a person to reduce or eliminate the amount of money he or she will owe the utility for electric energy" .

Energy losses is defined as the difference between energy purchased as measured at the transmission and distribution networks energy sold to all customers is termed and energy losses (Steadman, 2009; Smith, 2004). These losses comprise two components namely technical and non-technical (Davidson, 2002).

Technical losses are defined as the electrical system losses which are caused by the physical properties of the components of the power system (Navani et al., 2012). These losses represent an engineering issue, which is an economic loss that can

be engineered through technical and changes in network characteristics (Antmann, 2009).

Non-technical losses (NTL) is defined as any form of illegal consumption of electrical energy due to human manipulation or errors and caused by actions external to the power system (Suriyamongkol, 2002; Yasaghi and Kumar, 2011).

To study electricity theft, which constitutes a greater portion of non-technical losses and forms part of the total energy losses in electrical power system; the first logical step is to understand the origins of energy losses and the view of electrical power system from the generation of electricity to the end user.

2.3 Eskom and its business model

Eskom Holdings SOC Ltd is a state-owned company (SOC), South Africa's primary electricity supplier generating approximately 90% of the country's electricity and provides approximately 40% of the electricity used in the Southern African Development Community (SADC) region (Eskom, 2017). As the primary electricity supplier, Eskom's core operations include the generation, transmission, distribution and sale of electricity in bulk to redistributors (municipalities and metros), industrial, mining, commercial, agricultural and residential customers. The redistributors also supply electricity to businesses such as industrial, commercial, agricultural and the residential sector within their licenced area of supply as regulated by the National Energy Regulator of South Africa (NERSA).

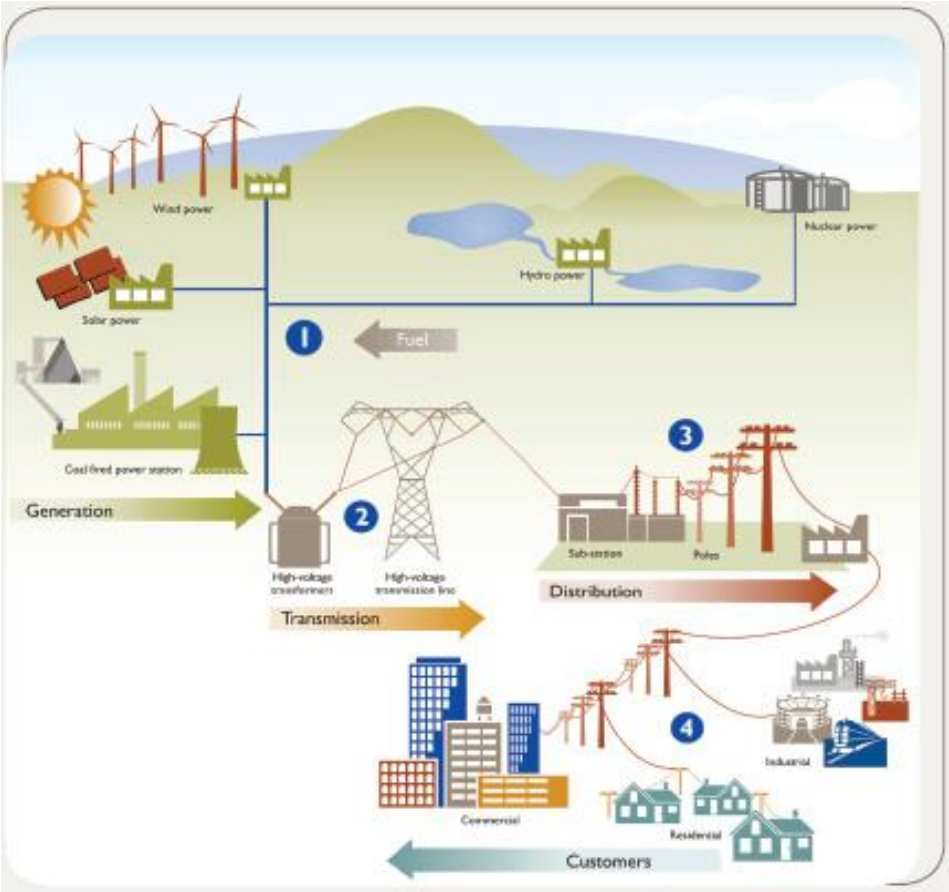

Figure 2.1: Eskom's business model

Adopted from Eskom (2017)

The process of delivering electricity to consumers involves three stages which is generation, transmission and distribution. Electricity is generated at power plants that include coal, solar, wind, hydro, gas and nuclear and moves through a complex system called grid that connects electricity supplier and consumers. This grid consists of thousands of kilometres of high voltage lines, substations transformers and low voltage lines that connect the generation to consumers at residential, industry, commercial and other sectors, as depicted in Figure 2.1.

Eskom reported that electricity sold for the year 2016/17 was "214 121GWh to 802 municipalities in bulk, as well as to 2 773 industrial, 1 012 mining, 50 956 commercial, 81 806 agricultural, 510 rail and 11 international customers and to 5 838 754 residential customers, which includes prepaid customers" (Eskom, 2017). In addition, the company reported the electricity revenue of R175.1 billion. The majority of sales are in the municipalities which contributes 41.6% and residential sector accounts for 5.5%, as depicted in Figure 2.2. The electricity sold to

municipalities in bulk from Eskom is redistributed to business and residential customers in areas of supply license.

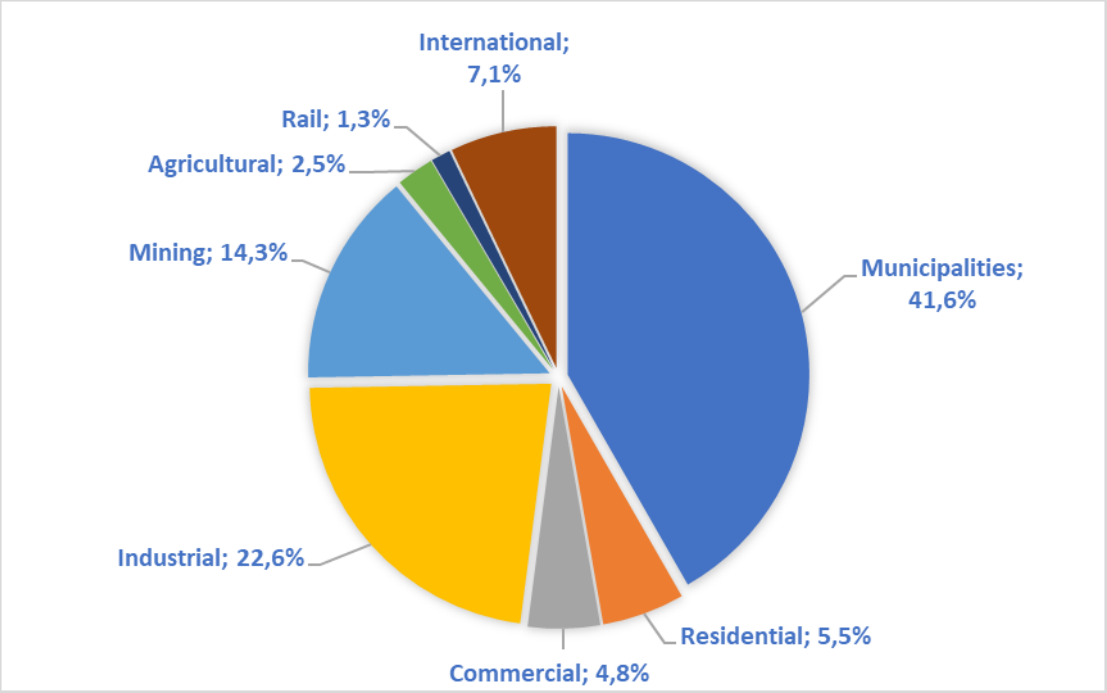

Figure 2.2: Eskom sales distribution per sector

Source: Adapted from Eskom (2017)

2.4 Conceptualising electricity theft

In South Africa, electricity theft is a growing national problem that Eskom and municipalities face in the distribution of electricity to consumers. Electricity theft is a multifaced challenge that leads to economic losses (Jamil and Ahmad, 2014). Electricity theft is a form of non-technical losses which is complex and difficult to measure due to the many variables ought to be evaluated (Winther, 2012; Agalab, 2009; Depuru et al., 2010) . Due to the nature of electrical power system, utilities find it difficult to distinguish between legal and illegal customers without physical onsite inspection (Nagi et al., 2008). The recommended method used by many energy experts is through energy losses, which is the difference between the energy purchased as measured at the transmission and distribution networks energy sold to all customers is termed and energy losses (Steadman, 2009; Smith, 2004). Energy losses are dominant on the distribution system.

2.4.1 Energy losses

The process of transmitting and distributing electricity to the end user (consumer) involves substantial energy losses (Reddy et al., 2013). Eskom defines energy losses as “the difference between energy purchased as measured at the transmission networks and energy sold to all customers. These losses are experienced in the form of technical and non-technical losses”

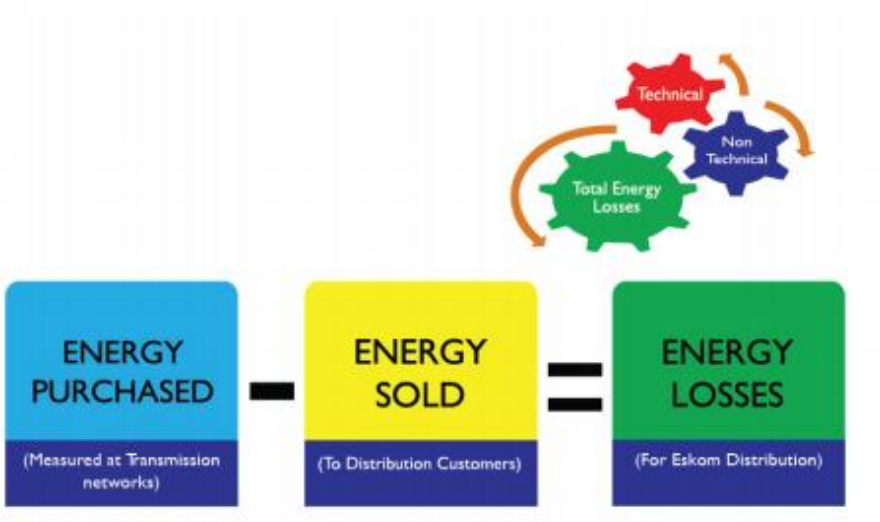

Figure 2.3: Energy losses calculation

Source: Adapted from Operation Khanyisa (2016)

These losses are both technical and non-technical, represent an economic loss which needs to be minimised in order to maximise revenue (Davidson, 2002). The optimisation of energy losses not only leads to higher revenue, but improves network performance and the quality of services offered to consumers (Kadhim, 2015; Antmann, 2009). Energy losses in a power system represents a significant operating cost (Anumaka, 2012) estimated to add 6% to 8 % to the cost of electricity and approximately 25% to the cost of delivery (Davidson, 2002) . For the year 2016/2017, Eskom reported a total energy loss of 8.9% of generated energy (Eskom, 2017). Researchers argue that technical losses represent inevitable economic loss, whereas non-technical losses represent an avoidable financial loss (Antmann, 2009). However, energy losses can be optimised.

2.4.2 Energy losses break down

Energy losses are dominant on the distribution network. Figure 2.4 and 2.5 indicate how energy losses are measured from generation to the end user.

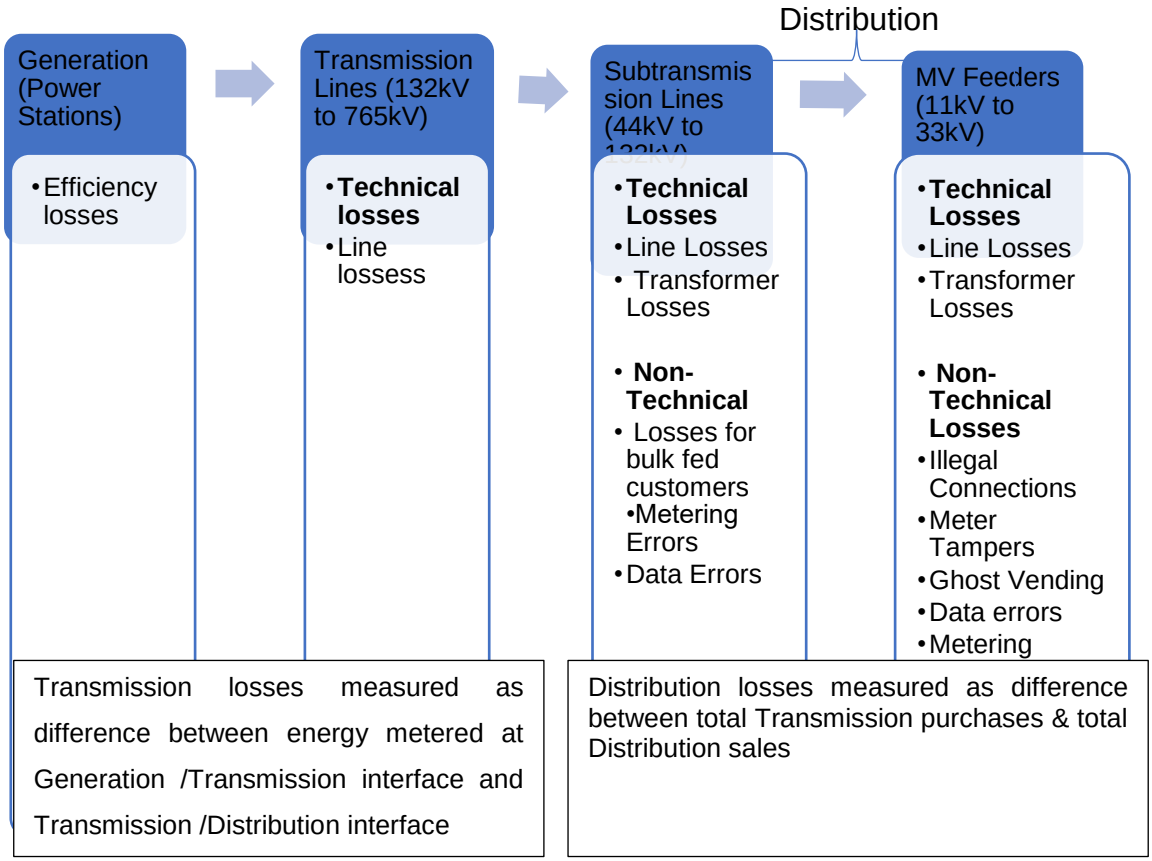

Figure 2.4: Energy losses breakdown Eskom Revenue Protection

Source: Adapted from Eskom (2016)

MV feeder level losses measured as the difference between statistical meter energy inflow and total sales for customers linked to the feeder (Eskom, 2016)

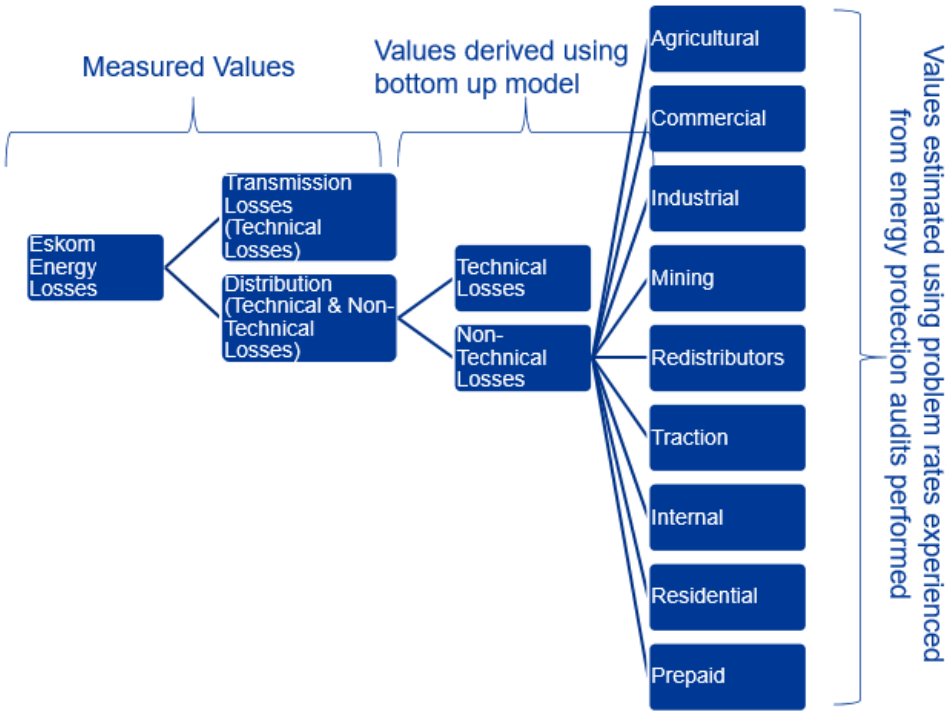

Figure 2.5: Energy losses breakdown per sector

Source: Adapted from Eskom(2016)

2.4.3 Measure non-technical losses

Non-technical losses in a distribution system is calculated using the equation

Figure 2.6: Non-technical losses equation

Source: Adapted from Anas et al., (2012)

Where **total energy loss** is the energy supplied, subtracting the amount of billed energy/paid energy (Anas et al., 2012). Energy supplied is measured using meters at the substation or feeder level. Billed energy is at the customer meter or level. Non-technical losses are difficult to measure and cannot be easily computed, but can be estimated. Utilities around the world calculate or estimate technical losses using load flow studies since these losses are based on the natural properties of components in the power system (Navani et al., 2012; Suriyamongkol, 2002).

In Eskom, non-technical losses are estimated by applying the problem rate per customer type and customer sector to the energy sales for the corresponding customer type and customer sector. This is then summated to derive the total non-technical losses for distribution. During the 2016/17 financial year, Eskom reported a significant increase in distribution total energy loss of 7.55% compared to 6.43% incurred during 2015/ 2016. Of that, it is estimated that non-technical losses contributed 48% which equates to approximately R5.4 billion of non-technical revenue losses, as depicted in figure 2.7.

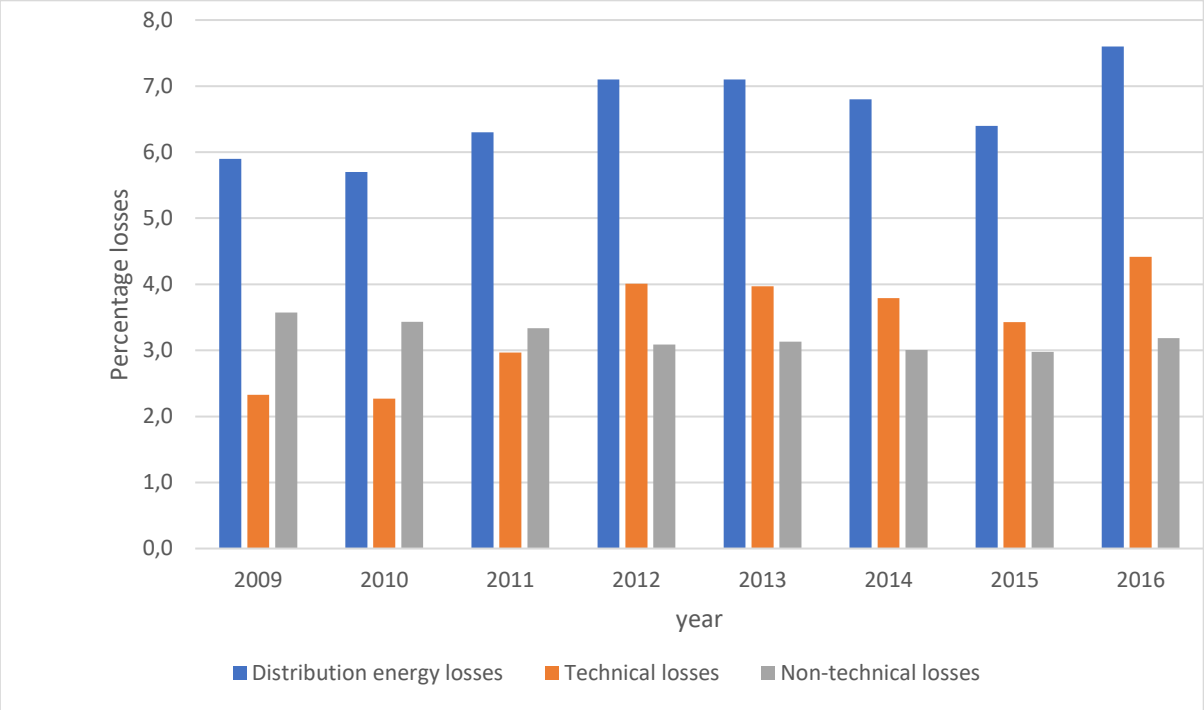

Figure 2.7: Trend of Eskom Distribution losses

Theoretically, technical losses vary between 3% and 6%, depending on the age of the system, line length and other factors (Ilo et al., 2003; Al-Mahroqi et al., 2012). High energy losses are indicative of high non-technical losses; therefore, revenue loss is also high. In developing countries, it is estimated that non-technical losses are in a range of 10 % to 40 %, contrary to the developed countries, where it reaches up to 3 % (Al-Mahroqi et al., 2012). Figure 2.8 shows Eskom's revenue loss due to non-technical losses.

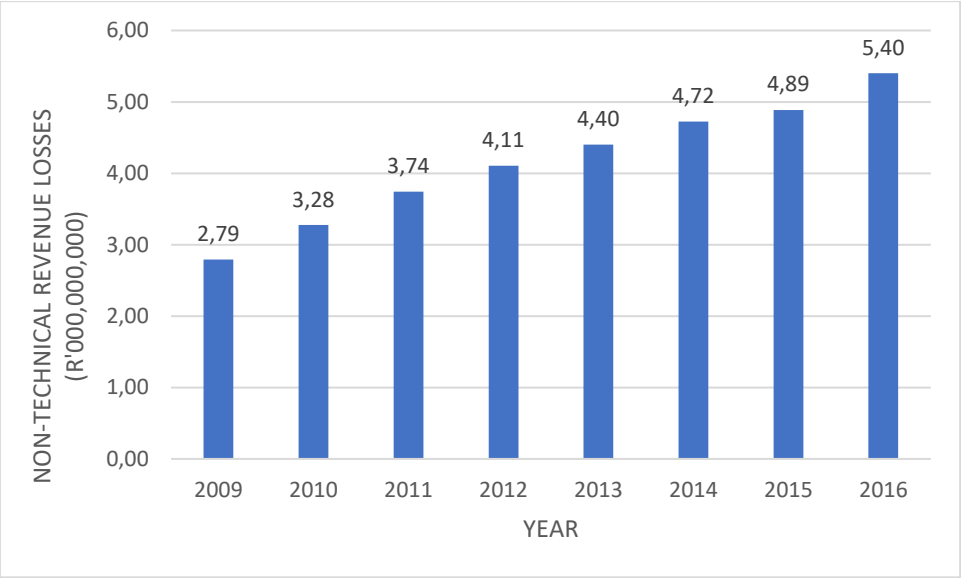

Figure 2.8:Trends in non-technical revenue losses in billions

Electricity theft and non-payment are considered to be the common form of non-technical losses and accounts for most, if not all NTL in the power system (Suriyamongkol, 2002; Gaur and Gupta, 2016). Many researchers agree that electricity theft is the most prominent form of and the main driver NTL (Joseph, 2010; Gaur and Gupta, 2016). Electricity theft relates to efforts and fraudulent activities deliberately performed by consumers geared to evade payments for the electricity used to the utility (Lewis, 2015; Chauhan and Rajvanshi, 2013). Electricity theft in many countries has been declared as a crime (Lewis, 2015).

Depuru et al. (2010) argue that electricity theft is a complex phenomenon correlated with many parameters to evaluate. These parameters include political, economic, criminal and managerial issues (Depuru et al., 2010) and have an impact on financial outcomes and political stability (Nizar et al., 2006). Financial impact represents the shortage of funds for investment in asset creation and a considerable operational cost (Nizar et al., 2006; Davidson, 2002).

2.4.4 Origins of Electricity Theft

Non-technical losses is one of the greatest challenges, causes of major revenue loss and widespread phenomenon faced by many utilities in developing countries (Depuru et al., 2010). Non-technical losses are difficult to measure and detect, mainly due to inadequate and poor infrastructure in developing counties. These losses represent an avoidable financial loss, increase operational cost, affect the quality of supply and tariff imposed on electricity consumed by genuine customers

(Depuru et al., 2010). Detecting and measuring NTL for power utilities is an important task. A significant body of literature exists on the techniques of detection and measurement of NTL. These includes data mining based analysis method such as decision trees (Nizar et al., 2008) and statistical methods (Fourie and Calmeyer, 2004), among others. Load profiling is the most commonly used technique to detect NTL in a power utility (Nizar et al., 2006; Monedero et al., 2012). Load profiling method allows the utility to monitor and measure deviations in customer behaviour (Monedero et al., 2012). It still requires an extensive use of human resources (Nizar et al., 2006) and is based on onsite inspection to some customers (Monedero et al., 2012).Quantifying the extent of electricity theft is a cumbersome task, as it requires physical checks of meter tampering and illegal lines by field personnel. The illegal lines are easy to detect as lines are often visible above the ground surface and are non-standard (Smith, 2004). However, the removal of these lines is not easy, field personnel are intimidated by communities and sometimes accompanied by security. Non-technical losses are more difficult to quantify because they are unaccounted for and there is no revenue collected from the consumed energy. In an ideal world, the energy generated from power stations should be equal to the energy registered as consumed. However, in reality, the situation is different because losses occur as an integral result of energy transmission and distribution.

In a distribution system, the most probable causes of non-technical losses are:

a) Metering inaccuracies: Utilities around the world use electric meters installed at customers to measure the amount of electric energy supplied to the customer for billing purposes. The accuracy of the meter is the most important to the energy billing process and should register the correct amount of electricity consumed. Utilities can overstate or understate electric energy consumption. For the purpose of this study, meter inaccuracies refer to a registered meter installed at customers premises' zero consumption in meter reading books, which may be due to defective or faulty meter.
b) Meter tempering and bypassing: Meter tampering or bypassing is described as any deliberate action resulting in the interference with the meter or any other installation with the intention of making the meter to stop functioning, so it does not record or register consumed energy. It is classified as a form

of electricity theft and normally conducted to avoid paying for the electricity used.

c) Illegal Connections: illegal connection is the most common and visible form of electricity theft, whereby people tap into electricity overhead lines, cable or any other forms of electrical installation without permission and with the intention of using free electricity (stealing) (Yasaghi and Kumar, 2011). It is one of the major contributors to non-technical losses. Illegal connections are not metered, billed and there are no revenue collections, which results in financial losses to the utilities (Arango et al., 2016; Mimmi and Ecer, 2010).
d) Illegal Prepaid Electricity Vending: illegal vending is a practice that is common to prepaid users, where unregistered vendors sell illegal prepaid electricity vouchers. This practice is also known as ghost vending (Khanyisa, 2013).
e) Data and processes issue: Data and process issues is more of the utility administration issue that is attributed from meter information errors, customer information errors, billing estimations, customer network link and unallocated transactions, among others (Khanyisa, 2013).
f) Non-payment: non-payment refers to an act where consumers refuse or unable to pay for electricity used (Suriyamongkol, 2002).

Non-technical losses in all forms are a major threat to the financial sustainability of the power utility. Most of these NTL are dominant on the consumer point of supply and lead to the loss of revenue (Davidson, 2002). Non-payment and electricity theft are the most dominant form of NTL. However, electricity theft affects the utility more than non-payment as it represents non-recovery of revenue lost (Steve and Skip 2007). Distribution utilities are losing billions of rands due to these practise (Parker and Africa, 2015).

The most probable causes of electricity theft are:

- Meter tampering / meter bypass
- Illegal connections
- False meter readings through bribes

Illegal connections take form in different ways

- Illegal connections on the street light pole

Figure 2.9: Illegal connection on a street light pole

Source: Adapted from Manqele (2011)

- Illegal connections on the overhead line

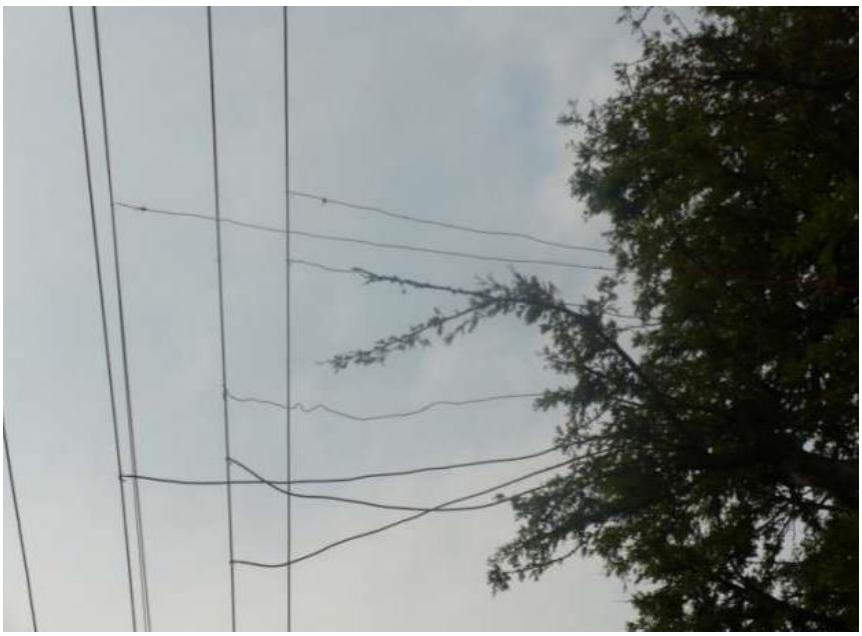

Figure 2.10: Illegal connection on the overhead line

Source :Adapted from Manqele (2011)

- Illegal connections on the underground main line

Figure 2.11: Illegal connection on the underground main line

Source: Adapted from Manqele (2011)

- Illegal connection in meter box and ring main unit

Figure 2.12: Illegal connection in meter box and ring main unit

Source: Adapted from Manqele (2011)

2.5 Factors contributing to electricity theft

Electricity is used for many purposes. Studies have shown that electricity plays a key role in stimulating economic and social development (Leung and Meisen, 2005). Apart from costing Eskom and municipalities billions of rands annually, it has a negative impact on the delivery of basic services (Landie, 2011), as well as governments target of 100% access to electricity by 2030 (Presidency, 2013). Several studies found that utility governance (Jamil, 2013) and socio-economic factors such as poverty, growing unemployment rate, bad economic conditions and the lack of access to basic services, are the main drivers of electricity theft (Depuru et al., 2011; Gaur and Gupta, 2016; Mimmi and Ecer, 2010).

2.5.1 Socio economic conditions

For decades, there has been a widely held view that electricity theft only occurs in poor communities, where those wanting electricity may not be connected to the infrastructure delivering electricity and may not be able to pay if they were connected (Smith, 2004; Winther, 2012). In addition, studies have revealed that households with low income and no income are more likely to commit electricity theft (Steadman, 2009) Furthermore, Steadman (2009) concludes that electricity theft is heavily influenced by the general cost of living in the society. On the other hand, studies have shown that this crime has become prevalent at all socio-economic levels (Landie, 2011; Smith, 2004). Electricity theft is not just for poor communities, but ranges from households in townships and rural areas running illegal connections, or tampered meters in suburbs, to large power users in the various business sectors, where power supply and meters are tampered with in a very sophisticated manner (McKinley., 2015; Khanyisa, 2013)

Findings from literature suggest that electricity theft is technically, politically and economically correlated (Jamil and Ahmad, 2014; Winther, 2012; Golden and Min, 2012). However, when addressing electricity theft, power utilities focus on technical measures and neglect the political and socio economic element (Jamil and Ahmad, 2014).

2.5.2 Access to electricity

In a world where economies, societies and cultures from different nations are increasingly becoming interdependent through globalisation, the level of inequality between the rich and the poor is widening. Theft of electricity is becoming an increasing problem, as the socio economic factors also increase challenging governments from extending access to electricity to the unserved population (Sharma et al., 2016). The provision of electricity is a foundation for economic growth. Access to energy services is a basic human right, integral to improving the lives of people (Bradbrook and Gardam, 2006). More than 1.2 billion people around the world lack the access to electricity and the benefits that it brings (Ki-moon, 2011). To many people, electricity is not only a basic necessity, but it symbolises progress, modernity, enhanced lifestyle, social equity and convenient energy source (Wentzel, 2005; Parbhoo et al., 2009). Access to electricity is a prerequisite for social development (Presidency, 2013), economic growth enabler and environmental sustainability.

Much of the literature supports the view that access to energy is the key element for economic and social development (Bazilian et al., 2014; Bradbrook and Gardam, 2006; Srivastava and Sokona, 2012; Magnani and Vaona, 2016). Many researchers have acknowledged that universal access to electric energy eradicate poverty and reduces social inequality (Pereira et al., 2010). Moreover, access to affordable and reliable electricity is central to the broader development efforts to improve education, health and environmental sustainability. As such, the Constitution Act 108 of 1996 of the Republic of South Africa places the responsibility on government to ensure universal energy access to all (South and Juta, 2011). The provision of electrical energy is recognised as an essential factor for sustainable development, eradicate poverty and is central to the everyday lives of people. Electricity plays a critical role in both the production and consumption of goods and services.

In the Sub Saharan Africa, 500 million people do not have access to electricity. Similarly, in South Africa, more than 3 million households do not have access to electricity (StatsSA, 2014). The United Nations, through the sustainable energy for all initiative, called for universal access to energy by year 2030 (Ki-moon, 2011; Nerini et al., 2016). South Africa has seen an improvement in the overall access to

electricity, from 77,1% in 2002 to 86% in 2014 (StatsSA, 2014). Despite an increase in the percentage of households connected to the electricity supply, achieving universal access to basic services remains a challenge. This is evident through an increased number of service delivery protests across the country, where people demonstrate their dissatisfaction with the delivery of basic services such as water, electricity, housing and sanitation especially in townships and informal settlements (Burger, 2009; Ndinda et al., 2013). Reaching the goal of universal access when there is loss of revenue through theft will be a challenge (Wentzel, 2005). In developing countries, electricity is used as a tool to pursue social, economic and political objectives (Jamil and Ahmad, 2013).While governments in developing countries are focused on providing universal access energy services, the issue of electricity theft is rapidly increasing, resulting in financial losses.

Eskom, in partnership with Department of Energy (DoE), have electrified more that 4.6 million homes since 2001 within Eskom's licence area of supply. DoE funded customers are all prepaid. The poor households receive free basic electricity (50kWh/month). Although DoE has made significant strides in providing access to electricity, more than 3 million households are still without electricity (StatsSA, 2014), which is an essential need. Electrification programme is funded by DoE, but Eskom carries the operational costs and receive revenue for electricity sold.

Various studies (Winther, 2012; Depuru et al., 2011) have shown that slow progress in the delivery of "electricity for all" increases the likelihood of illegal connections. According to Mimmi and Ecer (2010), the lack of electrification in poor communities and low income households aggravates a perception of exclusion and abandonment from service delivery, thus creating a further incentive to electricity theft in the form of illegal connections. This can be seen in areas with informal settlements, which constitutes a major part of South African cities. By denying access to electricity in informal settlements and backlog in application for new connections creates a situation whereby the society looks for alternatives and illegally establishes connections themselves (Lemaire, 2015).

2.5.3 Unemployment

Availability of reliable and affordable electricity can undoubtedly stimulate economic growth which contributes to job creation. Conversely, reduced economic activities results in high levels of unemployment. Most empirical studies agree with the theory that high levels of unemployment and customers' economic situation is related to electricity theft (Depuru et al., 2011; Depuru et al., 2010; Jamil, 2013; Steadman, 2009). Contrary to the view that unemployment is strongly correlated with electricity theft, Marangoz (2013) found that electricity theft in Turkey is not linked with economic factors such as unemployment rate and income.

Electricity theft is considered a silent crime and according to Becker (1968), crime is one of the economic activities. Economic factors such as unemployment influences a person's decision to participate in criminal activities, follow from rational criminal behaviour and is motivated by economic gain (Maddah, 2013; Wu and Wu, 2012). Becker (1968) links the issue of crime to socio economic conditions, suggesting that high unemployment rate due to less economic activities results in fewer employment opportunities available and encourages unemployed people to commit more theft (Maddah, 2013).

2.5.4 Poverty and inequality

South Africa, like many developing countries, faces a triple challenge of poverty, unemployment and inequality. Poverty and inequality issue is one of the increasing concerns, for governments have co-existed for generations in developing countries (Bhorat and Van der Westhuizen, 2010). Despite policies and interventions aimed at eliminating poverty and inequality, the gap between the rich and the poor is visibly more obvious. South Africa remains one of the unequal countries in the world. This is not all surprising, as it can be attributed to the policies of pre-1994 apartheid government that forcefully discriminated against the inclusion of the country's majority from the political, social and economic activities. Government policies, including energy policies, were designed to serve the needs of the minority White population which formed 11% of the country's population (Winkler, 2006). Energy policies focused on ensuring sufficient supply in the industrial sector, because of its role in economic and political security which formed the backbone of the economy

(Malzbender, 2005). Even today, the South African economy remains energy intensive. After the advent of democracy, the South African government has focused on fiscal policies that would progressively alleviate poverty, inequality and unemployment. Energy policies were directed to address the socio-economic consequences of apartheid. Against this background, the newly elected democratic government initiated a large-scale electrification programme, with the objective of improving access to electricity for the poor and ultimately providing access to electricity for all South Africans.

Prior to 1994, more than two thirds of South African households were without electricity (Dinkelman, 2011). The question of how many percentage households had access to electricity in 1994 is debatable, as there are confusing figures being quoted. However, there are no debates or confusion when it comes to the latest statistics, the roll out of electrification programmes has connected most South Africans to energy services. According to Statistics South Africa (Stats SA), the Annual General Household Survey for 2016 showed that nearly 90% of households have access to electricity. The study conducted by Dinkelman (2011) on the effects of rural electrification on employment shows that access to electricity increases the level of increased participation in modern labour markets. Furthermore, access to electricity is a development and employment enabler. Electricity demand has increased, this was evident when South Africa experienced electricity crisis (load shedding) in 2008. The substantial increase in electricity demand and the use of electrical appliances has an impact on energy losses. With an increased demand, energy losses also increases. Yelland (2008) argues that electricity theft and non-payment was a major cause of electricity shortages in South Africa.

According to Stats SA, the number of people living in poverty dropped from 57.2% (27.1 million) in 2006 to 45.4% (23.3 million) in 2011 (Lehohla, 2014). In addition, the number of people living below poverty line (R321 per capita per month in 2011 prices) declined from 26.6% (12.6 million) in 2006 to 20.2% (10.2 million) in 2011 (Lehohla, 2014). While poverty is improving, inequality however remains a challenge. Inequality is measured by the Gini coefficient which is a number between 0 and 1. The closer to 1 indicates inequality and the closer to 0 indicates equality. South Africa has the highest levels of inequality, with the Gini coefficient of 0,65

based on expenditure data and 0,69 based on income data in 2011 (Lehohla, 2014). The level of unequal society is worrying, since studies have shown that there is a positive correlation between inequality and crime (Fajnzylber et al., 2002). Income inequality is cited as the motivating factor and a real trigger for criminal activities (Mimmi and Ecer, 2010). Increase in income inequality has a significant impact in socio- economic conditions. Mimmi and Ecer (2010) argue that having a low per capita income has a much greater effect on electricity theft, rather than serious and violent crimes. In a country where inequality is high, crime rate is also high. According to Benjamin and Samson (2011), inequality connotes the feeling of rejection, worthless and not being valued, which increases probability to engage in criminal activities such as theft, thereby serves a real trigger for illegal activities.

2.5.5 Poor governance

Electricity theft is a complex phenomenon and its determinants varies per country or region. A comparative analysis study done by Smith (2004) in a sample of 102 countries shows that electricity theft is more prevalent in countries without effective accountability, political instability, low government effectiveness and high levels of corruption.

Poor governance has been cited by researchers as the key factor responsible for the continued increase in electricity theft (Gaur and Gupta, 2016; Steadman, 2009; Smith, 2004; Never, 2015). In countries where there is poor governance, there is a strong correlation between electricity theft and corruption (Smith, 2004). A case study conducted by Sudhir Kumar (2005) in Rajasthan, India, found that theft is closely linked to utility management and socio political environment. He further argues that corruption has become endemic and is a significant problem faced by electricity utilities because electricity theft occurs connivance of employees. This argument is supported by the study conducted in Soweto, where it was found that half of the illegal connections were offered by Eskom employees (Fiil-Flynn and Committee, 2001). Jadhav et al. (2012) argues that there is a widely held view in many people, which seems to suggest that it is an acceptable norm to steal from the state or state-owned enterprise, as compared to stealing something from your neighbour. This notion supports the finding by Smith (2004) who argues that

electricity theft is closely intertwined with governance indicator and high levels of corruption.

2.5.6 Politics

Golden and Min (2012) examine electricity determinants in India, associated with political economy. The study shows that local politics is a determinant of electricity theft. Around elections period, electricity theft is significantly higher. The study suggests that during electoral campaigns, there is a strong political influence where local politicians in power make promises related to electricity services, relax enforcement and tolerate electricity theft in an effort to secure political power. In addition, the study found that there is a deliberate political strategy by incumbent state legislators during election years. Similarly, Min and Golden (2014) argue that what is often described as an increased power theft in India occurring around elections is a deliberate political strategy aimed at persuading voters to vote for an incumbent party such that it retains assembly seat. While studies in India found evidence that links politics to electricity theft (Min and Golden, 2014; Golden and Min, 2012), studies in Turkey found no correlation between electricity theft and politics (Marangoz, 2013). However, the study found that illiteracy and terrorist attacks are linked to electricity theft.

2.5.7 Culture of non-payment

In South Africa, the widespread non-compliance with respect to paying for services rendered by government, municipalities and Eskom, such as fees, rates and electricity, has worsened (Fjeldstad, 2004). The culture of non-payment for services deemed as the “right” by the Constitution, is rife and costing government institutions billions of rands. The culture of non-payment is not a new phenomenon, it first began in the 1980’s during the apartheid era where Black South Africans boycotted paying rents and services in the townships (Mavhungu, 2011; Von Schnitzler, 2008; Fjeldstad, 2004). Withholding payment was a political weapon against what was considered an illegitimate regime (Fjeldstad, 2004). Following the first democratic elections in 1994, acts of cross-resistance by way of non-payment were expected to cease, but they did not. Under the new dispensation, non-compliance with respect to paying for services and in particular, electricity and water charges , has become

an established “norm” in many areas resulting in revenue losses (Mavhungu, 2011). Different arguments are used to explain the extensive and increasing phenomenon of non-payment and illegal connections. Fjeldstad (2004) argues that the culture of entitlement and dependency is one major factor contributing to the non-payment crisis. This is attributed to the liberation promises by the African National Congress (ANC), of free water, education, electricity and so on, and the fact that many Africans were directly involved in the liberation struggle. As a result, many people believe that they are entitled to public services such as housing, electricity and water, as it is their basic right (Von Schnitzler, 2008). According to the study done by Fiil-Flynn and Committee (2001) in Soweto, the electoral promise by the ANC of “free electricity” has received a lot of criticism, with some Soweto residence terming it an election ploy. Contrary to the popular belief that the culture of non-payment is a legacy of apartheid system boycott, the study by Fiil-Flynn and Committee (2001) noted that non-payment in Soweto is due to access and affordability of electricity for low income households electricity. The findings from the study support the argument by Mavhungu (2011), that the culture of non-payment is associated with poverty, the inability to pay rather than unwillingness to pay. In South Africa, the issue of non-payment has spread to other ethnic groups, but it is still not clear whether this act is a protest against the incumbent government, in accordance with growing dissatisfaction with government performance.

2.5.8 Electricity price hikes

The cost of energy is becoming a factor that cannot be ignored since its increase affects all sectors and individuals (Cameron and Rossouw, 2012). The price of energy increase is the only one of many price increase that attracts the amount of attention from the public, the media, policymakers and economists (Born, 2008). A common perception is that the rising energy prices have a negative effect on employment, goods and services and poses a serious threat to growth. Because the demand for energy is comparatively inelastic, consumers are left with little choice but to endure high prices.

Electricity prices has been identified by many researchers as a determinant to electricity theft (Smith, 2004; Depuru et al., 2011; Gaur and Gupta, 2016). Higher electricity tariffs deject some consumers from buying electricity (Lewis, 2015). In

addition, higher electricity prices increase the burden of cost of living on the poor, thus creating a further incentive to stealing electricity as the net payoffs tend to be higher (Jamil, 2013). Electricity is an essential need and when it becomes too expensive, many people, including businesses, struggle to pay off their debts, thus resorting to meter tempering which in turn has a negative impact on utilities. Tasdoven et al. (2012) found that there is a direct link between an increase in the cost of electricity and an increase in electricity theft.

According to Jamil and Ahmad (2014), from a study conducted with Electricity Distribution Companies in Pakistan, in relation to the economic factors, there is a strong evidence which suggests that the consumer price of electricity and per capita income is closely related to electricity theft. Electricity is considered as an engine of growth and plays a crucial role in socio economic development (Alter and Syed, 2011). Electricity is a form of energy that is used for various purposes at residential, industrial, mining, commercial and agricultural sectors. These sectors are strongly dependent on affordable, reliable and good quality of supply which has become a necessity.

The price of electricity in South Africa has rapidly and sharply increased by over 300% since 2004 (Fripp, 2015), as Eskom needs to raise capital to cover the cost of its expansion program (Team, 2008).

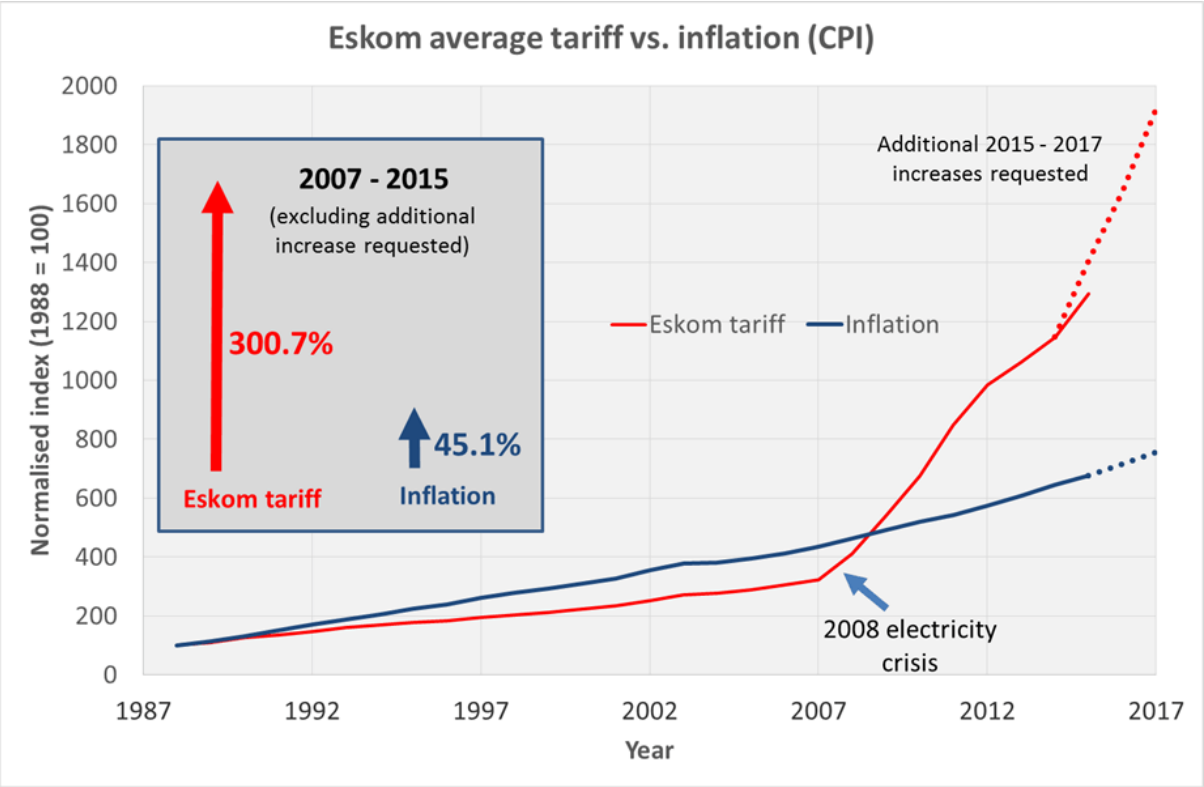

Figure 2.13: Eskom's average tariff increase over the years

Source: Adapted from Fripp (2015)

South Africa has had the lowest electricity average selling price, as compared to other countries in the world. This was due to the implemented pricing policy and practices which aim to improve social equity and fairness and ensure revenue recovery (DOE, 2008). The benchmarking shows that South Africa (Eskom) is ranked fourth cheapest average tariff, of the 15 countries utilities included in the survey. Because South Africa has for long enjoyed the historic artificially low electricity prices, it is argued that low tariffs have been a disincentive for the industry, as well the residential sectors, to use energy efficiently (Team, 2008; Blignaut et al., 2015). This has encouraged wasteful practices, leading to higher electricity consumption levels. Although the individual residential consumption is quite small, as compared to other sectors, however, the aggregated household consumption is very significant. Studies have noted that after the energy crisis of 2007/2008 and price restructuring of 2008/2009, the behaviour in electricity consumption for industrial sector changed, resulting in significant decrease in consumption (Blignaut et al., 2015). It may be argued that due to the shortage of supply, Eskom encouraged consumers to curtail load and be more energy efficient. However, with electricity

price increase, the industry sector which subsidies residential sector has been shrinking.

Electricity is the most important source of energy and its price affects all sectors of the economy. Today's economy is driven by energy intensive goods and services, any change in the price of energy changes consumption and energy demanded. In South Africa, energy prices have risen higher than the rate of income for consumers. Based on the concept of "Access for all", it can be argued that electricity may be considered as a public good. According to the theory of economics, a public good is characterised by non-exclusiveness and non- rivalry (Kiesling and Giberson, 1997). The economic theory offers guidance as to how consumers respond to price fluctuations. It is argued that electricity price increases adversely affect the poor. There is a belief among energy experts that an increase in electricity price reduces electricity sales and thus, increases non-payment, with defaulting redistributors such as municipalities and drive up electricity theft. There is a direct link between electricity prices and consumption. When the tariff increases, the consumption is expected to decrease. However, since electricity is an inelastic demand, it reaches a point where consumption increases with tariff increase.

2.6 Effects of electricity thefts

Electricity theft results in the loss of revenue and negatively affects the overall economy (Yurtseven, 2015; Smith, 2004). The ripple effect affects service delivery due to the shortage of funds to meet operational maintenance and investment expenditures. Electricity theft overloads the electrical grid, resulting in equipment failures causing interruption of supply to legal customers (Depuru et al., 2011). Power outages causes inconvenience to all sectors, as it slows production and sometimes leads to businesses closing and impeding job (Khanyisa, 2016). There is increased number of power outages, which leads to increased labour costs. The financial losses are recovered by higher tariffs and the consumers who legally consume electricity end up paying for theft "illegal usage share" (Yurtseven, 2015). Not only is electricity theft expensive, it is also hazardous (Tasdoven et al., 2012), resulting in fatalities and property damage, making it unsafe for maintenance staff to operate on the network (Van Zyl, 2003).

2.6.1 Power outages

According to a study conducted by Jamil (2013) in Pakistan, there is a strong correlation between electricity theft and power outages. Electricity theft plays a significant role in electricity shortages and rising electricity prices. Power outages caused by electricity theft is a recurrent phenomenon in most distribution system. It remains an ongoing challenge for power utilities, as it affects consumers. Power outages have a major impact on business production, affecting production efficiency and competitiveness (Moyo, 2012). The impact on business operation varies per industry production, ranging from being disruptive to life threatening.

A power outage can be described as a power interruption or equipment failure, resulting in complete absence of electricity at the consumer end (Amadi, 2015). This can further be classified into faults and failures. Faults in a power system are caused by external factors such as lightning, animal contact, tree contact, illegal connections and electrical infrastructure vandalism, among others (Grigsby, 2013). Failures occur as a result of equipment malfunction or human error, but not linked to external factors. Faults and failures in a distribution system are common and can cause short and long outages (Grigsby, 2013).

Eskom's mandate is to provide a reliable, efficient, affordable, safe and environmental friendly supply to all consumers. According to the South African Distribution Code, it is a function of a distributor, in this case, Eskom, to ensure it operates and maintains the highest degree of reliable electricity and shall promptly take appropriate corrective actions to address any condition that may subject the system at risk (NERSA, 2014). Furthermore, Eskom shall ensure that the distribution system operates with the defined technical standards and equipment operational ratings. This is to ensure that distribution system is operated safely, economical and the required quality service to customers is delivered at the appropriate time and price. However, with recurrent events of power interruptions due to illegal connections, achieving the objective of reliable, safe and uninterrupted supply is becoming an increasing challenge for the parastatal.

Reliable, efficient and secure electricity is a key to the sustainable socio-economic development of the nation. According to the World Bank, power in Sub Saharan

Africa is extremely unreliable and the average price is doubled that of other developing countries (Eberhard et al., 2008). It is said that the industry sector experiences power interruptions on an average of 56 days per annum, as compared to the United States, which is 1 day every 10 years (Eberhard et al., 2008). Power outages are common in an electrical system, erratic and results in financial loss and damaged equipment. To cope with unplanned outages, most industries in the formal sector are forced to maintain backup generators. To businesses, since they cannot operate, millions of rands are lost, whereas with households, it causes a lot of inconvenience.

The most common form of electricity theft is through illegal connections, which affects the quality of electricity supply (Tasdoven et al., 2012). In areas like Johannesburg and Soweto, where illegal connections are rampant, this act is believed to be the major cause of power failures or outages (Terrazas, 2010). Illegal connections continue to affect Eskom's operations in many ways. Firstly, illegal connections cause system overload and the supply fails to meet the uncontrolled demand. The electrical system is designed to withstand defined operational technical specifications and when exceeded, the probability of failure is high. Likewise, with illegal connections, the network is designed to carry a certain load. However, when there are too many people connecting themselves illegally on the network designed to supply one household per stand, power outages are inevitable. Secondly, the overloads of the system result in overvoltage, which may cause damage to voltage sensitive appliances. Furthermore, the utility incurs additional maintenance expense through the act of electricity theft, as they are required to normalise and clear faults (Tasdoven et al., 2012).

Electricity users who are connected illegally do not pay for electricity, therefore, they have no incentive to be energy-efficient. Studies have shown that in a region where illegal connections dominate, legal consumers also tend to follow suit and join the free riders (Sudhir Kumar, 2005). This finding is supported by Tasdoven et al. (2012), who refers to this case as a cyclic and complicated process.

2.6.2 Economic loss / loss of revenue

Power utilities in most countries are monopolies and regulated. In the South African context, the primary output of the state-owned utility is to generate, transmit and distribute electricity to the end user. Eskom is responsible for approximately 90% of electricity used in South Africa (Eskom, 2017). The revenue is generated from the sale of electricity. However, not all electricity generated is sold to the end user (consumer), part of the electricity is lost due to technical and non-technical losses (Arango et al., 2017). Loss of revenue through non-technical losses represents a major economic threat and compromises the compliance with regulatory targets and business efficiency (Arango et al., 2017). Power utilities with the highest percentage of energy losses face financial imbalances with lowest profits (Gaur and Gupta, 2016). The financial losses resulting from electricity theft are critical to the operations of many utilities (Nizar et al., 2006). In India, more than 20% of energy generated is lost through theft (Gaur and Gupta, 2016).

Most empirical studies agree that electricity theft deteriorates the financial condition of the power utilities (Jamil and Ahmad, 2014; Steadman, 2009; Gaur and Gupta, 2016). Steadman (2009) argues that the economic impact of electricity theft can be classified into foregone revenue, which leads to a loss in profits, avoided investment costs and increased electricity rates to consumers. Similarly, Gaur and Gupta (2016) agree that when the utility is unable to generate sufficient revenue due to electricity theft, this curtails new investments for better capacity infrastructure, which leads to electricity shortages. High energy losses adversely affect the profitability and consequently, the capability to invest in manpower to monitor electricity pilferage (Jamil and Ahmad, 2014).

2.6.3 High electricity tariffs

The cost structure of electricity is regulated with the aim of promoting economic efficiency and sustainability, while shielding the poor through subsidies (DOE, 2008). The electricity tariff structure is unlike the cost structure for most goods and services. This industry is regulated by NERSA. The pricing of electricity in the distribution sector has been the subject of extensive debate over the past decade (DOE, 2008). An increase in electricity affects all consumers across all sectors for both goods and services. It is argued that an increase in electricity tariffs directly

affects the production and economic growth, resulting in job losses. With the South African economy which is energy intensive, the shrinking of the industrial sector has an impact on the residential sector. The growing residential sector is cross subsidised in volume terms by industry. If the industry base is shrinking, then residential consumers would end up having to pay more for electricity used. In South Africa, tariffs and cross-subsidisation mechanisms is employed to meet the needs of the various customer groupings. To shield the poor from sinking into poverty due to electricity prices, the government introduced electrification grants, free basic energy and cross subsidies.

- Electrification grants: Funds allocated by the government to support Integrated National Electrification Programme by accelerating new connections to ensure universal access by 2025.
- Free Basic Electricity (FBE): This is a 50kWh of electricity offered to poor households per month.
- Cross- subsidies: Charging higher tariff to richer customer groupings to subsidise poor households.

Electricity theft diminishes the amount of revenue collected and returned to the utility for the electricity consumed. This revenue could be used for maintenance and capital expenditure programmes, among others. Electricity theft affects law abiding consumers who pay for their electricity, as they are being charged an additional amount through tariff increase in order to recover some losses (Tasdoven et al., 2012). The financial losses are recovered by higher tariffs and the consumers who legally consume electricity end up paying for theft “illegal usage share” (Yurtseven, 2015). Paying consumers are therefore paying the hefty price for electricity theft through tariff increase and are subsidising those who do not pay for electricity consumption (Tasdoven et al., 2012; Antmann, 2009). Studies conducted in Turkey have shown that the cost of electricity theft is reflected in the electricity prices. In addition, an increase in electricity tariffs increases electricity theft. Financial losses from theft slows the progress in delivering access to electricity to the unserved population.

2.6.4 Safety

Electricity theft has negative effects that are severe and dangerous. Not only is electricity theft costly, but it is also hazardous, resulting in fatalities and property damage (Tasdoven et al., 2012). A case study conducted by Sudhir Kumar (2005) in Rajasthan, India, discovered that backlog of electricity connections is a major incentive to electricity theft. Customers who apply for electricity and are not connected due to various reasons, tend to connect themselves illegally, making it unsafe for maintenance staff to operate on the network (Van Zyl, 2003). Illegal connections are done without following proper standards and are made in most cases by uncertified electricians (Tasdoven et al., 2012). Exposed lines and bare wires are extremely dangerous and presents a fire hazard.

With illegal connections, the safety features associated with the connections is absent, the cables and bare wire often lack protective insulation. Since electricity is the flow of current, when an illegal connection is made by untrained professional, the current may flow back into the powerline, thereby endangering the lives of utility personnel who may assume that the power line they are working on is de-energised. Electricity theft is a silent crime that directly affects the economy and cannot be ignored since it is a social evil (Jadhav et al., 2012). Illegal tapping on the electricity line not only poses danger to the public but high risk to the personnel who operate it (Depuru et al., 2011).

2.7 Measures to minimise electricity theft

Minimising electricity theft is an important task for utilities because of its negative impact on the utilities profit (Monedero et al., 2012). Researchers commonly approach electricity theft from an engineering perspective (Depuru et al., 2011; Henriques et al., 2014). The engineering techniques used to curb theft tend to centre around the advanced technologies such as split metering and smart grid (Yurtseven, 2015).

South Africa is one of the first developing countries who pioneered and implemented the use of prepayment system with the aim of improving revenue management and the recovery of bad debt (Telles Esteves et al., 2016). Prepayment system allows customers to purchase electricity from a prepayment vending agent that sells

electricity. Although prepayment system was introduced to allow customers to adequately budget for their electricity in advance, electricity theft in a form of meter tampering and bypassing is on the rise. Furthermore, vulnerable customers are getting enticed into buying illegal prepaid vouchers from the illegal vendors.

In South Africa, the government provides free basic electricity (50kWh/month) to poor households, which is deemed sufficient to basic services such as lighting, media access and ironing. Once the 50kWh has been exhausted, customers purchase more electricity from their income, but due to socio economic challenges and non-affordability, most of these customers end up bypassing meters. The study conducted in Soweto found that Free Basic Electricity offered to poor households per month is insufficient and only covers less than 10% of average household usage and therefore, makes little difference to the overall household electricity bill (Fiil-Flynn and Committee, 2001; Dugard, 2008). Despite the FBE programme, many low-income households do not afford to pay for electricity, even when there is a willingness to pay.

Based on the prepayment footprint, measuring the extent of theft is a challenge. Theft is detected through audits and inspection, management often comes up with strategies to minimise this behaviour. However, studies have found that neither technical innovations or managerial framework is sufficient to provide solution to the problem (Winther, 2012). Electricity theft is on an upward trend, despite all technical control measures put in place. Researchers agree that power utilities need to look beyond conventional engineering methods and understand and explain why theft occurs and what factors perpetuate theft (Smith, 2004; Winther, 2012). To combat electricity theft, power utilities need to look at adopting behavioural change approaches.

In South Africa, Operation Khanyisa was launched in 2010 by Eskom, in partnership with Proudly SA, Business Against Crime (BAC), Business Unity SA (BUSA), Primedia's Crime line and the South African Local Government Association (SALGA), aimed at fighting electricity theft and related energy losses (Khanyisa, 2013). This campaign aims to drive voluntary behaviour change and mobilises South Africans to use power legally (Landie, 2011). It encourages people to report electricity theft anonymously. Eskom reported that the campaign has helped the

power utility to recover revenue of almost one billion rand (Masinga, 2015). Court cases and convictions have also been reported, despite all the public awareness, electricity theft continues to be an ever-growing problem.

Theft of electricity in some countries is treated as petty crime (Lewis, 2015) or a socially acceptable norm (Gaur and Gupta, 2016) which lacks appropriate legislative framework (Landie, 2011) and hardly carries strict penalties (Steadman, 2009). Recently, however, there has been a growing interest in amending laws governing electricity theft to declare this act as a serious crime and punishable offence (Gaur and Gupta, 2016). Despite an increase interest in the subject of electricity theft, there is little empirical research done on energy related crimes and the implementation of legislative frameworks. Most of the available literature focuses on crime in general.

In South Africa, Electricity Regulation Act 4 of 2006 is criticised for not providing clear definition of electricity theft and falling short in several critical areas (Landie, 2011). It does not recognise illegal connection and the illegal use of electricity as a crime. It restricts Eskom to prosecute people involved in illegal activities unless it can be proven that the material used to illegally connect belongs to Eskom. Electricity Regulation Act 4 of 2006 stipulates that every illegal installation has to be disconnected and Eskom staff has to be involved in that exercise. However, resistance from the community during disconnection and removal often results in intimidation and threats. When customers are disconnected, reconnection is done almost immediately, resulting in loss of revenue.

In an attempt to combat theft, the South African government approved and published the Criminal Matters Amendment Act 18 of 2015 which allows for the prosecution of those who tamper with meters or infrastructure to be sentenced up to 30 years. Although the Act is victory for the power utility, the question remains as to whether Eskom will have enough resources to successfully prosecute businesses and many South Africans involved in electricity theft.

2.8 Summary

Most studies in the field of electricity theft have only focused on engineering techniques that will prevent the spread of electricity theft. However, studies have shown that electricity theft is on the rise due to socio-economic factors such as poverty and unemployment (Jamil and Ahmad, 2014; Gaur and Gupta, 2016). Despite an increased conventional, technology oriented means to combat electricity theft, little research has been conducted to determine the amount of economic loss caused by theft (Yurtseven, 2015). Tougher penalties, strong policy and regulations, are needed in dealing with the challenges of electricity theft.

Chapter 3 : Research Design and Methodology

3.1 Introduction

Business research is a truth-seeking mechanism that involves the investigation of a specific problem, with the aim of providing direction and obtaining solution for that problem. Research provides business with insights and knowledge through a process of gathering, analysing, interpreting and reporting information which enables informed decision making. In the same way, research is a ubiquitous yet ambiguous term which is used every day and connotes numerous meaning to different people. Leedy and Ormrod (2005) argue that the word research is at times mistaken for information gathering, discovering information about what one does not know or rummaging for information. They further argue about a common misconception that research is not:

- Merely information gathering for self-enlightenment or reference skills
- Documenting facts and presenting it to others
- Merely rummaging for information

Instead, research is a systemic empirical investigation process of collecting, analysing and interpreting data in order to establish facts and reach new conclusions about a phenomenon studied (Williams, 2011; Leedy and Ormrod, 2005). The research process has distinct characteristics, framework and guidelines.

- Research originates at least with one question or problem statement about one phenomenon of interest (Williams, 2011).
- Research requires a clear definition of an objective.
- Research divides research problem into manageable sub problems.
- Research is directed by hypothesis or research questions and provides a tentative answer to a research problem.
- Research uses a systematic approach guided by the research problem, hypothesis or assumptions to collect and analyse and interpret data.
- Research interprets data and hypothesis is either supported or rejected. The research cyclical process begins as more questions or new problems emerge.

In summary, business research is a systematic method of collecting, analysing and interpreting data in search for the truth or answers about the business phenomenon. This chapter outlines in detail, the research methodology and data collection strategies utilised for the current research. The research methodology chosen was based on the research objectives and the aim was to provide answers to the research questions by providing an understanding on the factors contributing to electricity theft, as well as providing insights into the effects of electricity theft in Eskom Distribution. There are multiple reasons that would make consumers decide not to pay for electricity, or illegally consume electricity.

A critical review of electricity theft literature was conducted in chapter two, using secondary data in order to identify the factors contributing to electricity theft, as well as examining the impact of electricity theft on the running of Eskom Distribution business. The key contributing factors to an increase in electricity theft could be related to socio economic conditions such as poverty, unemployment and inequality. Higher levels of unemployment results in inadequate or reduced income which leads to higher levels of electricity theft. The issue of affordability, access to basic services and willingness to pay on the part of consumers needed to be explored in order to gain an understanding to the drivers of electricity theft. Thus, the methodology chosen unlocked the interwoven reasons described in the previous chapters and provided insights into the factors that need to be managed in order to minimise electricity theft.

This chapter also discusses the location of the study and its participants. Sampling, population, data collection, ethical considerations and data analysis are discussed. Data were derived from primary and secondary sources. The combination of quantitative and qualitative will assist the researcher to understand the research problem being investigated. Furthermore, data recovered from the quantitative research instrument and personal interviews will form the essence of the primary data needed for the study.

3.2 Aim and objectives of the study

The aim of the study is to investigate and assess the effect of electricity theft on the operations of Eskom Distribution business in KwaZulu-Natal. Despite an increase in electricity theft, power utilities tend to focus on technical techniques. Winther (2012) confirms the need for a study that will look beyond conventional engineering methods, but acquires insights which explain why electricity theft occurs and what factors perpetuate the phenomenon. Although there are technical innovations, little empirical research has been conducted beyond the engineering framework, especially from the perspective of the consumer, utility and the effects thereof. This identifies a gap in the literature, which the researcher believes to be significant and therefore, warrants further investigation. In this view, the objectives of this study are as follows:

- To identify the factors contributing to electricity theft in KwaZulu-Natal Operating Unit.
- To assess the impact of electricity theft on the operations of Eskom Distribution in KwaZulu-Natal Operating Unit
- To identify the strategies employed by Eskom Distribution to minimise electricity theft
- To explore employee's perceptions and attitude towards Eskom strategies in minimising electricity theft.

3.3 Research Design

Research design can be described as the application of scientific and disciplined inquiry approach. Research design is the method that describes how to collect and analyse data with the aim of providing answers to research questions and an understanding of the objectives (Saunders et al., 2016; Kritsonis, 2009). According to Creswell (2014), research designs are "types of inquiry within qualitative, quantitative and mixed method approaches that provide specific direction for procedures in a research design".

3.3.1 Qualitative design

Qualitative research is described as a form of inquiry which is often employed to gain an understanding or provide insights into human behaviour, opinion and experience. It is often associated with the philosophical worldviews post positivist, constructivist, transformative and pragmatic (Creswell, 2014). Qualitative research world view assumes that knowledge is psychologically and socially constructed, it therefore aims to understand how social experience is created and given meaning (Yilmaz, 2013). It involves the collection of non-numerical data from unstructured techniques such as interviews observations, group discussions, surveys and case studies, and is concerned with trying to understand and provide meaning through inductive reasoning. Qualitative research approach can be explanatory, interpretative and critical, among other research approaches.

a) Explanatory aims to explain why and how there is a casual link between two or more factors that pertain to a situation or research problem. This type of research is structured in nature and provides insights into a phenomenon in order to test a theory (Rahi, 2017).
b) Interpretative research generally attempts to make meaning of actions that occur or understand a phenomenon through how others perceive their experience. It follows an inductive process from interviews, observations, or document analysis and interpretation is drawn from the data based on common themes (Darlington and Scott, 2002).
c) Critical theory refers to a set of loosely linked principles with many flavours and proponents (Klecuń, 2004). Critical research aims to enquire the conceptual and theoretical bases of the phenomenon to get insights beyond prevailing assumption an understanding.

Every research is grounded in certain set of assumptions about how things work, or what the nature of reality is (Donalek, 2004). There are several approaches for conducting qualitative research to meet different needs. These include case studies, grounded theory, ethnography, content analysis and phenomenology (Williams, 2011; Creswell, 2014). This study adopted the phenomenological approach to collect qualitative data., which attempts to understand what people experience or people's perceptions. The phenomenological research approach was the most appropriate to the objectives of the study, which was to understand the

factors and effects of electricity theft, with the aim of finding a sustainable and effective strategy to the issue of electricity theft. The lived experiences of Eskom employees involved managing and dealing with electricity theft. Phenomenological data collection process involves asking questions to an individual, focus group on a structured, semi-structured or unstructured interview process and listening to and recording answers.

3.3.2 Quantitative design

Quantitative research can be defined as a type of empirical research that explains a phenomenon according to a scientific approach of collecting numerical data from a large number of people, which analyses trends or phenomena using mathematically based methods (Aliaga and Gunderson, 1999; Yilmaz, 2013). From a broader perspective, it can be defined as a type of research that tests a theory consisting of variables through statistical concept and provides an explanation of variables' relationship.

Quantitative research uses structured techniques sources such as questionnaires, surveys and systematic measurements involving numbers to obtain numerical data, which is concerned with generalisation and cause – effect relationship through deductive reasoning (Yilmaz, 2013). It is generally associated with positivism and in this methodology, data are used to test theory (Saunders et al., 2016). There are three common types of quantitative design namely exploratory, descriptive and causal research method.

a) Exploratory is a type of research that explores the research question, but does not aim to provide conclusive evidence, but helps to provide a better understanding of the problem (Saunders et al., 2012). Exploratory research tends to tackle problems where there are high levels of uncertainty and the problem investigated is not well understood (van Wyk). It lays the foundations for future researchers.
b) Descriptive is a type of a research which involves describing and observing the status of an identified variable. It aims to quantify the variables investigated and provide systematic information about a phenomenon (Hopkins, 2008)

c) Casual is a type of research that is quantitative in nature and sometimes considered conclusive research conducted to test hypothesis about cause-and-effect relationships.

The nature of this study is exploratory, as it aims at providing a better understanding regarding the issues of electricity theft within the South African context in KwaZulu Natal.

3.3.3 Mixed method design

Mixed method research is a combination of quantitative and qualitative methodologies in the same research inquiry to address specific objectives. Mixed method design at its core involves more than one world view (Venkatesh et al., 2013). Mingers (2001) argues that to gain a complete understanding of the world view or social phenomenon, one needs to apply the objective world, the subjective world, as well as the social world. He further suggests that these paradigms have different meaning, modes of existence and epistemological possibilities. The objective world is associated with objectivism and observation, subjective world is associated with subjectivism and experience, and the social world is associated with participation and shared understanding (Ågerfalk, 2013). These world views cannot be fully understood by applying a quantitative or a qualitative method. Creswell (2014) argues that the integration of both qualitative and quantitative data helps to develop rich insights and strengthens the overall research design, as the weakness of one data is neutralised by the other form of data. The use of both qualitative and quantitative approach in a single study is complementary rather than competitive (Migiro and Magangi, 2011). The decision to conduct research using both methods must be based on the nature of the research problem, purpose and context (Migiro and Magangi, 2011; Venkatesh et al., 2013).

Although many designs exist for the mixed method research, integration at the study design level occurs through three primary mixed method design models found in social sciences:

a) exploratory sequential: the researcher begins by collecting and analysing data for a qualitative research phase, interpretation of the results inform subsequent quantitative data collection (Fetters et al., 2013; Creswell, 2014)

b) explanatory sequential: the reverse of the exploratory sequential, where the researcher first collects and analyses quantitative data, the findings inform qualitative data collection (Fetters et al., 2013; Creswell, 2014)
c) convergent parallel/ concurrent : is a form of a mixed method in which the researcher undertakes qualitative and quantitative data collection techniques at the same time, in order to provide a comprehensive analysis of the research problem (Creswell, 2014).

This study adopted concurrent designs in part, due to time constraints, qualitative and quantitative data were collected and analysed simultaneously.

3.4 Participation and location of the study

This study focused on the effects of electricity theft from the demand, as well as the supply side. The study is geographically bounded to Eskom Distribution, KwaZulu Natal Operating Unit. Edendale customer network centre provides a wide range of technical services such as fault management, asset conditioning monitoring, perform maintenance, provide technical customer support and provide safe technical environment to the people of Pietermaritzburg. The CNC is the first Eskom contact to customers and their role is to ensure that Eskom delivers safe, quality and reliable supply. In the Edendale area, non-technical losses are the highest, as compare to other areas in KZNOU. The researcher chose this area with the aim of getting an insight to electricity theft from both electricity supplier (Eskom employees) and electricity consumers (households).

Due the nature of the study, the researcher adopted a two-pronged approach to gain insights into the phenomenon investigated from the consumer and Eskom perspective. To understand the factors contributing to electricity theft from the consumers, this study therefore focused on the Edendale area, where non-technical losses is 86% (KZNOU, 2016) This means that in this community, less than 20% of energy supplied is accounted for and the rest is lost through theft, non-payment, incorrect or faulty metering, billing, etc.

The targeted population for the quantitative approach included the households within Edendale area, those with access to electricity either by illegal or legal processes. This was complemented by a qualitative approach which focused on

Eskom employees who had knowledge and experience in the field of electricity distribution. The researcher chose the participants based on their technical and non-technical experience in Eskom Distribution business, which balances the views and experiences in dealing with electricity theft. The participants were chosen through the combination of purposive sampling methods.

3.5 Target population

The target population for a qualitative part of this study was 95 experienced Eskom employees made up of both managers, supervisors and bargaining unit with exposure in the field of non-technical losses which are males and females, different age groups and different race groups which are Black, Indian, Coloured, and White. The researcher selected 12 Eskom employees based on their relevant experienced in the field of energy losses.

The target population for a quantitative part of this study was 64827 households serviced by Eskom's Edendale Customer Network Centre in the Edendale Area situated in Pietermaritzburg. This information was obtained from the general household survey Statistics SA (2016) for the Edendale area using Eskom Edendale CNC boundary. According to Krejcie and Morgan's Table for finite population, the sample size will be 381 for a target population of 64827 household.

3.6 Sampling

Samples must be representative of the population being studied; otherwise no general observations about the population can be made from studying the sample. This study employed probability and non-probability sampling.
Using Eskom boundaries, Edendale CNC services 58915 registered customers, this is inclusive of the commercial, but mainly dominated by residential sector, since the area is a black township. Since the area is predominantly non-paying for electricity, the study targeted all 64827 households and made no distinction between legal and illegal customers. The study employed both quantitative and quantitative methods, therefore the targeted population was divided into two.

3.6.1 Qualitative Sampling

Non-probability sampling was used for this section. Participants were selected according to their knowledge of the situation under investigation. In that regard, the participants for the personal interviews were chosen through the combination of purposive and snowball sampling methods. Participants were selected based on the fact that they had a minimum of five years' work experience within Eskom Distribution. The researcher first approached the participants requesting for permission to administer interviews. Upon acceptance, the researcher setup up an appointment for 30 – 60 minutes interview. Interviews were face to face and conducted at the respondents' offices.

Purposive sampling technique was followed. Eskom employees from the KwaZulu Natal Operating Unit were randomly selected based on their skills and knowledge. A total of 12 Eskom employees with relevant experience and expertise were selected as the sample. Out of 12 employees selected, only 9 were available for interviews and the researcher started receiving repetitive responses and no new themes emerged therefore researcher concluded that data saturation may have been reached.

3.6.2 Quantitative Sampling

In selecting the sample of households for the questionnaire based survey, a multistage sampling method constituting of cluster sampling, simple random sampling and systematic sampling, was utilised for this study. Probability sampling was used for the quantitative part of the study. Saunders et al. (2016) write that the chance of each person being selected from the target population is known and equal in this instance.

In the first stage, the geographical area of Edendale was split into 4 clusters using Eskom substations supplying electricity to consumers in the area. After numbering the substations, a simple random sampling method was used to select two substations out of the four. However, the selected substation area was too large. To further reduce it into small areas, cluster sampling method was utilised. In the second stage, the cluster sampling method was used to sub divide the area into smaller geographically discrete areas using substation feeders (high voltage lines)

supplying customers in the area. A simple random sampling method was used. In the third stage, systematic random sampling was initially preferred to identify 381 customers. The stratified random technique was proposed to be used, which could have divided the targeted population into groups. The stratification variables would have represented characteristics such as gender, age and income. Due to difficulties experienced in acquiring household characteristics, the researcher opted to use random sampling by utilising sub-wards and metering system that links customer name to a meter number and the upstream Eskom infrastructure which supplies that customer.

Table 3.1:Sampling method for quantitative study

1st stage		2nd stage		3rd stage		4th stage
Substation Name	**Customer base**	**Feeder Name**	**Customer base**	**Feeder Name**	**Customer base**	**Sample**
Azalia 20MVA	10587	Edendale NBEA	554	Edendale NBEB	742	381
Edendale 20MVA	9613	Edendale NBEB	742	Edendale NBEL	1145	
Imbali 2x20MVA	11824	Edendale NBEP	793	Dambuza NBDE	304	
Hospital 2x20MVA	15553	Edendale NBEL	1145	Dambuza NBDH	2114	
		Dambuza NBDD	567	Dambuza NBDJ	638	
		Dambuza NBDE	304	Hospital NBHD	4143	
		Dambuza NBDF	817	Hospital NBHG	2179	
		Dambuza NBDH	2114	Hospital NBHJ	429	
		Dambuza NBDI	997	Hospital NBHR	149	
		Dambuza NBDJ	638	Hospital NBHT	1593	
		Dambuza NBDK	942	Hospital NBHW	4383	
		Hospital NBHD	4143			
		Hospital NBHE	5			
		Hospital NBHG	2179			
		Hospital NBHH	801			
		Hospital NBHI	6			
		Hospital NBHJ	429			
		Hospital NBHQ	706			
		Hospital NBHR	149			
		Hospital NBHS	973			
		Hospital NBHT	1593			
		Hospital NBHU	186			
		Hospital NBHW	4383			

Questionnaires were drafted and conducted in English, However, the target population is predominantly a black township with isiZulu as the first local language.

Where there was a need to interpret, the researcher translated the questionnaires to isiZulu language. There were two questionnaires, isiZulu and English.

3.7 Construction of the instrument

The qualitative instrument consisted of 18 questions that were subdivided into 5 sections from A to E. Section A was on demographics, Section B was understanding factors contributing to electricity theft, Section C was on the effects of theft on the business operation of Eskom, Section D was on the strategies employed by Eskom to deal with electricity theft and E was on the perceptions and attitudes of Eskom employees about strategies employed to minimise electricity theft. The questionnaire is presented in Appendix E.

The study used two sets of questionnaires for the quantitative and qualitive methods, as the research instrument. The instrument for the research study was prepared by the researcher based on literature survey, with the aim of answering the research problem. The quantitative questionnaire consisted of 36 questions with 5 main sections from A to E. Section A was on biographical information, Section B was understanding socio economic conditions, Section C was on affordability, Section D was on culture of entitlement and Section E was on Eskom service. The research instrument was translated into isiZulu to accommodate non-English speaking people. The questionnaire is presented in Appendix D.

3.8 Recruitment of the respondents

3.8.1 Recruitment of the respondents for the qualitative study

For the qualitative part, the target population was the Eskom employees, who had experience in the field of customer services and engineering. Participants for personal interviews were chosen through the combination of purposive and snowballing sampling methods. Participants were selected based on certain criteria, for instance, the participants should have a minimum of five years' work experience within Eskom Distribution. The researcher first approached the nominated participants, requesting for permission to administer interviews. This process included the use of emails, telephones and face to face encounter to recruit participants. Upon acceptance, the researcher setup up an appointment for a 20 –

45 minutes interview. Interviews were face to face and conducted at the respondents' offices.

3.8.2 Recruitment of the respondents for the quantitative study

The target population for the quantitative part included the electricity consumers who were serviced by Eskom Edendale CNC, in the Edendale area Pietermaritzburg. The study targeted all electricity consumers in a form of domestic electricity usage and excluded commercial and agricultural electricity consumers. To identify participants for the quantitative part in the Edendale area, a multistage sampling method constituting of cluster sampling, simple random sampling and systematic sampling was utilized for this study. Msunduzi Municipality has an established numbering system for all households in the urban and semi- urban areas, so as to facilitate record keeping for their service delivery. In rural areas, the municipality uses numbering system together with names of sub-wards to facilitate service delivery. Similarly, Eskom has an established metering system that links customer name to a meter number and the upstream Eskom infrastructure which supplies that customer. All this information was utilised to randomly select participants.

To distribute the questionnaires, the researcher was assisted by an Eskom customer representative officer who looks after Edendale customer centre and is very familiar with the area and customers. The researcher approached the selected households and where there was an adult present, the researcher provided details of the purpose of the study.

Due to limited time and resources required for this study, the researcher hand delivered the questionnaires. To the respondents who were faster, the questionnaires were collected at the same time, but others were given up to a week. Ward councillors were approached and informed of the study taking place within their area.

3.9 Pre-testing and validation

Pretesting a questionnaire is a crucial element and is highly commended as an effective technique to serve as a yardstick of data reliability of good research design (Hurst et al., 2015; Van Teijlingen and Hundley, 2001). The quantitative

questionnaires for this study was given to a group of eThekwini residents who are similar to the target population. The residents were from Chesterville, this area was chosen based on close proximity to the researchers work office. The respondents for the pilot consisted of only 6 females. Based on the response from pilot participants, the questionnaire was amended and identified errors were corrected. The time taken to respond to questionnaires was noted. For the qualitative component, the research instrument was sent to 2 key individuals who were asked to comment on the relevance of the research questions and based on their opinions, changes were made.

3.10 Reliability of research instrument

The reliability of a research instrument is about consistency to which the research instrument yield the same results if the instrument were to be administered on repeat trials (Kimberlin and Winetrstein, 2008). The Cronbach alpha coefficient was used to measure the internal reliability of the measuring instrument. The Cronbach alpha coefficient for all the sections which were completed by all the respondents (n=71), was 0.765 which indicated that the measuring instrument is reliable.

3.11 Administration of Questionnaire

For the qualitative data exercise, the researcher conducted face to face interviews with the selected participants. Prior to distributing each questionnaire and conducting each interview, the researcher took time to explain to each potential respondent that the research is for academic purposes only and that there was no monetary reward for participating in the study. Potential participants were also being informed that their participation is on a voluntary basis, and that they could pull out of the exercise at any time without any negative consequences on them. The participants were also informed that information supplied by them would be treated with strict confidentiality. If the participants agreed to partake in the study, they were asked to sign an informed consent form, as evidence that they gave the researcher permission to interview them.

There were four attachments to the questionnaire. The first attachment was an ethical clearance approval from the University of KwaZulu Natal. The second attachment contained a brief overview of the research project and why the research

is conducted. The third attachment was an informed consent letter which highlighted the ethical dimensions of the research project and a statement on the voluntary participation in the study. The fourth attachment was the interview questions.

The interviews were audio recorded using a cellular phone and subsequently transcribed within the scheduled time frames using a word processor Microsoft Word. Hand written notes were also taken down during the interview, to aid the researcher with the analysis.

For the quantitative component, questionnaires were hand delivered to 381 households. The researcher was assisted by customer services representative who looks after the customers in the area. The questionnaires were hand delivered to the selected households. The researcher also delivered the questionnaires during community gatherings such as churches and community meetings. The questionnaires were administered to households or customers who were willing to participate and had given permission to be interviewed in a form of closed questionnaire.

Similar to the qualitative exercise, there were four attachments to the questionnaire. Attachment two to four were translated in isiZulu to cater for those who could not answer in English. Respondents were given up to a week to respond to the questionnaire. Only 71 household responded to the questionnaires. Data from the respondents were consolidated into Excel spread sheet and exported to SPSS version 24 for statistical analysis.

3.12 Data Analysis

In the qualitative section, interviews were audio recorded and subsequently transcribed for every interview session. The themes that emerged from the frequency of several key words and phrases during the interview were not and recorded.

Quantitative data obtained from the respondents were coded and consolidated into Excel spread sheet and exported to SPSS version 24 for statistical analysis. Descriptive statistics and inferential statistics were utilised to analyse the responses collected for the study and presented in the form of tables, diagrams and graphs.

Associations between the factors were tested using the Pearson's Chi-square test. The outputs from SPSS were presented in a graphical and tabular format.

3.13 Ethical Considerations

The etymology of the word ethics refers to the process of knowing what is right and wrong (Disoloane, 2010) . According to Manyaka and Sebola (2013) ethics "mean the code of moral principles and values that governs behaviour of a person or a group with respect to what is right or wrong; good or bad". Research Ethics outlines the principles and ethical standards that are required to guide behaviour of the researcher to those who become subject of researcher's work.

Due to the nature of the research subject, ethics is of highly priority. The researcher first requested permission to conduct the study from Eskom and University of KwaZulu Natal. The researcher obtained an ethical clearance/permit prior to the commencement of the study. Information obtain was solely for this study not for other personal reasons or criminal investigation. The confidentiality and protection of participant was agreed upon with the sponsor. Participation was voluntary, and information obtained was also be treated with confidentially. Personal information was not required from participant, including photographs and videos. This was explained clearly to the participants and to the entire research team. Participants who voluntary decided to take part on this study were informed that they were required to answer questions truthfully to the best of their ability and there were no incentives. The researcher presented data as obtained without manipulation.

3.14 Summary

This chapter presented the research methodology that was employed in this study to establish the effects of electricity theft in KwaZulu Natal Operating Unit. The chapter explained in detail the research design, sampling strategies, population and ethical clearance. The chapter explained why a mixed method approach was selected to collect primary data. Research ethical codes were adhered to in this study. Research data findings is presented in chapter 4.

Chapter 4 : Presentation of Results

4.1 Introduction

The previous chapter elaborated on the research methodology adopted for this study. The topic of the study, “the effects of electricity theft on Eskom Distribution in KwaZulu-Natal Operating Unit,” therefore the combination of qualitative and quantitative data collection approach was considered to be the most appropriate strategy in an attempt to achieve the objectives set out in this study.

Data gathered for this study provide insights into the phenomenon of electricity theft in Eskom Distribution. This chapter analyses, interprets and presents the data gathered for this study per design methodology. The first section is qualitative followed by quantitative analysis. The relevance of the findings is discussed in this chapter, in line with the objectives.

4.2 Qualitative Analysis

A qualitative design was considered appropriate for this study since it allows for an in-depth insight to the factors and effects of electricity theft. The data collection through phenomenological interviews intended to get an insight into the factors and effects of electricity theft based on the participants experience and interpretation. The results are premised on the need for a sustainable solution to address and manage electricity theft in South Africa. Semi structured interviews were conducted with Eskom employees from Maintenance and Operations, Customer Services and Asset Creation consisting of Managers, Supervisors, Engineers and technicians. The aim was to acquire an understanding how electricity theft affects Eskom and how can Eskom improve strategies employed to combat electricity theft. The results will assist and serve as a guideline for effective strategy formulation and management of electricity theft in Eskom and Municipalities.

4.2.1 Demographic profiles of the respondents

A summary of the respondents’ demographics elements which include gender, designation, field of expertise and years of experience is indicated in Table 4.1. It presents the demographics for the Eskom employees who were directly and indirectly impacted in their daily activities, by electricity theft.

Out of 9 respondents, 7 were males and 2 were females. This implies that there were more males in the sample than females. This is consistent with the general trend in the energy sector, where males are dominant. With regards to the years-of-service terms, all of respondents had been employed for more than 5years by Eskom, with 66% being in management positions.

Table 4.1: Respondents demographics - Eskom

Respondents	Gender	Designation	Field	Years of experience
Respondent 1	M	Senior Engineer	Engineering	35
Respondent 2	M	Engineer	Engineering	5
Respondent 3	F	Manager	Customer Services	16
Respondent 4	M	Manager	Customer Services	20
Respondent 5	M	Supervisor	Customer Services	35
Respondent 6	M	Manager	Engineering	37
Respondent 7	M	Technician	Engineering	10
Respondent 8	F	Anonymity requested	Anonymity requested	24
Respondent 9	M	Manager	Engineering	9

4.2.2 Reduced transcription

The instrument used to collect qualitative data was the semi-structured interviews. A total of 9 Eskom employees with relevant experience and expertise participated in this study. Out of 9 interviews, 8 were conducted face to face in the participants' offices and 1 was telephonic due to the respondent's location. All participants were informed that the interview will be audio recorded and all respondents agreed to be recorded. The interviews were audio recorded using a cellular phone as subsequently transcribed within the scheduled time frames using a word processor Microsoft World. Hand written notes were also taken during the interview to aid the researcher with the analysis. The interviews were analyzed as per qualitative phenomenological method. Summary of the key points or themes were formulated that emerged from the interview.

4.2.2.1 Understanding the factors contributing to electricity

Question: *What is your understanding of the concept of electricity theft within Eskom Distribution?*

The respondents interviewed appeared to have the same understanding of what electricity theft is about. They all agreed that electricity theft is the unauthorised or illegal use of electricity. It is a concept of non-payment for services. One of the respondents further added that electricity theft is about using electricity without the consent or without the right to use it. They pointed out that electricity theft manifests in various forms, resulting in revenue losses for the business.

a. Illegal connection - connections that are hard wired illegally directly to an electrical infrastructure on the low voltage and or medium voltage without metering. This happens in places where there is an electrical infrastructure and the consumers are unknown to Eskom or the utility.
b. bypassed /tampered meters - occurs when the legal customer bypasses the meter to avoid paying for electricity usage. This act happens on the prepaid and conventional customers. Prepaid customers bypass meters to avoid purchase of tokens and conventional customers bypass meters to evade payment for electricity usage or to receive a bill that is low in terms of consumption.

Respondent 4 identified electricity theft as

> *"a form of self-reconnection, whereby a legitimate customer is disconnected by authorized personnel due to non-payment and the customer reconnects him/herself illegally".*

Respondent 2 said,

> "*When you talk of electricity theft, what comes into mind is losing money. There could be several reasons why people steal electricity, but to Eskom as a business, when they generate and deliver electricity, there should be revenue received and collected.*".

The respondents stated that electricity theft is a major challenge for the country and is becoming uncontrollable. It was mentioned that there is a perception that electricity theft is rife in the traditional township, but it occurs across all sectors.

Large power users in the various sectors temper with meters and there is a much bigger revenue loss impact due to a larger volume of power consumed. All the respondents agreed that electricity theft is not only in one segment of customers, but occurs across all sectors.

- Question: *In your opinion, what do you identify as the main factors contributing to electricity theft?*

There were several factors and scenarios presented by the respondents, as to why people or customers steal electricity. This will be discussed per item.

- Socio Economic

Most of the respondents felt that the socio-economic condition in our country is one of the major contributors to electricity theft. They pointed out that unemployment levels are at all time high and the country is dealing with a situation where most of the population earns very little and more people live below the poverty line. Respondent 1 said,

> *"Socio economic, the root is unemployment and poverty. We have not properly managed it. If there is no income there is no income. Lot of communities are relying on grant income to survive which in a long term is not sustainable. We need to get employment".*

Respondent 7 felt that:

> *"The economic factor is the contributor especially amongst domestic users most people steal electricity because they can't afford".*

The socio-economic challenges may be attributed with the structure of the economy and the complicated history of apartheid. Respondent 1 felt that:

> *"high unemployment incentivizes a whole lot of social ills. The trick is turn that around, to create more employment and the only way you can do that is to grow the economy".*

When the economy is not growing, employment opportunities decline and the social ills like theft thrive.

> *"the country has not matured to a state where most of the population is employed and contributing positively to the economy".*

- Affordability

There were contrasting views in terms of affordability; most of the respondents felt that electricity has become too expensive for households relying on social grants. Respondent 1 said,

> *"more than non-payment I think the issue is affordability. There are communities that really live below the bread line".*

This statement was supported by respondent 5 who said,

> *"there are communities or households that live below the poverty line and cannot afford to pay for electricity".*

Since electricity is a basic need, those who are legitimate customers bypass meters to avoid payments. However, respondent 4 pointed out that:

> "*the bulk could be affordability but even if it is an affordability issue, the government does provide other forms of relief such as Free Basic Electricity to the indigenous poor household."*

Two respondents felt that it is not that communities cannot afford electricity, it is all about priorities.

Respondent 2 said,

> *"some say electricity is expensive but they can afford to buy airtime, data and DSTV without complaining. Why should electricity be free. It is not that communities can't afford electricity it is all about priorities. Why is it when the customer is disconnected he/she immediately makes payment if affordability was really an issue?"*

It was mentioned that some customers say electricity is expensive, but they can afford to buy airtime, mobile data and Digital Satellite Television (DSTV). Furthermore, the price of electricity was not highlighted as an issue, but in fact it was mentioned that people prefer to buy other things, including fuel no matter the price hike and sometimes live beyond their means. It was noted, based on the respondents' experiences, that households headed by pensioners or senior citizens in rural areas buy electricity, as compared to those headed by young and middle-aged adults in the townships.

Respondent 7 strongly felt about the issue of affordability, stating that:

"electricity is becoming more and more unattainable for many because most people are living in poverty and paying for electricity is a hustle for them. Even though they need it, they would rather pay for other things."

In other sectors like agriculture, commercial and industrial, the respondents felt that there is just lawlessness because those sectors can afford to pay for electricity. Respondent 1 said,

"it is just greed from commercial, agricultural and industrial; pure act of criminality".

- Lawlessness

Some respondents felt that the issue of electricity theft has to do mainly with lawlessness, especially for people who can afford. Respondent 7 pointed out that :

"this is embedded in the socio-economic factors, socially, we are a lawless society where certain laws are not enforced".

They argued that there is a lack of consequence for those who are caught stealing or bypassing the meter. There are no harsh sanctions against those who are stealing. According to respondent 6,

"when one member of the community starts getting free services, this serves as an incentive for the rest to join in."

Respondent 6 further referred to this as a snow ball effect and highlighted that:

"we are suffering from that since it is a culture that creeps into the community and if there are no consequences, you can do it and the neighbour also wants to get free electricity".

Based on observations throughout the areas, respondent 9 concurs with the notion that the majority of the people are not paying because there are no harsh consequences imposed by Eskom.

"in some areas, if there are 3 or 10 customers within a transformer zone, who decide not to pay for whatever reason, and if you go there after 2 or 3 months, the whole area or the majority of them does not pay. Customers know that there are no harsh consequences from the legal point of view".

Respondent 7 felt that there are few people that get prosecuted and very few people get arrested or fined.

"On the theft of electricity few people get prosecuted and very few people get arrested or fine most people get away with it becomes easy when I say

lawlessness I mean both on the party of those who are supposed to enforce the law and follow the law".

Furthermore, he made an example of Soweto, arguing that:

"the whole culture of not paying for services is not an issue of economics for some people, but an issue of unwillingness to pay because electricity theft is viewed as unpunishable offense."

- Culture of entitlement

All of the respondents felt that there is a national culture of entitlement for services, especially those deemed to be a "right" by the Constitution. The concept of non-payment for services has its own origins in South Africa. The respondents mentioned that there are various factors why people feel entitled to free services:

Respondent 1 felt that the issue of entitlement stems from non-payment for services.

"Non-payment has its own history back dating to the 1970's."

Respondent 5 said,

"in South Africa, during the time of struggle/ apartheid, politicians encouraged people not pay for services, they used that strategy to fight the apartheid regime. Even after the apartheid regime has passed, the non-payment of services did not end. Some people continue with that mentality of not paying for government services. People who steal electricity, it is not that they cannot afford, people feel that it is within their right to get it free. Self-entitlement is a government thing, mentality of saying we don't have to pay for government services. I question whether people are still using the strategy to fight the current government".

- Promise of free basic electricity

Some respondent felt that most customers feel entitled to electricity and think that electricity should be free as it was promised to them. Respondent 3 said,

"there is a national culture of entitlement for services especially those deemed to be a right by the constitution." Respondent 6 argued that "There are multitude of reasons and scenarios of why, from promises of free basic electricity, probably extended time period in service delivery and frustration."

Respondent 8 shared the same sentiments stating that:

"Twenty-four years ago, we made a promise that everyone will have access to electricity and we have not provided that access quickly enough."

- Access to electricity

All of the respondents pointed out that in places like KwaZulu-Natal, there is a huge electrification backlog and to achieve universal access may take years. The electrification program started almost 30 years ago, and South Africa has not reached universal access. They mentioned that the slow delivery of electrification projects has contributed significantly to the rise in illegal connections. Respondent 8 said

"we have not provided access to electricity quickly enough. I believe impatience is the root cause of illegal connections".

Respondent 5 felt that in areas where electrification backlog is high people find other means of connecting themselves illegally.

"In areas like KZN where electrification backlog is high, people steal electricity because they have been waiting for too long for this service therefore end up taking matters into their own hands."

- Skilled unemployed people and contractors

Respondent 5 mentioned that one of the major issues with electricity theft is that there are skilled unemployed people in communities. The respondent made an example of the process of executing electrification projects.

"The execution of these projects is done by contractors and part of the requirements is to employ locals for general activities. When the project is complete and Eskom contractors have left the area, the skills acquired from executing that project remains behind. The very same contractors and locals who are skilled to work with electricity then offer communities illegal services in an attempt to raise money."

When the respondents were asked about which factor they considered as the main contributor, these were the responses, presented in Table 4.2.

Table 4.2:Respondents view on key factors contributing to electricity theft

Respondents	Key Factors
Respondent 1	Socio economic (Unemployment and Poverty)
Respondent 2	Lawlessness
Respondent 3	Culture of entitlement
Respondent 4	Culture of entitlement
Respondent 5	Slow access to electricity and the culture of entitlement
Respondent 6	Socio economic (Unemployment and Poverty)
Respondent 7	Affordability and Lawlessness
Respondent 8	Affordability and socio economic
Respondent 9	Culture of entitlement and lawlessness

Question: *What are the factors that Eskom need to manage in order to minimise theft?*

The respondents felt that Eskom needs to electrify customers quicker. Respondent 4 pointed out that Eskom is a government agency and only implements government policies. One of the government policies is to electrify households. The respondent further said,

> *"If the government does not have enough funds to electrify people, obviously Eskom cannot accelerate the electrification program, as it is dependent on government funding (Department of Energy)".*

Respondent 1 felt that Eskom will have to go back and electrify homesteads that were left out when schools and clinics were electrified. The respondent argued that

> *"Eskom has put in an infrastructure and bypassed homesteads and that was a priority then, but that infrastructure is now used illegally by those who desperately need access to electricity".*

The respondents felt that the way of controlling people without access is to provide them with legal and safe electricity. Over and above, people who are funded by the government, there is another category of customers called direct customers who are self-funded, meaning that they use their own money to fund their own infrastructure. Respondent 4 felt that

> *"Eskom should reduce their bureaucratic processes to allow for quick connections, especially when the customer has committed by the way of payment".*

Respondents complained that it takes too long to connect a customer who has paid and as a result, there are many overdue connections that have passed the set timelines.

Two respondents felt that Eskom needs to manage network visibility and take ownership of their network or infrastructure. Respondent 5 pointed out that Eskom is not visible in communities where it has invested money.

> *"There is lack of visibility and action to report cases of electricity theft."*

Respondent 2 pointed out that Eskom needs to monitor buying patterns and follow up on disconnections. There are tracking mechanisms in place. The respondent felt that

> *"the current process allows for disconnections in the hope to reconnect on the day the customer makes a payment, but what happens in between that period or if the customer cannot afford to pay. It simply means a customer can reconnect illegally because Eskom will not come back to investigate"*

In relation to projects, respondent 3 felt that Eskom needs to manage stock better.

> *"If we did not have material lying around after a project, the material would not be available for an illegal connection"*

Respondent 2 pointed out that

> *" when normalisation projects are done, Eskom needs to remove an illegal supply and not add a second point without disconnecting the illegal or bypassed point. In areas where Eskom has normalized illegal connections, Eskom needs to get a buy in from communities for safety reasons."*

In dealing with large power users (LPU), respondent 2 pointed out that Eskom has a view of all LPU's and can quantify consumption every month without an estimate. Eskom needs to manage faulty meters and incorrect settings by conducting regular audits. The respondent was concerned about the large customer base when it comes to small power users (SPU) and prepaid users (PPU). They pointed out that managing increasing customer base may require more resources,

> *"Eskom can outsource some of the work and focus on red areas for that particular time and that can be done by investigating how much Eskom is losing and the investment required to recover that money and balance it"*

Respondent 9 felt that there is a lack of consequences and lack of action taken against those found stealing electricity. According to the respondent,

"Eskom must take a stronger stance and switch off communities for days in areas identified as a high volume of theft, until an agreement is reached with communities that illegals will be removed and never to be reconnected".

The respondent was aware that there are consequences on legal customers who complain and that they may be protesting, but the respondent is of the view that Eskom should adopt a military approach and deal with the consequences later.

Question: *Have you personally experienced the effects of electricity theft in Eskom, in what way?*

Respondents described their experiences as being frightening. According to them different forms of electricity theft have different effects. In terms of illegal connections, the respondents felt that it is negatively impacting on the quality of supply to paying customers.

In terms of quality of supply respondent 2 said,

"some customers would complain about the quality of supply and we are not sure whether this is a genuine complain or a reason why they bypass meters. They believe that Eskom does not deliver quality".

Respondent 3 said,

"illegal connections are unsafe, resulting in injuries and death to unrelated individuals, as well as damage to property (fires)".

All respondents were concerned about the loss of life, especially among children.

Respondent 2 said,

"people in communities die and some cases are not reported. Some police stations where illegals are rife would tell you that children and adults die, and the postmortem results would point to electrocution. It becomes worse under rainy conditions because the illegal cables absorb water which energises the route where people walk".

Respondent 7 narrated his experience with electricity theft and said,

"in an area where I grew up there was a squatter camp across the block I was living in. In winter we always had power outages. I think when you live in a township close to a squatter camp that is not properly managed by the municipality chances of experiencing the effects of theft are high. It is affecting us as a country; we are seeing it in a tariff. I'm not sure how much we could quantify it and work it back to the era of load shedding and say had

we not had theft maybe the impact of load shedding would not have been as much".

Respondent 3 felt that electricity theft has a direct link to tariff increases and all South Africans are personally affected by the increase.

"Tariff increase above inflation has contributed by lack of payment from revenue collection; the estimated figure runs into billions, all of us are paying a tariff increase because of theft to some extent".

Respondent 8 said,

"as a south African citizen, I have been affected by electricity theft through the tariff increases. If we had a better handle on illegal consumption whether through an illegal connection or a tamper I don't think we would be asking for high tariff increase".

Two respondents mentioned that they have had a direct encounter with effects of theft at work while executing their duties. These encounters included

- Dispute with customers over non-payment

  Respondent 2 said,

  "customers normally say that they don't see a reason or benefit why they should pay for electricity. Customer can be illegally connected but tend to make up stories".
- Refused access to the meter and customers will sometimes use violent means to block access.

According to respondent 9,

"I was personally monitoring Dambuza area for a specific project, we had an engagement with the community leaders with regards to that particular project in 1 transformer zone at Dambuza. A decision was taken with community leaders before we switched them off to say all of communities supplied from transformer zone 1 will be switched off since they were not paying. The problem came when we switched them off, the mistake we made was to send operators on the ground to remove fuses for that transformer zone. The community blocked the staff, I was called and went to site and I was blocked eventually we had to switch back the supply. We were threatened, and we had to weigh our options whether to choose life or fight electricity theft".

The overall effect of non-payment for electricity is the revenue loss to Eskom business. When asked about bypassed meters, the respondents pointed out that the effects are burnt houses and injured children, as the meter cannot trip when it should have. Respondent 4 pointed out that there had been situations where Eskom had to write off some money because some of the illegal connections are connected beyond a customer's meter and the consumption triples. Respondent 4 said,

> *"we've had situations where we had to write of some money because some of the illegal connections are connected beyond the meter and the owner of the transformer end has to foot the bill for illegal connections. Due to the illegal activities, Eskom had to reverse or adjust the bill by writing off some of the amounts".*

The major effect is the financial loss to Eskom, since customer no longer pay for consumption used.

As consumers of electricity, some respondents felt that the quality of supply has deteriorated due to illegal connections. They were of the view that tariff increase has been above inflation due to the lack of payment from revenue collection; the estimated figure runs into billions and all South Africans are paying a tariff increase because of theft to some extent. Respondent 7 felt that electricity theft is costing the country,

> *"we are seeing it in a tariff. I'm not sure how much we could quantify it and work it back to the era of load shedding and say had we not had theft maybe the impact of load shedding would not have been as much".*

4.2.2.2 Effects of electricity theft on the business operations of Eskom

Question: *Do you think electricity theft is costing Eskom?*

All of the respondents agreed that theft is costing Eskom in terms of revenue loss. Eskom is losing billions of rands and this also applies to municipalities and other utilities in other countries. Respondent 1 said,

> *"the municipalities are even facing a bigger challenge as much as Soweto is owing R6-8 billion, municipalities are owing Eskom R11billion and they cannot recover that money due to electricity theft".*

Respondent 4 and 9 made reference to Edendale and said revenue loss amounted to more than 80% on average. Respondent 9 said,

> *"Eskom KZNOU is struggling to recover money at Edendale area. Eskom is losing close to R13 million every month, as 90 % of electricity delivered in that area is not paid for".*

The respondents pointed out that electricity theft is costing Eskom in terms of network expansion and network strengthening. Respondent 7 said, "the strengthening of electricity infrastructure is based on the load seeing on the network and embedded in that load is theft. This was supported by respondent 4 who alluded to the that consumers who do not pay for electricity use electricity inefficiently as it does not affect their pockets.

> *"In areas where electricity theft is prevalent, consumers use electricity inefficiently., plugging all appliances and drawing more than what they should be drawing. This mainly affects lines and transformers, as the equipment operates above allowable limits and as a result, the transformers blow or fail. In areas where there is electricity theft, the transformers blow and get replaced almost every week".*

The respondents felt that electricity theft is costing Eskom in terms of reputation and image. Respondent 7 said,

> *"there are areas whereby, because of theft, people perceive outages occurring as Eskom not maintaining or taking care of their network/infrastructure, yet it is because of theft. With outages, customers complain and from a resource point of view, Eskom dispatches resources to restore supply to non-paying customers. In addition, there is overtime payment for the operators after working hours".*

Respondent 5 shared the same views and highlighted that dissatisfied customers with poor quality of supply could potentially report operational issues to executives.

> *"when there are unplanned outages, responding to faults is costing Eskom in terms of transport, manpower, overtime and to attend to unnecessarily breakdowns. You might find that in one transformer there are 20 connected customers but only 4 are loyal customers, when that transformer is faulty*

Eskom has to replace and if it not fixed timeous, customers can escalate this straight to executives. The 4 loyal customers to Eskom have every right to complain, Eskom is obliged to restore supply to them irrespective of whether those who are connected illegally to the transformer have supply or not"

Respondent 8 said,

"*it is costing us in terms of image because customers see that there are other customers stealing and there is a perception that we are not doing anything about it".*

When respondents were asked how does electricity theft affect the running of Eskom business, many felt that Eskom is losing billions in revenue through theft. However, respondent 1 felt that it is all relative when you compare Eskom revenue of R177 billion for 2016/17 financial year, against the losses. Due to cross subsidization, Eskom may not be impacted much by theft at a corporate level.

"It is all relative you are talking billions, but Eskom has a revenue of R177 billion for 2016/17 financial year, theft is not insignificant it is draining Eskom resources. In the past we've tolerated this act but now it is becoming intolerable because of all other compounding issues within Eskom. At the end of the day it is cross subsidization."

All of the respondents felt that electricity theft has an effect on operational cost. Respondent 3 said,

"it extends resources thinly on ground (unnecessarily so). Resources in terms of funding are spent on monitoring and remedial action, when these funds could be allocated more fruitfully to benefit the customer base through maintenance and expansion of the network."

The respondents felt that the safety of employees and public in general is affected by electricity theft. The accompanying risk is sending operators to maintain and restore unplanned outages. For Eskom operators, it is unsafe to work in an environment where there are illegal lines and the violent threats received when attempting to disconnect illegals. The respondents mentioned that loss of life, either from public or Eskom, is one of the major concerns. There are a number of reported cases where members of the public have been either injured or fatally electrocuted due to electricity theft. Respondent 7 cited an incident that happened at Empangeni

area, when one of the families lost their child through illegal connections. The family blamed Eskom and according to the respondent,

> *"the parents were right to blame Eskom because Eskom has the operating license as the distributor in that area. The role of Eskom is to ensure that it delivers safe and reliable supply".*

Respondent 4 mentioned that at one point, due to an incident that took place, Eskom Distribution was threatened that the operating license will be revoked if the issue of illegal connections is not sorted.

> *"If somebody dies, Eskom reputation is at stake we can't be killing people. Department of labor at some cases threatened to revoke our license if we don't sort out the connections".*

4.2.2.3 Strategies

Question: *What are strategies employed by Eskom to minimise theft?*

The respondents mentioned Operation Khanyisa as one of the strategies employed by Eskom to minimise theft. Eskom is subscribed to Operation Khanyisa, which is a national partnership campaign aimed at educating South Africans about the impact, consequences and dangers of electricity theft, and encouraging people to report electricity theft. Respondent 7 mentioned community campaigns and said,

> *"KZNOU has a campaign where it visits different areas and inform communities about electricity theft and the dangers thereof, especially with school children because they are trying to change the perception of young children about what electricity is and how to use it legally and properly".*

All of the respondents mentioned normalisation projects as one of the strategies adopted by KZNOU. Instead of disconnecting supply by removing or reaping out an illegal connection, the normalisation legalises the connection by removing an illegal connection and replacing it with a legal and safe connection. Respondent 5 said,

> *"Normalisation is a good strategy, Eskom might reduce losses if managed properly"*

Another strategy that respondent 7 felt it is at the forefront of the battle is the universal access program (electrification) that is on top of the agenda for KZNOU.

Four respondents mentioned feeder load balancing, which is used to determine anomalies on the network. It is used to balance energy delivered (energy inflows and outflows) to measure losses. Where there is identified losses, audits are

conducted and corrective action implemented by means of disconnecting illegal activities and to ensure that meters are functioning properly. Respondent 8 said,

> *"what we do in terms feeder balancing is to try and identify where the losses are, once we know where we believe the losses are, there is an audit that we do. We send people out to go and audit the installation, to ensure that meters are functioning properly, to pick up any supply that has been installed not through Eskom processes (illegal connections)".*

Respondent 3 mentioned that there is a focus on exception report. According to respondent,

> *"the report monitors movement on terminated points and where it say low consumption or no consumption. For a low consumption you might find that the customer has bypassed the meter so that the reported consumption is not as high as it should be. Most customers who fall into this category, their supply is tampered with by technical trained people."*

Three respondents mentioned the use of technology (split metering) to combat meter tampering in residential sector. According to them, split metering is implemented in areas with high electricity theft. There is a drive to install split meters for all new electrification projects (connections).

Question: *Which strategy would you consider effective and why?*

When questioned about which strategy they considered effective and why, most respondents felt that all strategies are effective, provided they are fully resourced. No single strategy can function on its own, positive results are realised through a combination of strategies.

Respondent 1 said,

> *"the most effective strategy is to mobilise the community to be responsible power users by educating them on the benefits of distributing electricity legally and safely, which means no injuries, no loss of life and it is sustainable. Eskom can use the bottom up approach to get communities involved".*

Respondent 2 felt that all Eskom employees should be involved in tackling theft. Respondent argued that change in technology will not work if implemented alone.

"Eskom needs to make the issue of losses owned by all not a departmental issue. When customers see an Eskom branded vehicle they should comply. Customers know how to distinguish Eskom people. They have a problem when we try to address electricity theft issue and it becomes personal because they deal with Eskom people who have never said anything. Customers should know that it does not matter whom they talk too, they will still receive the same treatment and service. Change of technology will not work on its own, people advance in how to manipulate technology. Eskom needs to monitor people physically. When Eskom recovers money they can afford resource".

Respondent 3 felt that monitoring consumer behavior through no and low consumption reports; movement on terminated reports is an effective strategy when punitive action is taken timeously.

"Monitoring exception reports is effective if done timeously, as it minimises the risk and engages the customer quickly, whilst it is still more affordable for the consumer to bring their accounts up to date".

Respondent 4 felt that a good strategy does not deliver the desired results if not resourced. The respondent mentioned the issue of technology, referring to split metering and smart meters that they are good technologies but expensive. If Eskom wants to roll out these meters, they will have to invest a lot of money. The respondent mentioned departments like energy protection, who are limping due to resource constraints and their role is to recover revenue.

"All strategies are effective, you need to resource them. You can have a good strategy but if it is not resources you will not get desired results. We have good technology split metering, smart metering but you need to have money because it is a bit expensive. A strategy of having a department that is looking after this which is energy protection unfortunately half of the people are not there. Some of them have left and some have passed on and we are all aware of staff embargo we cannot replace people. Some departments are running with one or two people for a department that needs to go out you can't rely on contractors you need internal permanent people to go out and police electricity. Currently Eskom is resource constrained".

Respondents 5 and 6 felt that investing in new technologies will bring about change, network visibility in such a way that if anyone is tampering with the network, Eskom

would detect in real time, the portion of the network tempered and take corrective measures.

Respondent 5 said,

> *"invest in technology for visibility of our networks and if someone tempers with the line, we must be able to disconnect remotely".*

Respondent 5 said,

> *"You've got to have some indication of where the problem is (metering) then form interpreting that you've got to have action on how to stop it. I'm not referring just to rural theft, I'm referring to LPU situation which is not appearing to be treated by customer services and that is easier to manage because they are not as many. Big hub paying customers should be easily manage, why is billing and revenue not being collected? In Eskom there is a big focus on rural theft and not on the LPU. There is less of them, but the impact is bigger. There is a lot of money being lost just through incorrect billing, no billing, meter tampering and wrong CT ratios. It has been like that for years and no one seems to query a mismatch between what demand (consumption) and billing".*

Respondents 7, 8 and 9 strongly believed that electrification, normalising and smart meters are effective strategies because they eliminate the reasoning that people do not have access to electricity and that is why we are stealing. The respondents agreed that those customers who do not have access to electricity, Eskom needs to find a way of connecting them. Those who have not or connected illegally, Eskom needs to find a way of legalising them and make their connections safe.

Respondent 7 said,

> *"the one where people are connecting themselves because they've been waiting for too long that one is within Eskom's power. If Eskom can focus on this one, electrify not live islands or make promises that we cannot keep that would surely be the most effective strategy".*

Respondent 8 said,

> *"I believe that the only effective strategy is to provide customers with a legal supply of electricity. When you look at the legal customers who are stealing we have processes and reports in place that would identify customers that may well be stealing. We need to action that but again what is happening*

because of all the constraints in the organisation we don't have the resources necessary to deal with this huge volume. We can't deal with it as quickly as we want too. In terms of customers who have tampered there are process in place that identifies them we need to action according, we do action but not as fast as we would want too. The limitation at the moment is how we handle things when we find an illegal connection because the expense of removing an illegal connection and a week later if not less the illegal is reconnected. We don't have the capacity to police all the areas where we have removed the illegal connection".

Respondent 9 said,

"To those specific area where there is high volume of illegal connections, Eskom legalises those areas. Strange enough when you go to those areas where we've had normilisation projects after 6 months or 2 years to the projects, they've bypassed the meters or bypassed fuses just to get free electricity. And if you conduct audits 40-80% are non-buyers. Since the neighboring customers are non-paying they influence them due to the fact that there are no consequences to those who steal electricity".

Question: *What other strategies or activities does Eskom need to manage in order to minimise theft?*

The respondents felt that Eskom needs to monitor the following strategies or activities:

- Plan to complete the electrification backlog and manage expectations and achievables

  Respondent 1 said,

  "We need to have a plan to complete electrification We have not done electrification planning efficiently".

- Eskom to deal with its employees first, before dealing with customers (Clean house)

  Respondent 2 said,

"Eskom must deal with its employees first before dealing with customers. Some think that Eskom is a ship that will never sink. Our data is incorrect and requires a lot of cleaning up.

- Improve processes and introduce new technologies or innovative solutions to deal with the issue of data.

  According to respondent 2, Eskom should investigate real time capturing of data.

  "Eskom needs to consider using the EDA concept to deal with PCA's files. Our data is incorrect and requires a lot of cleaning up. Eskom does not have a blueprint of the low voltage where customers are consuming. Some customers bypass the meter because they are not captured accurately on the system and as a result, they cannot buy tokens".

Respondent 3 said,

"Sticking to asset management processes (MATS, in the case of meter movement), in relation to material management (cables, meters, poles, etc.) Diligent reconciliation of material provided to contractors and staff for jobs, during and after completion of all projects. Air tight contracts in relation to all processes, with the contractors. Actionable recourse for any deviations".

- Focus on exception reports and monitor customer buying patterns

According to respondent 4,

"when you have terminated someone for non-payment they self-reconnect, and we are losing a lot of money. If you have terminated the supply and the person self-reconnects the next step is to do hard connections where you open the links unfortunately that can only be done by Eskom permanent operators from the CNC. There is a quite number of self-reconnected customers where we need the CNC's to go out and perform hard connections. The CNC have other priorities. We need to ensure that we resource the entire business correctly by looking at those exceptional reports. Without sufficient resources we battle as business to work through some of the strategies".

- Resource Revenue Protection Department

Respondent 5 said,

"Revenue protection exist by name only, it has been neglected and requires support from management in terms of resources".

- Improve Eskom physical visibility, as well as network visibility
  According to respondent 7,

  "Eskom needs to improve on network visibility such that if anyone is tampering with the network, Eskom would be able to see that this portion of the network has been tampered with in real time".
- Apply harsh penalties
  Respondent 9 said,
  "Eskom needs to disconnect legal customers who have tampered with meters and those who are perpetrators should be prosecuted".
- Normalisation
  Respondent 8 said,

  "instead of removing or reaping out an illegal connection, Eskom need to legalize or normalize however, this process is too slow. The target is about 6000 for this year".
- Amnesty
  Respondent 4 said,

  "Some people have been calling for amnesty making reference to Edendale in the past. Politician when you first rolled out split meters amnesty was granted to some households and why are not doing the same thing now".

4.2.2.4 Perceptions and attitude

Question: *Do you think Eskom has adequate resources to deal with the challenge of theft?*

Some respondents thought that Eskom does not have adequate resources to deal with the challenge of electricity theft. They pointed out that there is this huge growing customer numbers, but the resources required to tackle theft is not increasing at the same rate. Respondent 8 mentioned that in KZNOU, there is over a million customers and this include prepaid, SPU's and LPU's. There are limited resources and those who monitor these customers in terms of revenue collection. Currently,

Eskom relies on physical checkups for network tampering because there is no systematic tool for checking. They complained that the budget allocated for energy losses is not adequate. According to respondent 1,5 and 7 electricity theft is driven by factors external to Eskom and that requires a political intervention and will.

This view differs from that of two other respondents who argued that Eskom has adequate resources, but lack a clear strategy in dealing with electricity theft, or somehow the existing strategies are ineffective. Respondent 2 said,

> *"We've been normalizing, connecting and having campaigns, but we are not seeing improved results from the financial point of view".*

According to them, there are a lot of Eskom inefficiencies that hinder the successful implementation of existing strategies. Respondent1 felt that Eskom alone cannot deal with the issue of theft. It requires a strategic direction, it is a socio-economic problem and requires political will in and outside Eskom, as well as working with the communities.

> *"I don't think it is an issue of resources It is an issue of will and political will to actually do what needs to be done. It requires a strategic direction, it is socio economic problem and requires working with communities".*

Question: *Do you think Eskom is doing enough to deal with this issue, and why?*

Eight respondents felt that Eskom is not doing enough to deal with the challenge of electricity theft. According to them, there are several reasons listed below, as to why they think Eskom is not doing enough.

Respondent 1 felt that there is no end to end strategy.

> *"I see couple of traces of puzzle pieces, but I don't see the puzzle coming together properly and working but there are initiatives like where we are measuring losses, trying to determine and balancing feeders".*

According to Respondent 1, it is the leadership that creates economic growth, up until that happens, this scourge of theft will always be with us.

Respondent 2 felt that energy losses have been ignored by the business so much that most of the employees do not know what losses are. They can give technical definitions because it was taught at school. Respondent further adds that,

> *"Eskom has ignored losses to a point that the problem is bigger, and we can't deal with it and we are realising that we need a solution".*

According to Respondent 2, Eskom lacks a clear plan and depends on who is bringing a new idea.

Respondents 3 and 6 felt that there is no leadership will in dealing with the challenge of theft. Respondent 3 said,

> *"Where losses are occurring, and proof is available, decisive corrective and punitive action is not seen as being done. Processes are in place, it is the execution in some environments, that is lacking, mainly because of the focus, or lack thereof, by the direct leadership".*

Respondent 5 felt that Eskom can only deal with this challenge if they invest in technology and man power.

Respondent 7 felt that no employee is held accountable for failing to meet targets. The respondent pointed out that Eskom plays a major role in our society, is important in terms of our economy.

> *"If we can resolve the issues that are impacting us on a national level, we can open up economic opportunities which may indirectly solve our economic issues. We are so embedded in our society /communities in such a manner when any lack of our organisation falters, it has consequences and some of them manifest themselves in things like electricity theft, lawlessness, amongst others".*

Respondent 9 felt that Eskom as an organisation is not doing enough, but if you drill down to areas, people who are accountable for this work, the respondent believes they are doing everything within their power and everything within the limitation they have been put on it to execute their duties.

Two respondents felt that Eskom is doing enough. They have mentioned that there are awareness campaigns and programs employed by Eskom to reduce theft, but those programs are not effective, as the numbers depict an increasing trend in terms of theft.

Question: *Please identify some of the underlying factors that inhibit the successful implementation of the strategies that deal with electricity theft?*

The respondents identified the socio economic or social issues in the country at the moment, as some of the major inhibiters. Respondent 4 said,

> *"we are dealing with a situation where most of the population earns very little"*.

The respondents felt that the lack of political will is affecting the successful implementation of the strategies that deal with theft. Respondent 8 said,

> *"in order to get things done, you've got to have support from the politicians, as well as top managers, without that, there is very little we can do. For example, every time there are national elections, six months before the election we are not allowed to disconnect any tampered meter because everyone is trying to gunner votes, irrespective of the political party"*.

Respondent 7 felt that the major hindrance or inhibiter is "ourselves", small things like poor scoping, poor design or poor management of our projects. According to the respondent, not understanding the ripple effect of (a) not keeping to our promises (b) not meeting target dates or deadlines, is affecting the business and South Africans. The respondent further said,

> "*For example, if we saying we are electrifying an area with 300 houses, our projects they overrun, and we end up with not enough funds and we leave the project in the middle, we leave other households without electricity what are we saying to them. If we come back, we come back after two or three years and you can't expect those communities to wait for us"*.

Respondent 3 concurs with the statement of failing to meet targets. Targets set and or being focused on at the time, result in the slacking of controls in the pursuit of the said target. The respondent felt that there is no buy-in and ownership by each process partner.

Respondent 7 felt that Eskom is not engaging properly with its stakeholders. According to the respondent, Eskom has allowed external stakeholders to set the tone or dictate to them, whereas if Eskom spends more time in understanding different communities, their needs and coming up with a plan to attend to those needs, the entity would be forcing the stakeholders to drive those plans.

The issue of resource constrained was raised by several respondents. The respondents felt that lack of network visibility in terms of technology, is limiting the business. Physical audits and checkups have its own risk, as some operators are threatened by communities when attempting to execute their duties. The respondents felt that Eskom should improve on technology, smart meters and detecting mechanisms such that if a tamper is detected, disconnection should happen immediately without sending an operator to physically disconnect illegal activities.

Respondent 5 felt that the structure that was developed to support this issue should be fully resourced because all the appointments were put on hold.

Two respondents felt that Eskom's inability to act to cases of theft is the major inhibitor. According to them, Eskom is too lenient when it comes to electricity theft. Red areas should be targeted and disconnect the whole area if it means recovering revenue. The issue of conflicting Key Performance Indicators (KPI) is a major inhibitor.

Question: *How can Eskom improve the anti-electricity theft practices and success thereof?*

Respondent 1 and 4 felt that by involving communities, the issue of theft can be minimised by being part of the social revolution. According to them, political or community leaders can play a bigger role in persuading communities to pay for services, but they can also say the opposite is true. Politicians can play a bigger role in persuading communities to pay for services, but the opposite is also true.

Respondents 2, 4 and 6 felt that Eskom should introduce amnesty to serve as an incentive for reporting illegal activities on the network.

Respondent 2 said,

"Eskom should promote programs that will allow people to come up and report meter bypasses. How do we win our customers, business is all about strategy"?

They argue that threatening customers for disconnection with a tempering fee is not effective. Respondent 2 argued that the R6000 tamper fee may have to reviewed based on economic conditions. It hinders people who genuinely want to buy electricity, will allow people to come up and report meter bypasses. The respondent pointed out that Eskom should treat conventional customers the same as prepaid customers.,

> *"if Eskom allows payment arrangement for conventional meters, why not apply the same for a tamper fee to a prepaid user".*

Eskom needs to adapt to the new environment and changes and the policies are to align as well.

Respondent 4, 8 and 9 felt that there should be leadership decisiveness in the context of the prevailing landscape of each section. Improve on our internal processes and management of staff. Respondent 8 said;

> *"every single meter is supposed to be scanned in and out, our meters are in effect our cash register and they should be monitored always".*

The respondents mentioned that all employees should do normal business to a very high standard, do their jobs to the best of their ability. Every single job description was developed for a reason. there is a reason for every single position that exists and if every single person in a position did what they were accountable to do at the right time and in the right way, would also contribute in improving our losses.
Respondents 2 and 9 noted that the government and Eskom must provide electricity to all.

"*give people who don't have power legal power before they get impatient".*

Most respondents thought that in terms of general theft, Eskom has done a lot, however, there is still room for improvement. They felt that Eskom needs to be more innovative. Innovation, improving technology and visibility were identified as key to areas classified as red zones and experiencing problems.

4.3 Quantitative Analysis

The quantitative design was considered appropriate for this study since it tests theory consisting of variables through statistical concept and structured techniques such as questionnaires, in as much as it provides an explanation of variables relationship. The data collected through the structured questionnaire were intended to identify the factors and effects of electricity theft from the consumer perspective.

4.3.1 Reliability test- whole questionnaire

The Cronbach alpha coefficient was used to measure the internal reliability and the measuring instrument. For the questionnaire to be valid and reliable, the Cronbach alpha coefficients should be above 0.70 (Gwet, 2012). The Cronbach alpha coefficient for all the sections which were completed by all the respondents ($n = 71$), was 0.765 which indicated that the research instrument was reliable.

4.3.2 Demographic profiles of the respondents

A summary of the respondents' demographics elements, which include gender, marital status, level of education and age is indicated in Table 4-3. From the participants, 31 % of them comprised the males and 69% were females. This implies that there were more females in the sample than males. This is consistent with the general trend in the country and findings can be generalised across gender. Most of the respondents (57.7%) were single. The second largest group (39.4%) identified

themselves as married and only 2.8% of the respondents were widowed. In terms of level of education of the respondents, most of them (47.9%) were secondary school leavers, while 15.5% had postgraduate qualification. After summarising the age categories of the respondents, the largest percentage identified themselves as in the group of 19-30 years.

Table 4.3:Demographic profile of the respondents- households

Demographic variable	**Sub-category**	**Total**	
		n	%
Gender	Male	22	31.0
	Female	49	69.0
Marital status	Married	28	39.4
	Single	41	57.7
	Divorced	0	0
	Widow	2	2.8
Level of Education	Primary	13	18.3
	Secondary	34	47.9
	Diploma	8	11.3
	Degree	5	7.0
	Post graduate	11	15.5
Age (in years)	19 – 30	27	38.0
	31 – 40	24	33.8
	41 – 50	9	12.7
	51 – 60	7	9.9
	61 and above	4	5.6

4.3.3 Understanding socio economic conditions

This section is linked to objective 1 and seeks to identify the social and economic factors, and how they related to electricity theft.

4.3.3.1 Access to electricity

Figure 4.1 shows that 97.2% of the respondents had access to electricity and 2.8% had no access to electricity. This is in-line with the findings from Statistics SA (2013), which indicated that within Msunduzi Local Municipality, 91.9% of households had access to electricity.

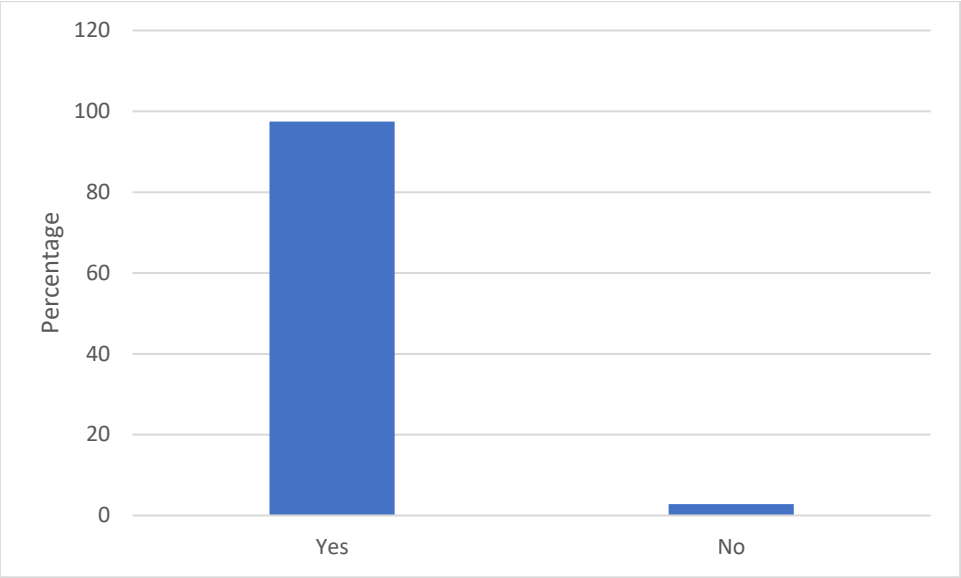

Figure 4.1: Distribution of responses by access to electricity

4.3.3.2 Type of electricity meter

In order to find out about the type of electricity meter used per household, respondents were asked to identify the electricity meter used for connection. Figure 4.2 shows that most of the customers (74.6%) indicated that they were connected to a prepaid meter, whilst the other 15.4% was not metered (connected through neighbour's meter and paying neighbour (4.2%), connected through neighbour's meter and not paying neighbour (1.4%), connected directly to Eskom line and not paying (2.8%) and no access to electricity (7%)).

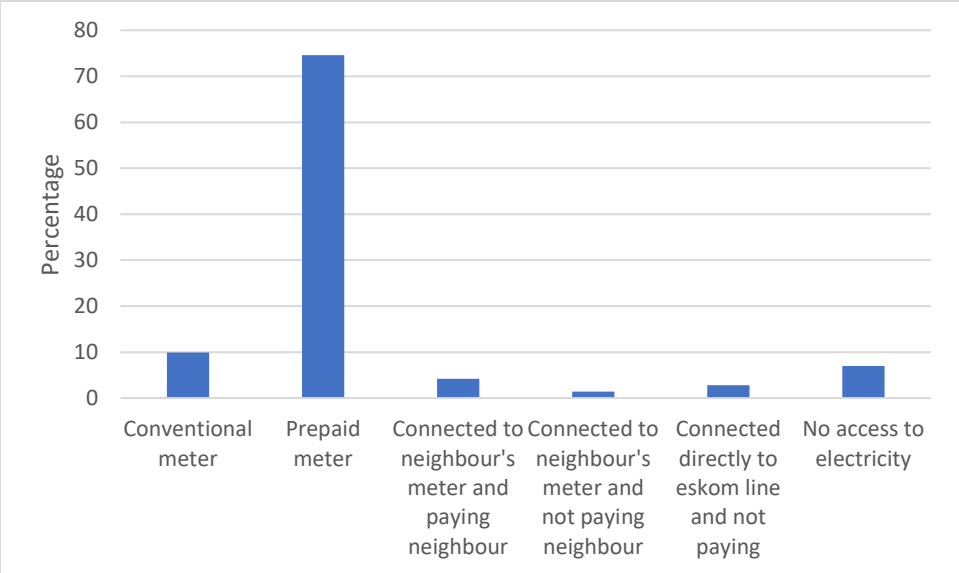

Figure 4.2:Distribution of respondents by type of electricity meter connected too

4.3.3.3 Period of access to electricity

To ascertain how long respondents had access to electricity, respondents were asked about the period of access to electricity. Most of the respondents (71.8%) indicated that they have had access to electricity for more than five years and 8.5% had access to electricity for less than a year, as depicted in Figure 4.3.

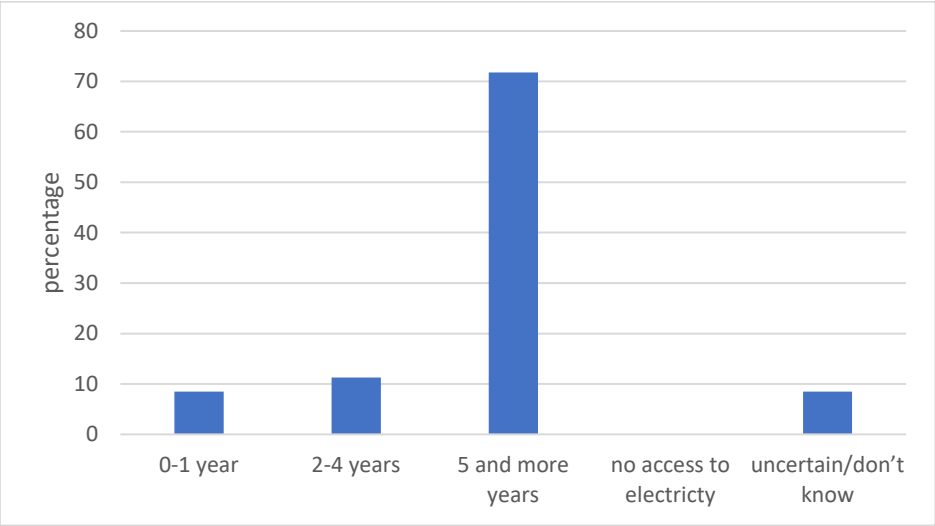

Figure 4.3: Distribution of responses by how long respondents had access to electricity

4.3.3.4 Main source of energy used for cooking and lighting

To determine the source of energy used for cooking and lighting, respondents were asked to indicate which source of energy did they use for cooking and lighting. Table 4.4 shows that100% of the respondents confirmed that they used electricity for lighting and 97.2% used electricity for cooking. It is observed that the respondents who indicated that they did not have access to electricity from previous questions, when providing answers to these questions, they all indicated that they use electricity for cooking and lighting.

Table 4.4:Distribution of responses by source of energy used for cooking and lighting

Source of energy used		Percentage
What is the main source of energy for lighting in this household?	Electricity	100
	Paraffin	0
	Gas	0
	Candles	0
	Wood	0
	Solar	0
	Generator	0
	Other	0
What is the main source of energy for cooking in this household?	Electricity	97,2
	Paraffin	0
	Gas	2,8
	Wood	0
	Solar	0
	Generator	0
	Other	0

4.3.3.5 Household expenditure on electricity per month

The respondents were asked how much did they spend on electricity per month, on average. Figure 4.4 shows that almost 45.1% indicated that they did not spend a single cent on electricity, while 38.8% spent less than R500 monthly on electricity. It was noted that 7% was uncertain about their monthly electricity bill.

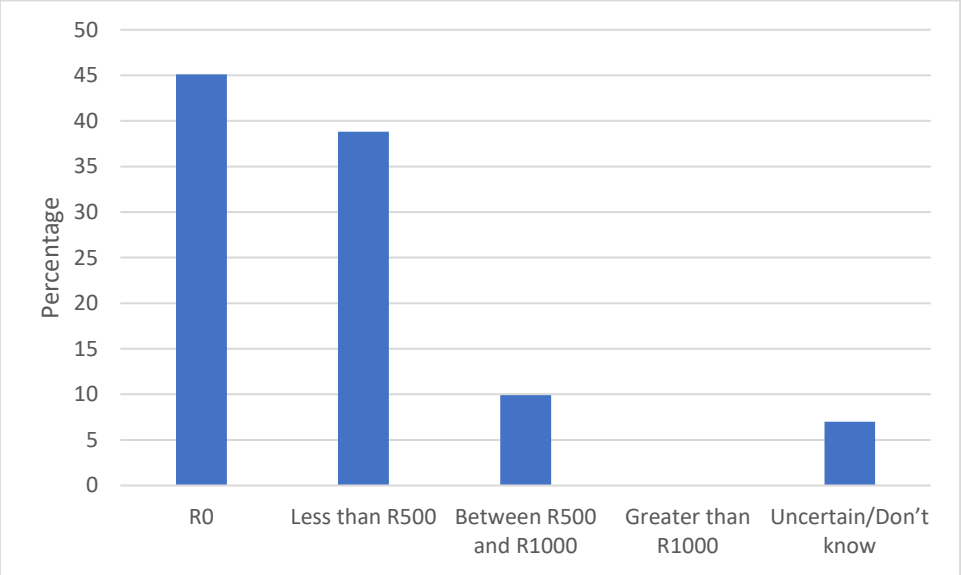

Figure 4.4: Distribution of responses by household expenditure on electricity per month

4.3.3.6 Electricity buying pattern

The respondents were asked when was the last time they purchased electricity. Most of the participants (39. 4 %) indicated that they did not buy electricity, as depicted in Figure 4.5. It was also observed that 11.3% was uncertain.

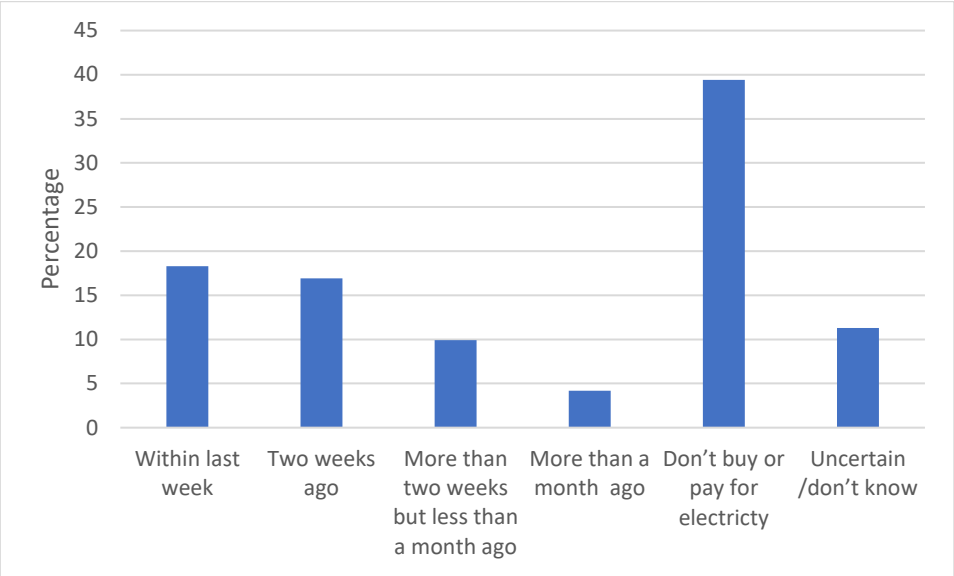

Figure 4.5: Distribution of responses by last time electricity was purchased

4.3.3.7 Method of payment for electricity bill

Figure 4.6 below shows that a total of 46.6% did not pay for electricity. It was also observed that 26.8% used easy pay services from the retail shops to settle their electricity bills.

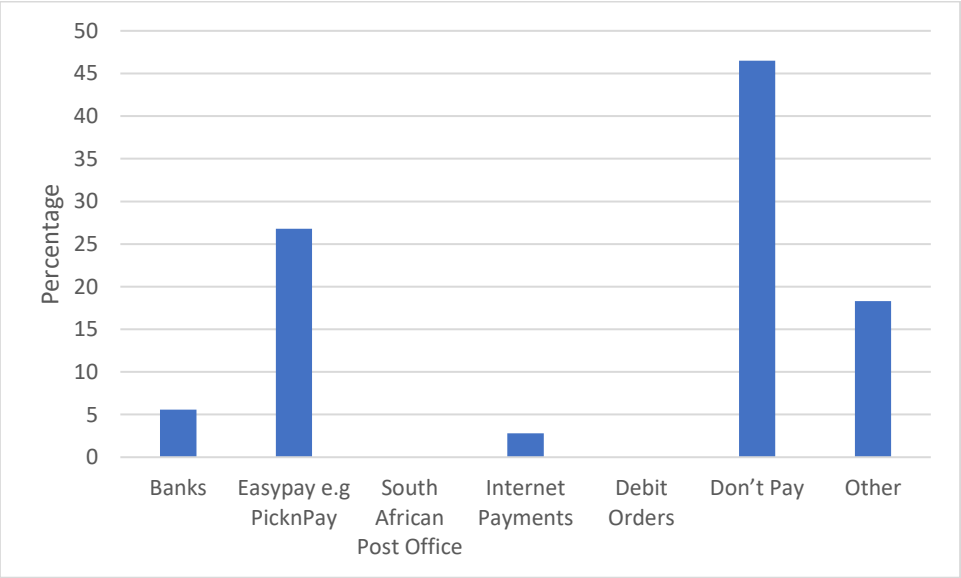

Figure 4.6: Distribution of responses by method of payment for electricity bill

4.3.3.8 Source of income

In order to find out whether respondents could afford to pay for electricity, respondents were asked about the source of income for their household. Almost 43.7% of the participants was formally employed and 42.7% depended on social grants, as depicted in Figure 4.7. According to Statistics SA (2013), Msunduzi Municipality had an unemployment rate of 33%.

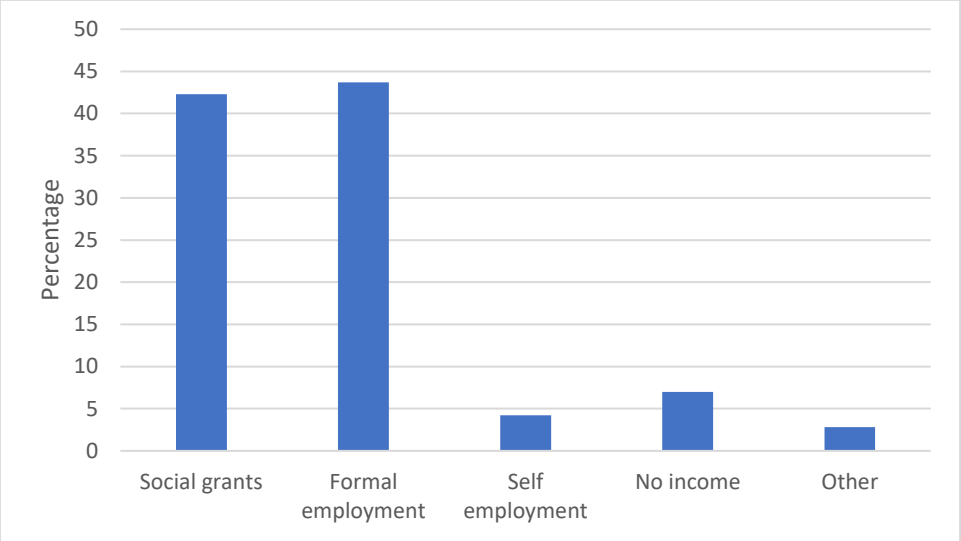

Figure 4.7: Distribution of responses by source of income

4.3.3.9 Period of unemployment

Respondents who indicated that they were unemployed were further asked how long they had been unemployed. Figure 4.8 shows that 28.2% had never been employed and 16.9% was last employed more than two years ago.

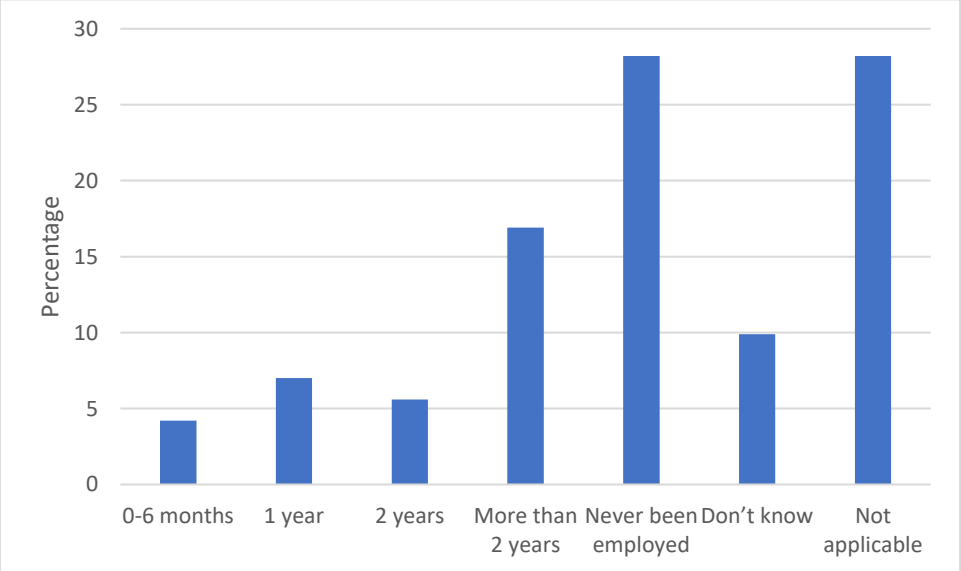

Figure 4.8: Distribution of responses by period of unemployment

4.3.3.10 Level of income

Figure 4.9 indicates that a total of 59.2% had an income of more than R1000 and 8.5% indicated no income. Statistics SA (2013) reported that in this area, 16.1% had no income and most households were dependent on government social grants.

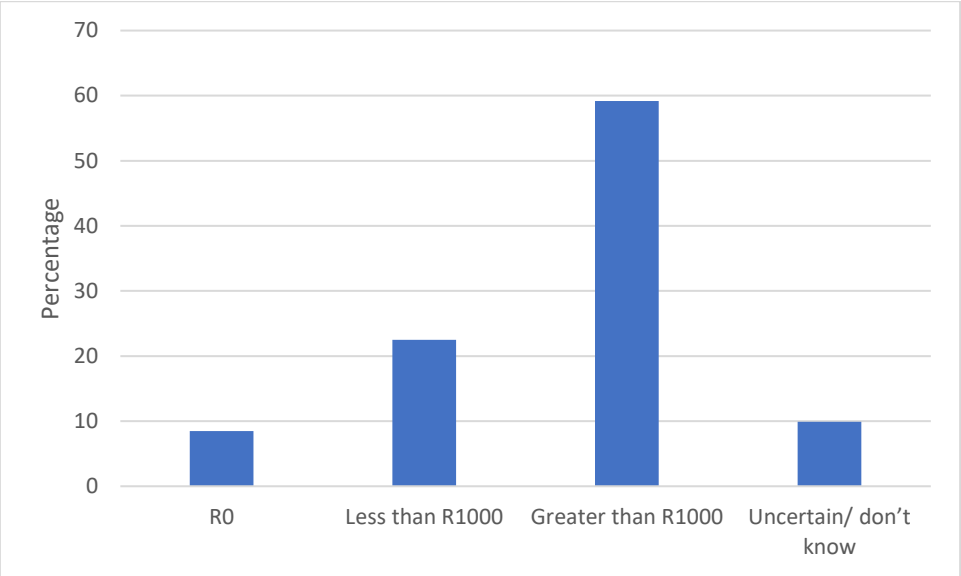

Figure 4.9: Distribution of responses by level of income

4.3.3.11 Illegal connection /meter bypass offer

To determine the extent of illegal activities in the area, or potential of meter tamper, respondents were asked if they had ever been offered illegal connection or meter tampering by anyone. Figure 4.10 shows that total of 52.1% had been offered illegal connection or meter bypass and 47.9% indicated they had never been offered illegal connection or meter tampering.

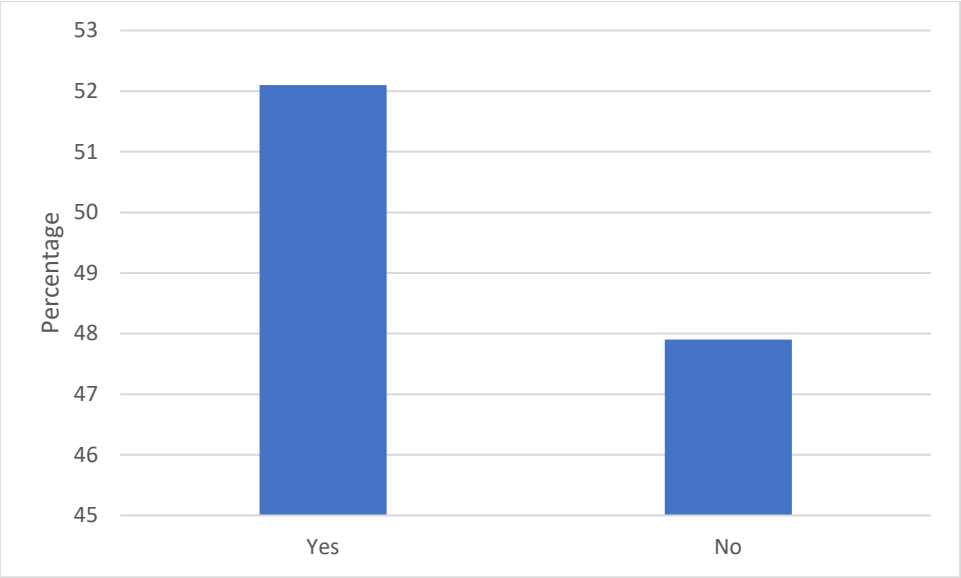

Figure 4.10: Distribution of responses by illegal connection offer

4.3.3.12 Unemployed and poor households access electricity illegally

To check the perception that electricity theft is prevalent amongst the poor households and the unemployed, the respondents were asked about their opinions on this matter. Most of them (66.2 %) felt that illegal use of electricity is not limited to poor households and unemployed. About 33.8 % of the respondents felt that electricity theft is associated with poor households and unemployed access that support the statement as depicted in Figure 4.11.

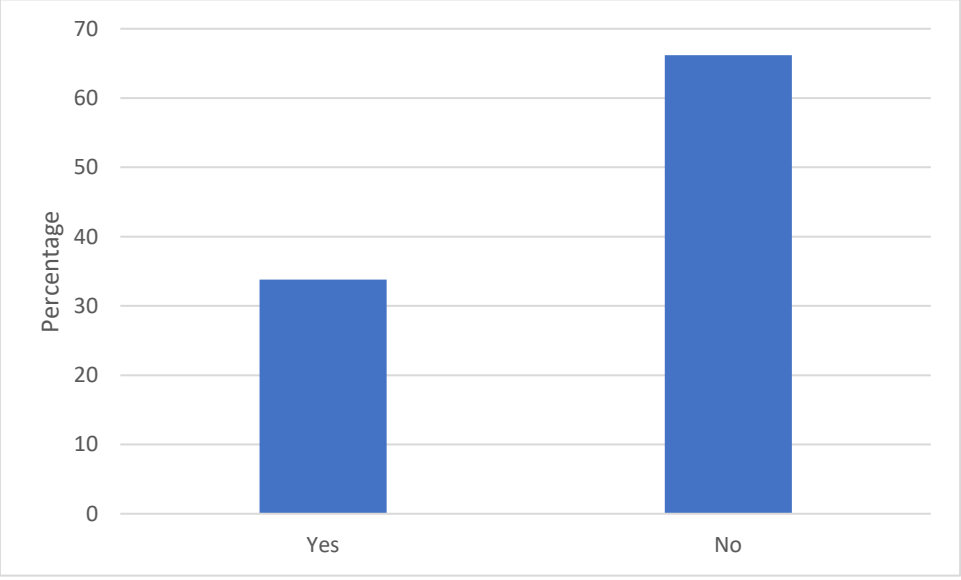

Figure 4.11: Distribution of responses about who accesses electricity illegally

4.3.4 Affordability

There is a commonly held view that the practice of electricity theft is attributed to affordability due to an increase in electricity tariffs. This section attempts to check the views and opinions of Eskom customers in the Edendale area.

4.3.4.1 Receive Free Basic Electricity (FBE)

Free basic electricity is a government grant awarded to poor indigenous households as a form of electricity subsidy. To find out whether the community of Edendale was receiving or aware of this service, the respondents were asked if they received Free Basic Electricity. Figure 4.12 shows that 91.6% of respondents did not receive FBE and 8.5% received FBE.

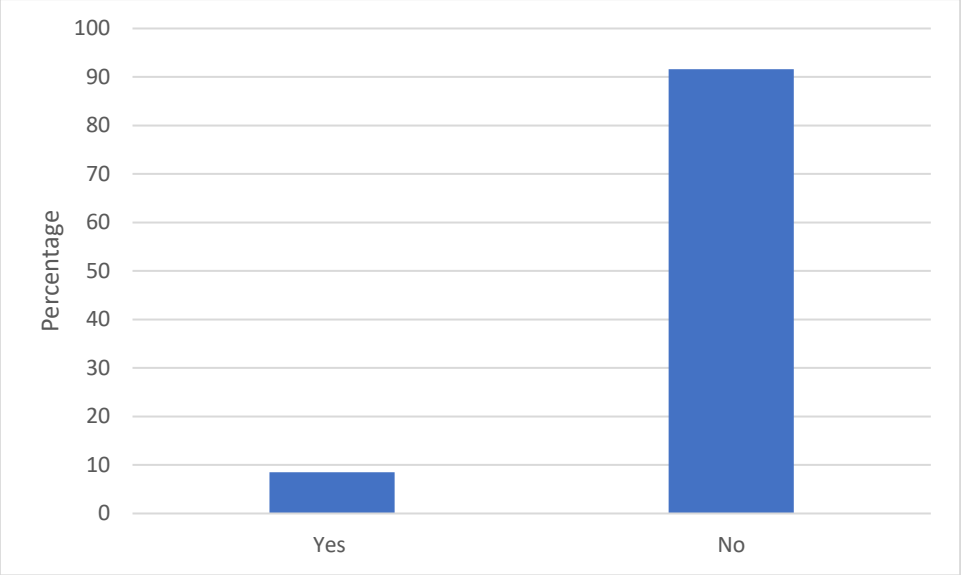

Figure 4.12: Distribution of responses by recipient of Free Basic Electricity

4.3.4.2 Reasons for not receiving FBE

Most respondents did not receive FBE and the researcher was interested in finding the reasons why. When asked to provide reasons for not receiving FBE, the majority (70.4%) of respondents was not aware that this service was rendered to indigenous people, 15.5% thought that FBE was not available in their area and 5.6% thought that they did not qualify, as depicted in Figure 4.13.

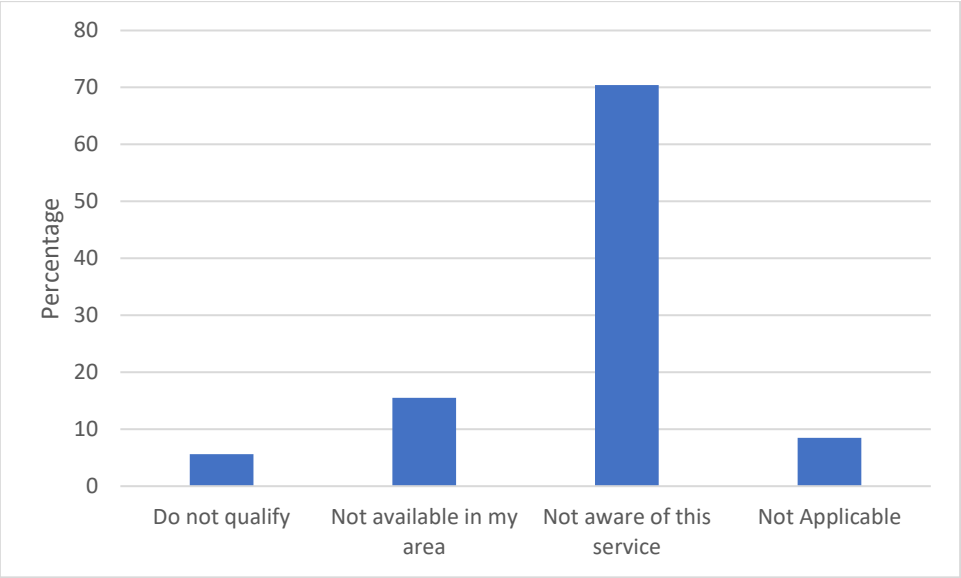

Figure 4.13: Distribution of responses by providing reasons for not receiving FBE

4.3.4.3 Is electricity becoming too expensive?

To check for the perceptions which state that many households adjust their consumption or turn to electricity when there is an increase in electricity prices, but continue using the same consumption as before. Respondents were asked the following:

- *In your opinion, do you think electricity is becoming too expensive for your household to keep using the same amount of electricity as before?*

Figure 4.14 shows that a total of 80.3% indicated that electricity had become too expensive for their household to keep using the same amount as before and 11.3% indicated that electricity was not expensive for their households.

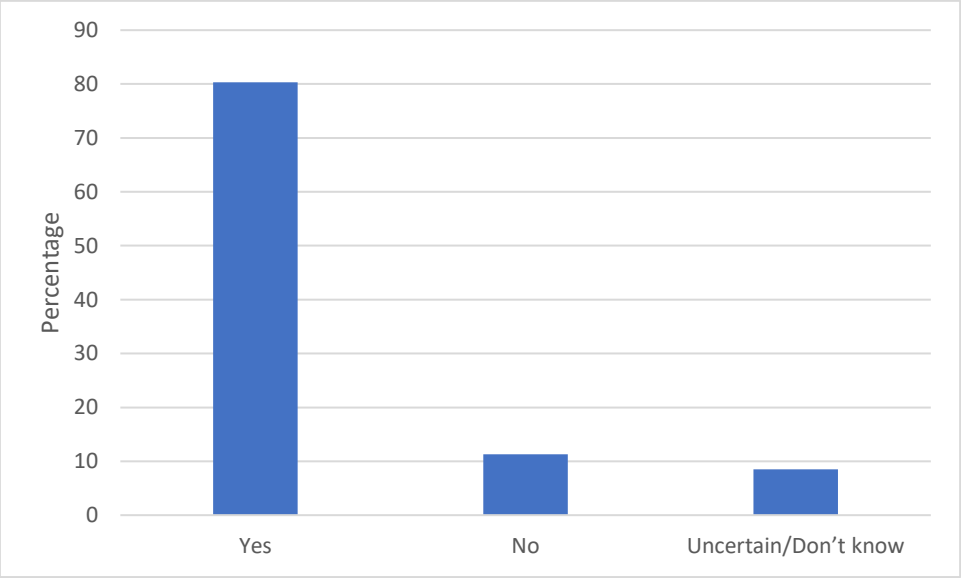

Figure 4.14: Distribution of responses by who thinks electricity is expensive

4.3.4.4 Affordability rating

Respondents were asked to rate their affordability of electricity. A total of 53.5% indicated that electricity was unaffordable and 9.9% indicated that electricity was very affordable, as shown in Figure 4.15.

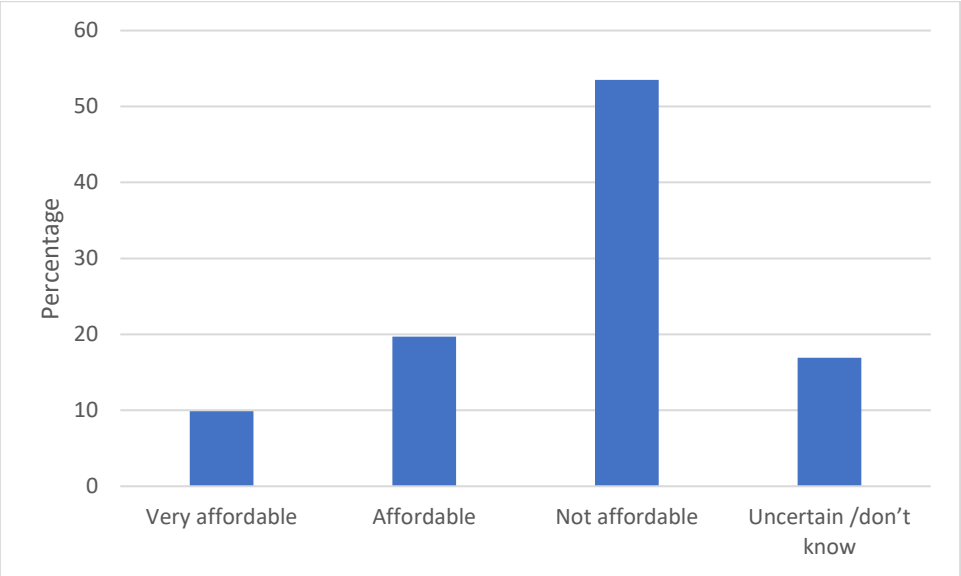

Figure 4.15: Distribution of responses by affordability rating

4.3.5 Culture of entitlement

Many have warned that South Africa has become a nation dependent on the social security system. There is a strongly held view that government "must provide" free education, free housing amongst others. This section attempts to check if this is true and could it be the reason why many customers do not pay for electricity.

4.3.5.1 Preferred services for non-payment

Figure 4.16 shows that a total of 56.3% of the respondents preferred not to pay electricity, 29.3% would not pay for municipality rates and 14.1% preferred not to pay for water.

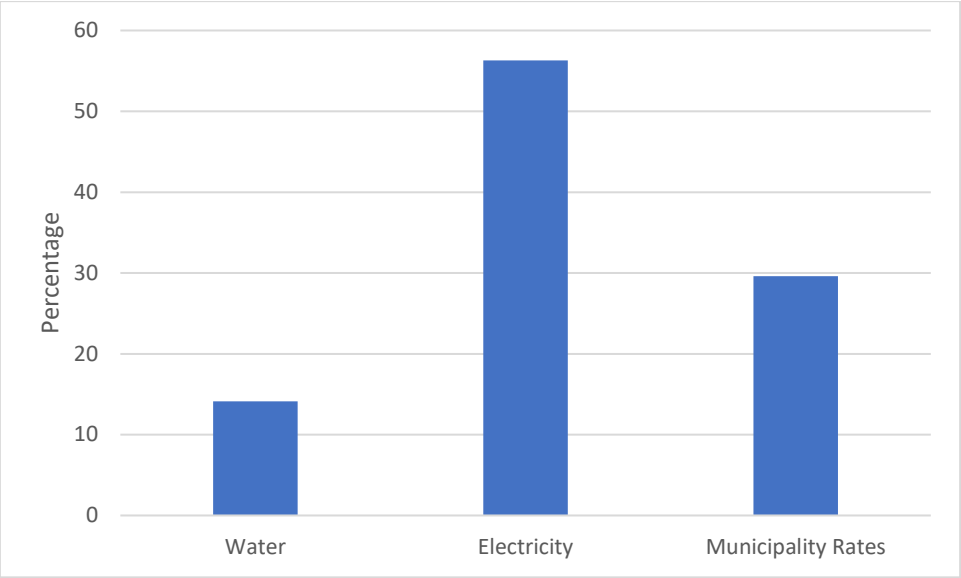

Figure 4.16: Distribution of responses by services preferred for non-payment

4.3.5.2 Cost of electricity result in non-payment

To check the perception which says that cost of electricity results in non-payment. Respondents were asked the following:

- *In your opinion, do you think increase in electricity price has caused most household not to pay for electricity used?*

Figure 4.17 shows that a total of 84.5% of the respondents indicated that the cost of electricity had an impact on electricity theft and 5.6% indicated that the statement was false.

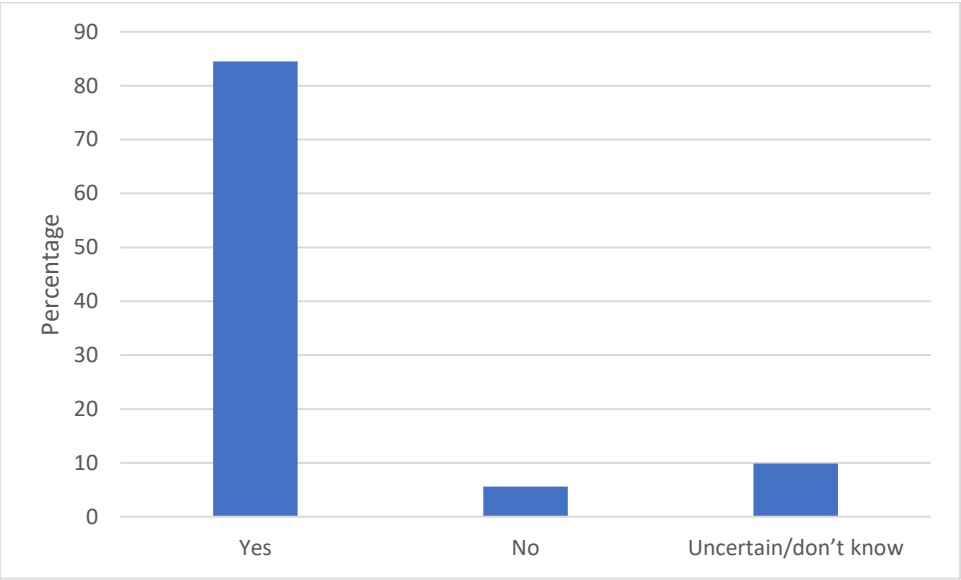

Figure 4.17: Cost of electricity results in non-payment

4.3.5.3 Understanding election promise of free electricity

To understand the perception of people on the election promise of free basic electricity, the respondents were asked the following question:

- *What is your understanding of "free basic electricity" promised by the ruling party?*

Figure 4.18 shows that a total of 38.0% had an understanding that FBE is awarded to the poor, 9.9% indicated that a portion of electricity is free and 7.0% had an understanding that all electricity is free. Almost 28.2% indicated that they did not know about the election promise and 16.9% have never heard of such a promise.

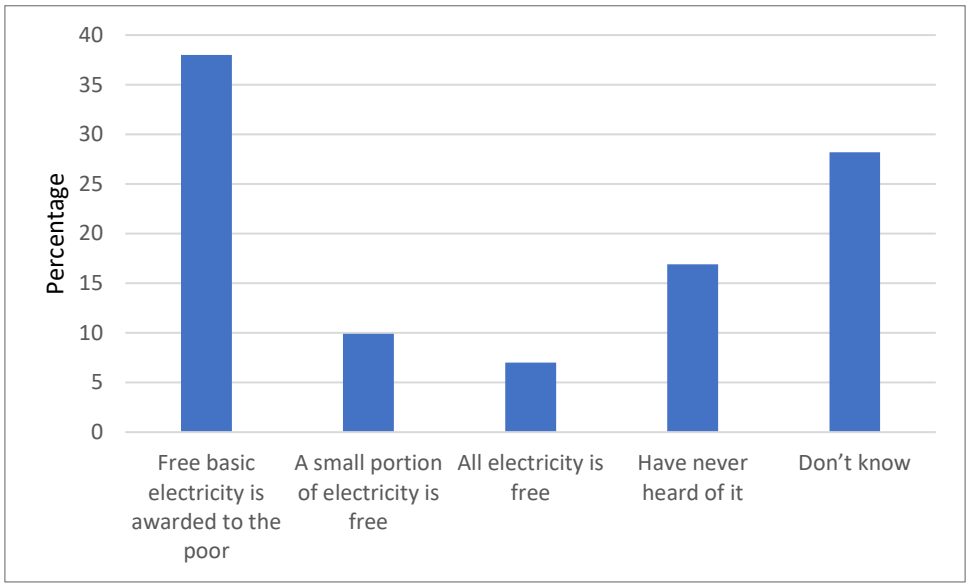

Figure 4.18: Respondents perception on the electoral promise of free electricity

4.3.5.4 Who should be responsible for payment of electricity

On the questioned of who, in their opinion, should be responsible for the payment of electricity usage, almost 42.3% indicated that the breadwinner should pay for electricity, while 39.4% felt that the government is responsible and 11.3% felt that Eskom must pay for electricity usage in their households. A total of 57.7% thought that electricity usage in their households must be paid by others, other than the users of electricity, as depicted in Figure 4.19.

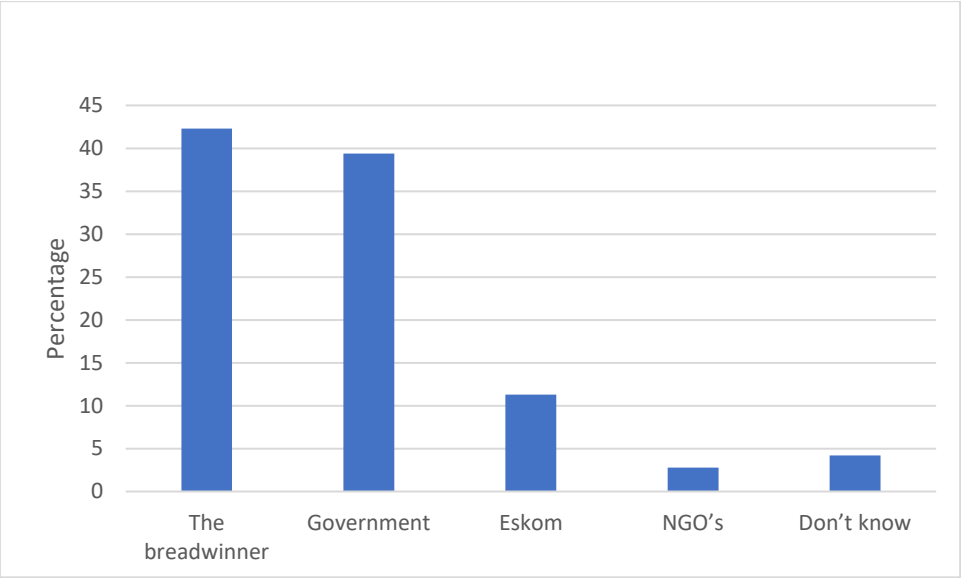

Figure 4.19: Distribution of responses by who should be responsible for the payment of electricity usage

4.3.5.5 Reporting of faults / application for a new connection

Question: *Have you ever reported a faulty meter or applied for a new connection through Eskom? ".*

A total of 53.5% have had contact with Eskom, either reporting a fault, or applying for a new connection, as shown in Figure 4.20.

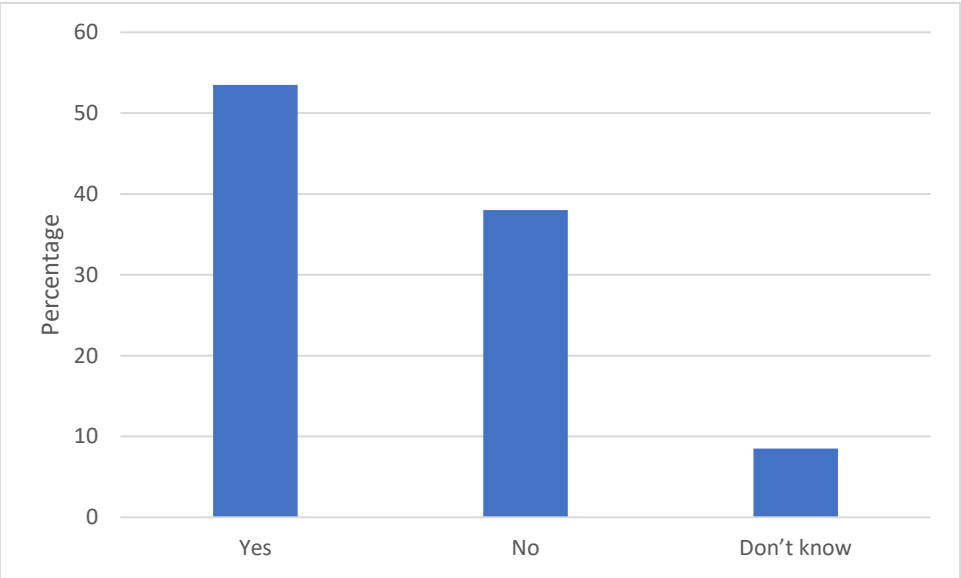

Figure 4.20: Distribution of responses by reporting faults / application for a new connection

4.3.5.6 Eskom response period to queries and applications

From Figure 4.21, it is observed that 40.8% indicated that this question is not applicable to them. This means that these respondents had never contacted Eskom.

Almost 22.5% indicated that Eskom responded within a day, 23.5% indicated that response time from Eskom was between 2-5 days. For 2.8% of the respondents, it took Eskom more than a month to respond, 1.4% said it took between 2 to 6 months and 8.5 % indicated that Eskom's response time was more than 6 months.

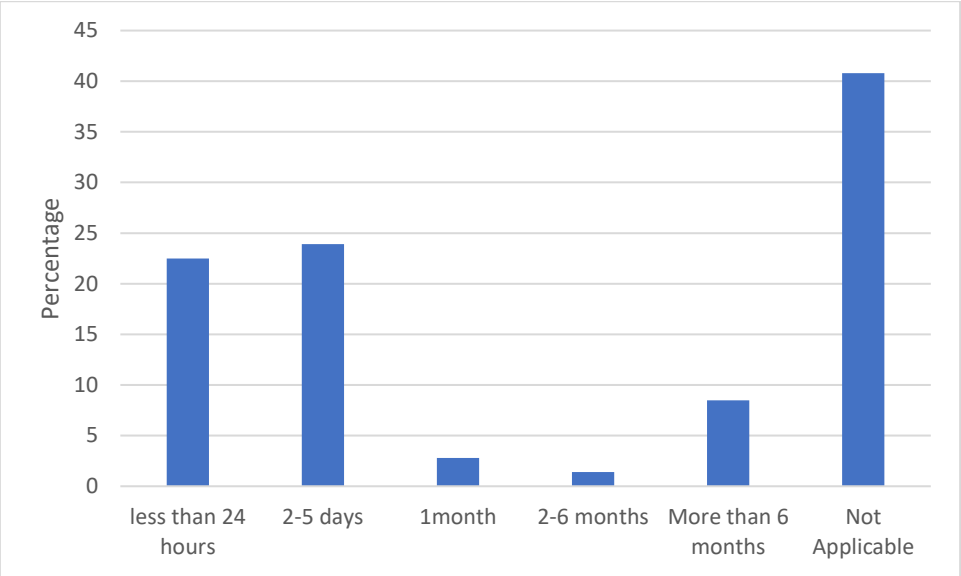

Figure 4.21: Distribution of responses by Eskom's response period to queries and applications

4.3.5.7 Eskom service satisfaction survey

From Figure 4.22, a total of 39.4% of the respondents were satisfied with level of service provided by Eskom to consumers, while 11.3% were very dissatisfied.

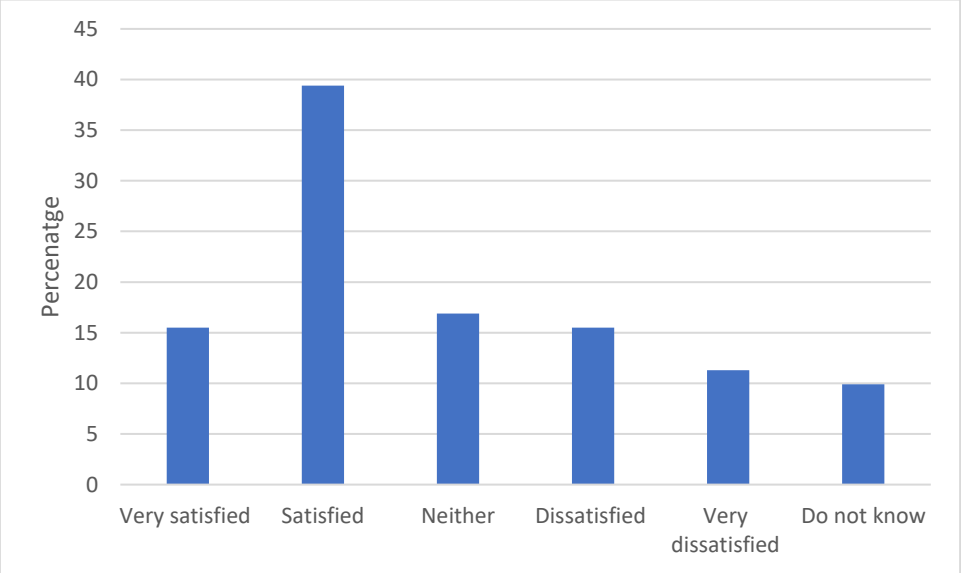

Figure 4.22: Distribution responses: Eskom service satisfaction survey

On the question of whether the respondents would pay for the level of service rendered by Eskom, the responses were divided, with 43.7% saying yes, 43.7 % saying no and 12.7% being uncertain, as shown in Figure 4.23.

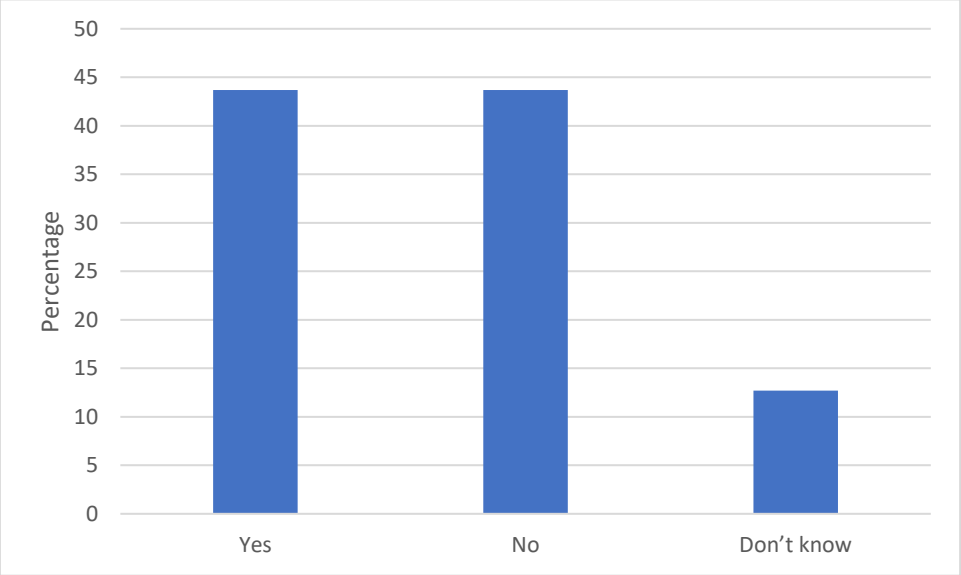

Figure 4.23: Distribution of responses by paying for Eskom service

4.3.5.8 Effects of electricity theft on Eskom

To understand if respondents knew about the consequences of electricity theft, a question was: *In your opinion, how do you think electricity theft affects Eskom?* Figure 4.24 shows a total of 46.5% indicated that there is a revenue loss, 16.9% indicated that electricity theft has an effect on load shedding, 16.9% tariff increase, 14.1% power interruptions and 1.4% indicated that electricity theft causes fatalities and injuries.

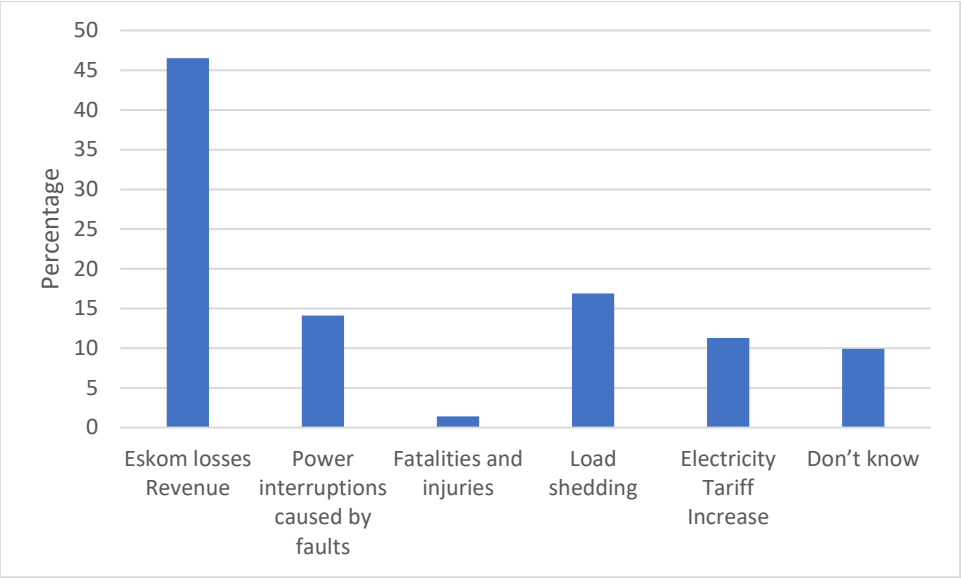

Figure 4.24: Distribution of responses: effects of electricity theft on Eskom

4.3.5.9 Harsher penalties minimise electricity theft

To check the view held by many in terms of stringent penalties, respondents were asked the following question:

- *In your opinion, do you think introducing harsher penalties would minimise electricity theft?*

Figure 4.25 shows that most respondents were in favour of harsher penalties. Almost 35.2% strongly agreed and 22.5 % agreed with the statement. A total of 21.1% and 4.2% felt that introducing harsh penalties would not reduce electricity theft. A total of 16.9% was neutral in this regard.

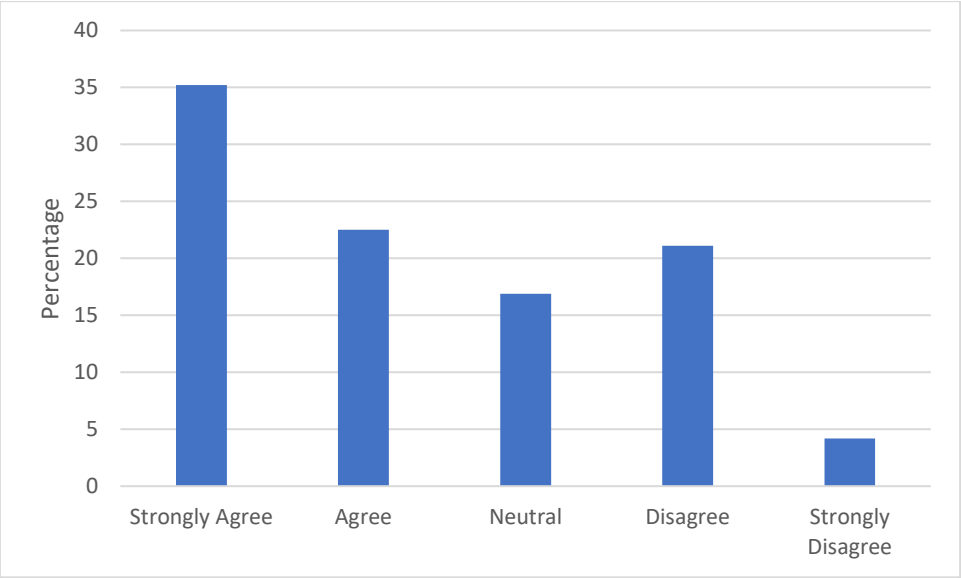

Figure 4.25: Distribution of responses in introducing harsher sentences to minimise electricity theft

4.3.6 Testing for association between the factors

The test for association between factors was conducted using the Pearson's χ^2-test. Table 4.5 shows the results of the Pearson's χ^2-test. The null hypothesis is two factors are not associated, that is, there is no relationship. The null hypothesis is rejected if *p*-values are less than 0.10. At 10% level of significance, there is an association between electricity theft and affordability and entitlement. From Table 4.5, it is evident that affordability and entitlement have a statistically significant relationship with electricity theft. Since their *p*-values were lower than the significance value of 0.10.

In summary, affordability (p –value =0.073) and entitlement (p –value =0.072) are statistically related to electricity theft at 10% level of significance.

Table 4.5: Test for association between factors using Pearson's chi-square test

Factors	p value of the Chi-square statistic		
	Electricity household expense	**When was the last time you paid/bought electricity**	**Method of paying electricity bill**
Affordability	0.500	0.000***	0.073**
Literacy	0.343	0.573	0.300
Unemployment	0.411	0.672	0.734
Income	0.313	0.909	0.578
Entitlement	0.077**	0.102	0.072**
Eskom service	0.855	0.297	0.684

Note: ** and ***indicate significant at 10 % and 5% level of significance respectively

Cohen's d statistic is used to indicate the standardised difference between two means. It can be used, to accompany reporting of the t-test and ANOVA results. A small practically significant difference can be seen when Cohen's d statistic falls in the interval $0.20 < |d| < 0.50$ and a moderate practically significant difference is found when Cohen's d statistic falls in the interval $0.50 < |d| < 0.80$.

4.3.6.1 Analysis of electricity and affordability

Since there is an association between electricity theft and affordability, the effect of sub-categories on the association was checked, that is, the association is with which affordability sub-class. Using the Cohen *d*-statistic, the effect of affordability was checked on the association. The Cohen's *d*-statistic between very affordable and affordable sub-classes = 0.225 is in the interval $0.20 < |d| < 0.50$. This indicates that there is small practical difference between respondents in the categories very affordable and affordable.

Table 4.6: Statistics for relationship between affordability and non-payment/theft

Category by Electricity theft	**Sub-category**	n	**Mean**	sd	**Mean difference (above diagonal) and Cohen's value**			
					1	**2**	**3**	**4**
Electricity theft by affordability	Very affordable	7	4.430	2.878	-	0.225	0.165	**1.157**
	Affordable	14	5.070	2.841	0.224	-	0.076	**0.781**
	Not affordable	38	4.870	2.632	0.155	0.073	-	**0.840**
	Uncertain/do not know	12	6.920	1.621	**0.999**	**0.814**	**1.070**	-

Table 4.7: Statistics for relationship between entitlement and Electricity theft

Category by Electricity theft	**Sub-category**	n	**Mean**	sd	**Mean difference (above diagonal) and Cohen's value**				
					1	**2**	**3**	**4**	**5**
Electricity theft by entitlement	Breadwinner	30	4.570	2.873	-	0.430	0.196	0.148	**1.114**
	Government	28	5.680	2.245	0.433	-	0.235	0.289	**0.916**
	Eskom	8	5.130	2.748	0.195	0.210	-	0.042	**1.042**
	NGOs	2	5.000	4.243	0.104	0.164	0.031	-	**1.069**
	Do not know	3	7.670	0.577	**3.023**	**2.236**	**1.676**	**0.807**	-

Having identified the factors that are likely related to electricity theft, the presence of linear relationship was investigated between the factors as explanatory variables, and electricity theft as the dependent variable using univariate regression techniques. The *p*-value of the F-statistic was used to determine whether to reject the null hypothesis of a linear relationship. The *p*-value of the t-statistic was used to determine whether the factors are statistically significant in the regression model. The model's accuracy, using the coefficient of determination (adjusted R^2), was also checked. The coefficient of determination measures the proportion of the variation in the dependent variable that can be described by the explanatory variables. If adjusted $R^2 > 0.60$ indicates that the model is good. The Durbin-Watson statistics measures the auto correlation of the residuals from the regression model. A good model has a Durbin-Watson statistic≈ 2. Table 4.8 indicate the univariate regression analysis results.

Table 4.8: Univariate regression analysis results

Independent variable	**Parameter estimates(sd)**	***p*-value of the t-statistic**	F-Statistic *(p*-value*)*
Affordability	1.301(0.217)	0.000	137.061(0.000)
Entitlement	0.747(0.296)	0.014	

Adjusted $R^2 = 0.793$, Durbin-Watson =1.973

From Table 4.8, the results indicate affordability and entitlement are linearly related to non-payment, with a *p*-value of the F-statistic =0.000<0.05. The model has an adjusted $R^2 = 0.793 > 0.60$, which may be regarded as a good model. This indicates that affordability (*p*-value of t-statistic =0.000) and entitlement (*p*-value of t-statistic =0.014) explain 79.3% of the variations in non-payment/theft of electricity. The constant variable was not statistically significant, thus, was not included in the final model. Autocorrelations of the residuals from the fitted model were checked, the Durbin-Watson statistic = 1.93 which is approximately equal to 2. This indicates that the model does not violate the assumption of a no serial correlation in the residuals.

4.4 Summary

The mixed method approached was employed for this study, in order to provide a comprehensive analysis of the research problem (Creswell, 2014). The study was based on data gathered from the semi-structured interviews with 9 Eskom employees and close- ended questionnaires from 71 Eskom customers. A total of 80 participants voluntarily participated in the study. In the qualitative section, interviews were audio recorded and subsequently transcribed for every interview session. Summary of the themes were formulated that emerged from emerged from the frequency of several key words and phrases during the interview.

For quantitative section, questionnaires were used as the survey instrument to collect data from 71 Eskom customers. The questionnaire consisted 36 questions which were grouped according to the research objectives. Data from respondents was consolidated into Excel spread sheet and exported to SPSS version 24 for statistical analysis. Cronbach's Alpha Coefficient Test was used to measure the reliability of the quantitative survey instrument. The data was analysed at a 76% confidence interval based on calculated Cronbach alpha indicating an acceptable reliability of the results. Associations between factors were tested using the

Pearson's Chi-square test. The outputs from SPSS were presented in a graphical and tabular format.

It was observed that the combination of quantitative and qualitative data highlighted areas of convergence between Eskom employees and Eskom customers on the factors of electricity theft and its impact on Eskom. The findings from this chapter are further discussed in chapter 5, linked to the study objectives and supporting literature.

In the qualitative component of study, where semi structured interviews were conducted with Eskom employees to get an insight into factors and effects of electricity theft. Interviews revealed that there were numerous factors contributing to electricity theft. The common factors were socio economic conditions which relates to unemployment and poverty, lawlessness, culture of entitlement, access to electricity and affordability

In the quantitative component of the study, where Eskom customers or households residing in the Edendale area, Pietermaritzburg were subjected to a closed ended questionnaire in order to get an understanding to factors contributing to electricity from a consumer perspective. Quantitative data analysis revealed that there is an association between socio economic conditions such as employment, culture of entitlement and affordability.

The next chapter will link the objectives and the finding of the study. Conclusions, together with recommendations to address the research problem, will be proposed and suggestion for future studies will be presented.

Chapter 5 : Discussion

5.1 Introduction

This chapter provides a discussion of the research findings from the gathered quantitative and qualitative data. Findings for each research objective will be discussed, interpreted and explained in conjunction with literature reviewed in Chapter 2, with a view to establish the similarities and differences on the subject matter.

This chapter reviews the research objectives and establish if the research questions have been resolved. For each objective, the researcher links the results of quantitative and qualitative data of Chapter 4 to the literature review. This chapter seeks to draw conclusions of the research from the results and translate this into recommendations.

5.2 Research objectives overview

The aim of the study was investigate and assess the effect electricity theft has on the operations of Eskom Distribution business in KwaZulu-Natal. Winther (2012) confirmed the need for a study that will look beyond conventional engineering methods but acquire an insight which explains why electricity theft occurs and what factors perpetuate theft. The study aims to gather the experienced views from the perspective of the consumer (Eskom customers), utility (Eskom employees) and the effects thereof, in an attempt to determine a sustainable solution to address and manage electricity theft in South Africa. This section links objectives of the study to the study findings.

5.2.1 General understanding of the concept electricity theft

All of the respondents interviewed understood what electricity theft is about. They all agreed that electricity theft is an unauthorised or illegal use of electricity. Furthermore, electricity theft is the use of electricity without paying or the illegal use of electricity to evade payments. This is according to identified literature which relates electricity theft to efforts and fraudulent activities deliberately performed by consumers geared to evade payments for the electricity used to the utility (Lewis,

2015; Chauhan and Rajvanshi, 2013). Eskom employees identified electricity theft in form of illegal connection and meter tampering/ bypass. Electricity theft in any form has devastating consequences, resulting in revenue loss to the business. Electricity theft is not confined to a specific group of customers but occurs across all sectors of society and impacts all South Africans. In areas where there is no legal connection, perpetrators run illegal lines and where there is a legal connection, perpetrators bypass or temper meters. Respondents felt that electricity theft is a major challenge for the country and is becoming uncontrollable.

5.2.2 Objective 1: Factors contributing to electricity theft in KwaZulu-Natal Operating Unit

This objective was to determine the understanding held by Eskom's employees and Eskom customers, on the factors contributing to electricity theft. Most empirical studies support the view that electricity theft is a multifaceted issue which is strongly related to technical, political and economic challenges (Jamil and Ahmad, 2014; Winther, 2012; Golden and Min, 2012). However, when addressing electricity theft, power utilities focus on technical measures and neglect the political and socio economic elements (Jamil and Ahmad, 2014). To support or refute this view, Eskom employees and customers were asked to identify the key contributing factors to electricity theft.

The findings from qualitative component revealed that there were numerous factors contributing to electricity theft. The common factors were socio-economic conditions, which relates to unemployment and poverty, lawlessness, culture of entitlement, access to electricity and affordability. From the quantitative data analysis, it was revealed that there is an association between socio-economic conditions such as employment, culture of entitlement and affordability.

Although affordability was identified as the contributing factors to electricity theft, some respondents felt that affordability is not an issue, but a matter of priorities since some communities can afford to buy other necessities such as fuel, DSTV and airtime, among others. One of the respondents pointed out that even if it is an affordability issue, the government does provide other forms of relief such as Free Basic Electricity to the indigenous poor households. Contrary to this view, a study conducted in Soweto found that free basic electricity is insufficient and only covers

less than 10% of average household usage bill (Fiil-Flynn and Committee, 2001; Dugard, 2008). Despite the FBE programme, many low-income households do not afford to pay for electricity, even when there is a willingness to pay. This supports the findings by Mavhungu (2011), that non-payment for services is associated with affordability. When Eskom consumers were questioned about affordability, a total of 80.3% indicated that electricity has become too expensive and 53.5% felt that electricity is unaffordable.

Affordability is linked to various factors such as poverty, unemployment, lifestyle and household income, amongst others. The study did not check whether the issue of affordability is related to household income, but there was a question on whether the issue of theft is only limited to poor households and unemployment. Most of the respondents (66.2 %) felt that the illegal use of electricity is not limited to poor households and unemployment. To check if the poor households were receiving free basic electricity, 91.6% of respondents did not receive FBE and were not aware of this service which subsidies the poor who cannot afford to pay for electricity.

The culture of entitlement was identified as a common factor from both qualitative and quantitative data, contributing to electricity theft. Fjeldstad (2004) argues that the culture of entitlement is one major factor contributing to the non-payment crisis in South Africa. There are many contributing factors to entitlement. The respondents argued that non-payment for services was used as a strategy to fight the government during apartheid. Respondents were concerned that even after the apartheid regime has passed, the non-payment of services did not end. Respondents were of the view that some people continued with that mentality of not paying for government services. One respondent questioned whether people are still using the strategy to fight the current government. However, there is no supporting literature which seeks to suggest that the culture of non-payment for services in this current dispensation is linked to people fighting the incumbent government. The promise of free basic electricity was mentioned as the factor contributing to the crisis of electricity theft. This is attributed to the liberation promises by the incumbent government, of free water, education, electricity and so on and the fact that many Africans were directly involved in the liberation struggle. As a result, many people believe that they are entitled to public services such as

housing, electricity, water, as it is their basic right (Von Schnitzler, 2008). All of the respondents felt that there is a national culture of entitlement for services, especially those deemed to be a “right” by the Constitution. It was observed from Eskom employees, that most customers feel entitled to electricity and think that electricity should be for free. From the quantitative side, almost 57.7% of the respondents felt that electricity usage in their households must be settled by others, such as Eskom, the government and NGO’s, other than the users of the electricity. Responding to the promise of free electricity, a total of 38.0% had an understanding that FBE is awarded to the poor, 9.9% indicated that a portion of electricity is free and 7.0% had an understanding that all electricity is free. Almost 28.2% indicated that they did not know about the election promise and 16.9% had never heard of such a promise.

Lawlessness or lack of consequence was flagged by most respondents from the Eskom side. A comparative analysis study done by (Smith, 2004), in a sample of 102 countries, shows that electricity theft is correlated to poor governance and corruption. Furthermore, the study found that in countries where there is lack of accountability, political instability and low government effectiveness, electricity theft is more prevalent. Most Eskom employees concurred with these findings, some respondents felt that the issue of electricity theft has to do mainly with lawlessness, especially for people who can afford, such as the agricultural, commercial and industrial sector. One of the respondent pointed out that socially, South Africa is a lawless society where certain laws are not enforced. They argued that there is a lack of consequence for those who are caught stealing or bypassing the meter. It was also pointed out that in some of the cases, this is a pure act of criminality from commercial, agricultural, industrial. They do it knowingly, bypassing the meters and thinking they would not be caught and when they are caught, they often plead ignorance.

Electricity theft occurs with the assistance or connivance of employees (Smith, 2004). This argument is supported by the study conducted in Soweto, where it was found that half of the illegal connections were offered by Eskom Employees (Fiil-Flynn and Committee, 2001). Respondents from this study pointed out that electricity theft has grown to a level where certified Eskom contractors construct illegal lines and sometimes Eskom employees are involved in the tampering of electricity cables.

Based on this finding, the researcher strongly believes that the factors contributing to electricity theft are political, economic, criminal, while some are associated with Eskom / business deficiencies or inefficiencies. Considering that the South African economy is shrinking and unemployment is at its highest level, one can reach a conclusion that affordability by some households contributes to some extent, to electricity theft. Meter bypass by other sectors is purely related to criminality. Businesses have a much bigger energy loss impact than electricity theft by a household.

To manage the factors listed above requires a political, social, economic and technical solution. The issue of electricity theft cannot be addressed by looking at technical solutions only, it requires a multi-pronged strategy. These include the following:

- Eskom needs to electrify or quickly connect customers.
- Provide safe and legal electricity by converting illegal consumers to customers through normalisation projects.
- Manage network visibility and take ownership of their network or infrastructure.
- Monitor buying patterns and follow up on disconnections.
- Management of projects and material
- Management of field operators (contactors and Eskom employees)
- Conduct regular audits especially for (LPU’s and SPU’s)
- Disconnections and Prosecution
- Eskom needs to look at introducing incentives against employee field workers performance for recovery targets or by the count of cases detected and rectified.
- Introduce an amnesty that would encourage consumers to come forward and report theft
- Review tampering fee based on economic conditions, conventional customers and prepaid users must be treated equally. If payment arrangement is permitted for conventional meters, the same should apply to prepaid metres for a tamper fee.
-

5.2.3 Objective 2: Impact of electricity theft on the operations of Eskom Distribution in KwaZulu-Natal Operating Unit

This objective was to assess how electricity theft affects the operations of Eskom technically and financially.

Most empirical studies agree that electricity theft deteriorates the financial conditions of the power utilities (Jamil and Ahmad, 2014; Steadman, 2009; Gaur and Gupta, 2016). Steadman (2009) argues that the economic impact of electricity theft can be classified into foregone revenue, with a negative impact which results in the loss of profits, avoided investment costs and increased electricity rates to consumers. Similarly, Gaur and Gupta (2016) agree that when the utility is unable to generate sufficient revenue due to electricity theft, this curtails new investments for better capacity infrastructure, which leads to electricity shortages. High energy losses adversely affect the profitability and consequently, the capability to invest in manpower to monitor electricity pilferage (Jamil and Ahmad, 2014). Electricity theft represents an avoidable financial loss, an increase in operational cost, affects the quality of supply and tariff imposed on electricity consumed by genuine customers (Depuru et al., 2010). From the findings, it is evident that the respondents shared the same views. According to them, electricity theft affects Eskom in various ways which include the following:

- *Revenue loss*

  All the respondents from Eskom employees agreed that theft is costing the business in terms revenue loss. Eskom is losing billions of rands and this also applies to municipalities and other utilities in other countries. This was supported by 46.5% of the consumers, who indicated that Eskom loses revenue through the act of electricity theft. For the financial year, Eskom reported a revenue of R177 billion for 2016/17 and the distribution losses of financial year against the losses of 4.8 billion. Electricity theft drains Eskom resources. However, municipalities have a much bigger impact due to their cash flows. Municipalities generate most of their revenues through the sale of electricity and they are faced with a much bigger challenge as they struggle to recover money through acts of electricity theft.

- *Network expansion and network strengthening*

Respondents pointed out that electricity theft is costing Eskom in terms of network expansion and network strengthening. The strengthening of electricity infrastructure is based on the load seeing on the network and embedded in that load is theft. In areas where electricity theft is prevalent, consumers use electricity inefficiently, plugging all appliances and drawing more than what they should be drawing. Illegal consumers have no incentive to be energy efficient, as they are not affected by price hikes since electricity is received for free. This mainly affects lines and transformers, as the equipment operates above allowable limits and as a result, the transformers blow or fail. In areas where there is electricity theft, the transformers blow and get replaced almost every week.

- *Reputation and image*

  An electricity theft, especially illegal connection, leads to unplanned power outages. There are areas whereby because of theft, people perceive outages occurring as Eskom not maintaining or taking care of their network/infrastructure, but it is because of theft. One respondent referred to load shedding and pointed out that electricity theft put the grid under undue pressure, had we not had theft maybe the impact of load shedding would not have been as much. This view seems to be common, even amongst Eskom customers. A total of 16.9% indicated that electricity theft has an effect on load shedding, while 14.1% pointed to power interruptions. Eliminating electricity theft reduces peak demand.

- *Increased operational cost*

  All of the respondents felt that electricity theft has an effect on the operational cost. A properly designed network supplying legitimate load should not overload. Due to electricity theft, operation and maintenance cost increases. The cost of repairing and replacing equipment is affecting Eskom's Capital expenditures (CAPEX) and operating expenses (OPEX) budget. There is a cost associated with strengthening networks, sending operators to maintain and restore unplanned outages. Respondents felt that the cost of replacing equipment, overtime and travelling to restore supply due to electricity theft is not quantified when measuring losses. As part of the recommendations,

Eskom needs to quantify on average, how much is electricity theft costing Eskom in terms of OPEX and CAPEX.

- *Safety*

  Respondents felt that the safety of employees and the public in general is affected by electricity theft. The accompanying risk is sending operators to maintain and restore unplanned outages. For Eskom operators, it is unsafe to work in an environment where there are illegal lines and the violent threats received when attempting to disconnect illegals. Respondents mentioned that the loss of life, either from the public or the Eskom members, is one of the major concerns. There are a number of reported cases where the members of public have been either injured or fatally electrocuted due to electricity theft.

5.2.4 Objective 3: Strategies employed by Eskom Distribution to minimise electricity theft

Electricity theft is a complex phenomenon which is difficult to measure. Utilities rely on engineering techniques to estimate the extent of electricity theft. Due to the nature of electrical power system, utilities find it difficult to distinguish between legal and illegal customers without physical onsite inspection (Nagi et al., 2008). Theft is detected through audits and inspection, management of electricity, theft is done through engineering techniques. Despite the known facts contributing to electricity theft and technical measures put in place to minimise the losses, it continues to be on the upward trend. However, studies have found that neither technical initiatives nor managerial framework is sufficient to provide solution to the problem (Winther, 2012). There are several strategies employed by utilities to minimise theft, this include smart metering.

- *Free Basic Electricity*

Free basic electricity is one of the strategies employed by the South African government to shield the poor from sinking into poverty due to electricity prices. However, for this study, it was observed that most of the respondents (91.6%) indicated that they did not receive or were not aware of this government grant offered to the poor indigenous people. According to the study conducted by Fiil-

Flynn and Committee (2001) in Soweto, it was found that electricity offered to poor households per month was insufficient and only covers less than 10% of average household usage and therefore, makes little difference to the overall household electricity bill. There researcher could not support or disagree with this finding, as most of the respondents did not receive FBE. This theory needs to be further tested to areas where households receive FBE.

- *Operation Khanyisa*

Respondents mentioned Operation Khanyisa as one of the strategies employed by Eskom to minimise theft. Operation Khanyisa, which is a national partnership campaign aimed at educating South Africans about the impact, consequences and dangers of electricity theft, and encouraging people to report electricity theft. Respondents felt that Operation Khanyisa is working to some extent, because it allows communities to report theft anonymously. However, some felt that it is ineffective when a case has been reported and there is no immediate action to address the reported case, especially in areas classified as red zones (no go area) because employees know they may experience threats of violence when disconnecting or repairing a fault.

- *Universal Access Program (Electrification Program) and Normalisation Program*

Access to energy services is a basic human right , integral to improving the lives of people (Bradbrook and Gardam, 2006). Many literature supports the view that access to energy is the key element for economic and social development (Bazilian et al., 2014; Bradbrook and Gardam, 2006; Srivastava and Sokona, 2012; Magnani and Vaona, 2016). As such, the Constitution of the Republic of South Africa places the responsibility on the government to ensure universal energy access to all (South and Juta, 2011). Access to electricity is a basic human need in a modern society, although many South Africans lack the access to electricity and the benefits that it brings.

Almost 97.2% of the respondents had access to electricity, the respondents from the quantitative survey. Universal access program (electrification) is on top of the agenda for KZNOU. The respondents mentioned that in areas where there is an

electrical infrastructure and, yet people are still not connected, they tend to use that infrastructure to connect themselves illegally. Some of the illegal connections are caused by slow delivery of UAP. Studies have shown that the lack of access to basic services are the main drivers of electricity theft (Depuru et al., 2011; Gaur and Gupta, 2016; Mimmi and Ecer, 2010). This is evident in KZNOU, in areas where illegal connections are rife. To deal with the issue of illegal connections, Eskom adopted the normalisation strategy. Instead of disconnecting supply by removing or reaping out an illegal connection, the normalisation process legalises the connection by removing an illegal connection and replacing it with a legal and safe connection.

- *Feeder load balancing*

Four respondents mentioned feeder load balancing, which is used to determine anomalies on the network, is used to balance energy delivered (energy inflows and outflows) to measure losses. Where there is identified losses, audits are conducted, and corrective action implemented by means of disconnecting illegal activities and to ensure that meters are functioning properly. One respondent mentioned that there is a focus on exception reports, for example, no and low consumption reports as well as movement on terminated report.

- *Technology (Smart Meters)*

Three respondents mentioned the use of technology (split metering) to combat meter tampering in residential sector. According to them, split metering is implemented in areas with high electricity theft. There is a drive to install split meters for all new electrification projects (connections).

- *Exception reports*

Employees from customer services referred to the exception report and mentioned that it is one of the reporting tools that can be used to monitor electricity theft. The exceptional report reports on the movement on terminated and where there is no consumption and or low consumption.

- *Energy loss task team: Focused on reducing losses*

Two respondents from Eskom employees indicated that there is an energy loss task team which is focused on reducing non-technical losses.

5.2.5 Objective 4: Employees' perceptions and attitude towards Eskom strategies in minimising electricity theft

There is a difference between having a strategy and executing it, but what is important about strategy is the implementation and evaluating the results (Brinkschröder, 2014). The successful implementation of any good strategy is dependent on matching business resources and capabilities to the opportunities and challenges that arise in the internal and external environment (Wilden et al., 2013). To assess the effectiveness of the strategies employed by Eskom in dealing with electricity theft, this objective explores employees' perceptions and attitude towards Eskom strategies in minimising electricity theft. Respondents were asked if Eskom had adequate resources and capabilities to deal with the challenge of theft.

The Eskom employees expressed different views in terms of strategy effectiveness. However, they all agreed that there were existing strategies which were employed by Eskom to minimise electricity theft. Some of the respondents thought that Eskom did not have adequate resources to deal with the challenge of electricity theft. They pointed out that there was a huge growing customer base (numbers), but the resources required to tackle theft were not increasing at the same rate and in this case, there is a mismatch in terms of supply and demand. The KwaZulu Natal Operating Units had over a million registered customers comprising of prepaid users, small power users and large power users. There were limited human resources to monitor the customers in terms of revenue collection. Eskom relies on contractors for audits and inspections.

Some respondents argued that Eskom had adequate resources, but lacks a clear strategy in dealing with electricity theft, or somehow the existing strategies are ineffective. Eskom has been converting illegal consumers into customers, electrifying new households, auditing and conducting awareness campaigns aimed at educating communities about the illegal use of electricity. However, electricity theft is on the upward trend and there is little or no improvement in terms of financial losses to the business. The respondents felt that electricity theft is driven by factors external to Eskom and therefore requires political intervention. The lack of political

will is affecting the successful implementation of the strategies. Respondents felt that Eskom and the government strategies should look beyond conventional engineering methods and focus on social and economic issues that are contributory factors to electricity theft. Researchers agree that power utilities need to look beyond technical initiatives and understand and explain why theft occurs, as well as what factors perpetuate theft (Smith, 2004; Winther, 2012). Theft can be minimised using technology, however, as technology advances, perpetrators also find sophisticated ways of tampering with technology. Theft can be controlled by a combination of strategies and creating awareness in communities.

Respondents identified the following factors as inhibitors to the successful implementation of strategies

- *Social and Economic*
    - High levels of unemployment
    - Weak law enforcement or lack of consequences
    - Poverty
- *Business Deficiencies*
    - Leadership decisiveness
    - Inability to act to reported cases of electricity theft
    - Poor scoping, poor design or poor management of projects
    - Weak internal controls
    - Collusion by contractors and employees
    - Poor engagement with external stakeholders
    - Limited resources
- *Lack of political will*

5.3 Summary

Chapter 5 seeks to discuss findings on the issue of electricity theft. Previous research on electricity theft found that electricity theft is correlated with many variables. These variables include political, economic, criminal and managerial issues (Depuru et al., 2010). This study attempted to prove some of these tested theories to check if they are applicable in the South African context. Most empirical studies agree with the theory that high levels of unemployment and customers' economic situation (Depuru et al., 2011; Depuru et al., 2010; Jamil, 2013; Steadman, 2009), inequality and crime (Fajnzylber et al., 2002) corruption and poor governance (Smith, 2004), illiteracy and terrorist attacks (Marangoz, 2013), consumer price of electricity and per capita income (Jamil and Ahmad, 2014) and power outages (Jamil, 2013), are closely related to electricity theft.

The study found that affordability and the culture of entitlement are associated with electricity theft. Although 66.2% of the respondents (consumers) indicated that their highest level of education is secondary level, this study could not distinguish a relationship between electricity theft and illiteracy.

Relating electricity theft and power outages (Eskom service), most respondents, 39.4% and 15.5% indicated that they were very satisfied and satisfied with the level of services they received from Eskom, therefore this research could not find a correlation between electricity theft and power outages.

In order to check whether electricity tariff is a determinant to electricity theft, the respondents were questioned if they thought that the cost of electricity results in non-payment. A total of 84.5% felt that the cost of electricity had an impact on the increasing electricity theft. According Jamil (2013), higher electricity prices create an incentive to steal electricity.

The study also found that half of the population 52.1% indicated that they had been offered illegal electricity or meter tampering. This is worrying and presents a challenge to Eskom, which needs to be managed. Half of the population surveyed had been offered an illegal alternative of consuming electricity. The researcher is of the view that electricity theft is a multifaceted subject which requires a multi-pronged approach. The researcher also believes that the issue of electricity theft requires a

combination of strategies, there is no single strategy that can systematically work on its own to minimise electricity theft. A bottom-up approach with community involvement, government, Eskom and the corporate world may be required in the fight against electricity theft.

The next chapter presents the conclusions and whether the study met the research objectives stated in Chapter 1. It also details the implications of the study, limitations of the study and overall recommendations.

Chapter 6 : Conclusion and Recommendations

6.1 Introduction

This chapter presents the conclusion and recommendations of the investigation into the effects of electricity theft on Eskom Distribution in KwaZulu-Natal Operating Unit. The chapter details whether the study objectives were achieved and bring the study to a close. The limitations and implications of this research are also detailed in this chapter.

The objectives of the study were achieved through a combination of the literature review and research methodology. The research methodology employed the mixed method approach, based on semi-structured interviews and close-ended survey questionnaires. The qualitative research questionnaire was distributed to experienced Eskom employees in the field of engineering and customer services, whilst the quantitative questionnaire was distributed to electricity consumers (Eskom customers) in the Edendale area, in Pietermaritzburg. Quantitative data provided a general understanding on the factors contributing to electricity theft, from the consumer perspective. The qualitative aspect of the study provided insights into factors, effects of electricity theft and strategies employed by Eskom to minimise theft. Eskom employee's insights and opinions assisted in providing answers and helped further the literature to the topic of electricity theft. The use of the mixed method approach adopted for this research study is vindicated as study objectives were met.

The study has been designed around the need for a sustainable solution to address and manage electricity theft in South Africa. The findings and recommendations might therefore assist and serve as a guideline for effective strategy formulation and management of electricity theft in Eskom and municipalities.

This research study has revealed that electricity theft is a growing national problem which has impacted on the overall economy of the country. It manifests in various forms, driven by numerous factors and occurs across all sectors. The objectives of the study were specifically set out to identify the various factors contributing to the problem, in an attempt to identify the measures that can be taken in finding an

effective solution. Understanding these contributing factors can produce a sustainable solution to the growing challenge of electricity theft.

6.2 Conclusion and Recommendations

Conclusions and recommendations is based on empirical findings and addresses each of the study objectives.

6.2.1 Objective 1: Factors contributing to electricity theft in KwaZulu-Natal Operating Unit

The study identified several factors contributing to electricity theft. These factors were identified by the respondents, as well as in the literature review, but there were exceptions.

- *Socio economic*
  The study found that electricity theft is a socio-economic problem. Socio economic challenges can be attributed to unemployment, poverty, inequality and the lack of access to basic services. The issue of unemployment, poverty and inequality is not a technical problem; therefore it cannot be resolved by Eskom alone, but requires a holistic solution which is political and economic. Socio economic is a factor that needs to be addressed by the government and the corporate world. Eskom is state owned and implements government policies. In a growing economy, the issue of poverty and unemployment which leads to electricity theft can be tackled. However, in a shrinking economy, the levels of unemployment, poverty and inequality rises. Socio economic conditions is directly linked to electricity theft.

  The researcher proposes that in areas where there is no access to electricity, Eskom and government need to expedite electrification programs (UAP). The government needs to adopt policies that will alleviate poverty and unemployment, which in turn reduces social ills accompanied by this phenomenon.

- *Lawlessness*
  The lack of consequences has been identified as the major contributor to electricity theft. There is a lack of consequence to perpetrators who are

tampering with electricity. Lawlessness is a snow ball effect, when one member of the community starts getting free services (stealing), this serves as an incentive for the rest to join in.

The researcher proposes that Eskom revisits its disconnection process. Eskom needs to take a stronger stance (harsh sanctions), especially in red areas. When Eskom disconnects due to illegal activities in an area, all illegal consumers should be disconnected and there must be no selective approach. Punitive action must be taken when electricity theft is reported or identified through audits. The researcher further proposes that Eskom should increase its visibility in areas where theft is rife. Eskom should conduct regular meter audits and take corrective action in areas where there are signs of faulty meters or tampering.

- *Culture of entitlement*

  The researcher found that most consumers prefer not to pay for electricity. Respondents pointed out that either government or Eskom, must pay for electricity usage in their households. Eskom employees felt that there is a national culture of entitlement to services, especially those deemed to be a "right" by the Constitution, to be a major contributor to electricity theft. The culture of non-payment for services was used as a strategy to fight the apartheid regime and consumers were encouraged not to pay for services. Consumers had an understanding that if they did not pay for services, it will collapse the government. It was interesting to note that when Eskom customers were asked about the effect of electricity theft, most of them had an understanding that it leads to revenue loss. The researcher thus proposes that the issue of non-payment for services requires a political intervention. Eskom needs to engage the communities and their leaders, to create awareness on the financial implications of not paying for electricity.

- *Affordability*

  Affordability is the inability to pay, rather than the unwillingness to pay for service and is often associated with poverty (Mavhungu, 2011). If electricity theft is linked to poverty, the researcher observed that 91.6% of the

respondents did not receive FBE, which is aimed at subsiding the poor. The study found that almost half of the respondents felt that electricity is unaffordable. This indicates that the electricity price is linked to affordability. On the contrary, most Eskom employees felt that affordability does not cause people to steal electricity. In the business sector, this is an act of criminality, whereas in residential sector, it can be argued.

The researcher thus proposes that Eskom and municipalities educate the consumers about Free Basic Electricity and the benefits therefore. FBE will assist those customers who are willing to pay but cannot afford to pay for electricity.

6.2.2 Objective 2: Impact of electricity theft on the operations of Eskom Distribution in KwaZulu-Natal Operating Unit

The study found that electricity theft has an impact on the running of Eskom Distribution business. According to previous studies, electricity theft represents an avoidable financial loss, increase operational cost, affect quality of supply and tariff imposed on electricity consumed by genuine customers (Depuru et al., 2010). Both Eskom employees and customers agreed with the findings from literature. The research identified the following effects which are detailed in Chapter 5:

- Revenue loss
- Network expansion and network strengthening
- Increased operational cost
- Reputation and image
- Safety

Electricity theft requires a political, social, economic and technical solution. The issue of electricity theft cannot be addressed by looking at technical solutions only, it requires a multi-pronged strategy. These include the following, from Eskom's side:

- Eskom needs to electrify or connect customers.
- Provide safe and legal electricity by converting illegal consumers into customers through normalisation projects.
- Manage network visibility and take ownership of their network or infrastructure.
- Monitor buying patterns and follow up on disconnections.

- Management of projects and material, this will reduce the material available for illegal connections.
- Management of field operators (contractors and Eskom employees)
- Conduct regular audits especially for (LPU's and SPU's)
- Disconnections and prosecution
- Eskom needs to look at introducing incentives against employee field workers performance for recovery targets, or by the count of cases detected and rectified.
- Introduce an amnesty that will encourage consumers to come forward and report theft
- Review tampering fee based on economic conditions, conventional customers and prepaid users must be treated equally. If payment arrangement is permitted for conventional meters, the same should apply to prepaid metres for a tamper fee.

6.2.3 Objective 3: Strategies employed by Eskom Distribution to minimise electricity theft

The study found that Eskom adopted several strategies to combat electricity theft. These strategies include:

- An internal energy loss task team has been formed by KZNOU, which is focused on reducing non-technical losses.
- Free basic electricity is one of the strategies employed by the South African government to shield the poor from sinking into poverty due to electricity prices.
- Universal Access Program (Electrification Program) and Normalisation Program. Electrification program is focused on providing universal access to electricity. In areas where there are illegal connections, KZNOU is converting illegal consumers into legal customers (paying customers).
- Feeder load balancing is one of the strategies employed by Eskom, which is the feeder level losses measured as difference between statistical meter energy inflow and total sales for customers linked to the feeder.
- Operation Khanyisa is a national partnership campaign aimed at educating South Africans about the impact, consequences and dangers of electricity theft, as well as encouraging people to report electricity theft.

- Technology (Smart meters) is one of the technical mechanisms used to combat meter tampering in the residential sector. Split metering is implemented in areas with high electricity theft. There is a drive to install split meters for all new electrification projects (connections).
- Audits

The effectiveness of these strategies was questioned, and the respondents expressed mixed views on the effectiveness of the strategies adopted by Eskom to manage electricity theft. The views are expressed in objective 4. It was also observed that the respondents mentioned more than two strategies per person.

6.2.4 Objective 4: Employees' perceptions and attitude towards Eskom strategies in minimising electricity theft

The study found that there were contradictory opinions in terms of the effectiveness of the strategies employed by Eskom to minimise electricity theft. Some respondents thought that Eskom did not have adequate resources to deal with the challenge of electricity theft, whilst others thought that Eskom had adequate resources, but lacked a clear strategy in dealing with electricity theft, or somehow the existing strategies are ineffective.

The study found that there are good strategies adopted by Eskom to deal with the issue of theft. These strategies are in line with how other countries tackle the issue of electricity theft. However, the challenge may be with the implementation, resources and capabilities. It was noted that the customer numbers are growing and yet the human resources who should manage these losses are not increasing at the same rate. Electricity theft is on the upward trend and requires an arrest. The study found that although there were many strategies employed by Eskom to minimise electricity theft, there were several factors identified as inhibitors to the successful implementation of strategies that were aimed at combatting theft. Some of these inhibitors are external to Eskom. Apart from the socio-economic challenges, the study found that there were many business deficiencies from Eskom and when addressed, it would reduce the impact of electricity theft. There were weak internal controls that need to be tightened, especially when managing contractors and employees. To tackle the issue of electricity theft, it is recommended that Eskom invests in technologies that would eliminate the need for physical checkups.

Investing in technologies such as smart metering and or smart grid might improve network visibility and bring about change on how Eskom constructs and manages its networks. Network visibility will ensure that if anyone is tampering with the network and is unauthorised, Eskom would be able to receive a signal and view the portion of the network that has been tampered. Corrective action will then be implemented to isolate that incident. For example, Eskom can adopt an IT infrastructure model where one cannot put a repeater on an IT network without the network administrator picking up on the fact that there is an additional repeater on. Due to resources required for a SMART grid network, Eskom can partner with institutions of higher learning to investigate an effective alternative technology or methodology that be used to minimise electricity theft. The researcher notes that technology alone cannot solve this problem, but in combination with other initiatives, it will assist Eskom and municipalities to deal with electricity theft.

The study recommends that Eskom directs more resources to energy loss management. Departments like revenue protections and energy trading should be fully resourced and utilised to combat electricity theft. The study further recommends that Eskom funds and supports initiatives aimed at minimising electricity theft. The study recommends that Eskom needs to encourage consumers to report theft by introducing some form of an amnesty to all sectors.

The researcher therefore concludes that electricity theft is a socio-economic problem which requires a political, economic and technical solution. It can be managed, but requires a holistic solution from the government, Eskom, communities and the corporate. The researcher believes that the issue of electricity theft requires a combination of strategies, there is no single strategy that can systematically work on its own to minimise electricity theft.

6.3 Implications of this research

The study of this nature has never been conducted in Eskom nor municipalities. Limited or no research has been conducted from a South African context, as the researcher struggled to find literature relating to this study. The data gathered and the findings from this research serve as a benchmark for future studies related to electricity theft in South Africa. Eskom may use the outcome of the study to

formulate strategies or improve on the existing strategies, to better manage electricity theft.

6.4 Limitation of the study

A census of the whole population of the Edendale area could have provided more accurate results for the study. Due to time and resources required to execute the quantitative survey, the researcher managed to receive only 71 responses out of the targeted 355. Although it took respondents between 10 and 15 minutes to answer the questions, some of them felt that the survey questionnaire contained a lot of questions. The study was based on household data, to fully understand the views and perceptions of other customer segment, the researcher is also of the opinion that a quantitative study is necessary for the business sector.

6.5 Recommendations for future studies

The current study investigated a traditional township dominated by prepaid users with almost similar backgrounds. Further research is required, to include consumers from the upper end residential, as well as businesses. A study similar to this nature may be initiated to other areas and provinces, to ascertain if comparable outcomes are derived. Further research is required to quantify how much is electricity theft costing Eskom in terms of their OPEX and CAPEX. In addition, the study recommends that further research will have to be undertaken to determine the extent of the culture of non-payment for services and whether South Africans are using this as a strategy to protest the current government.

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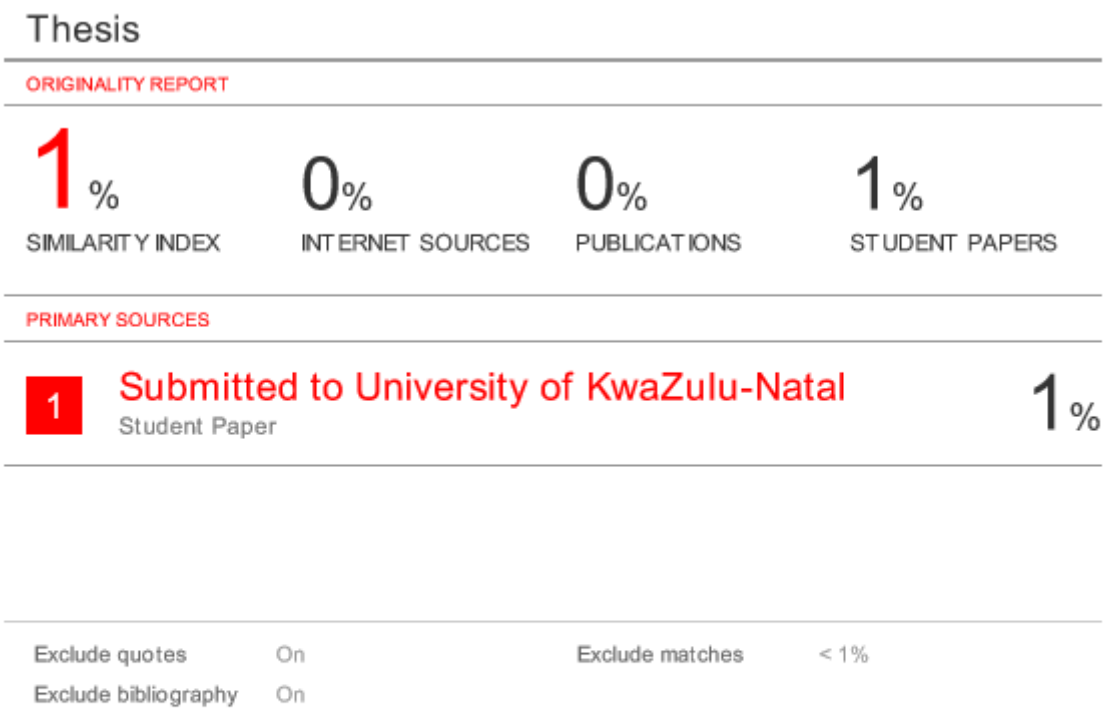
APPENDIX

Appendix A: Turnitin Report – Similarity Index



Thesis

ORIGINALITY REPORT

1%	0%	0%	1%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	Submitted to University of KwaZulu-Natal Student Paper	1%

Exclude quotes	On	Exclude matches	< 1%
Exclude bibliography	On		

Appendix B: Gatekeepers Letter - Permission to conduct research from Eskom

Eskom

Mrs Zanele Mhaule
P O Box 5
Mkondeni
Pietematitzburg
3212

Date:
23.06.2017

Enquiries:
Tel : +2731 710 5074
PapuPB@eskom.co.za

Dear Zanele

Re: PERMISSION TO CONDUCT RESEARCH AT ESKOM DISTRIBUTION, KZNOU

The above matter refers.

I **P Papu** the undersigned, hereby give permission for **Zanele Mhaule** to conduct research in her dissertation entitled **"The Effects of Electricity Theft on Eskom Distribution in KwaZulu Natal Operating Unit".** I hope that the results of the study will give some light in this aspect of our organization.

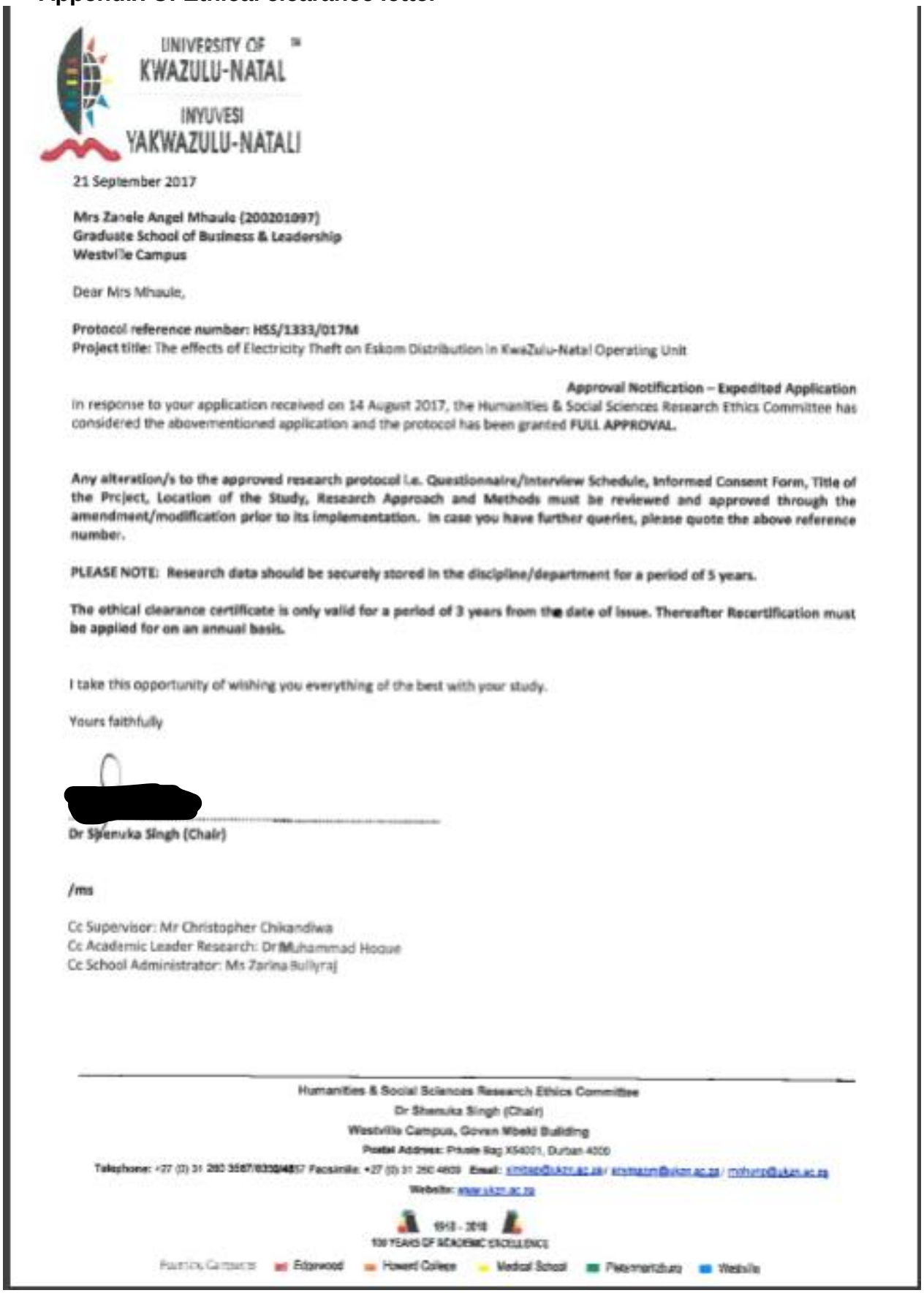
Should you need further help, please do not hesitate to contact me on the above details.

Yours sincerely

[redacted]

Mrs Portia Papu
Senior Manager Asset Creation
Eskom Distribution: KwaZulu-Natal Operating Unit

Appendix C: Ethical clearance letter



UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

21 September 2017

Mrs Zanele Angel Mhaule (200201097)
Graduate School of Business & Leadership
Westville Campus

Dear Mrs Mhaule,

Protocol reference number: HSS/1333/017M
Project title: The effects of Electricity Theft on Eskom Distribution in KwaZulu-Natal Operating Unit

Approval Notification – Expedited Application

In response to your application received on 14 August 2017, the Humanities & Social Sciences Research Ethics Committee has considered the abovementioned application and the protocol has been granted **FULL APPROVAL.**

Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the amendment/modification prior to its implementation. In case you have further queries, please quote the above reference number.

PLEASE NOTE: Research data should be securely stored in the discipline/department for a period of 5 years.

The ethical clearance certificate is only valid for a period of 3 years from the date of issue. Thereafter Recertification must be applied for on an annual basis.

I take this opportunity of wishing you everything of the best with your study.

Yours faithfully

[redacted]

Dr Shenuka Singh (Chair)

/ms

Cc Supervisor: Mr Christopher Chikandiwa
Cc Academic Leader Research: Dr Muhammad Hoque
Cc School Administrator: Ms Zarina Bullyraj

Humanities & Social Sciences Research Ethics Committee
Dr Shenuka Singh (Chair)
Westville Campus, Govan Mbeki Building
Postal Address: Private Bag X54001, Durban 4000
Telephone: +27 (0) 31 260 3587/8350/4557 Facsimile: +27 (0) 31 260 4609 Email: singhsh@ukzn.ac.za / snymazm@ukzn.ac.za / mohunp@ukzn.ac.za
Website: www.ukzn.ac.za

1910 - 2010
100 YEARS OF ACADEMIC EXCELLENCE

Founding Campuses: Edgewood, Howard College, Medical School, Pietermaritzburg, Westville

Appendix D: Quantitative Questionnaires to electricity consumers (households)

Quantitative Questionnaires (Please tick appropriate box)
Biographical Information

1. Gender

Male	
Female	

2. Marital status

Married	
Single	
Divorced	
Widow	

3. Level of education?

Primary level	
Secondary level	
Diploma level	
Degree level	
Post graduate level	

4. How old are you?

19yrs- 30yrs	
31yrs-40yrs	
41yrs-50yrs	
51yrs-60yrs	
Above 61yrs	

UNDERSTANDING SOCIO ECONOMIC CONDITIONS

5. Do you have access to electricity in your household?

Yes	No

6. If yes, what type of an electricity meter are you connected too?

Conventional Meter	
Prepaid Meter	
Connected to neighbours meter and paying neighbour	
Connected to neighbours meter and paying neighbour and not paying	
Connected directly to Eskom line and not paying	

No access to electricity	
Uncertain/Don't know	

7. How long have you had access to electricity in this household?

0-1 year	
2-4years	
More than 5 years	
No access to electricity	
Uncertain/don't know	

8. What is the main source of energy for lighting in this household?

Electricity	
Paraffin	
Gas	
Candles	
Wood	
Solar	
Generator	
Other	

9. What is the main source of energy for cooking in this household?

Electricity	
Paraffin	
Gas	
Wood	
Solar	
Generator	
Other	

10. How much does your household spend on electricity per month on average?

R0	
Less than R500	
Between R500 and R1000	
Greater than R1000	
Uncertain/don't know	

11. When was the last time you paid or bought electricity?

Within the last week	
Two weeks ago	
More than two weeks but less than a month ago	
A month or more ago	
Don't buy or pay for electricity	
Uncertain/don't know	

12. How do you pay for electricity?

Banks	
Easypay e.g PicknPay	
South African Post Office	
Internet Payments	
Debit Orders	
Don't Buy or Pay for electricity	
Uncertain/don't know	
Other	

13. What is the source of income for this household? if selected Formal employment or self-employment Q14 is no longer applicable

Social Grants	
Formal employment	
Self-employment	
No income	
Other	

14. If unemployed, how long have you been unemployed?

0- 6months	
1 year	
2 years	
More than 2 years	
Never been employed	
Don't know	

15. What is the level of income for this household?

R0	

Less than R1000	
Greater than R1000	
Uncertain/ Don't know	

16. Have you ever stayed without any electricity in the house? If selected No move to 19

Yes	No

17. What was the reason for staying without electricity in this house excluding power failures and load shedding from Eskom

Did not have adequate money to buy electricity units or pay the bill	
Forgot to buy units or pay the bill	
Faulty meter	
Disconnection from Eskom	
Uncertain/ Don't know	

18. How long was your household without electricity?

0 day	
1 day	
Less than a Week	
More than a Month	
Don't know	

19. Have you ever been offered illegal connection or meter tampering by anyone?

Yes	No

20. In your opinion, do you think it is only unemployed and poor households that access electricity illegally?

Yes	No

AFFORDABILITY

21. Do you receive free basic electricity? If selected NO move to 24

Yes	
No	

22. If yes, how often did your household receive free basic electricity in the last 12 months?

Every month	
Most months	
Don't know	

23. Is free basic energy adequate for your household needs?

It is not adequate for my household's needs	
It is just adequate for my household's needs	
It is more than adequate for my household's needs	
It is more than adequate for my household's needs	
Don't know	

24. If no, why does your household not receive free basic electricity every month?

Do not qualify	
Not available in my area	
Not aware of this service	
Don't know	

25. How do you rate the affordability of Electricity provided by Eskom

Very affordable	
Affordable	
Not Affordable	
Uncertain/ Don't know	

26. If you were given a choice, which services would you prefer not to pay for?

Water	
Electricity	
Rates	

27. In your opinion, do you think electricity is becoming too expensive for your household to keep using the same amount of electricity as before?

Yes	
No	
Don't know	

CULTURE OF ENTITLEMENT

28. In your opinion, do you think increased in electricity price has caused most household not to pay for electricity used?

Yes	
No	
Don't know	

29. What is your understanding of "free basic electricity" promised by the ruling party?

Free basic electricity is awarded to the poor	
A small part of electricity is free	
All electricity will be free	
Have never heard of it	
Don't know	

30. In your opinion, who should be paying for electricity used in your household?

The breadwinner	
Government	
Eskom	
NGO's	
Don't know	

ESKOM SERVICE

31. Have you ever reported a faulty meter or applied for a new connection through Eskom? If selected No move to 33

Yes	
No	
Don't know	

32. How long did it take for Eskom to respond to your query or application?

less than 24 hours	
2-5 days	
1month	
2-6 months	
More than 6 months	

33. In your opinion, are you satisfied with the level of service you receive from Eskom. How would you rate the service you receive from Eskom?

Very satisfied	
Satisfied	
Neither	
Dissatisfied	
Very dissatisfied	
Do not know	

34. Would you pay for the level of service you receive from Eskom?

Yes	
No	
Don't know	

35. In your opinion, how do you think electricity affects Eskom?

Eskom losses Revenue	
Power interruptions caused by faults	
Fatalities and injuries	
Load shedding	
Electricity Tariff Increase	
Don't know	

36. In your opinion, do you think introducing harsher penalties would minimize electricity theft?

Strongly Agree	
Agree	
Neutral	
Disagree	
Strongly Disagree	

Appendix E: Interview Questions for Eskom's Employees

ADMINISTRATIVE

1. Gender

Male	
Female	**x**

2. Race

African	**x**
Coloured	
Indian	
White	
Other	

3. What is your job designation in Eskom?
4. What is your length of service in Eskom's employment?

UNDERSTANDING FACTORS CONTRIBUTING TO ELECTRICITY THEFT

5. What is your understanding of the concept electricity theft within Eskom Distribution?
6. In your opinion, what do you identify as the main factors contributing to electricity theft?
7. Out of the factors listed above, which one would you consider as a key factor and why?
8. What are the factors that Eskom need to manage in order to minimize theft?
9. Have you personally experienced the effects of electricity theft in Eskom, in what way?

BUSINESS OPERATIONS OF ESKOM

10. Do you think electricity theft is costing Eskom? Please elaborate
11. In your opinion, how does electricity theft affect the running of Eskom Distribution business?

STRATEGIES

12. What are strategies employed by Eskom to minimize theft?
13. Which strategy would you consider effective and why?
14. What other strategies or activities does Eskom need to manage in order to minimize theft?

PERCEPTIONS AND ATTITUDES

15. Do you think Eskom has adequate resources to deal with a challenge of theft?
16. Do you think Eskom is doing enough to deal with this issue and why?
17. Please identify some of the underlying factors that inhibit the successful implementation of the strategies that deal with electricity theft?
18. How can Eskom improve the anti-electricity theft practices and success thereof?

Appendix F: Informed consent letter

Informed Consent Letter 3C

UNIVERSITY OF KWAZULU-NATAL
GRADUATE SCHOOL OF BUSINESS AND LEADERSHIP

Dear Respondent,

MBA Research Project: The Effects of Electricity Theft on Eskom Distribution in KwaZulu Natal Operating Unit
Researcher: Zanele Mhaule (073 308 8122)
Supervisor: Christopher T Chikandiwa (031 260 8882)
Research Office: Ms P Ximba 031-2603587

I, **Zanele Mhaule** an MBA student, at the Graduate School of Business and Leadership, of the University of KwaZulu Natal. You are invited to participate in a research project entitled **THE EFFECTS OF ELECTRICITY THEFT ON ESKOM DISTRIBUTION IN KWAZULU-NATAL OPERATING UNIT**. The aim of this study is to investigate and assess the effect electricity theft has on the operations of Eskom Distribution business in KwaZulu- Natal Operating Unit.
Through your participation I hope to understand factors contributing to electricity theft and the impact it has on the technical and financial sustainability of Eskom Distribution The results of the study are intended to contribute to finding a sustainable solution to address and manage electricity theft in South Africa. Furthermore, it will serve as a guideline for effective strategy formulation and management electricity theft in Eskom and municipalities.

Your participation in this project is voluntary. You may refuse to participate or withdraw from the project at any time with no negative consequence. There will be no monetary gain from participating in this survey/focus group. Confidentiality and anonymity of records identifying you as a participant will be maintained by the Graduate School of Business and Leadership, UKZN.

If you have any questions or concerns about completing the questionnaire or about participating in this study, you may contact me or my supervisor at the numbers listed above.

The survey should take you about **15-60** minutes to complete. I hope you will take the time to complete this survey.

Sincerely

Investigator's signature_Zanele Mhaule Date :

Appendix G: Respondents Informed Consent Letter

UNIVERSITY OF KWAZULU-NATAL
GRADUATE SCHOOL OF BUSINESS AND LEADERSHIP

MBA Research Project: The Effects of Electricity Theft on Eskom Distribution in KwaZulu Natal Operating Unit
Researcher: Zanele Mhaule (073 308 8122)
Supervisor: Christopher T Chikandiwa (031 260 8882)
Research Office: Ms P Ximba 031-2603587

CONSENT

I……(full names of participant) hereby confirm that I understand the contents of this document and the nature of the research project, and I consent to participating in the research project. I understand that I am at liberty to withdraw from the project at any time, should I so desire.

SIGNATURE OF PARTICIPANT DATE

……