The influence of continuous electricity supply on selected commercial customers in Klerksdorp

DH Mokoena

orcid.org/0000-0003-1198-9443

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Student number: 23907657

Supervisor: Dr HM Lotz

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ABSTRACT

The electricity shortages that occurred in the recent years have negatively affected both businesses and the South African economy. Power shortages, together with high electricity tariffs, have made it difficult for small and large businesses to reach daily production targets and desired profits. This research project examines the influences of interruptions to the continuous electricity supply, by observing the impact of both power-cuts and high electricity tariffs that have affected commercial customers based in the Klerksdorp and surrounding areas. To perform this task, a quantitative survey was conducted by developing a questionnaire based on a Likert scale, and then sending this questionnaire to different respondents from a range of business sectors. The questionnaire was divided into three sections with the intention of measuring the impact of load-shedding on the chosen companies' daily business operations, secondly to measure the influence that the current high electricity tariffs have on the businesses and lastly to measure the consequences of power cuts and high electricity tariffs on investment of the sampled business sectors. The quantitative results revealed that load-shedding, together with high electricity tariffs, had a negative effect on the different commercial customers that are based in the Klerksdorp area. A major reason for this adverse impact was that, when load-shedding was initially introduced in South Africa in 2008, customers were unprepared and had to start making arrangements for a 'backup' electricity supply that ranged from the massive diesel generators required by large businesses to renewable energy sources such as solar geysers for domestic use.

Key Words: Load-shedding, high electricity tariffs, commercial customers, power insecurity, backup supply, investment.

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LIST OF ACRONYMS AND ABBREVIATIONS

CPI	Consumer price index
CDE	Centre for development and enterprise
CoM	City of Matlosana
DME	Department of energy
DMP	Demand market participation
DSM	Demand side management
ECS	Energy conservation scheme
GAIA	Green audits into action
GDP	Gross domestic product
GVA	Gross value added
IPPs	Independent power producers
KIC	Key industrial customers
LPU	Large power user
SPU	Small power user
MTSAO	Medium-term System adequacy outlook
MYPD	Multiyear price determination
NERSA	National energy regulator of South Africa
NERT	National electricity response team
SA	South Africa
SARB	South African Reserve Bank

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CHAPTER 1
BACKGROUND AND OVERVIEW OF THE STUDY

1.1 Background

The load-shedding dilemma of 2008 was like a ticking bomb waiting to explode; it was a consequence of uncertainties relating to strategy and controlling frameworks that happened in the past period as well as to the inadequacies in the running of the electrical system. Eskom has always been the only company generating electricity in the country, so the old South African policy of the late 1990s required Eskom and electricity industry to be competitive; consequently, the power utility was not allowed to build any additional generation plants. This was done to allow other power producers to connect to the grid. Although the government wanted other independent power to connect to the grid, there were no guiding documents and controlling measures that steered the whole process of getting additional power to the grid. Furthermore, the electricity prices for independent power producers (IPPs) were not set at levels that would give new power producers the desired earnings and returns from the investments made towards the new generation plants. In 2004 the government realised that it was getting late to get required supply to the grid, therefore the issue of the new private power producers was set aside and Eskom was commissioned to build new power plants. The power utility needed huge investments funds for building additional power plants that were needed to close the gap between the supply and the demand for electricity. At least, it can take five years or more to build an electricity generation plant, so there was not enough time to build new power stations in a short space of time. Hence, load-shedding of 2008 occurred (Joffe, 2012:32).

The above matter resulted in load-shedding which was purely triggered by rapid growth in the economy of the country. Due to growth in demand, the electricity supply fell short which caused the electricity reserve margin to be extremely low. Over and above the issue of shortage of electricity supply, Eskom was confronted with other challenges like shortage of good quality coal, the poor performance of aged generation infrastructure, an excessive rainy season that caused the coal to be wet; with all these challenges it was difficult for Eskom to produce the required supply of electricity. With all the above being mentioned Eskom had no choice but to implement a rotational load-shedding scheme from as early as 2007. This was done to safeguard the grid from a total shutdown of electricity supply. Thus a national emergency regarding electrical power supplies was declared on 25 January 2008 (Joffe, 2012:33).

The demand for electricity supply was getting bigger and was now encroaching the amount of electricity that Eskom could produce to the grid. With this being said, Eskom had no funds to build new power plants to cater for the new demand. Therefore, Eskom and the National Energy Regulator of South Africa (NERSA) had far-reaching negotiations regarding the funding of new power stations; therefore, NERSA had no choice but to allow Eskom to increase electricity tariffs to gain funds for building new plants. The power utility was forced to seek investment and loans from abroad as well as hiking up the electricity tariffs to oddly high levels to raise funds for the build programme. The current tariffs are 24.8%, 25.8% and 25.9% increases to the tariffs for the years 2010 – 2012 (Slabber, 2010; Van der Waal, 2009).

It was necessary for all electricity users to reduce the consumption to balance the electrical system. The required load reductions were mainly received from the electricity intensive users being mining and heavy industries. Load-shedding is an uneconomical method for balancing the supply and demand for electricity supply. The better method to curb the high electricity usage when it is not enough to meet the demand is to increase its price. Global involvement suggests that a hike of 50 % in tariff price would yield the 10 %drop in usage of electricity supply. The power utility has been increasing the electricity tariffs significantly, and the logic behind the price increases was to gain funds for building new power plants and to curb the high usage of the electricity supply (CDE, 2008a:8).

According to Groove (2006:1) after a twenty-year period of owning surplus generation capacity, power utility is planning to spend R15 billion per year over the next five years in the power generation capacity expansion, while smaller amounts will be spent by independent power producers (IPPs). This investment may have a large impact on electricity prices, Eskom finances and the South African economy.

Before load-shedding occurred, the electricity prices for this country were constantly low and affordable. This happened for many years and for this reason the investors were always tempted, fascinated and looking forward to investing capital in the electricity intensive user companies. Investors benefited a lot because low electricity prices gave them a competitive advantage over their competitors and they also benefited from low overheads costs. Furthermore benefits of low electricity prices, covered up for other disadvantages such as unstable exchange rates and high labour costs (Van der Waal, 2010; Slabber, 2010:27).

Suddenly there was a rapid growth in the mines and other industries subsequent to low electricity prices. The growth was prompted by the policies of the country, which aimed at increasing the employment levels by incentivising the investors with low electricity supply. Regrettably, the policy was not designed for long-term usage, simply because low electricity tariffs were far less than the cost of its generation. Due to low electricity tariffs, the country was well recognised and highly favoured for investment purposes (Reuters, 2011).

South Africa eventually achieved the goal of increasing GDP by having low electricity prices; in 2007 the growth rate was 5.6%. The very same economic growth that was needed is the one that depleted the Eskom spare capacity, thus leading to a shortage of supply (Altman *et al.*, 2008:14).

Over the nineteen years of democratic freedom since 1994, South Africa's intrepid macroeconomic developments have enhanced economic growth, job creation and have opened-up South Africa to world markets. South Africa's success in restructuring its economic policies is undoubtedly mirrored by its GDP figures, which reflect an unprecedented 62 quarters of uninterrupted economic growth between 1993 and 2007 when GDP rose by 5.1%. Even though South Africa increased its integration into the global market, its GDP contracted to 3.1% due to the 2008-2009 global economic crises. Nevertheless, the economy continues to grow, driven largely by domestic consumption, even though growth is at a slower rate than previously forecast. In 2012, the economy was projected to grow at 2.7% in 2013, 3.5% in 2014 and 3.8% in 2015 (SARB, 2012).

The increment in aggregate demand for electricity rose as a result of higher economic growth and the developmental needs of a modern economy. The failure of both the utility and the South African government to invest adequately has created a real constraint on the growth prospects of the country because extremely disruptive load-shedding episodes were experienced in the country in 2008. The tariff increased by 78 % within three years' time, the increase was realised between 2008 and 2011. The electricity tariffs were set at low levels with the intention to attract the investors; now the reality has surfaced, it was the time that electricity tariffs increased to levels that will reveal the true cost of its production. Also it is claimed that electricity charges will have to keep increasing until the prices are closer to its production costs; if the cost reflective is reached there will never be a need to recur of the expensive over-investment in generation capacity in future, and there will never be a repeat of supply shortages (Cameron & Rossouw, 2012).

Shortage of power supply had considerable negative economic impacts throughout different business industries. If load-shedding had to be persistent, the economic growth rate would be negatively affected. A small percentage of load-shedding occurring for a year it would result in a significant cut in the gross domestic growth. Therefore the electricity supply crisis finally prompted decision-makers to respond to the capacity shortage that had emerged. However, in the 20 years since Eskom had last invested in base load capacity, electricity tariffs had declined to such an extent that it became apparent that Eskom would not be in a position to finance the new building programme on the basis of its existing low tariffs and inadequate revenue stream (Deloitte, 2012).

1.2 STATEMENT OF THE PROBLEM

The influence of load-shedding and increased electricity tariffs in the Klerksdorp area has not been determined. The different business sectors have experienced the limitation on electricity usage due to expensive electricity prices and rotational power cuts; as a result, it is imperative for businesses to invest in a backup electricity supply that can be used to sustain businesses. Eskom is contemplating on building the second nuclear power station, should the project be approved the power utility will require substantial capital to fund this project, the cost of building this project will surely be passed to end-users of electricity supply as such; businesses are compelled to invest in long-term reliable and cheaper electricity such as renewable energy plants.

1.3 MOTIVATION AND PURPOSE OF THE STUDY

Electricity brings immeasurable benefits to human life. With electricity come lighting, cooling, heating and cooking. Electricity also facilitates communication, production and transportation. A reliable, low priced source of electricity is critical to the success of the business sector in South Africa. For this reason, this study seeks to investigate the influence of interruptions in the normal continuous electricity supply and the impact of high electricity prices on commercial businesses in Klerksdorp area. Businesses experienced load-shedding in 2008 and 2015 and production was affected adversely by scheduled and unscheduled power cuts. Furthermore, the power utility continually increases the electricity tariffs abnormally high for the sake of covering the needed capital cost for the build programme. In short, customers are paying high tariffs for electricity for poor electricity supply that can be cut-off whenever the demand supersedes the supply.

Most of the power utility generation plants were not operational in January 2008. The unavailability of power plants increased further during the same month, by then at least 25% of the generation plant was off the power grid. Load-shedding was implemented to balance the

supply and demand for electricity (Inglesi-Lotz & Blignaut, 2011b:449). Due to the unplanned emergency, most of the metropolises had abnormal traffic congestion as the traffic lights were inoperative. Most of the food-producing companies lost production (CDE, 2008a).

According to InvestSA (2009), , Western Cape companies had to cope with a reduction in service levels, an increase in operating costs, a negative impact on competitiveness and turnover and poor customer experience as a consequence of regular load-shedding during business hours in 2008 and 2009; this was a scenario that was common to many South African businesses.

As a result of the negative effects of load-shedding and high electricity tariffs stated above, this research study will investigate the impact of these two problems as experienced by Eskom's commercial customers within the Klerksdorp Metropole. The researcher will thoroughly investigate and quantify the detrimental influence of load-shedding on the production of a wide range of businesses and will also look at the impact of high electricity tariffs and the affordability of buying a backup supply.

1.4 RESEARCH QUESTIONS

- Did any of your investors/potential investors pull out of your business due to the insecurity of the electricity power supply?
- Did you lose customers to your competitors due to power interruptions?
- Did you encounter dissatisfied customers due to delayed orders?
- Was the revenue of the company negatively impacted by load-shedding?
- Did you encounter damage to your equipment due to power cuts?
- Did you have sufficient funds to invest in a backup power supply?
- Did you meet production targets during the load-shedding period?
- Did you close down some of your operations due to load-shedding
- Were any of your employees made redundant due to load shedding?
- Is electricity a high contributing cost to your business?
- Did you reach your target profit margins with the high electricity tariff?
- Did you reduce the usage of electricity due to high prices?

1.5 SPECIFIC OBJECTIVES

1.5.1 Primary objective

To measure the influence of interruptions to the continuous electricity supply on selected commercial customers in Klerksdorp.

1.5.2 Secondary objectives

The secondary objectives of this research are (1) to perform a quantitative study with the aim of investigating the impact of the high electricity tariffs that were experienced as a result of electricity shortages in South Africa and (2) to investigate the influences of load-shedding on different business sectors in the Klerksdorp Metropole. (3) To investigate if customers had adequate backup supply before load-shedding and if they are willing to invest on backup supply post load-shedding; (4) to investigate the impacts the insecurity of supply had on customers' investors and their ultimate customer base.

1.6 RESEARCH DESIGN

According to Mouton (1996:107), the core purpose of research design is to assist and allow the investigator to expect the desired and suitable outcomes of the research and to magnify the reliability and existence of the ultimate outcomes. The much sought-after data was mined and based on the focal point of the study is the impact of load-shedding and high electricity tariffs on businesses operating within the Klerksdorp Metropole.

According to Fouché (2002a:109), a descriptive research study has a basic or realistic research aim. Descriptive research can either be applied in both qualitative and quantitative studies. The descriptive research will always yield the empirical results of the study under the investigation (Ventry & Schiavetti, 1980:41).

The quantitative method is regarded as one that typically uses random sample surveys and structured interviews to collect mainly quantifiable data which is then analysed using statistical systems. On the contrary, the qualitative method employs different sampling method, such as purposive sampling and semi-structured to obtain data from the chosen sample. Interviews can be used for collection of data, which purely involves human attitudes, inclinations, precedence and or observations about a particular matter and examine this data through sociological or anthropological investigation methods (Kanbur, 2001:15).

According to Welman *et al*. (2005:95), the cross-sectional design is a special case of the criterion-groups design. In the cross-sectional design, the criterion groups typically comprise different groups (such as technikon, university or organisational year groups), known as cohorts. These cohorts are examined regarding one or more variable, at approximately the same time. A longitudinal design is an observational study, during which the researcher conducts several observations of the same subjects over a period and, as a result, is able to detect developments or changes in the characteristics of the population (Welman *et al.,*

2005). Unlike the longitudinal observation, the cross-sectional observation used in this research project will be completed in one session, which will be conducted after the load-shedding has taken place.

Bless, and Higson-Smith (2000:156) define a questionnaire as 'an instrument of data collection consisting of a standardised series of questions relating to the research topic to be answered in writing by participants'. Neuman (2003:268) emphasises the fact that a good questionnaire forms an 'integrated whole where the researcher weaves questions together so that they flow smoothly'. According to Delport (2005:166), the basic objective of a questionnaire is 'to obtain facts and opinions about a phenomenon from people who are informed on the particular issue'. During the construction of the questionnaire used in this research project, the researcher implemented the ten suggestions made by Neuman (2003:269-272) to avoid possible errors during question writing. In this way, the researcher tried to implement her 'skills, practice, patience and creativity', as suggested by (Neuman, 2003:269).

1.7 AIM OF THE STUDY

The aim of this study is not to prove or attack any hypothesis but rather focuses on using the measured feedback obtained from the respondents to create an understanding about the influence of a break in the continuous electricity supply in the Klerksdorp Metropole. This research project, therefore, will take a quantitative approach and will be an empirical study containing the descriptive results. The first basic principle of historical research is that, wherever possible, preference should be given to primary data rather than secondary information sources. In this study, the data used will be primary data which is sourced directly from the sampled companies based in Klerksdorp Metropole.

1.8 SAMPLE AND POPULATION

The population is the study object and consists of individuals, groups, organisations, human products and events, or the conditions to which they are exposed ((Welman *et al.*, 2005:52). A population is a complete set of individuals in which the researcher is interested, for the study purposes (Howell, 1989:3).

Leedy and Ormrod (2005:199) denote a sample as a subclass of a bigger group. It comprises a chosen collection of elements or units from a certain population. The population for this study is based on different sectors of customers receiving their electricity supply from City of Matlosana (CoM) Municipality and is based in the Klerksdorp area. It would be costly and time-consuming to engage all Klerksdorp commercial customers in this research project; therefore, it was crucial to sample the population in the manner presented below.

Out of the following five sectors, 63 Klerksdorp-based customers were sampled for the research:

- Agriculture Sector
- Food Sector
- Mining Sector
- Health Sector
- Hospitality Sector

The simple random sampling strategy was applied. In the simplest case of random sampling, each member of the population has the same chance of being included in the sample and each sample of a particular size has the same probability of being chosen ((Welman *et al.*, 2005: 59). The chosen sample employs a large number of people, and some of these companies are production companies while others are service companies.

1.9 DATA COLLECTION

The required data was gathered from the sample; afterwards, it was thoroughly analysed and validated for reliability using statistical analysis to provide a meaningful and comprehensible outcome of the study. The results were used to present the severity of impacts caused by load-shedding on Klerksdorp businesses.

According to Brink (2001:109), when conducting a survey, one should focus on collecting data for the matter under the investigation. Data can be collected from the chosen sample using different methods like questionnaires, interviews and observation.

After an extensive literature review, a questionnaire based on a Likert scale was developed by the researcher and administered to the respondents in the different sectors via email. The questions were divided into four broad categories and sought to establish (1) the influences of the electricity cuts, (2) the impact of the high electricity tariffs triggered by power shortages, 3) benefits of backup supply and possibility of purchasing backup supply, and (4) the impacts the insecurity of supply had on customers', shareholders and their ultimate customer base.

1.10 ETHICAL CONSIDERATIONS

In dealing with ethics of research, involving the protection of the rights of participants Huysamen (1994:178-186) recommends that researchers should do the following:

- Provide participants with a consent form and request them to sign it.
- Inform them that participation in the study is voluntary.
- Respect the participants' privacy.
- Ensure that no part of the data received from the participants is falsely represented in the research findings.

Other important ethical issues include the following:
Competence – researchers should not embark on research involving the use of skills in which they have not been adequately trained. To do so may risk causing harm to subjects such as abusing a subject's goodwill and/or damaging the reputation of the research organisation and may involve wasting both time and resources.

Researchers should behave ethically at all times; ethics should be practised throughout the research process. Researchers should put a close eye and guard against issues such as plagiarism, integrity, loyalty, confidentiality, correct capturing and reporting of the end result. Other matters rise when the researcher includes factors that affect human beings on both the biological and social sciences. The ethics principles call for honesty and respect for the rights of individuals (Welman *et al.,* 2005:181).

1.11 RESEARCH LAYOUT

The study comprises five chapters. The first chapter introduces the research topic, and also provides the background of the topic under investigation. It contains the motivation for performing the study as well as the aim and objectives of the study.

The second chapter provides information based on the literature review of similar studies undertaken by other researchers. In essence it identifies research that has been/is being completed about the impacts of electricity supply interruptions to the economy and selected commercial, industrial and mining customers; furthermore, it provides an analysis of all pertinent information.

The third chapter describes the Research Design and Methodology. This chapter provides a detailed description of how the study was conducted. It depicts both the method and approach that were used in carrying out the study and explains how the information was gathered to complete the study.

The fourth chapter is the body of the dissertation; it reveals the final results of the research data collected from the sampled population. It also shows the analyses of the data and sub-conclusion.

The fifth and final chapter yields the outcome of the research process undertaken by providing the detailed findings, conclusion and recommendations.

1.12 Summary

Chapter one provides the problems of the statement and the main aim of the study. It also provides research design and method followed for data collection. This study is a quantitative one and was focused on measuring the influence of interruptions to the continuous electricity supply on selected commercial customers in Klerksdorp.

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CHAPTER 2
REVIEW OF THE LITERATURE

2.1 INTRODUCTION

South Africa always had electricity in abundance until 1994, when democracy was introduced to the country. After that date, a new Constitution was introduced which stated that every person in the country had an equal right to basic electricity, adequate housing and sanitation. Due to the inequality that emanated from the previous undemocratic governmental system, many Black South Africans were living in shacks with no electricity and sanitation. To correct this situation, it was necessary for the Government to build proper electrified, brick and mortar houses with access to clean drinking water and adequate sewage disposal. In 1994 Eskom, together with South African Government, undertook to electrify 1.75 million homes by the year 2000.

According to Le Roux (2006), Eskom generation capacity was always around 37000MW; since 2001, the shortage of supply was realised between 2005 and 2006. The power shortages began by the end of 2005 when the nuclear power plant was shut down for maintenance purposes. Cape Town was affected severely by the power shortage; as a result, the city was plunged into darkness due to power cuts. The problem persisted until February 2006. The problem worsened to a point where the government had to seek a way out for the matter. The presiding president of the country then denied the existence of a power crisis.

According to Timberg (2008), load-shedding was rolled out throughout the country, negatively affecting the commercial businesses based in Gauteng and the entire country. Load-shedding worsened leading to the closure of most mines and others for several days. During that time, it was quite clear that the country was confronted with a massive energy crisis.

2.2 ELECTRICITY SHORTAGES

During 1996 and 2004, Eskom was not allowed to build additional power stations. This was to encourage the private sector such as IPPs to put the electricity supply to the national electricity grid. Eskom alarmed the government that such a decision to allow private providers to build new power stations should be taken on or before the year 2000. The low electricity prices that were offered to the IPPs by Eskom were very low, and this effect demoralised the IPPs from investing in the electricity generation sector. Eskom received an approval to build new power stations in October 2004, but then it was already late to start building a new

plant. Power stations require a long lead time to be fully erected and functional; there was never enough time for building a new plant. Thus, the reserve margin for Eskom depleted from safe levels of 15% to unacceptable levels of 8%. With low reserve margins, this means the remaining plants have to operate at the maximum. This effect of running the plant at maximum level makes the generation infrastructure to be susceptible to interruptions and permanent failures as the infrastructure is already old and very close to the end of its lifespan.

This matter was aggravated by the poor quality of coal which required Eskom to burn more than double the quantity of poor coal to obtain the same output of good quality coal. The adverse rainy season exacerbated the shortage of supply and also caused production delays at the collieries. The wet coal resulted in mud, causing major problems for the coal handling both at the collieries and the generation plants. Challenges emanating from wet coal made it impossible for power plants to be fully operational. Due to lack of extra electricity supply from both Eskom and independent power produces the demand for electricity surpassed the supply leading to the load shedding of 2008 (Eskom, 2008:46).

To perform regular maintenance, generating power stations should be stopped from running, or simply they should be switched off. When a generation station or a unit within a station is under maintenance, that particular unit will not produce the required electricity to the grid. Thus, the power utility should ensure sufficient safety margin capacity to allow both planned and unplanned maintenance to take place without cutting or interrupting supply to end-users. With adequate safety margin, the unavoidable electricity system faults can be sunken without causing any degeneration leading to an emergency situation (Eskom, 2008:34).

The environment in which Eskom operates today has significantly changed over the last 20 years. During the period when Eskom had large reserve margins, there was a concerted drive to increase access to electricity and drive down real prices of electricity. Eskom achieved both of these goals. However, these changes resulted in a lack of investment into new electricity generating assets as well as electricity tariffs not being reflective of what would be required to support renewed capital expansion/replacement (Koko & Singh, 2016:47).

The table 2.1 below summarises all the events that led to the power crisis, as mentioned earlier on load-shedding first occurred in 2008, it can be seen that in 2006 there were already intermittent power cuts, but load-shedding was not yet introduced to the country. The rotational power cuts could have occurred again in 2014 however they were avoided by de-

ferring the maintenance of power plants. In 2015 load shedding reoccurred, at this time Eskom was working hard to bring the first unit of the new power station, Medupi, on the grid.

Table 2.1: Timeline for Eskom from 1994 to 2015

	Eskom time line 1994 to 2015
1994	Eskom undertook to electrify 1.75 million homes by 2000 as part of the government's reconstruction and development plan Eskom agrees with the government to reduce the real price of electricity by 20 % by 2000
1995	The national electricity regulator is formed Southern african power pool becomes a reality
1996	Eskom confirmed as the cheapest producer of electricity in the world
1998	The white paper on the energy policy of South Africa, approved by cabinet, shows Eskom warning that its surplus capacity will be fully used by 2007 Plans to stimulate interest from private power producers were in development
2001	Eskom recieved the award "the power company of the year" at the global energy awards ceremony in New York
2004	Eskom approval to start building power plants, two years after "return-to-service" programme started
2006	Intermittent power cuts begin and maintenance constraints emerges Procurement of new coal-fired power plants underway
2007	Eskom places first contracts for new build projects (Medupi and Kusile) within the scope of its capital expansion programme
2008	Controlled power cuts termed "load-shedding" introduced Various demand side management initiatives are introduced
2009 to 2014	Focus on "Keeping the Lights on" Load shedding avoided Construction on new build programs delayed, maintenance backlog continues to increase Existing plant performance is deteriorating Renewable Energy Independent Power Producers Program (REIPPP) launched
2015	Widespread "load-shedding" re-introduced Medupi Unit 6 supplies first electricity to the national grid Sere windfarm 100 MW commissioned Eskom introduced turn-around strategy

Source: Adapted from the Overview of the Eskom and South African new build programme: (2016)

2.3 POWER CONSERVATION SCHEMES

As mentioned above, since the commencement of the democratic government system in 1994, the demand for electricity increased substantially. However, the Government's delayed approval for Eskom to build more electricity generating stations led to a national shortage of electricity. To address the shortage of electricity supply, both Eskom and the South African Government had to create energy conservation schemes that will keep the electricity supply and demand in balance, while allowing Eskom to build more power stations.

The Department of Energy, together with the Power Utility (Eskom), developed plans to balance the demand against the supply by introducing three programmes at different intervals; these programmes are named Energy Conservation Scheme (ECS), Demand Side Management (DSM) and Power Buy-Back.

2.3.1 Energy conservation schemes

This programme was introduced to help manage the electricity supply shortages in South Africa. Through the use of high tariffs, the scheme penalises electricity consumers that do not reduce their consumption by an allocated percentage. For industries, the target is a reduction of 10% compared to a historical consumption profile. The Power Conservation Programmer (PCP) provides a short to medium- term solution to South Africa's electricity shortage. It is designed to result in behaviour changes that will ensure sustainable development and reduce environmental impact, while meet the country's energy needs (DME, 2008).

The Energy Conservation Scheme (ECS) will be phased into all targeted customers, starting with the largest consumers (i.e., those consuming above 25GWh per annum). The Energy Conservation Scheme (ECS) will require all participating consumers to achieve energy savings targets, with associated incentives and penalties which will become effective when the mandatory scheme comes into effect later in the years to come (Anon, 2008:2).

2.3.2 Power Buy-Back

Eskom developed a Power Buy-back programme, which required the Eskom customers (specifically Large Power Users (LPUs) to reduce their electricity consumption when electricity demand was excessively high, in return Eskom would pay the LPUs a certain fee for every kWh reduced during the emergency**.** The power utility used to buy electricity back from the large power users; meaning customer were paid for not using electricity during an emergency. However this was done cautiously so as not to harm customer profitability negatively thus leading to job losses. The most targeted customers are high electricity users, and the anticipated load reductions from the power Buy-Back programme are quite high. The

expected load reductions are significantly high to relieve the pressure from the constrained power grid.

The demand market participation (DMP) is a system that allows Eskom customers to offer load to Eskom by switching off the electricity supply at agreed cost. When the power utility experiences load shortages, it commands the contracted DMP customer to reduce load as per the contract before it can proceed to implement the rotational load-shedding. The demand market participation process is authorised by the Regulator and in many days had assisted in avoiding load-shedding from occurring (Eskom, 2008:50).

2.3.4 Demand Side Management

The objective behind DSM was to promote behavioural change in the usage of electricity supply for Eskom customers. Eskom subsidised customers who purchased energy efficient equipment, the amount of subsidy differed according to the size of the electricity producing equipment purchased. The benefit of this subsidy was extended to all energy users, including residential customers. Most residential customers could purchase a Solar Powered Geyser at a discounted price; when buying it from Eskom approved suppliers (Eskom, 2015).

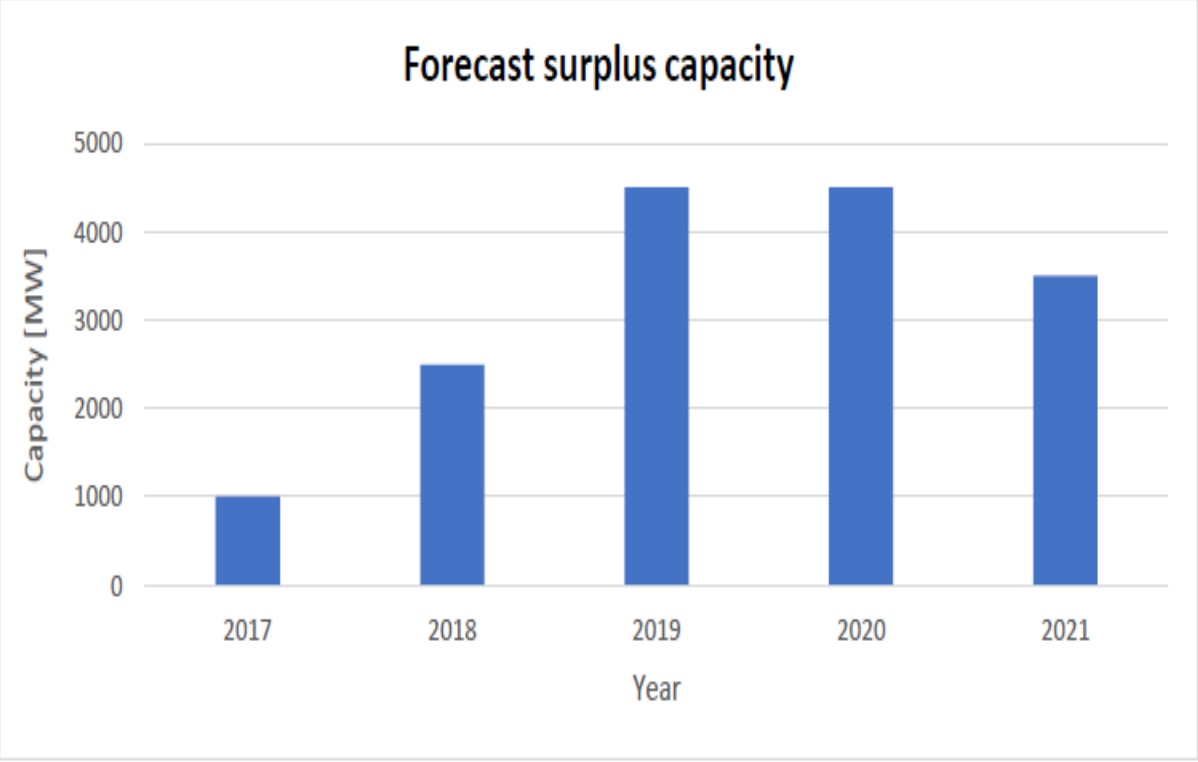
The South African Government realised that to manage the huge electricity shortages it was necessary to employ multifaceted methods. Therefore, the precedence was not only awarded to Independent Power Producers and Eskom for bringing new power on the grid but also through investigating and executing the demand side management methodologies. During January of 2008, the minister of mineral and energy urged all South Africans to put a concerted effort in saving electricity. The South African Government had to devise an emergency programme, which dealt with the control of the crisis for supply and demand for electricity. Demand side management schemes involve the use of energy efficiency technologies such as solar power and replacing normal equipment with energy efficient ones. The government had set a target of 10% for households which were supposed to be reduced voluntarily. When the electricity grid was in dire constraints, Eskom would broadcast the communication on national television alarming the residents about the situation and also requesting for reductions for the sake of evading load-shedding. The rotational load-shedding is used as a last option to avoid a total blackout in the country (DME, 2008:113).

2.4 CURRENT STATE OF SOUTH AFRICAN ELECTRICITY SUPPLY AND ASPIRATIONS

This Medium-term System Adequacy Outlook (MTSAO) study has shown that the system is adequate in the medium term to meet demand from 2017 to 2021 in all the scenarios studied. The findings of this study are similar to the October 2016 publication for the MTSAO.

Lower-than-expected demand, improvements in the EAF of Eskom coal-generating sources, and the earlier commercial operation dates of Eskom's 'new-build' programme have contributed to the improved adequacy of electricity supplies since the April 2016 study. The system has excess capacity throughout the study horizon of this 2016 MTSAO. Figure 2.1 below indicates the excess capacity associated with the base case of this MTSAO study (moderate growth with official commercial operation dates (CODs). The excess is based on the average growth of 2.16%, which is higher than what is currently being observed. The existing fleet has no mid-merit-type generators, only base-load and peaking. Therefore, the excess production is made up mainly by base-load generators, i.e. the Eskom coal-fired plant. Furthermore, it can be concluded that extending the life of plant beyond 50 years, further reduction in demand, and additional IPPs beyond Bid Window 3.5 will increase the excess capacity beyond what is indicated in the base case (Eskom, 2017:13).

Figure 2.1: Forecasted excess capacity (MW) from 2017 to 2021



Source: Adapted from Eskom MTSAO (2017)

2.4.1 Plans to increase electricity capacity on the grid using nuclear power

The South African state-owned power utility, Eskom, said in a statement that recent global developments indicate an international shift towards nuclear power generation of electricity and South Africa stands in good stead with its 'new-build' plans. According to a statement made by Eskom 'current global projections indicate that nuclear power plants will provide

over 1,000GW of electrical power by 2050 from its current level of 396GW. These figures will be the sum of existing generation plants as well as new developments and market entrants. There is an expected increase in the number and size of nuclear power plants from the current 450 commercial nuclear reactors operating in 30 countries to generate this 1,000GW.

In Cape Town, Koeberg (Africa's only nuclear power plant) contributes 4% of the country's power supply, and the country plans to develop additional nuclear capacity, diversify its energy mix to lower carbon emissions, as required under COP21 energy targets, and in order to generate cheaper electricity and, thereby, further stimulate economic growth (ESI Africa, 2016).

2.5 CITY OF MATLOSANA ELECTRICAL DISTRIBUTION SYSTEM

The City of Matlosana is based in North West province, in the past, it was called Klerksdorp municipality, it covers 3625km², and it is located about 164 km south-west of Johannesburg. The name change was done in July 2005. The City of Matlosana (COM) is a local municipality, and it forms part of the Dr Kenneth Kaunda District Municipality. The name Matlosana means 'People helping each other to move from one area to the other'. To warrant local economic stimulation and industrialisation for Klerksdorp, the council plans to promote what is known as the 'N12 Treasure Corridor'. CoM is categorised as a Category B Municipality by the Municipal Demarcation Board, regarding Section 4 of the Local Government Municipal Structures Act, (SA, 1998). The COM includes Klerksdorp, Jouberton, Alabama, Orkney, Kanana, Stilfontein, Khuma, Tigane and Hartbeesfontein and is the largest of all towns in the North West Province (City of Matlosana, 2015:4).

2.5.1 Licensed distributors of electricity in Klerksdorp

In South Africa, the government utility, Eskom, has a monopoly on the generation and transmission of electricity, and municipalities purchase bulk electricity from Eskom to fulfil their constitutional mandate of electricity distribution. During the Apartheid era in South Africa, electricity was subsidised, and Eskom tariffs were kept low, declining in real terms between 1980 and 2007 (DME, 2008).

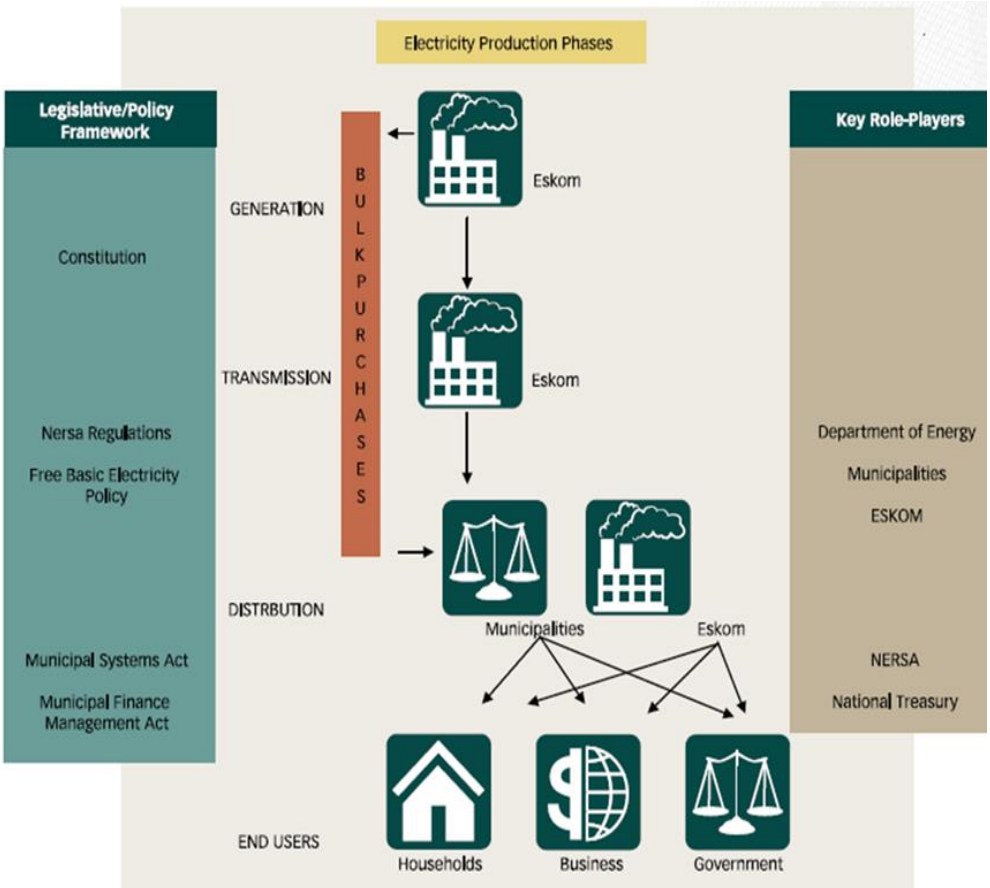
Electricity supply to users within the COM metropole and surrounding regions are separated from the municipality and the power utility. Key supplies within the COM are categorised into three areas. COM has other key points of supplies, and it has been awarded the licence to distribute electricity by NERSA. Within the COM jurisdiction, Eskom also supplies electricity to mines and industries as well as to residential customers, using a distribution licence ob-

tained from NERSA. The townships supplied by the power utility are Kanana, Khuma and Tigane (South African Cities Network, 2014:58).

As mentioned above both Eskom and COM hold the licence to sell electricity within the COM metropole. A distributor is a legal entity that owns, or distributes, electricity through a distribution system; it should have a licence to construct, operate and maintain an electrical distribution network. The COM Municipality purchases bulk supply electricity from Eskom and distribute it to different categories of customers from electrical, agricultural, residential, industrial and commercial customers; most of the customers are urban customers (City of Matlosana, 2017:132).

The figure 2.2 below exemplifies that electricity is solely generated by Eskom, it gets transmitted and transformed on Eskom transmission and distribution networks and infrastructure. Furthermore, municipalities and Eskom share responsibility of distributing supply to the end customer, although Eskom has a greater portion of diversified customers. National Energy Regulator of South Africa is regulating both Eskom and municipalities.

Figure 2.2: Electricity Distribution System between Eskom and Municipality



Source: Division of Revenue (2015/2016)

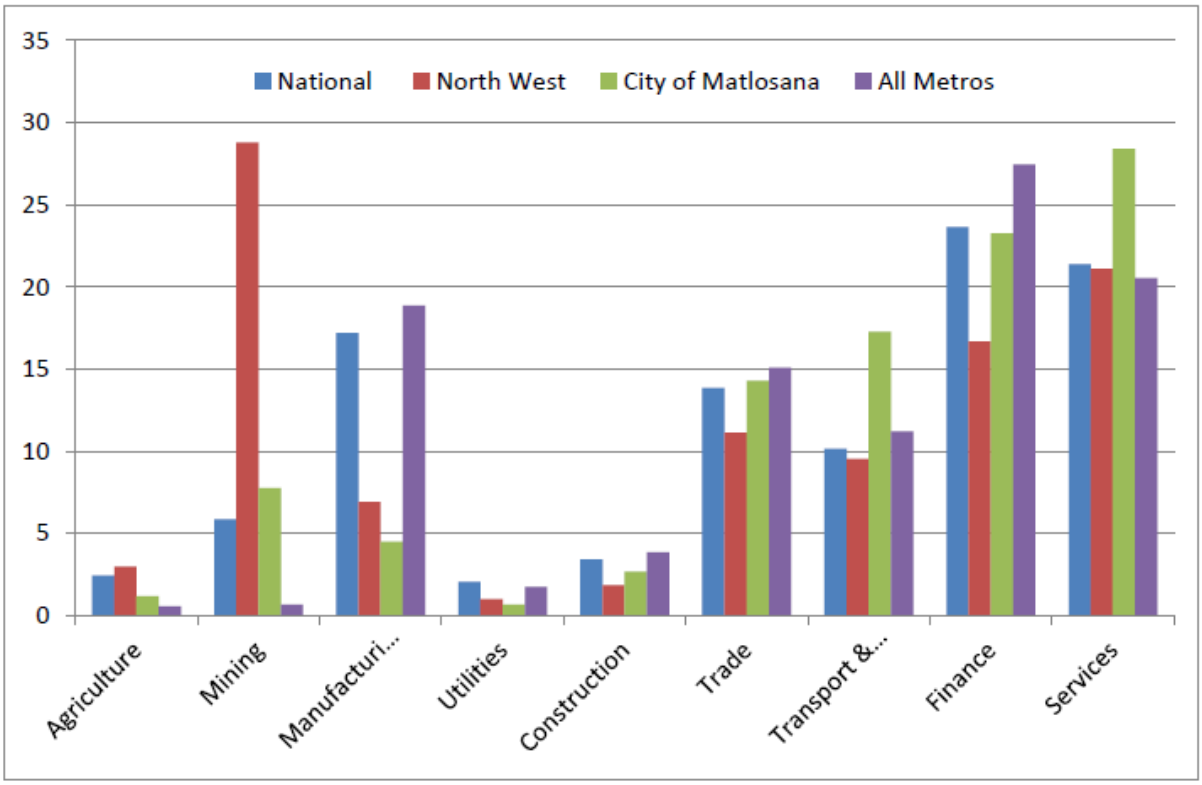
2.6 ECONOMY OF MATLOSANA

It is evident that the local economy within the COM Metropole has become more diverse over the past ten years and has declined from 54.6 in 1998 to 39.3 in 2008. This reduction can be ascribed to the fact that the local economy has become less dependent on the mining sector, with the tertiary sectors growing in the long term (City of Matlosana, 2015:5). The City of Matlosana's economy will still be susceptible because it is heavily dependent on the mining businesses. The new business ventures being financial and business services were introduced in the metropole to close the vast gap of job losses which occurred due to the closure of mines. However, the gap remains unmet.

Presently there are only six mining shafts still fully operational; the remaining 22 shafts were closed due to uneconomical reasons. The CoM, therefore, can no longer depend on the mining sector to sustain the economic growth in place. The mining businesses such as AGA SU are working hand in hand with the CoM to transform and introduce the services aspect of business into the area rather than relying exclusively on production aspects of the business (South African Cities Network, 2014:16).

Dr Kenneth Kaunda District municipality forms part of North West province; the district municipality contributed 27.9 % towards the economy of North West. CoM is a local municipality, and it forms part of Dr Kenneth Kaunda District Municipality thus, CoM contributed a whopping 43.8% towards the economy of the district municipality. Figure 2.3 below presents the key economic sectors for CoM compared to the North West Province, Metropolitans and National sector.

Figure 2.3: Different economic contributions from different sectors



Source: South African Cities Network (2014)

Finance (27.47%), services (28.11%), and transport sectors are performing exceptionally well. However, Agriculture, utilities and construction sectors did not contribute vastly (South African Cities Network, 2014:17).

2.7 MUNICIPAL ELECTRICITY COSTING STRUCTURES

Municipalities have little control over the electricity supply and costing procedures, and these have a huge effect on the profitability of the municipal business. The Eskom prices that are above CPI are demoralising and reducing the willingness of customers from paying the electricity services. This effect is putting an unbearable financial burden on municipalities as they struggle to recover the required revenue. Due to this effect of low revenue recovery municipalities are facing the financial crunch. Municipalities are constantly seeking ways of reducing their expenditures while still sustaining delivery of services (Green Audits into Action, 2016).

According to Barnard (cited by Peters, 2015:271), tariff increases affect not only end users of electricity but also municipalities. The provision of electricity is a significant source of revenue (electricity tariffs represent approximately a third of total municipal revenue) and a major expenditure item for municipalities. Significant tariff increases, coupled with the poor eco-

nomic environment, present a dilemma for municipalities because the electricity sector is subject to administered prices. This means that prices (or end-user tariffs, in the case of electricity) are determined through a regulated framework, not through market supply and demand forces. Municipalities purchase bulk electricity at the given price and then resell electricity (at a high tariff) to end-users. However, NERSA imposes regulatory restrictions that limit the extent to which tariffs can be increased; effectively limiting how much of the increased costs can be passed on to end-users by the municipalities. Municipalities have historically overpriced electricity, charging high tariffs and earning large surpluses. These surpluses, which should be reinvested in the electricity sector, are, however, often used to fund the delivery of non-electricity services and other expenditure items such as wages (Barnard, 2010 in Peters, 2015; Bisseker, 2012).

2.8 KEY FINANCIAL CHALLENGES FACED BY MUNICIPALITIES REGARDING ELECTRICITY SUPPLY

- Eskom is struggling to adhere to the electricity prices approved by NERSA for MYPD. Should the contemplated nuclear power plant be approved and built, this will worsen the electricity prices which are already deemed unaffordable by the consumers. As it is the sudden increment on electricity tariffs poses and lack of control for municipalities over these charges and creates major problems (Green Audits into Action, 2016).
- A national shortage of electricity supply together with expensive electricity tariffs reduces expected sales and revenue for the municipality. Previously, the only way municipalities could generate the revenue from electricity sales is by putting a markup price on top of Eskom approved rate for municipalities. Thus, municipalities are incurring losses on the electricity revenue due to power shortages. The derived revenues are generally used to subsidise high electricity costs to indigent homes and other facilities (Green Audits into Action, 2016).
- Municipalities are not granted a clear decree to produce electricity. Electricity is a product that reinforces the responsibility of municipality which requires the installation of infrastructure to safeguard the economy, well-being and protection of the society (Green Audits into Action, 2016).
- South Africa has a relatively huge CO2 footprint when compared to other countries, Eskom is contributing to the CO2, by using coal-fired processes when generating electricity; the consequences of carbon emission are experienced by all inhabitants of the country and impact badly on municipalities especially when dealing with ramifications of drought and storms issues (Green Audits into Action, 2016).

2.9 IMPACTS OF HIGH ELECTRICITY TARIFFS

2.9.1 Background on electricity prices

Since the establishment of Eskom's earliest predecessor, the Electricity Supply Company (ESC) in 1923, the electricity industry in South Africa, has been dominated by a single state-owned enterprise with an effective monopoly in the generation, transmission and distribution of electricity. The electricity supply industry, which is also of considerable strategic importance as a key enabler of industrial activity and economic growth, has, therefore, been dominated by a large and vertically integrated state-owned monopoly. As a result, the trend in electricity prices has always been heavily swayed by the changing policy and political priorities of the government. The current price of electricity is not even close to the real cost of its production (Deloitte, 2017:38).

In the late 1970s and early 1980s, Eskom embarked on a massive capacity expansion programme. Real electricity prices raised sharply so that Eskom was in a financial position to raise the capital required to fund the 'new build'. However, the sharply rising electricity tariffs sparked a public outcry and a commission appointed to investigate the increased tariffs, found that Eskom had substantially over-invested in capacity. In the three decades between 1978 and 2008, the 'real' (inflation-adjusted) electricity prices in South Africa were allowed to gradually decline to artificially low levels while the then current government sought a market for Eskom's surplus generation capacity.

The normal price of electricity reduced vastly from 49.5 cents per kilowatt per hour to 30.1 % kilowatt per hour; this occurred between the year 1978 and 2004. In the following year, the industries in the country enjoyed the cheapest electricity prices in the world (Deloitte, 2017:39).

South Africa reduced the electricity prices, and the reason behind the reduction was to boot the economy of the country. After achieving the economic growth, Eskom was confronted with new problems such as shortage of supply leading to low standby electricity margin (Altman *et al*., 2008:14).

It was necessary for Eskom to invest in generation stations to curb the load shedding caused by power shortages. With this required capital for the investment, it would mean that electricity prices, which were ranked low in the world, would now become expensive. Expensive electricity tariffs will necessitate repercussions for the South African economy that is mainly depending heavily on electricity supply (World Bank, 2010).

Immediately after the abovementioned electricity crisis South Africa was swept into the global financial crisis. Like many countries, South Africa had trouble borrowing money from private banks. Fortunately, currently South Africa is coming out of the economic downturn, but inadequate power supply could undermine the country's economic recovery and ability to create new jobs (World Bank, 2010).

Between the years of 2008 and 2013, the full extent of the electrical power supply crisis in South Africa became evident: real prices more than doubled as the 'new build' programme was launched. The power crisis resulted in the introduction of load-shedding in 2008. Eskom received approval from NERSA for its overdue capacity expansion programme and over the 5-year period (2008 – 2013) a cumulative 114% increase in real electricity prices were approved by NERSA to facilitate the raising of capital. The demand for electrical power slows as the economy enters a period of recession, thus providing consumers with a few years' reprieves from load-shedding but public and political resistance to NERSA's tariff decisions.

2.10 ELECTRICITY PRICING

2.10.1 Electricity price determination process

The National Energy Regulator was substituted by NERSA in 2005. Shortly after the substitution, NERSA introduced a new system called multiyear price determination; this process was allowed Eskom to set electricity prices for a period of five years; this was recently changed to three years. The rationale behind the change was that the MYPD would allow Eskom gain price firmness and a better planning programme prospect because the power utility had to generate huge funds for building power plants (NERSA, 2009).

Eskom determines the prices of electricity through a process called Multiyear price determination; the price increases are set for three years and are approved by NERSA. Multiyear price determination focuses on the power utility returns and is mainly used to regulate the tariffs via 'allowable revenue'. Under the MYPD methodology, the tariff increase allowed by NERSA is a function of the allowed revenue divided by Eskom's total anticipated sales. As a result, forecasts of electricity sales (or demand for electricity) are key elements in tariff setting and thus are used by Eskom and NERSA to determine what average tariff increase should be applied, to raise the revenue allowed by NERSA (Deloitte, 2017).

The multiyear price determination has been set to regulate the electricity prices based on the rate of return. This regulation process was authorised in 2003 and was put into practice the following year. Before load shedding the electricity, tariffs were increased in parallel or mostly approximate to the consumer price inflation (NERSA, 2010).

Electricity distribution in South African is shared between Eskom and Municipalities, with Eskom supplying power to a larger portion of the country relative to municipalities. Eskom generates electrical power and distributes it at the bulk form to municipalities; after that the municipality marks up the prices and redistributes to end customers. Eskom doesn't not only sell electricity to municipalities, but it also has a varied range of customers such as mining, industrial, agricultural and household customers. In fact, most of the South African electricity intensive users such as mines and smelters are receiving electricity supply from Eskom while municipalities supply electricity to the small businesses, through the various mining processes (Montmasson-Clair, Moilwa, & Ryan, 2014, 2014).

Municipalities are permitted by the constitution of the county to put additional charges on top of Eskom approved tariffs by NERSA. The logic behind the marking up of the prices is to allow the municipalities to generate more revenues for supporting other activities in the municipality. There are twelve municipalities that obtain major electricity sales between 2010 and 2011. The huge sales were purely achieved due to the high competency and skill possessed by these municipalities in managing their electrical network infrastructure and providing good quality of electricity supply through excellent service to their end-users. The challenges faced by municipalities that obtain little electricity sales of less than 24% range from a shortage of resources, lack of skills and therefore processes do not allow these municipalities to gain huge sales from economies of scale. Depending on whether the electricity is supplied by Eskom or a municipality, for example, two same businesses may be allocated different tariffs for same operations or the opposite may be true. Furthermore, municipalities set higher tariffs for industries and bigger businesses because these businesses are seen as quick money for the municipality, and it allows the municipality a chance to generate more income. The customer supplied by the municipality pay higher electricity prices than those supplied directly from Eskom's network, and therefore this gives a cost advantage to the customer that receives the electricity directly from Eskom over those customers supplied by the municipality (Montmasson-Clair, Moilwa & Ryan, 2014).

2.10.2 Reasons for the large variance in electricity charges levied by municipalities

Roughly 42% of Eskom's total sales of electricity are distributed to end-consumers via 187 municipalities who act as re-distributors. NERSA's authority to regulate the tariffs charged by municipal distributors, however, is not clear. While the Electricity Regulation Act of 2006 (SA, 2006) gives NERSA the responsibility to regulate electricity prices and tariffs, the current South African Constitution gives local government exclusive jurisdiction over electricity reticulation. The Municipal System Act of 2000 (SA, 2000) requires that municipalities determine

their tariff policies for municipal services and, as a result, NERSA has adopted a fairly 'soft' approach to the regulation of municipal tariffs whereby it publishes a guideline percentage increase each year, following the approval of the increase in Eskom's wholesale electricity price. The benchmarking of costs is based on information collected from selected municipalities on their previous year's electricity distribution cost structures in the format of distribution forms (D-forms) (Deloitte, 2017:58).

2.10.3 Background on electricity tariff increases

In December 2007, the National Energy Regulator of South Africa allowed power utility an increase of 14.2% on electricity prices; this was replacing the 6.2% that was initially approved for the 2008 and 2009 financial year. To ensure enough funds for building more generation plants, the power utility had to abandon the 14.2% increase that was already granted and ask for a 60% increase. NERSA turned down the request and further allowed Eskom an increase of 13.3%, so in total Eskom obtained an increase of 27.5% for the financial year starting in 2008 and ending in 2009. For the following financial year, NERSA approved an increase of 31.3% (NERSA, 2009).

The figure 2.4 below depicts the approved electricity price increases by NERSA versus the average yearly inflation. It is quite clear that electricity prices are exceeding the inflation with a great margin especially from 2008 to 2011; the year 2009 has seen an increment of 31.3% against 7.1% inflation.

Figure 2.4 South African electricity prices – 1994 to 2015

Approved Tariff Increases vs Inflation

Approved Tariff Increases vs Inflation: 2008 – 2015		
Year	Average approved tariff increase	Average yearly inflation
2008	27.5%	11.5%
2009	31.3%	7.1%
2010	24.8%	4.3%
2011	25.8%	5%
2012	16%	5.7%
2013	8%	5.7%
2014	8%	6.1%
2015	Possible 24.78%	Estimated 6%

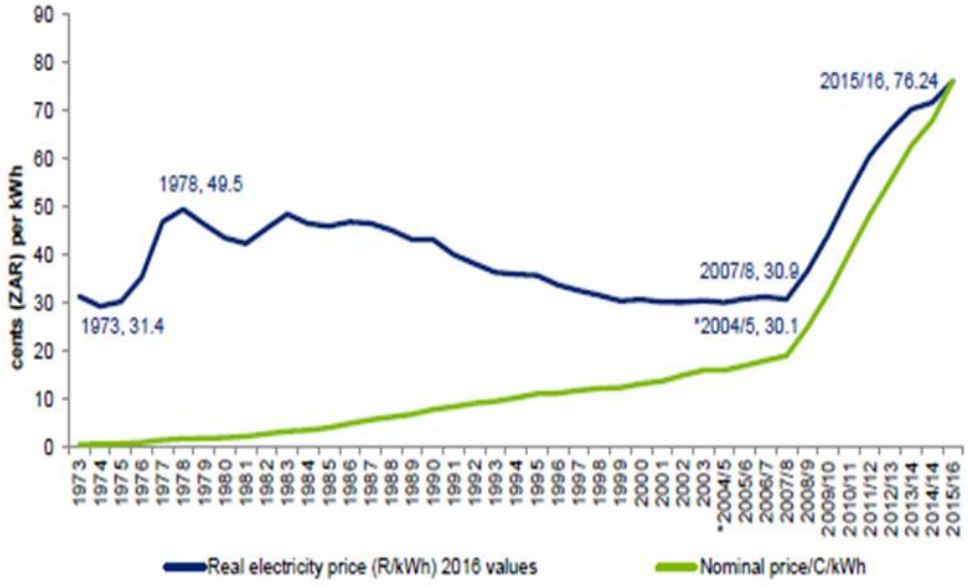
Source: Adapted from My broadband (2015)

When the shortage that had been threatening the growth of the country reached a critical point, Eskom was forced to introduce load-shedding. As a result (and after lengthy delays due to political indecision) Eskom was permitted to embark on a massive 'new build' programme to increase its power generation capacity. But at this point, electricity tariffs were at long-term-lows, and Eskom had neither the cash reserves nor the future revenue streams to cover the cost of the proposed 'new build' programme. NERSA approved several sharp increases in annual tariffs to enable Eskom to begin raising the capital it required. In the five years between 2008 and 2013, electricity prices more than doubled in real terms (inflation-adjusted) rising by a cumulative 114%, while nominal prices rose by 191% over the same period (Deloitte, 2017).

The figure 2.5 below shows the 45 years' trajectory between the average real and nominal electricity prices for Eskom. In the early years of 1980, Eskom had planned to increase the electricity on the grid by building more generation plants, to fund the new build, the electricity prices increased significantly. Even then the odd electricity increases generated community uproar, and the commissioned investigation found that Eskom had considerably over-invested in the generation plants. Thus, the electricity prices were permitted to steadily reduce to extremely low levels while the government was busy creating a demand for the abundant electricity. Between 1978 and 2004 the real price of electricity declined considerably from 49.5 cents per kilowatt hour to 30.1 cent kilowatt per hour thus yielding 40% in

savings. By the year 2004 and 2005, the electricity prices were exceptionally low in the entire world, especially for the industrial users.

Figure 2.5: Average electricity prices realised



Source: Adapted from Deloitte (2010)

The oddly increasing rate of energy cost within the country is negatively affecting the operational costs of the companies using the energy intensively. The other small industries are also affected by the sudden rise in energy prices however they are not impacted severely by the rigorous users. The consequences of these high costs can be tied to large operational costs (Cameron & Rossouw, 2012:1).

The power utility embarked on a project of R 343 billion for building new power plants; the first project was due to produce power to the grid in 2013. The plan of building new coal electricity generation plants and a nuclear station was on the way (Eberhard, 2008).

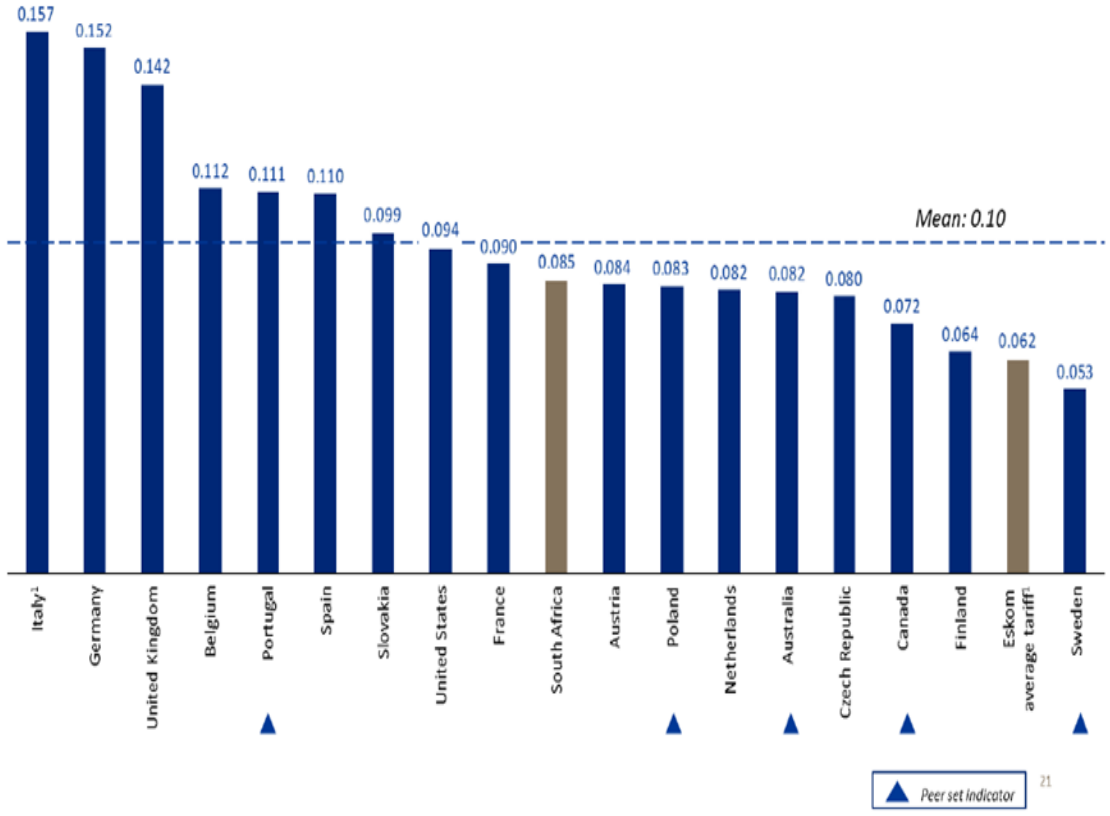
2.10.4 SA Electricity price comparison with other countries

It must be kept in mind that SA's electricity is still not expensive when compared to the rest of the world or even Africa. In 2014, Uganda, Namibia and Ghana had tariffs more than double that of South Africa. However, the problem remains that the South African economy is structured around cheap electricity, and it will be costly to change this practice and introduce a more energy-efficient infrastructure (Moolman, 2015).

According to the graph presented in figure 2.6 below, it is evident that South Africa's electricity prices have previously been relatively low compared to other countries; however, this

situation has now changed because Eskom needs funds to build new electricity generation stations to meet the ever-growing demand for electricity.

Figure 2.6: International comparison of the price of electricity delivered in June 2015



Source: Deloitte analysis based on the NUS energy market (2015)

2.10.5 Effects of high electricity prices

Given the undisputed theoretical and practical importance of energy, including electricity, it can be stated that electricity prices represent an important foundation for economic growth and development. That is because it not only because it improves the productivity of labour, capital, technology and other production factors, but also due to the fact that increased consumption of energy, primarily electricity (as its most flexible, commercial and purest form and a key infrastructural input in the socio-economic development), but also eaffects economic growth (Jakovac, 2017:1).

Electricity is a vital commodity to both society and economy of the country; anyhow it is still used regardless of its high price. Therefore it can be concluded that electricity serves as a necessity, it is reflected as a main contributing factor to the economy (Gibbs, 2012:43).

Cameron and Rossouw (2012:3) say some of the reactions towards increased electricity prices comprise the following:

- Some businesses pass the high costs of electricity to their end customers by increasing the ultimate price of the end product, while other businesses absorb these high electricity costs because their product prices are regulated by other regulatory bodies or by the markets.
- Some businesses may embark on the process of conserving the electrified energy or even better generate their own electricity;
- Other businesses may reduce the operational cost where possible, by chopping the working hours.
- The other factor that hinders businesses from passing the high electricity cost on the end product is due to low demand for a particular product and fierce competition in the market.

Energy efficiency methods assist in saving electricity costs and can be achieved by replacing the plant machinery with energy efficient gear or even investing in alternatives supplies such as solar power plants or generating own power for own use. Huge capital is required for purchasing the required energy efficiency infrastructure, thus, desired electricity savings costs will not be realised quicker because the initial capital put toward the project has to be recovered (Kohler, 2006:25-28).

Business sectors with low-profit margin are negatively affected by high electricity prices; production for the steel industry export was restricted when the steel price hit bottom low. This was done to avoid flooding of products in the market. Some Smelter close for two months in 2009 due to low market demand (Creamer, 2009). A tipping point is defined as the reason a company will close its operation due to failure in reaching the required profits that will sustain the business and keep it economically viable. The major contributing factors that lead businesses to tipping point are the high input cost to the business such as high electricity costs. Therefore, companies can easily close down operations due to tipping points (Cameron & Rossouw, 2012:3).

2.11 TYPES OF ELECTRICITY INTERRUPTIONS

The electricity disruptions affect the economy in one way or another, and therefore it is important to know and understand the different categories of the disruptions. There are three types of power interruptions; first one is called temporary interruptions, the second class of faults are infrequent interruptions and long-lasting interruptions. Temporary disruptions don't last for a long time; normally they take less than a minute.

Intermittent disruptions emanate from rather, and they normally occur during the stormy and rainy season, or whenever the weather is adverse, such disruptions last for long hours and this puts a huge risk on the electricity network, and in return, it negatively affects the productivity levels of the recipient of the electricity supply. Many times, the prolonged power disruptions emanate from different dynamics such as inadequate electricity generation and poor or lack of infrastructure maintenance on generation plants leading to failure of power generation plants. Mostly, when there is an inadequate generation of electricity supply, the demand for electricity supply exceeds the available supply; this ultimately leads to load-shedding. Delays in bringing new power plant on board cause the aged power plants to be run at a maximum level to cover the shortage of supply and this has the ramification of destroying the old infrastructure that already has passed its lifespan. Prolonged or chronic power interruptions have a tendency of lasting for a long period, especially if there is a shortage of supply; it takes at least five years or more to build an electricity generation plant and therefore these types of the interruptions have damaging impacts on the economy of the country (Küfeoğlu, 2015:16).

According to Castro, Faias and Esteves (2016:48) regulations of electricity are threefold:

(i) Electricity supply should be constantly available on the grid thus ensuring and obtainability;
(ii) The quality of electricity supply, in connection with harmonics and voltage
(iii) Good response time when dealing with customer issues.

2.12 INFLUENCES OF ELECTRICITY INTERRUPTIONS

There are different electricity users consuming electricity for different needs. Therefore the consequences of power interruptions will not have the same effects on all different users, thus impact will vary depending on the usage of the supply. Consequences of power disturbances for healthcare sectors such as hospitals will differ from those of industries and residential customers. If the power grid has a good quality of supply that is reliable, consumers tend to have less interest in the backup supply; these customers suffer great damage when the power crisis occurs (Rathenau, 1994:101).

According to Jamasb and Poudineh (cited by Goldberg, 2015:11), in developing countries the power interruption occurs quite frequently and they affect the economies of those countries. The impacts of power interruptions are insignificant in the residential sector than on businesses. The consequences of power interruptions have far reaching negative impacts on the confidence of the business and this in return affects the level of confidence of the

investors. Frequent power interruptions primarily affect the profit margins of the businesses and have deteriorating effects on the economy of the country. Electricity is an essential need that helps businesses to enable growth in the economy. The power interruption does not only affect the economy the country it had a chain effect of affecting the socio-economy and interdependencies on infrastructure.

Although there is little empirical evidence substantiating that electricity is fundamental and also an enabler towards the growth of the economy, electricity is a major driving force behind most processes that develop the well-being of the country. This commodity enhances production level within industries and in any type of business thus increase the revenue and profitability of the companies. The multifaceted interactions and collaborations on growth factors, such as an investment for electricity infrastructure, and allowing governmental, socio-economic and cultural conditions, put challenges to separating and measuring the impact of electrification. Certainly, it is known that inputs like gaining financial services have a consequence of increasing accessibility to electricity which leads more revenue generation and poverty mitigation system (Motta & Reiche, 2001).

2.12.1 Impacts of load shedding on companies

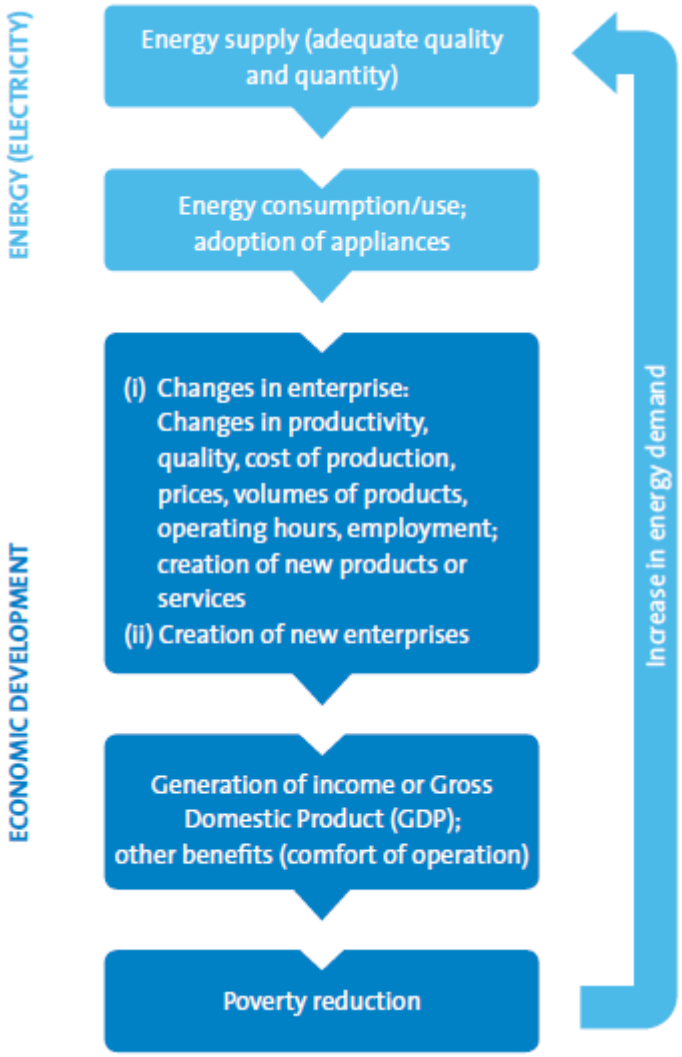
There are three types of damages seen by the companies due to power interruptions. The first damage is that the company's production is drastically reduced due to power interruption when there is no electricity, production comes to a complete halt, and therefore the required production targets are not met, furthermore, some computer files go unsaved due to abrupt power cuts. It normally takes a longer period to restart the business or plant after the electricity supply has been restored. The second damage is the sudden increases in overheads costs such as extra working time for catching up on production target and for payment of incentives where possible. The third, and last, damage for companies is loss of damaged material due to incomplete process caused by abrupt power cuts, for an example if a hot iron material is heated for normal processing and suddenly an interruption of supply occurs while the iron is being processed, the lack of electricity supply will cause the steel to be cold and unusable, thus, that material will be deemed redundant (de Nooji, 2006:281).

2.12.2 Impacts of power interruptions on varied sectors

Companies are impacted differently by power crisis, with the mining industry being the most harshly affected industry followed by nonferrous metal. The mining is most affected on trading bases, and it also linked to the volatility of the South African currency (Rand Value) on the economic currency of the South African Rand. The agricultural sector is more linked to gross domestic product, and it consists of multiple slowing down effects (Gibbs, 2012:43).

There is lack of knowledge regarding the fact that availability of electricity supply reduces poverty by generating more income, this is due to many contributing factors that underlie this matter. The delivery of electricity to a plant and the decision by the business owner to use it is regarded as the first step in alleviating the poverty. The usage of electricity in companies brings the changes in the production level, increases the production volumes and enhances the creation of new enterprises. The electricity consumption increases the income, the gross domestic product and other operations Thus, alleviating the poverty (Dijk, 2008).

Figure 2.7: Steps from electricity supply to poverty reduction



Source: Adapted from Kooijman-van Dijk (2008)

Electricity brings immeasurable benefits to human life. With electricity come lighting, cooling, heating and cooking. Electricity also facilitates communication, transportation and produc-

tion. The energy sector, thus, has both economic and social functions in that it powers productive activity and also provides basic energy services for households (Trends in Intergovernmental Finances: 2000/01-2006/07).

According to Manson and Targoz, 2008, electricity supply interruptions can be classified into three main categories, which are direct, indirect and economic impacts and social impacts (Manson & Targoz, 2008).

1. The direct economic consequences include the following
   - Losing considerably on production costs.
   - Costs involved on time taken to restart the plant after the supply has been restored.
   - Failure and damage to electric motors and other machinery after the restoration of supply.
   - Material lost due to power cuts.
2. Consequences of indirect economic impacts are poor service delivery and losing customers to other businesses.
3. Consequences of social impacts, the security level becomes weak when there is no electricity, and this puts the people's lives at danger. Loss of leisure time at home due to lack of facilities such as air conditioners, television and many more reduces the quality of lives.

Table 2.2: Impacts of power interruption

Direct economic impacts	Indirect economic impacts	Social impacts
Loss of production	The cost of income being postponed	Uncomfortable temperature
Restart costs	The financial cost of loss of market share	Loss of leisure time
Equipment damage		Risk to health and safety
Raw material spoilage		

Source: Impacts of power interruptions (Linares & Rey, 2013)

Table 2.3 gives a summary of the studies of electricity conducted in different countries and regions using different methods and samples such as companies, agriculture and enterprises, thus, giving impacts the electricity interruption has on these sectors.

Table 2.3: Effects of Infrastructure and Energy on Productivity

Source	Country/Region	Data Source/Sample Size	Conclusion
Arnold, Mattoo and Narcisco (2008)	10 African countries	Approx. 1,000 manufacturing enterprises	Unreliable electricity supply has a significant negative impact on a firm's total factor productivity, while generator possession has a significant positive effect.
Barnes and Binswanger (1986)	India	Surveys conducted in 108 villages in 1966 and 1980	Rural electrification had a direct impact on agricultural productivity through private investment in electric pumps.
Blalock and Veloso (2007)	Indonesia	20,000 manufacturing enterprises	Significant positive effect of energy consumption on firm productivity was found.
Eifert et al. (2008)	17 African countries	Enterprise surveys	Indirect costs (of which energy costs comprise the largest share) are a major factor for explaining the low productivity of enterprises in Africa.
Escribano et al. (2009)	26 African countries	Investment climate surveys	Infrastructure quality has a significant negative impact on total factor productivity.
Fernandes (2008)	Bangladesh	575 manufacturing enterprises	Power supply problems are of considerable relevance to firm productivity.
Hill and Kalijaran (1993)	Indonesia	2,250 small clothes producers	Significant positive effect of energy consumption on technical efficiency
Kirubi et al. (2009)	Kenya	12 carpentry and 5 tailoring workshops	Use of electricity can increase productivity per worker by approx. 100-200 % for carpenters and by 50-170 % for tailors, depending on the item being produced.

Source: Pinstrup-Andersen and Shimokawa (2007)

CDE (2008b:10) asserts that the following sequence of the reported impact of the electricity crisis on large and small firms gives a sense of how it has already damaged the economy: Productivity declines and costs rise, stock is damaged or destroyed, confidence drains away, and jobs are lost.

- Harmony Gold estimated that the production halt due to power-outages prevented them from mining over 25 000 ounces of gold. The company laid off 5 000 workers in February 2008.
- DRD Gold says it was forced to fire 400 workers as a direct result of the power crisis.
- Gold Fields' gold production for the first quarter of 2008 was forecast to decline by between 20 and 25 % against the previous quarter. The total number of employees and contractors potentially affected at all of Gold Fields' South African mines is 6 900. Gold Fields spent R200 million on securing additional emergency powers to safeguard employees underground in the case of a total blackout.

- BHP announced that they were closing two potlines at their Bayside aluminium smelter, potentially causing 500 jobs to be lost. At the current world aluminium price, the closure will result in a revenue sacrifice of over R3 billion per year for BHP.
- Nestlé spent an estimated R37 million on purchasing generators for their production lines to overcome an erratic electricity supply. Nestlé has 27 factories around the country and has invested more than R1 billion in South Africa over the last three years. Buying generators have a large negative cost impact on the company, and so has the loss of production that happens during power-outages.
- Nearly 40 tourists were trapped in a cable car on Table Mountain, Cape Town, in high winds for more than two hours. Hundreds more were left stranded until after midnight on the top of the mountain. As a Cape Town city councillor put it, 'The knock-on effect of power-outages on Cape Town is immeasurable. A headline today is lost business tomorrow.
- Bakeries reported major losses as a result of power-outages because blackouts meant that oven-loads of bread and other baked goods would go stale. The owner of one bakery estimated that each power cut costs his shop between R5 000 and R15 000.

According to CDE (2008b:12) the mining industry accounts for a great portion on exports, therefore electricity emergency and interruptions have adversely affected the export market and the job creation levels. Some companies have a big influence on the GDP and have a high level of employment, while others have a great influence only on the level of employment. Residential customers do not consume electricity intensively when compared to the businesses. However, measures in place for saving electricity have a balancing effect on them as well. Both elements of GDP and employment are negatively affected by the load-shedding; therefore, reduction in the level of employment has a negative impact on the poor of the poorest people. Shortage of power supply has an adverse effect on the national and international investment.

The mining and steel industries are the ones that are hit hard by load shedding. Established big companies manage to absorb the consequences of power interruptions better than the smaller ones in that big companies employ huge numbers of people and therefore the impact may be subdued. Other businesses manage to move to rigorous workforce operation plans. Furthermore, the negative consequences experienced by some businesses may happen to be a positive outcome for another business (Gibbs, 2012:44).

2.12.3 Industries that were most affected by power shortages

The companies that fail to shift their operation times outside the load-shedding period are severely impacted by power interruptions. Most of those companies are electricity intensive users, and they are more industrial customers. These sectors are also the most energy intensive and the least likely to gain from reducing wastage or non-essential electricity consumption in their production processes (Gibbs, 2012:44).

2.13 BACK UP SUPPLY

Both the expenditure on backup facilities and the use of interruptible contracts can provide information on how households or industries value interruptions of the power supply. For example, expenditures on backup facilities show how much firms and households are willing to pay for a higher level of supply security than is currently provided by the network (Caves *et al*., 1992).

Sanghvi (1982) hospitals are required to have backup supply given the nature of their business. Generators are normally used temporarily only when the electricity supply has been discontinued; they are not used throughout the entire day. Thus, the price of running a generator for a short while will surpass that of electricity price and this will surpass both businesses and residential customers from investing in backup supply.

2.14 LITERATURE AROUND THE INTERRUPTION OF SUPPLY

The production-function uses a quantitative method, and therefore it yields statistical information. This is a special method that checks the after-effects of electricity interruptions by assessing the production lost due to power interruptions on organisations, and it assesses lost time gone for residential customers. This approach uses quantitative statistical information (Munasinghe & Gellerson, 1979).

According to Linares and Rey (2013:7) mentioned in the Literature Review, there have been different attempts to quantify electricity interruption costs. The three most common methods are Customer Surveys which were used to gather data from industrial, commercial and residential sector customers. The main idea was to get the true cost impact of power interruptions by applying a direct and indirect method. To get better real experiences from customers, the direct method was used.

Other methods founded on specified choices, use survey on customers who are predominantly required to examine the costs suffered owing to disturbances (Kufeogluet al., 2008).

2.14.1 Electricity Consumption at mine industry

Electricity is consumed for the following activities in the Mine Industry for:

- supplying air circulation for people working underground;
- compacted air production;
- pumping of water to avoid flooding underground;
- transporting people from the ground surface to underground with elevators;
- conveyor belts which are used for carrying materials from one place to another;
- Crushing of commodities obtained underground;
- Electrical motors and furnaces;
- Electricity is used mostly in the housing of mines on stoves, lights and air conditioners; and
- In offices, it is mainly used for servers, computer, lights and air conditioners for the sake of controlling the temperature in the office.

A huge portion of electricity consumption at mines is allocated to pumping of water; refrigeration and air circulation. Thus, the power interruptions do not only negatively affect the production of the mines such as pumping of water and refrigeration, but it also puts the high risk on lives of people working underground. Consequently, mines cannot operate effectively with enormous power interruptions (NERT, 2008:44).

2.14.2 Different approaches to assessing impacts of electricity interruptions

The following methods are used to collect information regarding power interruptions from different users or electricity supply, such as residential customers, and industries. Balducci (2002) asserts that big businesses such as mines and industries are more heavily impacted by power interruptions than household customers. The impacts of load shedding on residential customers are insignificant relative to the industries. Thus, businesses are in a better position to quantify the consequences of power interruptions.

The indirect method is used to test the willingness of the individuals to pay for backup supply in an attempt to avoid the power interruptions, or willingness to accept the allowance for suffering the consequences of power interruptions. This method is an indirect one and is very cumbersome because customers are answering unreal or imaginary experiences and they are not in a position to quantify the real cost incurred. Most probably customers are aware that their responses are most likely to be used for altering the policy and therefore they respond tactfully.

The other method used for measuring the impacts of power interruptions are case studies.

Unlike the indirect method that focuses more on hypothetical situations, this method focuses more on events that occurred for real, thus, the respondents, in this case, can give true reflections of their experiences, and they are also in a position to give monetary quantification accruing from electricity supply consequences. The limiting factors on this method are when the incident happened a long time ago, it would be difficult for respondent to give the accurate figures on time and the duration of power cuts, therefore it would take a broad view of the results (Linares & Rey, 2013:7).

The case study method focuses mainly on real power crisis cases that occurred in the past and quantifies the consequences of those interruptions (Corwin & Miles, 1978). The case study can be used to find out the cost involved from experiences of load-shedding by necessitating a valuation of consequential damages emanating from blackouts that occurred in reality previously. To determine the direct and indirect costs, the obtained data can be used. The challenger with this method is, it tends to generalise on that old experiences will bear same results as new results (Linares & Rey, 2013:7).

The last method is the production function approach; this method usually assumes the costs involved with the impacts of power stoppages ties it up to economic GDP. To calculate this figure, it takes the ratio of the impacts of power crisis against the GDP to measure the cots (Linares & Rey, 2008). There are many methods used to examine the impact of power crises. However, there are three approaches that are mainly liked by the researchers. The three methods are indirect analytical methods, customer surveys and case studies. These methods are normally shown to CIGRE Task Committee after being put together (Küfeoğlu, 2015:19).

2.15 SUMMARY

The purpose of this chapter was to review the literature concerning the impact that power interruptions and associated high electricity prices have on commercial customers based in Klerksdorp metropole. Different sources of information such as scholarly articles and journals and other documents were used to source the information regarding the topic under research. The literature covered the cause of power crisis in South Africa and background on the history and current state of electricity prices. It also covered the different types of power interruptions and impacts these interruptions have on the economy of the country. Different methods used to assess the consequences of power interruptions were discussed in detail in this chapter.

CHAPTER 3
RESEARCH DESIGN AND METHODOLOGY

3.1 INTRODUCTION

This research study aims to find the impact of load-shedding and high electricity tariffs on Klerksdorp's commercial businesses. For this study to be carried out effectively and successfully, it was necessary to send the questionnaires for this survey via email to the large businesses that contribute immensely to the economy of both Klerksdorp and South Africa. The selected sample will be able to provide the required information based on the impact on their business of the high electricity tariffs and the intermittent periods of load-shedding which occurred during January 2008 and October 2015. Since the commencement of electricity shortages there has been a need to increase the electricity tariffs to fund the building of new power stations and, as a result, Eskom's customers have had to use electricity sparingly to avoid high electricity bills which would have resulted in higher operational costs. Thus, the questionnaire required the participants from the chosen sample to answer questions related to the impact of high electricity tariffs on their businesses. The majority of survey respondents held positions relating to finance, process and/or general management within their organisations.

3.2 RESEARCH DESIGN AND METHODOLOGY

A research design is seen as a strategy that is used by the researcher to obtain trustworthy data from the respondents. The information obtained from the sample can be used to draw conclusions for the study not neglecting the literature review for the study. It offers explicit and unambiguous structure since it monitors research approaches selected (Mouton, 1996:107). Mouton (2001:56) offers an appropriate example for the distinction between research design and research method. The research design is seen as an architectural plan for building a house. It centres around the ultimate goal. The research method embodies the actual processes followed for the completion of the house.

This research is an exploratory process. Thus, the design and method selected aims to assess the influences of continuous electricity supply on Klerksdorp's commercial businesses, focusing mostly on the impact of both the interruption of electricity supply and the high electricity tariffs Eskom imposes on commercial customers. This research project will use descriptive statistics which will yield imperial results. The research design applied in this study is a cross-sectional one, which comprises various criterion groups, such as different ages

and different business sectors. Furthermore, the respondents can provide an accurate account of their experiences of the matter under investigation since load-shedding occurred fairly recently, namely between 2008 and 2015.

The research method is used simply as a working plan for different types of data to create or deduce an inference or connotation for a specific topic under research (Leedy & Ormrod, 2001:100). Descriptive research encompasses of a practical goal; it can be applied either to quantitative or qualitative approach (Fouché, 2002a:109). Based on the measured phenomenon, descriptive research derives actual experience that can be interpreted empirically (Ventry & Schiavetti, 1980:41).

In reality exploratory and descriptive research do not differ a lot, in fact, they link up at some point. The descriptive study gives an image of a certain condition strictly focusing on how things happened and why they occurred (Neuman, 1997:20).

3.3 QUANTITATIVE METHOD

Quantitative research is mostly used as an enquiring platform to assess the relationship between different essentials between people and other factors, the aim is of this type of research is to clarify, forecast and regulate occurrences, thus, give a broad view of results (Leedy & Ormrod, 2001:101).

The quantitative method takes a more formal structure when compared to qualitative research, it is straightforward and more openly managed than the latter. It can be more defined, as it is prone to engagements with social sciences (Kumar, 2005:12).

Bless, and Higson-Smith (2000:156) define a questionnaire as an instrument of data collection, consisting of a standardised series of questions relating to the research topic to be answered in writing by participants in the research study. Neuman (2003:268) emphasises the fact that a good questionnaire forms an integrated whole in which the researcher weaves questions together so that they flow smoothly. According to Delport (2005:166), the basic objective of a questionnaire is to obtain facts and opinions about a phenomenon from people who are informed on that particular issue.

The quantitative survey was designed based on the Likert scale, and the questionnaire was divided into three categories, the first one being the ‘Consequences of load-shedding’, the second one the ‘Impact of high electricity tariffs’ and the third one the “Impact on competition and investment’. The Likert response format is an interval level that uses a 5-point integer

scale. The questions constituted a structured response format whereby closed or pre-coded questions were used when formulating the questionnaires, thus giving the respondent an opportunity to select the appropriate answer on the interval scale.

3.4 PRE-TESTING

The sample questionnaire which sought to establish the impact of load-shedding and high electricity tariffs was tested with a sample of fifteen different commercial enterprises within the Klerksdorp area. The information requested in the questionnaire concerned very sensitive issues for both the owners/managers and employees of the said businesses. The feedback received from the pre-testing sample indicated a strong need for conducting the investigation. Furthermore, testing was conducted to ensure the chosen questions were coherent and easily comprehended by the respondents. It was also necessary to perform the pre-testing to prompt respondents to comment on the contents of the questionnaire to establish what additional factors should be measured. The questionnaires were subsequently modified based on the feedback received from the pre-testing activity.

3.5 SAMPLE AND POPULATION

The population is the study object and consists of individuals, groups, organisations, human products and events and/or the conditions to which they are exposed ((Welman *et al.*, 2005: 52). A suitable sample is chosen by the researcher for the sake of executing a research study. Thus, a sample is a small segment or portion of a complete part. It normally comprises chosen units from a particular population (Brink, 2001:133). To ensure data is retrieved and gathered in an orderly way, the researcher has to follow a particular method when selecting the data; this will help the researcher to meet the set objectives of the research effectively (Hackley, 2003:25).

The simple random strategy was applied to different business sectors within Klerksdorp metropole to perform this study. From the beginning, the residential sector was omitted because this sector does not consume electricity intensively as the businesses and furthermore the impacts of load-shedding on these customers are insignificant when compared to the impacts of businesses. Due to the applied method, the shopping centres were also excluded from the study. The simple random procedure is a method that ensures that all sampled unit gains the same opportunity of being chosen from the entire population (Hair *et al.,* 2000:345). This research project sought to examine the influences of continuous supply by assessing impacts load shedding and high electricity tariffs on commercial businesses based in Klerksdorp. For the past 20 years, most companies and business have been fully reliant on electricity for meeting the production target. Without electricity most businesses become

inoperative. Although some businesses resort to other types of energy, such as gas and solar power, these types of energy are expensive, and for this reason, most businesses revert to electricity supplied by the municipality. The population for this study is based on variable sectors of businesses receiving electricity from both the City of Matlosana Municipality and Eskom.

The following business sectors in the Klerksdorp area form part of the sample:

- Agriculture;
- Industrial and Mining;
- Food;
- Health; and
- Hospitality.

A list of Klerksdorp companies covering the abovementioned five business sectors was compiled. The selection was conducted to ensure that most of the main business sectors are included in the sample, namely industrial, agricultural and hospitality. The simple method was used to select the sample. The electricity usage for the identified sample varies vastly from one sector to the other and, as a result, the questionnaire was designed to classify the electricity size of companies participating in research. The Likert scale shows electricity usage; as such it includes a range of size of businesses from small power users to key power users. The names of the sampled businesses were mainly obtained from the internet and local media. After identifying the companies, the researcher set up a meeting with the senior managers of the selected companies to obtain permission to conduct the research.

3.6 DATA COLLECTION

Surveys can be conducted differently by performing framed observation, interviews or by questionnaires. Surveys are mainly used for collection of data from the chosen sample. It should be highlighted that the procedure followed when gathering information is as important as the information collected for the study (Brink, 2001:109). There is a difference between the primary data and secondary data, in that primary data is regarded as the information contrived, collected or obtained by the researcher for the sake of completing the study while the secondary data is regarded as the information written or compiled by other people or sources (Malhotra & Birks, 2006:94).

A Likert scale questionnaire was designed to collect the quantitative data from the respondents; the questionnaire was based on the experiences the respondents had during load-shedding. Questionnaires and surveys using the Likert scale have been used widely by re-

searchers in the past. A few researchers used customer surveys to investigate the economic impact of power interruptions.

In Cameroon, customer surveys were used to examine the direct worth of electricity supply problems to industry sectors (Diboma & Tatietse, 2013).

Data for this study is primary data and was collected over a two-month period during September and October 2017. Before conducting the survey, consent was also obtained from the respondents who had to complete the questionnaire. The questionnaires were sent to the participants for completion via email; after completing the questionnaires, they were returned to the researcher by email. The participants were not forced to complete the questionnaires and were not given any incentive for taking part in the survey. Follow-up emails were sent to the respondents who had not returned the surveys by the due date. A total of 90 questionnaires were sent via email to the identified respondents, and an additional 15 questionnaires were hand-delivered to respondents who were unfamiliar with email communication. Out of these questionnaires, 70 were returned to the researcher, of which seven of the questionnaires were deemed unusable. This data was captured from 63 questionnaires, and therefore results of the study were drawn from these usable questionnaires.

3.7 DATA ANALYSIS

Cooper and Schindler (2008:93) describe data analysis as the process whereby collected data is reduced to a more controllable and convenient size so that the researcher can start to identify trends or patterns, apply statistical techniques and summarise the data. This procedure allows the investigator to understand the results better and to see how the results connect with the matter under the investigation (Malhotra & Bricks, 200:10).

According to Marshall and Rossman (1995:111), data analysis is a messy, ambiguous, time-consuming, creative and fascinating process which does not proceed linearly. Krueger and Casey (2000:127) believe that analysis begins by going back to the purpose of the study. A key principle is that the depth and intensity of the analyses are determined by the purpose of the study. Furthermore, Krueger and Casey (2000:132) mention both the ‘long table’ approach (where all data is coded and sorted on a long table) and the computer as strategies for analysis.

This study is designed to be exploratory; there is no formal hypothesis that is being tested. Since the study is a quantitative one, it will use the descriptive statistics to present the results of the collected data. The descriptive study will report summary data such as measures

of central tendency, including mean, median and correlation between variables of different business sectors in Klerksdorp. All descriptive measures received from small-power users to key-power users will be tested.

Rotational load-shedding was executed to all Eskom's customers, including Municipalities, and as such, the electricity supply would be switched off for two hours at the most. The Key Industrial Customers (KIC) were exempted from load-shedding. However they were requested to curtail their electricity usage on their own as per the table 3.1 below. Thus, in stage 1, KICs were expected to reduce 10% of their base load for two hours, and as the shortages increased the stage 2 or 3 would be declared according to the severity of the crisis. And this meant that KIC would have to reduce up to 20% of their electricity consumption. If key customers failed to honour the request imposed to them by NERSA of curtailing load on their own, they would face the consequences of being put under rotational load-shedding schedules of having their power supply switched off by Eskom in the same manner as for the small power users. Load-shedding comprised four stages, table 3.1 below shows percentages required per stage; it can be seen that the more the stages moved up in sequential order, the higher the percentage of load reductions were required from customers to keep the electricity frequency from decaying. As mentioned above, the key industrial customers supplied by Eskom were privileged as they could curtail the electricity according to the table below, even so, the key customers that were supplied directly from municipalities did not have this privilege of curtailing their own, in fact, they were switched off together with municipalities.

Table3.1: Eskom Load Shedding Stages

Stage	Type	Reduction obtained by interrupting supply - *load shedding*	Reduction obtained by instructing reduction - *curtailment (pre-agreed)*
Stage 0 70-100 MW	Unscheduled (pre-agreed)	Ad hoc	Load offered by customers under the *immediate* curtailment option (min 25% for 2 hrs)
Stage 1 1600-2000 MW	Scheduled / Notified	Shed 5% of national non-curtailment load at peak	Curtail 10% of normal demand within 2h of *notification*
Stage 2 2500-3200 MW	Scheduled / Notified	Shed 10% of national non-curtailment load at peak	
Stage 3 5000-6300 MW	Scheduled / Notified	Shed 20% of national non-curtailment load at peak	Curtail 20% of normal demand within 2hrs of *notification*
Stage 4	Unscheduled (instructed)	Shed >20% of national non-curtailment load at peak	As *instructed* by the National System Operator at the time.

Source: Eskom Load-shedding Stages (Eskom, 2015)

3.8 RESEARCH ETHICS

It remains the responsibility of the investigator to protect the research respondents or participants from any form of harm such as hurting their feelings or belittling the respondents. The respondents should be familiarised with the content of the study and its intentions. Furthermore none of the participants should be forced to participate in the study, and therefore they should participate willingly and voluntarily (Leedy & Ormrod, 2001:107).

Research processes should be conducted ethically from the beginning to the end to ensure answerability for all participants who were involved in the research study (Babbie, 2001:475). Dealing with people in a research study most of the times will elicit some problems more especially if a researcher fails to adhere to the set ethical principles. It is very important for the researcher to have a sense of reverence and integrity toward the participants throughout the entire process of research ((Welman *et al.*, 2005:42-50). The two major characteristics of ethics are listed below:

- The principles of the researcher about the trustworthiness, openness and uprightness are vital.
- The researcher should be cautious when dealing with the respondents, in that information received from respondents should be treated with utmost privacy and confi-

dentiality. Participants should permit the researcher for partaking in the study. Over and above this the researcher should show some gentility towards the participants.

To ensure clear and coherent communication between research parties, it is necessary for the researcher to be truthful in all dealings, and this will yield reliable and credible results. The prerequisite should be applied to research studies (Welman *et al.*, 2005:42-50).

3.9 SUMMARY

This chapter covered all the research methodology, as well as other research and processes that were followed when conducting this research project. Due to the quantitative nature of this research, the findings thereof were descriptive. Compliance with research ethics' procedures was adhered to throughout the study. It was mentioned in this chapter that the Likert scale was used to conduct the survey and, therefore, the next chapter will yield the findings of the research and will provide details of the methods used to produce the findings.

CHAPTER 4
RESULTS

4.1 INTRODUCTION

The purpose of the study was to examine the influence of continuous electricity supply on Klerksdorp commercial customers. This chapter describes the analysis of data received after performing the research study. The results narrate and correspond to the research questions asked during the study. Using statistics such as frequency, percentages, Anova and T-test, data was scrutinised to identify and describe the influence of continuous electricity supply, focusing on elements of continuous supply being high electricity tariffs and power-cuts during load-shedding.

Data were obtained from self-administered questionnaires that were completed by the chosen sample. Out of 90 questionnaires distributed, only 70 questionnaires were returned, and 63 of these met the inclusion criteria and were deemed usable. The seven questionnaires that were not included in the data used in this research project had major errors because respondents had ticked two answers to one question or, in some instances, had left questions unanswered.

The questionnaire was divided into four broad categories and data was generated according to the categories shown below:

- Influence of load-shedding;
- Impact of high electricity tariffs;
- Backup supply; and
- Competition and Investment.

4.2 STATISTICAL RESULTS OF THE STUDY

Cronbach Alpha

As mentioned above, the questionnaires were categorised in four classes, which were used to form a construct for each topic, such as the influence of load-shedding, electricity tariffs, backup supply and competition and investment. The IBM SPSS statistics was used to measure the Alpha for each construct. Thus, the Cronbach on load shedding is 0.621, and although the figure is not significantly high, it still shows that there is internal consistency or reliability on the influence of load-shedding. The Cronbach's Alpha is considered reliable at 0.57 and above (Field, 2009:668).

The Cronbach for electricity tariff is 0.52 which is lower than the acceptable value of 0.57; this low score could be because the questions were administered to different classes of customers who use different types of tariffs and who do not have same electricity needs.

Under competition and investment, the alpha result is 0.669; this shows there is a real consistency across all customers, and this means that investors are more interested in good returns, if they suspect that a business might be uneconomical due to factors as insecure supply they tend to withdraw their funds before they lose substantial funds.

The backup supply yielded an alpha of 0.601; there is internal consistency on this matter given the fact that load-shedding did not only occur once. The first occurrence of load shedding had already warned most businesses about the necessity of having a backup electricity supply, and, therefore, most businesses were in a better position to cope with electricity shortages than they had been when the first load-shedding occurred in 2008. Therefore, at the time of the study, Eskom customers are planning to have an alternative electricity supply at a cheaper rate, such as solar power and Photo Voltaic supply. The advantage of this type of alternative supply is that it can be supplied completely off the Eskom grid which will safeguard the security of the supply for the customer.

Table1: Cronbach Alpha

Factor	**Items**	**Cronbach Alpha**
➢ Influence of Load-Shedding	1,2,3,4,5,6,7,8,9	0.621
➢ Electricity tariff	10,11,12,13,14	0.52
➢ Backup Supply	15,16,17,18,19	0,601
➢ Competition and Investment	20,21,22,23,24,25,26,27,28	0,669

Gender T-test

The T-test was used to measure the mean between the two groups, being male and female, under the completion and investment construct. Therefore, the females were more prone to scores around three, while the males were more inclined to scores around two. The p-value for the two gender groups is below 0.05 and, therefore, there is a statistical difference based on the competition and investment. The effect size was 0.47 with a medium effect which is quite close to 0.5.

Table 2: Gender T-test

Group Statistics – T-Test for Gender						
		N	Mean	Std. Deviation	Sig. (2-tailed)	Effect size
	Male	38	2.4357	0.31784	0.026	
	Female	25	2.6667	0.48750	0.043	0.47

ANOVA Age

The significance value on the age group is 0,008 which is much lower than the p-value of 0,05 and, therefore, this shows that the people completed the questionnaire differently as per their age group.

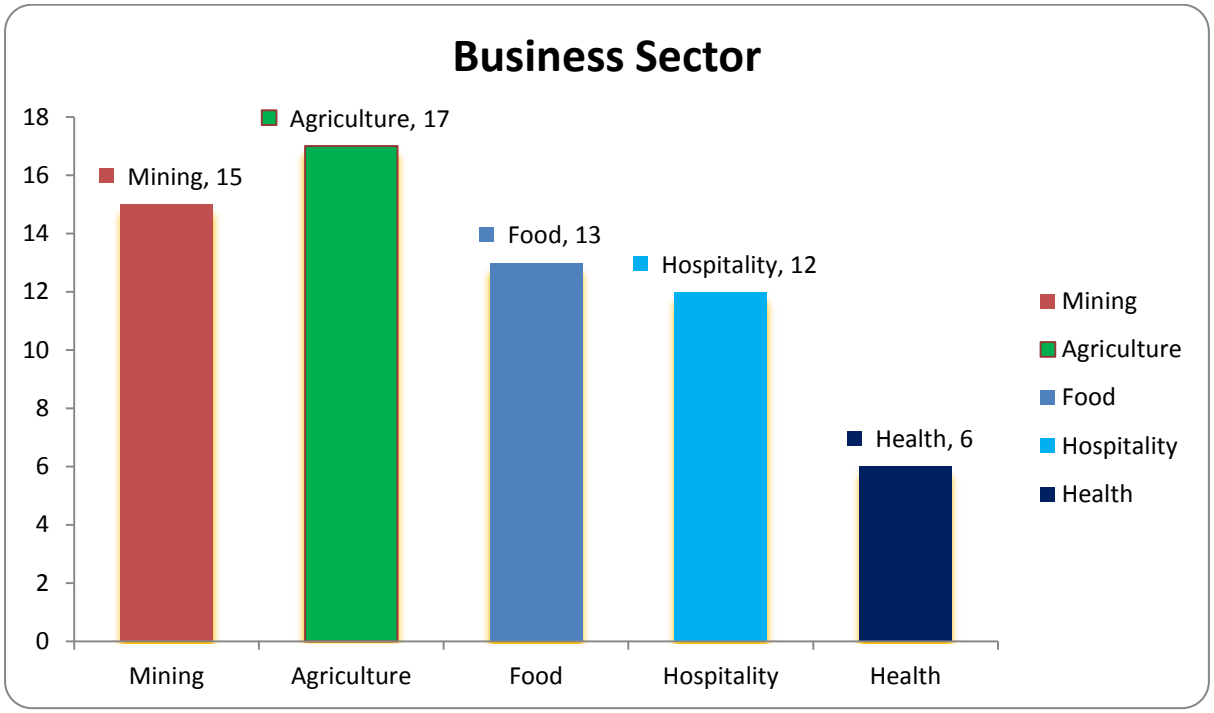
Table 3: ANOVA test for Age groups

ANOVA Age					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.526	2	0.763	5.251	0.008
Within Groups	8.720	60	0.145		
Total	10.246	62			

Business Sector

The sample was based on commercial customers based in the Klerksdorp area which forms part of CoM Municipality. The business sectors that were engaged in this study are depicted in Figure 4.1 below. As shown, the Agriculture sector has contributed immensely to this project because most of the questionnaires were completed by respondents from this sector. Most of the questionnaires submitted to the Health sector were not completed correctly and were deemed unusable. Based on this study, the Agricultural and Mining sectors are regarded as intensive users of electricity. The Mining sector uses a high consumption of electricity, followed by the Agricultural sector. The Food, Health and Hospitality sectors in most cases indicate little consumption relative to the Mining and Agriculture sectors. As shown in Figure 4.1 below, respondents from the Agriculture sector completed 17 questionnaires, followed by the Mining sector with 15 completed questionnaires, the Food sector with 13, the Hospitality sector with 12 and the Health sector with only 6 completed questionnaires.

Figure 4.1: Sampled Business Sector



Anova Tests – Business Sector

According to the business sector, there is very little statistical difference regarding Competition and Investment simply because the significance value is slightly greater than 0.05.

Table 4.1: ANOVA test for the business sector

ANOVA Business Sector					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	0.351	3	0.117	0.750	0.527
Within Groups	8.259	53	0.156		
Total	8.609	56			

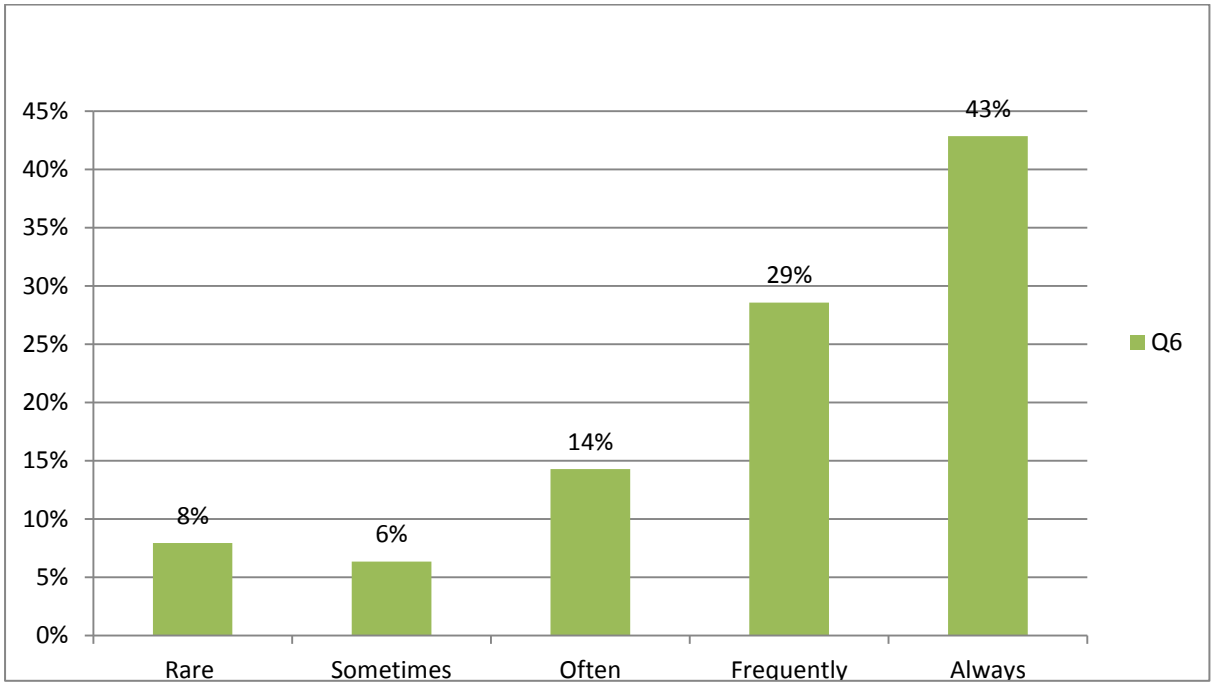
4.2.1 Influence of load-shedding on commercial customers

The influence of the electricity shortages has a damaging effect on all business sectors, and most businesses reported a loss of trade or productivity due to carrying the cost of overheads while not trading or reaching set production targets. Most of the businesses are heavily dependent on electricity and are unable to operate their business effectively from alternative electricity supplies such as diesel generators and solar power, the reason being that fuel is more expensive than electricity. Furthermore, financial capital is required to invest in the

alternative source of electricity, which will cause already financially struggling companies to go out of business.

Figure 4.2 ties up with Question 6, which examined whether customers experienced any spoilage of material due to electricity cuts. It can be noticed that out of the 63 respondents who completed the survey, 43% indicated that they were faced with raw material spoilage and damaged goods due to power cuts that occurred on a daily basis. Thus it can be assumed that most businesses have encountered material spoilage as a result of electricity power cuts. Within the Food sector, some of the food manufacturing methods involve batches and continuous processes that should run from the beginning to the end without any interruption. When electricity is cut off for long periods, it leads to the damage of stock due to the interruption of the manufacturing process and also the loss of refrigeration. The Food industry is a source of many of South Africa's exports which rely on timeous delivery. Thus power cuts have had a devastating effect on this industry.

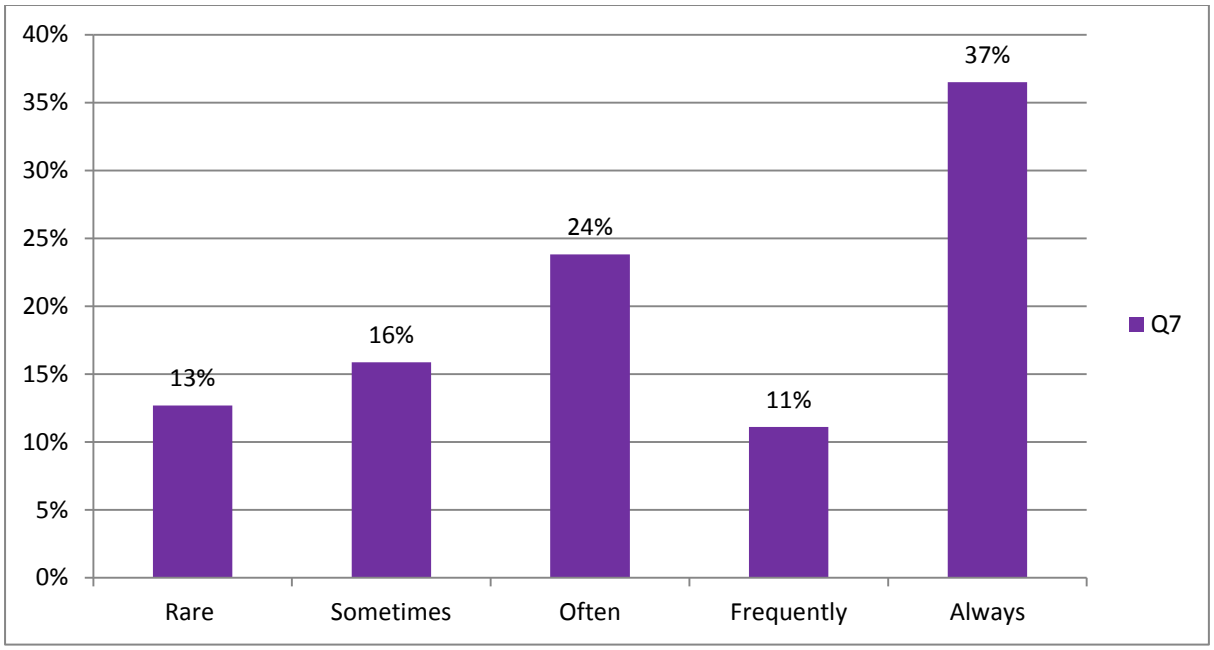
Figure 4.2: Question: Did you encounter any spoilage of material due to electricity cuts?



From a study of Figure 4.3 which ties up with question 7, it is evident that other businesses had experienced equipment failure when electricity was restored. Some of Eskom's customers' machinery or electrical appliances are old and, as such, need to be operated with minimal power interruptions to avoid failure, thus, with excessive load-shedding, the lifespan of this machinery is fast-tracked to permanent failure. Both the small power and large power

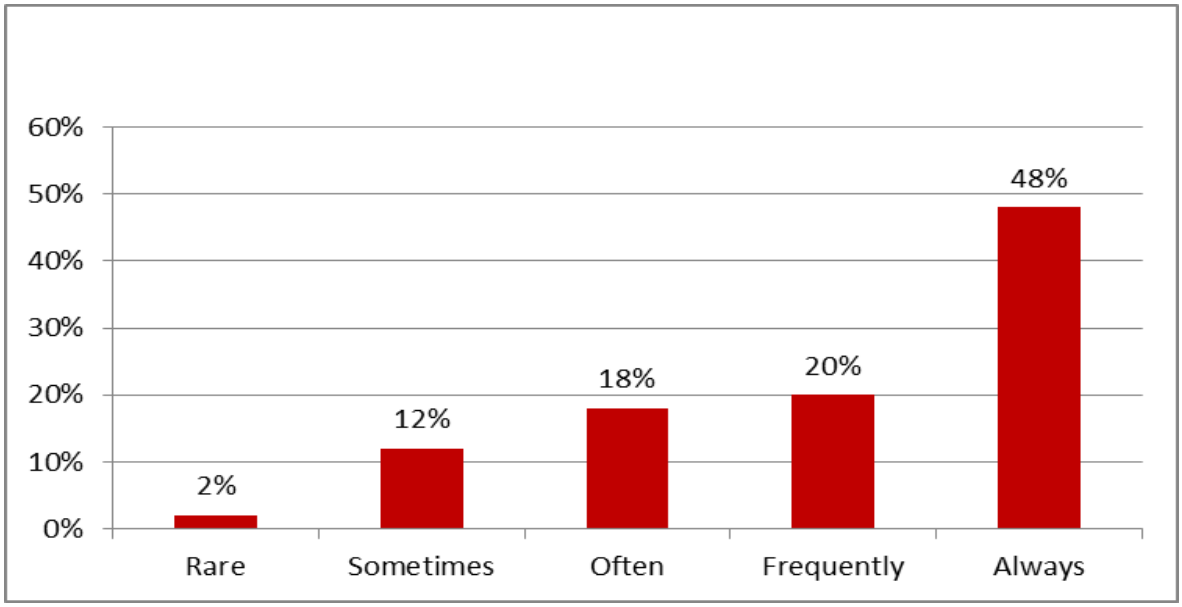
users who are still developing their business, such as Agricultural farms, receive a knock-on effect when they lose their significant equipment because this, in return, affects the export market as well as the employment and livelihood of those living on farms. The duration of the power interruption also determines the costs associated with the loss. Some customers lost computer files while others lost working hours.

Figure 4.3: Question 7: Did you suffer any damage to your equipment when electricity was restored?



Unplanned cuts are dangerous in the Mining sector because they can result in the loss of the ventilation needed for human life working underground. Over and above this problem, if power cuts are of a long duration; the slurry thickens, potentially causing damage to the stirring rakes when power is restored. Load-shedding is extremely damaging also to the crucial Agricultural sector, especially for dairy and poultry businesses.

Figure 4.4: Question: Did you struggle to reach the daily production targets due to power cuts?



4.2.2 Investment on Backup Supply

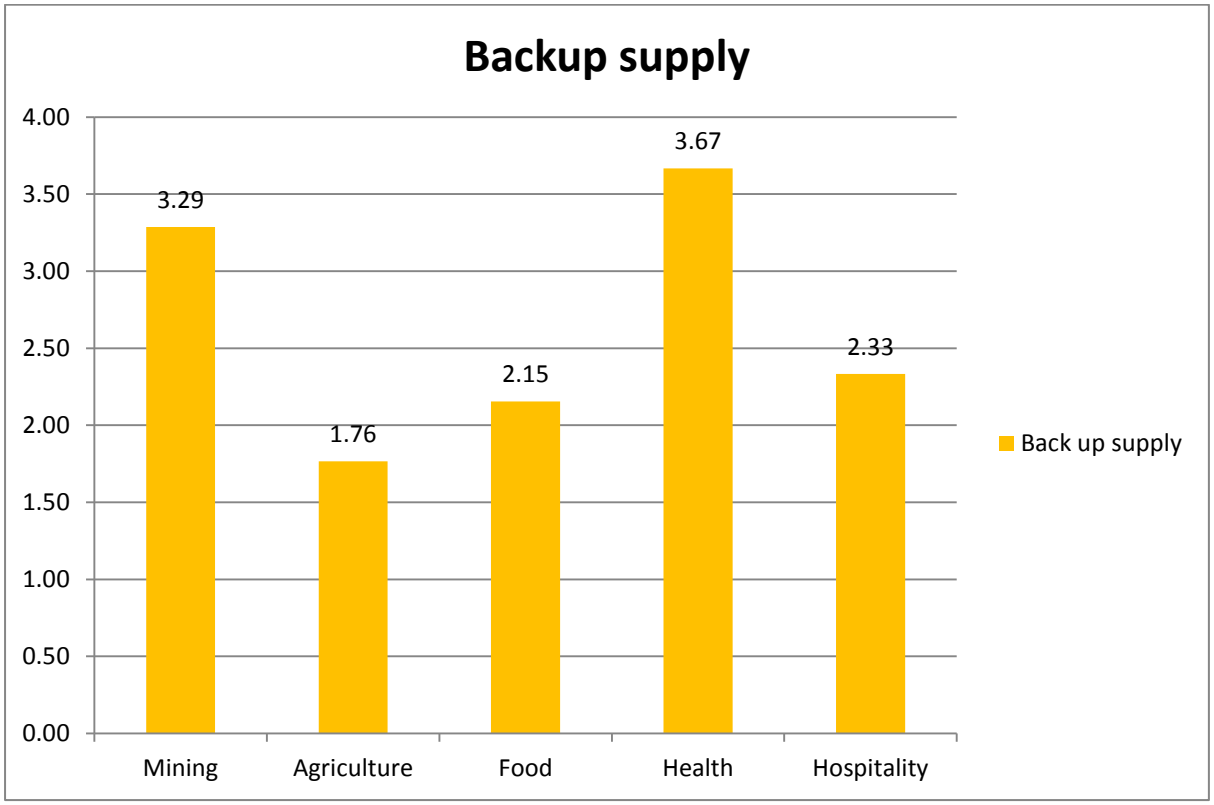
Eskom introduced load-shedding in January 2008, and only then did most South African businesses and members of the general public begin to know about the shortages in electricity supply and had to ensure they had an alternative electricity supply to the Eskom one, to ensure the normal running of their businesses and daily lives. The second load-shedding period occurred in March 2014, however, by the second time around, Eskom had learned from the previous load-shedding period in 2008 to communicate better with businesses and society at large. There were different communication campaigns that took place on different media levels, such as television, twitter and facebook, and thus Eskom customers were more informed about the planned power cuts and the status of the Eskom power grid than they had been before and, therefore, could make the necessary plans to safeguard their businesses and homes where possible.

The Mining and Health sectors are required to have a backup supply system by statutory law, given the nature of their business. The mines are required to have a backup supply to ensure the safety of employees by providing ventilation to people underground and evacuation from underground to ground level. Healthcare units are also required to have a diesel generator or any alternative supply, such as a Photo Voltaic supply, over and above the supply received from Eskom. This system is needed in case a normal power outage occurs, and electricity would still be needed to keep the life support machines and other necessary tools working to sustain and safeguard human life. It is also imperative for the Agricultural

sector to have backup generators to keep the farm running because power outages can have a serious effect on the farm's financial viability.

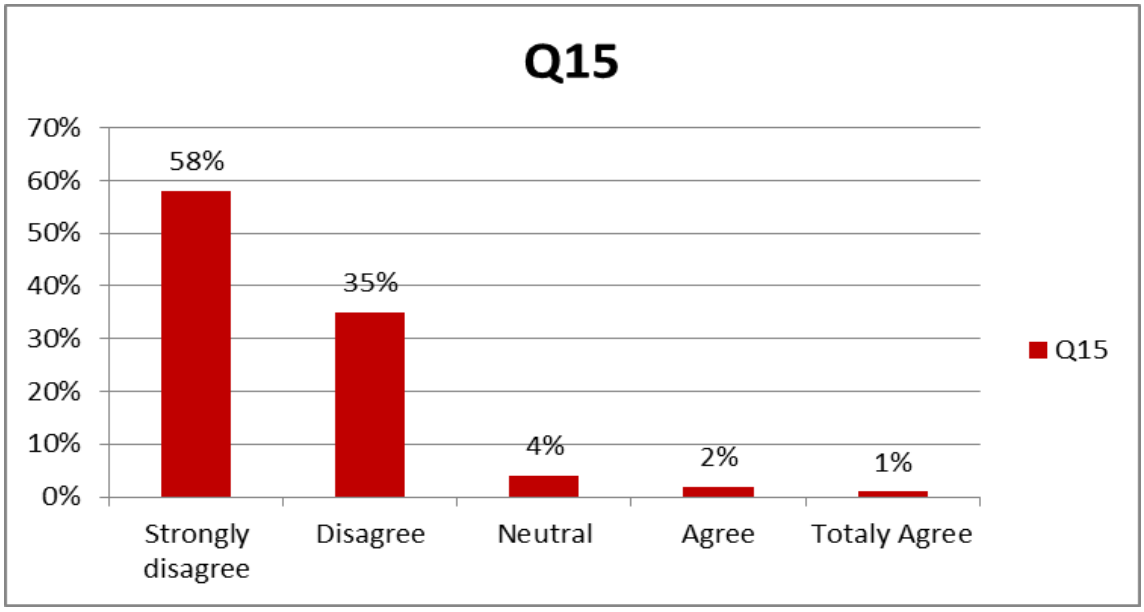
For this reason, Figure 4.5 shows that the Health and Mining sectors already had the backup supply in place. However, while that backup supply is regarded as an essential supply and is used for the survival or the protection of human life, it is not sufficient to run the whole business effectively. On a Likert scale ranging from 'strongly agree' to 'agree', the measurement on the Health and Mining sectors shows a high score which signals the existence of a back-up supply for their operations. Other sectors scored low, and this indicates that these Eskom customers still need to invest in the backup supply. Going forward, Eskom customers need to invest in alternative electricity supply to ensure their businesses are not severely affected by power outages.

Figure 4.5: Question: Before load shedding did you have a backup electricity supply?



All sectors are not in a position to run their business process effectively entirely from a back-up generator supply only, simply because diesel fuel is expensive and, in other cases, the power generators are very costly.

Figure 4.6: Question: Would you be able to run your business effectively from a generator?

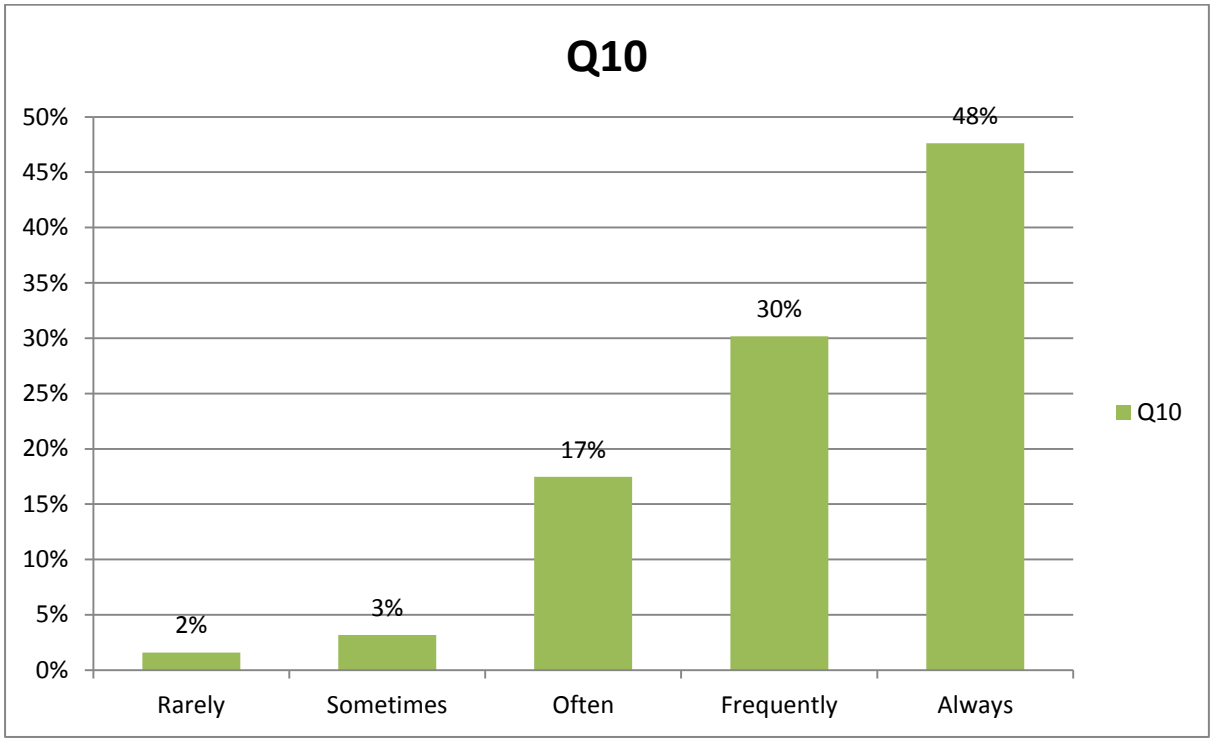


4.2.3 Impact of high electricity tariffs

Electricity is an essential input for practically all businesses, the recent rapid increases in electricity tariffs have had negative effects on all business sectors. Eskom's commercial customers are unable to absorb the high electricity tariffs, and these have the potential to adversely affect the business processes by increasing the cost of business overheads. Moreover, the price increases for businesses who purchase electricity from the CoM municipality are further exacerbated by municipal mark-ups in addition to those Eskom charges or that are requested by NERSA.

The tariffs for the key customers and large power users are related to the time of use and allow customers to use electricity during three different periods within one day, these periods are 'off peak', 'on peak' and 'standard period'. As a result of the introduction of these three tariff periods, it is now easier for key and large customers to shift the bulk of their production load to the less expensive 'off-peak' period which is available to this category of customers. Small customers mostly have a flat tariff, which does not give them much leverage to shift their production load. Eskom users are charged different tariffs for different periods of usage, and these tariffs are mostly determined by the size of the supply the customer uses. To avoid the high electricity prices, large and key customer reduce their usage of electricity or even employ energy efficiency mechanism to avoid high tariffs and an insecure supply.

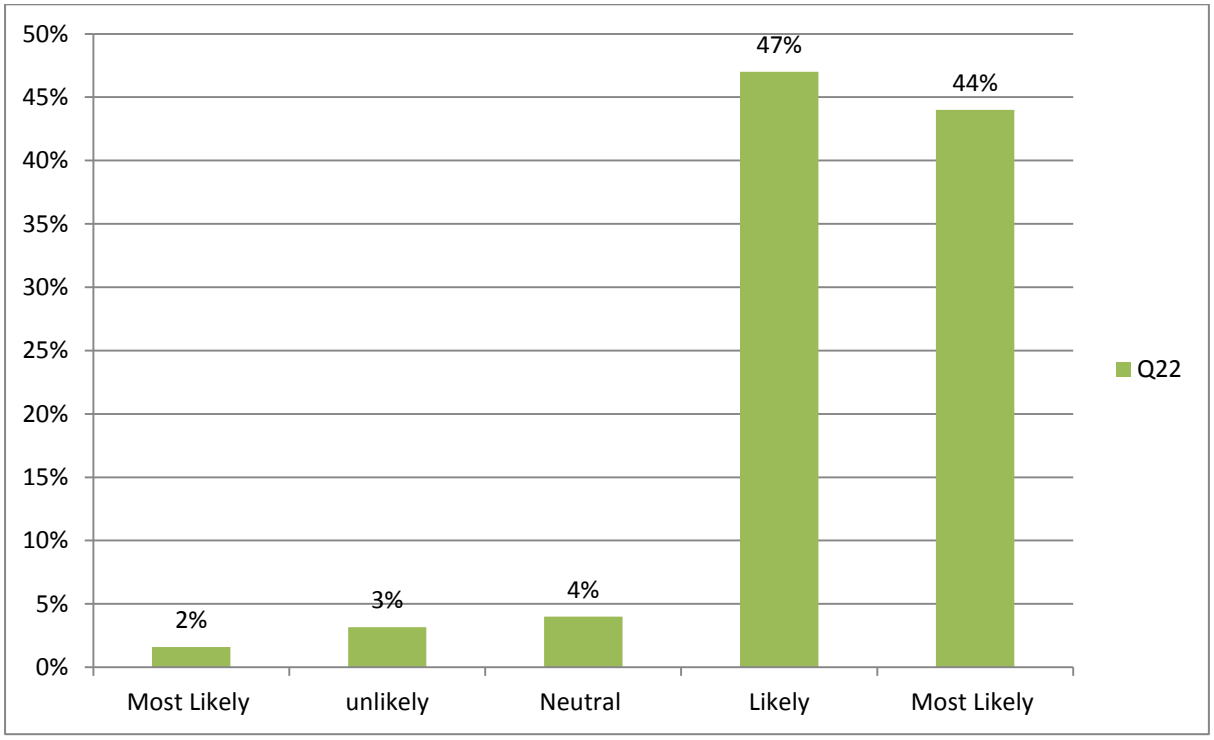
Figure 4.7: Electricity contribution to the operating costs of most businesses.



4.2.4 Competition and investment

Electricity shortages and expensive tariffs have jeopardised the viability and production of firms and industries that invested in businesses in the Klerksdorp Metropole, given the fact that investments were previously made by cheap electricity, thus giving investors a good competitive advantage when investing in South Africa. Amongst some of the small power users, there were investors that pulled out due to the businesses' failure to achieve the desired profit margins, while the large and key customers managed to carry on with productions due to economies of scale. Some of the research respondents indicated that they had lost their market to their competitors who had an alternative supply of electricity. Furthermore, the image of their companies was severely tarnished due to poor performance triggered by electricity power cuts.

Figure 4.8: Question: Did you encounter any poor customer satisfaction due to delayed orders triggered by electricity power cuts?



4.3 SUMMARY

This chapter is the most vital chapter of the study as it revealed the result of the study, thus giving support to fulfill the purpose of the study. Greater efforts were taken when applying the statistic systems to ensure the credibility of the study.

CHAPTER 5
CONCLUSION AND RECOMMENDATIONS

5.1 INTRODUCTION

The previous chapter was a presentation of the results of data gathered from the respondents; the study was a quantitative one and, therefore, the data presented was empirical. The main objective of this study was to examine the influences of continuous electricity supply on a selection of Eskom's commercial customers in the Klerksdorp area. This chapter aims to present the highlights of the main findings of the study. This chapter ties up the purpose of the study together with the results, after measuring the influences of a break in the continuous electricity supply, together with higher electricity tariffs on the selected businesses in the Klerksdorp area.

5.2 FINDINGS

Findings are presented in this pattern listed below:

- Influence of load-shedding
- Impact of high electricity tariffs
- Backup electricity supply
- Competition and Investment

5.2.1 Influences of interruptions to Eskom's electricity power supply, due to load-shedding, on different business sectors

Before load-shedding, customers were satisfied with Eskom's stable electricity supply as well as the associated electricity tariffs. However, the introduction of load-shedding in 2008 had a disruptive impact on the continuity of the electricity supply. It is quite evident that load-shedding has a detrimental effect on all business sectors regardless of the size and nature of the business. The negative consequences of power cuts for businesses include issues such as failure to reach the desired production targets, equipment failure and spoilage of material used for production. The damaging effect of load-shedding was worsened by the power utility's failure to adhere to the planned power cuts, more especially when there were delays in restoring the electricity supply to customers.

Indeed, the unstable electricity supplies sternly threaten the survival of all businesses that consume electricity. The major impact on sustainability is the unanticipated loss of productiv-

ity, the loss of revenue and increases in overheads. Spoilage of raw material, equipment maintenance and start-up time and fringe effects were reported as other major costs that were incurred due to load-shedding.

5.2.2 Backup supply

Most businesses within the Klerksdorp area who participated in this research project do not have a backup supply that can be used in place of Eskom's electricity supply. Those businesses that have generators use them to protect either their equipment or human life, while a few businesses such as those in the Hospitality sector, use them for daily production. As a result of load-shedding, businesses have had to invest heavily in backup electricity supply to ensure the survival of their business. There are different types of backup supply such as photovoltaic panels, gas and diesel generators and solar panels and geysers. A major problem with these alternative power supplies is very expensive infrastructure which is required for the installation of such supplies. Businesses should at least have funds available for investing in these alternative supplies to purchase the required infrastructure. Even if customers could afford to buy these expensive infrastructures, it is impractical for businesses to absorb the high variable costs related to the usage of these alternative power sources, because Eskom and the CoM Municipal electricity charges are relatively low when compared to the cost of self-generated electricity by the businesses. In addition to these matters, the amount of capital invested in the alternative supply will only yield a financial return after 5 to 10 years of installation. The funds invested in the alternative power supply could have been used to generate more revenue for the business or even grow the business further. Another hindering factor for alternative power supplies such as Photo Voltaic (PV) is the technology needed to implement and maintain the backup power schemes.

Backup supply is quite expensive especially for mining and big industries; for this reason, the companies have to evaluate and compare the benefits rendered by the backup supply versus the amount spent in acquiring the equipment. Proper planning should be done before purchasing the backup supply otherwise the investment might be a wasteful expenditure. Thus, companies should select the correct size of backup supply bearing in mind the consequences that can be caused by the unsupplied to the financial aspect and business processes of the company (Oseni, 2012).

Most of the business owners throughout the country condemn the issue of the backup supply, simply because the required investment will raise the input costs for the survival of their businesses instead of investing the capital towards expanding the businesses (Mgibisa, 2008).

5.2.3 Competition and Investment

Emerging customers, especially those in the Agriculture (Poultry) and Hospitality sectors had to close their businesses as a result of the enormous power cuts experienced, lack of back-up electricity supply and the difficulties associated with shifting their operations to outside of load-shedding hours. With other businesses, such as farming, it was possible to move the milling process out of load-shedding times, although it was compulsory to pay employees overtime for these activities. Many businesses incurred enormous revenue losses due to load-shedding and most emerging businesses, which were already struggling to break even, were forced to close their business due to load-shedding. Business closures were exacerbated by investors or shareholders withdrawing their funding from businesses due to the financial losses incurred due to the insecurity of electricity power supplies.

Small businesses also experienced major revenue losses when loyal customers moved to their competitors who had backup supply and were well-established companies. Although load-shedding was a national crisis, for some reason the end customer was unhappy with the service received from their suppliers or service providers. According to the results of this research project, the level of unhappiness from end customers was quite significant.

The reputation of most of the companies covered by this study was tarnished severely, and some of the respondents indicated that some of their customers' orders could not be fulfilled and, moreover, the quality of their end-product was compromised, due to the shortage of electricity as a result of load shedding.

5.2.4 High electricity tariffs

Municipalities have not embarked on new technologies for producing their own electricity, and they redistribute the electricity received from Eskom (Department of Minerals and Energy, 2008:8). This means that the CoM Municipality purchase electricity from Eskom and re-distribute at a marked-up price. Most of the businesses based in Klerksdorp are supplied by CoM Municipality while Eskom supplies others. Those supplied by CoM Municipality pay higher electricity charges than those supplied directly from Eskom. Usually, Municipal electricity is more expensive than electricity supplied directly by Eskom (Le Cordear, 2015).

According to the research results, under the impact of high electricity charges, businesses have resorted to conserving energy through Demand Side Management (DSM) by using fluorescent bulbs, switching off lights and other electrical appliances and equipment when

these appliances are not needed. From the results it could be noticed that 38% of respondents passed the high electricity costs onto their customers or end users; if they had not done this, their business would not have been able to survive. Most of the small power users, which happen to be small businesses, are more susceptible to the pressures of the electricity tariff increases than larger firms. Excessive electricity price increases have the damaging consequence of hindering further business expansion. High electricity charges increase the overheads of companies which make the businesses economically unviable. A continuous increase in electricity prices also has a negative result on economic growth because it increases the insecurity for businesses and consumers and has a potential to limit investment spending (Blignaut & Inglesi-Lotz, 2011a:4779).

The rapid increases in electricity tariffs are fatal to commercial businesses that are breaking even on financials. These commercial businesses will fail to carry the increasing operational costs arising from continual increments on electricity prices. Customers using electricity rigorously for operational purposes such as marginal mining and manufacturing will suffer the consequences of the high electricity tariffs. As the situation is these companies are confronted by changes such as hostile global economic conditions and unstable currency, now the issue of high electricity costs is worsening matters for these companies. The price of electricity is not a threat to the consumers; however, the abnormal tariff increment within a short space of time is causing major problems to the companies such as the inability to absorb increments in the production cost. Due to high tariffs companies decrease productivity to save on electricity costs, reduce the number of employed staff, or even shut down the complete businesses (Deloitte, 2012).

Demand-side management is an improved energy-efficiency and economical way of reducing electricity prices as well as electricity usage while getting out the same business output received before implementing these measures. To reduce the demand for more electricity generation stations, the use of energy efficiency and demand-side management method within the companies should be followed and implemented. This method also reduces the need for constantly increasing the consumer charges. High electricity prices force the customer to invest in energy efficiency and demand-side measures (DNA Economics, 2011).

5.3 RECOMMENDATIONS

The City of Matlosana should come up with a strategy of protecting its commercial business from being cut during an emergency to avoid hurting the economy of Klerksdorp during load-shedding. This can be achieved by switching off the residential customer instead of com-

mercial customers since they are not severely impacted the most by power interruptions like businesses.

Eskom, together with South African Government, should ensure that load-shedding does not reoccur and, therefore, there should be strategic planning as to when and how Eskom should build more electricity generating plants that would bring more electricity to the grid. This planning should not be undertaken as a means of reaction due to power shortages or being under pressure, because such reaction would call for unnecessary electrify price hikes, especially if there are no funds available for building the new power plants. Furthermore, the government should allow more IPPs to connect to the grid because this will ensure a stable and secure electricity supply.

Most businesses connected to the Eskom power grid should look at possible ways to reduce the cost of electricity. The current electricity prices are very high; therefore, it is recommended that customers should invest in alternative energy supply such as renewable energy plants and also invest in energy efficiency technologies rather than relying completely on Eskom's electricity supply. The truth is alternative supply equipment, and machinery do not yield savings immediately; they take time to provide a return on the money invested. However, once the infrastructure is installed, the savings will be significant.

Major businesses that have the financial capacity to invest in renewable energy systems need to pursue that route to ensure the security of their electricity needs. Furthermore, key customers should plan to build their generation capacity and if possible wheeling of energy across the grid should be pursued. Marking up of Eskom electricity prices results in demoralised municipal customers from paying for services received. The government should set policies that allow customers to be charged the same electricity prices regardless of the supplier of electricity.

The City of Matlosana Municipalities should embark on investing heavily in renewable energy and move away from the grid. Once done the municipality will reap high revenues after the invested capital is fully recovered. Should the power utility run short of electricity, CoM will not be affected by the power crisis. Thus, this initiative will serve as a safety net for the municipality.

5.4 LIMITATIONS AND SUGGESTIONS FOR FURTHER RESEARCH

The findings of this research project are limited by the size of the sample and the time frame for the study. The chosen sample was based on different business sectors based in Klerks-

dorp Metropole. It would have been better to focus on one sector to precisely quantify the consequential damages caused by load-shedding per sector; however, due to area confinement, it was necessary to diversify the range of business sectors included in the research. Future studies could examine the exact financial costs suffered by the businesses based in the Klerksdorp Metropole.

5.5 CONCLUSION

The impact and consequences of power shortages on business based in Klerksdorp were closely examined in this study. A quantitative survey based on the Likert scale was administered to 63 respondents from different sectors including Mining and Agricultural. The SPSS statistics was used to analyse the reliability of the study, and it was later analysed and interpreted in the previous chapter. In light of the findings made above, load-shedding hurt the selected businesses within Klerksdorp area because some business had to close down due to lack of backup electricity supply, while others closed because their investors pulled out of the businesses.

As mentioned in the literature review in chapter two, it is evident that respondents could attest to the fact that load-shedding resulted in considerable damage which often resulted in equipment failure during the resumption of power. Furthermore, it was also mentioned in the literature review, that some respondents had to pass on the high electricity costs to their end customers.

Power shortages in South Africa came at a dangerous time when Eskom had no funds to invest in new power stations and, therefore, customers had to pay for the new supply. The rapid increases in electricity prices forced the research respondents to seek alternative ways of saving electricity by reducing their electricity usage; this was achieved by altering the business processes and using electricity sparingly. Some clients had to invest in energy efficiency measures to save on high electricity prices.

5.6 SUMMARY

The purpose of this final chapter was to give a brief interpretation of the research results and to draw conclusions and provide recommendations on the research topic, namely the impact of the interruption of continuous electricity supply on selected businesses in the Klerksdorp area. The research results show that load-shedding, together with high electricity tariffs, had a detrimental effect on the profitability of a wide range of businesses. Recommendations for dealing with power outages were also offered.

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ANNEXURE A: QUESTIONNAIRE

BIOGRAPHICAL INFORMATION:

The following information is needed to enable meaningful data analysis.

Mark the applicable block with a cross (X) and kindly complete all questions.

Gender:	Male	Female

Race:	African	White	Coloured	Indian	Other

Age	18-25	26-36	37-47	50+

Level of Employment:	Junior	Middle	Senior	Top	Unsure

Highest Qualification:	Matric	Diploma	Degree	Postgraduate

Years working in this company	5	10	15	20+

Size of Supply	Small power user	Large Power user	Key Customer

Business Sector	Mining	Agriculture	Food	Hospitality	Health

SECTION A - Influences of load-shedding on business

Please indicate to what extent each of the following statements affected your business. **Answer by placing X on 1, 2, 3, 4 or 5 for each statement below.**

1	2	3	4	5
Rare	Sometimes	Often	Frequently	Always

Influences of Load Shedding					
Rated statement	1	2	3	4	5
Were load-shedding schedules adhered to at all times, meaning the supply was switched off and on according to the schedule					
Load shifting, was it easy to shift your normal operating hours outside the load-shedding scheduled time?					
Did you work extra hours to catch up on production lost during load-shedding?					
Did you reduce the hours of your business /production due to power cuts?					
Did you struggle to reach the daily business target due to power cuts?					
Did you encounter any raw spoilage material due to electricity cut offs?					
Did you encounter any damage to your equipment when electricity was restored?					
Were there any losses due to start-up time and fringe effects?					
Did you close some of your plants or operations during load-shedding time?					
Electricity tariffs					
Is electricity a major contributing cost to your business?					
Did you reduce your production or processes to avoid high tariffs that were increased to combat high usage					

of electricity and for building new power stations?					
Were there limitations on electricity usage due to high tariffs?					
To cushion your profit margins did you pass the high electricity costs to your customers?					
Did you initiate energy efficiency projects to save on electricity tariffs?					

Section B: Alternative supply to the grid supply

Back up Supply	Strongly disagree	Disagree	Agree	Totally agree
Would you be able to run your business effectively from a generator or any other source of power?				
Prior to load-shedding did you invest in a backup supply such as generator set or renewable energy?				
After experiencing load-shedding were you considering to invest in a backup supply?				
Was it economical and suitable to run a business on backup supply such as a diesel/petrol generator?				
Post load-shedding did you consider to invest in an alternative source of supply such as renewable energy?				

Section C: Influence of insecure electricity supply on Competition and Investment

Please select the suitable answer by placing an X on the relevant number. The number work as follows.

1: Not probable

2: Somewhat improbable

3: Somewhat probable

4: Very probable

Competition and investment	*1*	*2*	*3*	*4*
Did any of your investors / potential investors pull out of your business due to the insecurity of supply?				
Did you lose customers to your competitors due to power interruptions?				
Did you encounter dissatisfied customers due to delayed orders or disturbances on your processes due to power cuts?				
Was the revenue of your company negatively impacted by load-shedding?				
The image of your company was hurt due to poor service of limitations on electricity supply?				
Was the quality of your products compromised due to a shortage of supply?				
Did you reduce the price of your products just to stay in the market and to protect your clientele?				
With the unreliable supply of electricity would it be easy to grow your business in the country?				
Did you lay off some of your employees as a result of being unable to reach the required profit to sustain your business?				

ANNEXURE B: LETTER OF LANGUAGE EDITOR

Dynamic Language & Translation Specialists

Antoinette Bisschoff
71 Esselen Street,
Potchefstroom
Tel: 018 293 3046
Cell: 082 878 5183
Language@dlts.co.za
CC No: 1995/017794/23

Sunday, 06 May 2018

To whom it may concern,

Re: Letter of confirmation of language editing

The dissertation **The influence of continuous electricity supply on selected commercial customers in Klerksdorp** by **DH Mokoena (23907657)** was language and technically edited. The referencing and sources were checked as per NWU referencing guidelines. Final corrections remain the responsibility of the author.

Antoinette Bisschoff

Officially approved language editor of the NWU since 1998
Member of SA Translators Institute (no. 100181)

Precision ... to the last letter