



An analysis of the effect of the intermittent supply of electricity to consumers in the North West Province, South Africa

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Mini-dissertation accepted in partial fulfilment of the
requirements for the degree [Master of Business
Administration](#) at the North-West University

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Graduation: July 2023

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ABSTRACT

Electricity is one of the contributions that has impacted the lives of everyone in the country. Electricity is an essential part of modern technology; without it, most of the items we use every day would not function and would never have been invented. In addition, in South Africa, there has been an increase in economic activities, which has led to increased energy demand. Consequently, the inconsistency of electricity supply becomes a challenge to consumers and the country. In this study, we researched the effect of intermittent electricity supply on consumers in the North West province in South Africa. The purpose of the study was to investigate and identify factors affecting intermittent electricity supply to consumers. The research approached a quantitative method to examine the impact of the unavailability of electricity on the residents of the Brits' and Maboloka geographical areas in the North West province that were conveniently selected. Self-administered questionnaires were used to collect data. There were also open-ended questions to gather the opinions of the residents of the Brits' geographical area on how they source alternative methods of electricity supply during the absence thereof. Quantitative data were analysed using the SPSS software version 28 for the closed-ended questions. Qualitative data were analysed using thematic analysis. The results indicated that the inconsistency in electricity supply has a negative impact on consumers. It negatively affects various factors, which include the economic growth of the country, socioeconomic, and development of the country. The results also revealed a few alternative methods of survival used by the respondents during the absence of electricity: generators, inverters, gas, coal and paraffin. The study concluded that renewable energy and proper infrastructure maintenance will assist in reducing the intermittent supply of electricity.

Keywords: electricity, power, supply, Escom, intermittent, generation

ACKNOWLEDGMENTS

I want to thank the community of Brits and Maboloka for participating in the research.

I appreciate my research supervisor Prof JJ Prinsloo for guidance, support and kindness throughout this process, from the proposal's design to the research documents' submission.

My gratitude goes to my friends and the Rogue team, who became my brothers, Thindothe, Pagias and Karabo, for the motivation and inspiration during the identification of this fascinating area of research and formulation of the study topic and documentation of the proposal.

I also acknowledge the support rendered to me by my husband, Thembelihle Jele, my children, Thembokuhle, Bonguthando and Thandoluhle, as well as my parents, Nomvula and Stanley Maseko, for your endless support during the research project. My family remained steadfast despite dedicating some family time towards this research.

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LIST OF ABBREVIATIONS

A.N.C.	African National Congress
D.R.C.	Democratic Republic of Congo
DoE	Development of renewable energy
E.C.B.	Electricity Control Board
E.D.R.C.	Energy and Development Research Centre
E.P.R.E.T.	Energy Policy Research and Training
E.S.I.	Electricity Supply Industry
G.D.P.	Gross Domestic Product
GDP	Gross Domestic Product
I.P.P.	Independent Power Producer
IPP	Independent Power Producers
KMO	Kaiser, Meyer and Olkin
M.E.C.	Minerals-energy complex
MENA	Middle East & North Africa
MeSH	Medical Subject Headings
N.E.R.S.A.	National Energy Regulator of South Africa
NGO	Non-governmental organisations
NWU	North-West University
PA	Paralell Analysis
POPIA	Protection of Personal Information Act
R.E.I.P.P.P.P.	Renewable Energy Independent Power Producer Procurement Programme
R.I.E.P.	Regional Integrated Electricity Planning
RDP	Reconstruction and Development Programme
S.A.P.P	South African Power Pool
S.O.E.	State-Owned Enterprises
SADC	South African Development Community
SAPP	Southern African Power Pool
SAR&H	South African Railways and Harbours Administration
SME	Small and Medium Enterprises
UKZN	University of KwaZulu-Natal

UPS

Uninterruptible Power Supply

V.F.T.P.C.:

Victoria Falls and Transvaal Power Company

CHAPTER 1:

NATURE AND SCOPE OF STUDY

1.1 INTRODUCTION

Electricity access is well established within the framework of human rights, which is acknowledged broadly by the state of the desirability of eliminating energy poverty for all, yet, particularly for the rural poor and women (Tully, 2006: 30). In South Africa, electricity is supplied solely by the utility, Eskom. The company was founded in 1923 by a parliamentary act, namely, the Electricity Act of 1922. Eskom is a company that generates, transmits and distributes electricity to the country and extends to other countries outside South Africa. The utility is mandated to provide sustainable electricity to stimulate economic growth to improve the quality of life of people in South Africa. However, the utilities' ability to fulfil this mandate has been declining in recent years due to the intermittent supply of electricity, so-called load shedding. The intermittent supply started in April 2008 and is caused by the constrained generation capacity (Integrated Report, 2015: 4).

The benefits of a consistent electricity supply cannot be understated if national development depends on power availability. The rural areas in Africa should be earmarked for development if Africa is to develop. That development will, without a doubt, begin with the guaranteed provision of electricity in rural areas (Zadawa & Omran, 2019). South Africa is one country that has not fully achieved the goal of electrifying rural areas. An intermittent electricity supply in the North West of South Africa will only lower the development rate. Therefore, it is important to ensure that electricity is always provided consistently in all parts of the country.

Thus, this study aims to analyse the effect of intermittent electricity supply on South African consumers.

1.1.1 Background to the problem

As alluded to earlier, electricity's importance to any country should never be understated, as electricity determines economic success. According to Dada (2014: 1003), the poor state of the electricity supply system in Nigeria is threatening the welfare and security of life and properties of millions of individuals. The adverse economic consequences for the country with the inadequacy of the National Grid, especially the inability of the electricity generation capacity to match increasing demand in the country, have led to increased agitation for increased penetration of renewable energy sources into the electricity supply mix. The Nigerian example is an epitome of a society bedevilled by the lack of power, and such can be the situation in South Africa if the intermittency of electricity supply continues.

It should be considered that Africa is a continent that has developing countries. One of the biggest challenges faced in Africa is the lack of electricity (Hafner *et al.*, 2018:1). According to Kaygusuv (2012: 1119), this acute lack of power has contributed to a lot of problems in Africa's industrial sector. He further states that Africa has also continuously struggled to electrify rural areas, properly resulting in poor rural development. South Africa is no exception. Even though the government has made strenuous efforts to ensure that electricity is supplied adequately, there continue to be intermittent supplies of electricity in the North West province, which, if not curbed, will be detrimental to the development of the country at large (DBSA, 2012).

South Africa is one of Africa's economic and industrial powerhouses; therefore, electricity should always be consistently supplied in all parts of the country (Ateba *et al.*, 2019: 1324). According to Monyeneni (2017), South Africa is ideally posited to be Africa's most industrialised economy, with an economy heavily reliant on energy. Ateba *et al.* (2019: 1324) state that the South African business environment is characterised by supply uncertainties, which have enormous economic implications on the country's capacity to achieve its industrial goals. South Africa's industrial decline and falling economic growth are directly associated with decreasing electricity sustainability, as the industrial sector is the main economic contributor to South Africa's GDP (Gross Domestic Product) (Ateba *et al.*, 2019: 1325). It is, therefore, clear that South Africa has an electricity challenge.

1.1.2 North West province

The North West province lies in the north of South Africa on the Botswana border, fringed by the Kalahari Desert in the west, Gauteng province to the east and the Free State province to the south (Municipalities of South Africa, 2022). It is stated further that it covers an area of 104 882 square kilometres and has a population of 3,748,436. The North West province is predominantly rural, with 60% of the population living in rural areas (Global Security, 2020). According to the Department of Economic Development, Environment, Conservation and Tourism (2012), the North West province is the 4th largest electricity-consuming province in South Africa. According to Ateba *et al.* (2019: 1327), the North West province consumes approximately 12% of the available electricity, mainly due to the high demand for electrical energy-intensive mining and related industrial sectors. Ateba *et al.* (2019:1327) highlighted that its mining sector consumes 63% of the electricity supplied to the North West province.

It is noteworthy that the North West province is one of the largest provinces in South Africa, covering 104 883 km² of land with a population size of 3,5 million (2011). According to Municipalities of South Africa (2022), given the relatively sheer size of the province, it is important to note that it plays a pivotal role in the South African economy. Therefore it behoves the state to ensure a consistent supply of electricity. According to Municipalities of South Africa (2022), mining is the major contributor to the North West province's economy and represents almost a quarter of South Africa's mining industry. The Rustenburg and Brits districts produce more platinum than any other area worldwide. The North West province also produces a quarter of South African gold, granite, marble, fluorspar and diamonds (Municipalities of South Africa, 2022). Against this background, electricity becomes a necessity in the North West province, as this province immensely contributes to the South African economy. An intermittent supply of electricity will only disturb the province's economy, which will, in turn, harm the national economy. According to Ateba *et al.* (2019:1327), it, therefore, behoves the South African government to make sure that electricity supply is always constant all over South Africa, and this would include the

rural areas as well, particularly in the North West province where the intermittent supply of electricity has been leading to a stalling in development.

1.2 PROBLEM STATEMENT

Electricity is a developmental need; therefore, it is essential to ensure that electricity is consistently available if development occurs. According to Ateba *et al.* (2019: 1327), the North West province, which doubtlessly contributes largely to the South African economy, does not have a consistent electricity supply. The South African electricity infrastructure has been degrading in the past decade, with both scheduled and unscheduled power outages increasing (Winkler, 2022). The author further stated that despite slow economic activity due to the COVID-19 pandemic, the country experienced 1130 hours of planned power cuts during 2021, the highest ever. Furthermore, the intermittent supply of electricity in the North West province has adverse effects on the consumers, including disruptions to their day-to-day functionalities. This leads to anger and frustration among the public and handicaps businesses in their productivity. Therefore, alleviating the electricity crisis is critical for the country's economic recovery.

Based on the discussion above, this study's problem is a lack of consistent electricity supply in the North West province, affecting various society-based functionalities.

1.3 LITERATURE REVIEW

Much research has been executed on the effects of intermittent electricity supply in South Africa as a whole. This research will use prior research done in the area to come up with comprehensive research.

The problems of intermittent electricity supply are not unique to South Africa alone, as it is clear that a large part of Africa still experiences an erratic supply of electricity. According to Forkuoh and LI (2015: 312), the poor quality of electricity supply has been recorded as a major problem hampering the operations of Small and Medium Enterprises (SMEs) in developing countries. This is more prevalent in sub-Saharan African countries and some parts of the Middle East. Therefore, the electricity challenge has been wreaking considerable havoc on African economies. In recent times, access to reliable electricity supply and associated high tariffs is creeping into the top spot of SMEs in Ghana, with SMEs in the country losing over US\$ 686.4

million in sales annually since the beginning of 2009 (Forkuoh & Li, 2015: 313). It is noteworthy that SMEs contribute to the growth of economies. Therefore, economic hardships arising from the lack of electricity adversely affect the whole economy (Forkuoh & Li, 2015:313).

Many researchers have grappled for years with the question of what causes intermittent electricity supply in developing countries. According to Newberry (2002:8), the electricity supply industry is highly capital-intensive, and its success depends upon its investment management. In most developing countries, investment is managed and maintained poorly. Investments are also often inadequate. It is, therefore, clear that the intermittent supply of electricity that bedevils most of Africa in general and parts of South Africa such as the North West province in particular, may be intertwined with the poor management of the investments in the energy sector and in most cases, corruption is often at the heart of the lack of electricity (EPA,2021).

The South African business environment is characterised by supply uncertainties, which have considerable economic implications on the country's capacity to achieve its industrial goals (Ateba *et al.*, 2019: 1325). According to Ateba *et al.* (2019: 1327), South Africa's industrial decline is directly associated with decreasing electricity sustainability, as the industrial sector is the main economic contributor to South Africa's GDP. It should be taken into account that electricity is at the centre of development and all technology exists on the availability of energy. Therefore failure of a country to ensure dependable electricity supplies in the 21st century can have adverse effects on the economy. This is because industries will not function at optimum capacity. According to Kenny (2015), electricity is one of the most important new technologies of the 21st century. Ahmad and Othman (2014: 155) postulate that electricity is currently the most demanded necessity in the world. The huge demand for electricity stems from the dire need for power in industries that consume a lot of energy in production. This is especially the case with the North West province of South Africa, where energy is greatly needed to facilitate the industrial work that is carried out there (North West Info, 2014).

The demand for electricity in South Africa has risen sharply, and the sole power supplier, Eskom, has faced many challenges in meeting the demand. Various

loopholes have been noted within the company. These have arguably led to the electricity challenges faced in South Africa, particularly in the North West province (Inglesi & Pouris, 2010:51). The researcher presented a paper regarding corruption and mismanagement at Eskom were highlighted as being among the leading causes of the energy crisis in South Africa during a webinar hosted by UKZN'S Corporate Relations Division (CAES, 2021). According to Ebenhard (2021), Eskom, South Africa's state-owned power utility, is facing many challenges. Eskom's power stations' performance and availability has declined from above 90% in the early 2000s, to an average of 64% in the 2021 financial year (Ebenhard, 2021).

The other primary challenge Eskom faces is its use of outdated coal-fired power stations. Ebenhard (2021) states that Eskom's fleet of coal-fired power stations, excluding Medupi and Kusile, are, on average, 41 years old, and these power stations have been run over capacity than international norms and have not been maintained as they should have been. In addition, the new generation plants, Medupi and Kusile, have design defects that will take time and money to address. The South African generation system is challenging to operate (Ebenhard, 2021). These severe challenges bedevilling the state-owned Eskom have far-reaching effects. The North West province has had a share of turmoil due to detrimental power outages that negatively affect business operations (Moore, 2014).

Another cause of electricity shortages highlighted during the seminar is the use of household appliances that consume a lot of electricity, for example, stoves, heaters and geysers (Viljoen & Struweg, 2016: 07). Against these backdrops, it is improbable that the South African energy sector will revive unless robust measures are taken within the Eskom management and the country through the encouragement of energy-saving techniques and investment in alternative energy sources (Green Carbon SA, 2008).

People and businesses are challenged because of the electricity shortages common in almost all areas. According to Fakihi *et al.* (2020:1), power supply in developing countries is often characterised by unreliability and inefficiency, resulting in disruption costs for operating firms. It should be noted that in the wake of severe power outages, industries suffer the most. As alluded to earlier, millions of dollars are lost, thus, dealing a significant blow to the economy at a national level.

Ineffective privatisation policies, increasing fuel costs, lack of public investment, political instability, and poor infrastructure are among the factors that cause the inadequate supply of electricity in developing countries (Um *et al.*, 2009:23). According to Fakihi *et al.* (2020:3), power outages generally have direct and indirect effects on the overall performance of firms, causing increases in economic costs, reductions in produced quantities and eventually decreases in sales and productivity.

The importance of electricity should never be underestimated as the electricity supply must be dependable in this industrial age. According to Attigah and Mayer-Tasch (2019:4), of all modern types of energy, electricity is the most undisputable category that is considered frequently in the strategic objectives of industrial growth. According to Ateba *et al.* (2019:1325), the electricity grid system was designed in the image of the “first industrial revolution”, with the grid modelled to enable mass production and to attain economies of scale.

Electricity was a key contributor during the “second industrial revolution” by the last quarter of the 19th century and the beginning of the 20th century (Ateba *et al.*, 2019:1325). This seeks to show the importance of electricity in the development process, especially considering that this age demands a lot of energy in various sectors of the national economy.

1.4 RESEARCH AIM AND OBJECTIVES

1.4.1 Primary objective

Based on the problem statement, the study’s primary objective was to determine the importance of curbing the intermittent supply of electricity to consumers.

1.4.2 Secondary objectives

The secondary objectives of the research are as follows:

- To determine the importance of the North West province to the South African economy.
- To determine the importance of electricity supply to the economy of the North West province.

- To identify challenges faced by electricity consumers in the North West province.
- To identify measures that can be considered to alleviate the electricity problem.
- To identify alternative methods of sourcing electricity supply by consumers.

1.5 RESEARCH QUESTIONS

1.5.1 Primary research question

What are the effects of intermittent supply of electricity to consumers?

1.5.2 Secondary research questions

- What impact does the North West province have on the South African economy?
- What impact does the supply of electricity have on the North West economy?
- What are the challenges phased by electricity consumers in the North West province?
- What measures can be considered to alleviate the electricity problem?
- What are alternative methods of survival used by consumers without electricity?

1.5.3 Research philosophy

Based on business research methodology, research philosophy is associated with the study's assumption, knowledge and nature, and it deals with a specific way of developing knowledge. This matter needs to be addressed because researchers may have different assumptions about the nature of truth and knowledge in philosophy helps us about the nature of truth and knowledge and philosophy helps us to understand their assumptions (Carnaghan, 2013).

This research seeks to bring empirical evidence about the challenges faced by people in the North West province due to the intermittent electricity supply. There are

various research philosophies, including pragmatism, positivism, realism and interpretivism. This research will make use of the positivist research philosophy. This type of research philosophy, according to Saunders *et al.* (2012:101), adheres to the view that only “factual knowledge gained through observation (the senses) including measurement is trustworthy and in positivist studies”. Therefore, the role of the researcher was limited to data collection and interpretation objectively. However, it should be taken into consideration that in this type of research, data is quantifiable and measurable. Therefore the positivist research philosophy will be the most ideal.

1.6 RESEARCH DESIGN

Research design is another vital element of research. According to McCombes and Bhandari (2021), a research design is a strategy for answering your search question using empirical data and creating a research design means making decisions about the following:

- Overall aims and approach.
- The type of research design to be used in research.
- Data collection methods.
- Procedures to be followed in the data collection process.
- Data analysis methods.

Several research designs work well with a quantitative type of research. These include the following:

- Experimental
- Quasi-experimental
- Descriptive
- Correlational

This research, however, will adopt the descriptive research design, which according to Bhandari (2021), will allow the researcher to describe characteristics, averages

and trends, among other things, and it can also permit the researcher to measure variables without influencing them.

1.7.1 Research paradigm

According to authors (Abdul & Alharthi, 2016:51), a paradigm is a fundamental belief system and theoretical framework with assumptions about ontology, epistemology, methodology and methods. This study will follow a positivist paradigm for the quantitative research method.

1.7.2 Research approach

According to Bryman *et al.* (2014:30), the research approach can identify quantitative and qualitative research as distinctive research approaches that differ in epistemology, ontology, and the connection between the theory and research. The author further explains the tendencies of quantitative research approaches as follows (Bryman *et al.*, 2014:31):

- Quantitative research approaches tend to emphasise quantification in the collection and analysis of data.
- It adopts the deductive approach to explain the relationship between theory and research. The emphasis is on the testing of theories.
- It incorporates the practice and norms of the natural science model and positivism.
- It embodies a view of social reality as an external, objective reality.
- In this study, the researcher used a quantitative approach to determine the connection between the theoretical framework and research.

1.7.3 Research strategy

This study was based on a quantitative approach using non-probability convenience sampling. According to Saunders *et al.* (2012:135), survey strategy is usually associated with the deductive approach. Surveys are popular as they allow the collection of a large quantity of data from a sizeable population in a highly economical way. The survey strategy is perceived as authoritative by people in

general and is comparatively easy to explain and understand (Saunders *et al.*, 2012:135). The author further states that questionnaires are not the only data collection technique that belongs to the survey strategy. A survey strategy allows the researcher to collect quantitative data for analyses using descriptive and inferential statistics.

1.8 RESEARCH METHODOLOGY

According to Jansen & Warren (2020), research methodology refers to the practical “how” of any given piece of research. More specifically, it is about how a researcher systematically designs to ensure valid and reliable results that address the research aim and objectives.

There are a variety of research methodologies that are used in research, and these include qualitative and quantitative research methods. This study will use a quantitative, non-probability approach with convenient sampling.

According to Bryman *et al.* (2014:171), non-probability sampling is a sample that has not been selected using a random selection method; it implies that some units are more likely to be selected than others. Non-probability sampling has four types: convenience, snowball, quota, and judgemental. This study convened with a non-probability approach with convenience sampling.

1.8.1 Population and sampling

According to Bryman *et al.* (2014:170) study population is the universe of units, like people, nations, cities, regions, and firms from which the sample is to be selected. A population is also defined as the individual participant or object on which the measurement is taken (Cooper *et al.*, 2014:338).

1.8.1.1 Population

When carrying out research, it is important to consider the research population. It is from this population that research data is collected. According to Kluwer (2020), any inferences from a sample refer only to the defined population from which the sample has been appropriately selected. We may call this the target population. In the simplest terms, a population refers to the selected people who will be used to

formulate the research. It may be selected according to various issues, such as age group, sex, occupation, or any other criteria.

The target population for this research was the Brits' geographic area in the North West province. This target population was used as an epitome for the larger North West province. The study targeted the quantified populations. The focus areas of the population were identified as urban (65 113) and rural villages (fixed housing structures) (31 113) in the Brits area, North West province. Figure 1 illustrates the visual summary of the targeted population.

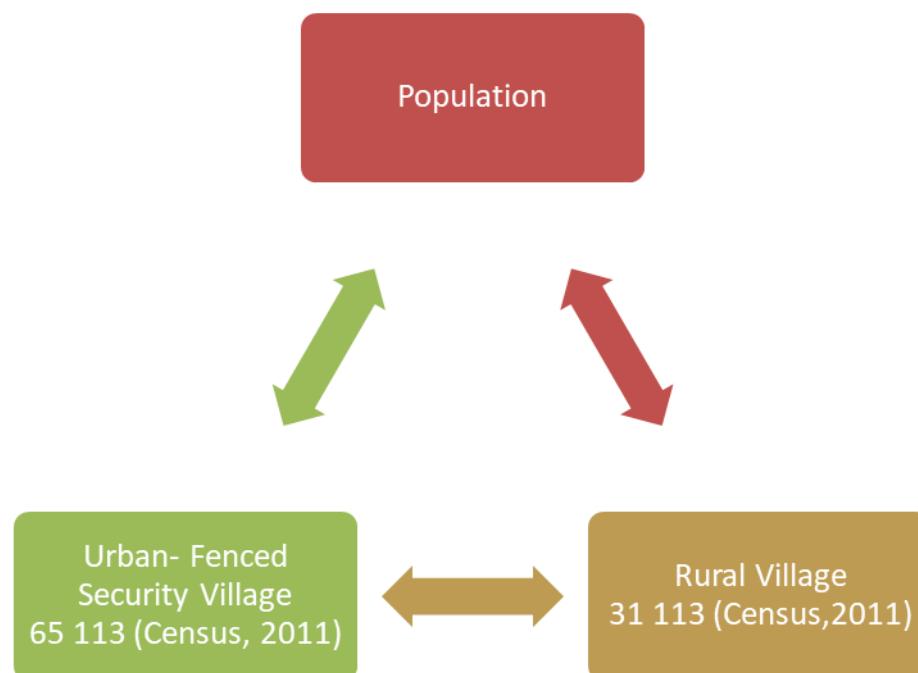


Figure 1.1: Illustration of the population of the Brits geographical area

Source: Census (2011) Population for Brits Geographic area's population

1.8.1.2 Sampling

Sampling is defined as the segment or subset of the population selected for investigation; the method may be based on probability or non-probability (Bryman *et al.*, 2014:170). In addition to the population selection, a sample frame is formulated. A sample frame lists all units in the population from which the sample will be selected (Bryman *et al.*, 2014:170).

A sample refers to a part of the selected population. According to McCombes (2022), when one researches a group of people, it is rarely possible to collect data from

every person in that group. Because of that, one must select a sample, and this sample is the group of individuals that will participate in the research. The sample must be big enough to give detailed research and small enough to be manageable within the given time limits.

In this study, a convenience sample was used and formulated as follows: as indicated, the population quantified to 96226 (65113 - urban + 31113 - rural) in its totality. A confidence level of 95% with a 0,05% margin of error (accuracy), equates to 67% versus 33% of the total population. Respectively, it represents urban (43,626) potential respondents and rural (10,267) potential respondents. The total size of the sample equates to 383, based on the Research Advisors (2006). Thus, the urban sample equates to 257 (67%), and the rural sample equates to 126 (33%) sample respondents to be represented within the selected geographic area.

1.8.1.3 Inclusion criteria

Inclusion criteria are the critical features of the target population that the investigators will use to answer their research questions. These include demographics and clinical and geographic characteristics (Patino & Ferreira, 2018:85). In this study, the inclusion criteria were based on urban security villages and rural villages (Maboloka) in the wider Brits geographical area.

1.8.1.4 Exclusion criteria

Exclusion criteria are features of potential study participants who meet the inclusion criteria but present with additional characteristics that could interfere with the study's success or increase their risk for an unfavourable outcome (Patino & Ferreira, 2018:85).

The study excluded participants in urban areas who are not living in security-fenced villages. The study also excluded participants who will not be residing in rural areas.

1.8.2 Recruitment of participants

The selection of the topic of the study was based on issues related to the effects of intermittent supply of electricity in the Brits' geographical area in the North West province. It was not offensive to any of the participants. The recruitment process focused precisely on the residential area. In this case, it was urban security villages

and rural villages in a Brits geographical area. The request for urban security villages was sent to the House Owners Association for security complexes through online platforms (email). The request for the rural village was sent to the Maboloka Tribal Authority for permission to conduct the study. Both requests were approved.

In this study, data was collected by distributing a questionnaire to respondents in urban areas through online platforms (e-mail). A link will be distributed to all participants residing in fenced security villages.

In the rural area, the data was collected through a link through online and social media platforms. The researcher arranged a stall at the local shopping complex in Maboloka village. The link was shared with the participants on their permission to participate in the study. The researcher explained the purpose of the research and that the study was only used for academic purposes. (Section 1.8.4, paragraph 3 addition)

In case the participants are illiterate, the researcher explained the questionnaire in their home language. The predominant language for Brits' geographical area is Setswana. (Section 1.8.4, paragraph 4), which was familiar to the researcher.

1.8.3 Process of obtaining informed consent

The participants were allowed to give their consent willingly to participate in the study; no participant was forced to participate without their consent. All participants had to give consent concerning the POPIA Act. All participants were informed of the purpose of the study. Participation was voluntary, and they were told that the data would be used solely for the study. A confidentiality and anonymity agreement was made available to the participants to ensure comfort in victimisation during the study. The participants were not rewarded or offered incentives in this study.

1.8.4 Data collection

The collection of data is very significant in the research process. It is the data that helps people evaluate the research. Data collection can refer to the various methods used in the data collection process, including, among other things, open-ended surveys, online analytic tools, interviews and observational data collection.

In this study, data were collected using convenience sampling. Data collection was conducted in the Brits geographical area, focusing on urban and rural residential areas. The data were collected in rural areas targeting residents. As well as in the urban area, targeting fenced security village residents in the Brits geographical area.

1.9 DATA COLLECTION TOOL

According to Bhandari (2021), a questionnaire is a list of questions or items used to gather data from respondents about their attitudes, experiences or opinions. Questionnaires can be used to collect quantitative and/or qualitative information (Bhandari, 2021). In addition, a questionnaire will allow the researcher to tailor-make questions that would enable the respondent to address the research objectives (Bhandari, 2021).

1.9.1 Advantages of using a questionnaire

Questionnaires have a variety of advantages, and according to Bhandari (2021), these include the following:

- They are cost-effective.
- They are easy to administer for small and large groups.
- They are anonymous and, therefore, suitable for sensitive topics.
- They are self-paced.
- Questionnaires can also be administered online, so participants can easily respond in their free time.

Disadvantages of questionnaires, according to Bhandari (2021), include the following:

- They may be unsuitable for people with limited literacy skills.
- They may be susceptible to a nonresponse bias (most people invited may not complete the questionnaire).
- They may be biased towards people who volunteer because impersonal survey requests often go ignored.

The questionnaire contained six sections; Section A will be demographic information. Sections B, C and D, had statements that were measured using a Likert scale of 1 to 5, from strongly disagree (1), disagree (2), Neutral (3), Agree (4) and strongly agree (5). Sections E and F contained open-ended questions to gather respondents' views and opinions. Section A, with demographic information, was to determine the sexual identity, age, home language and classification of the area classification between urban and rural. Section B contained statements to assess the impact of the North West province on the South African economy. Section C had statements to determine the importance of electricity to the North West province. Section D had statements to determine the challenges faced by electricity consumers. Finally, sections E and F contained open-ended questions to identify measures taken to alleviate consumers' unavailability of electricity supply.

1.10 DATA ANALYSIS

Statistical analysis was done through the SPSS Statistics 28 program to help ensure high-quality accuracy and quality decision-making. Open-ended (qualitative questions were analysed using thematic analysis, where applicable themes were identified).

The data analysis for section A was descriptive; sections B, C and D contained quantitative statements measured with Likert scales, will apply a factor analysis, and sections E and F were based on qualitative thematic analysis as indicated.

The study was analysed through a thematic analysis. According to Bryman *et al.* (2014:350), thematic analysis is a flexible method that is not tied to a specific philosophical orientation, "he further states the goal of thematic analysis is to identify, analyse and describe patterns or themes across the data set." Table 1 below illustrates the phases of thematic analysis.

Table 1.1: Phases for thematic analysis

Phase	Description of the process
Familiarising yourself with the data	Verbal data need to be transcribed first. Then read and re-read the data while noting down initial ideas.
Generating initial codes	Systematically code interesting features of the data and collect data relevant to each code.
Searching for themes	Sort codes into potential themes and gather all relevant data for each theme.
Reviewing themes	Check if the themes work in relation to the coded extracts and the entire data set, then make a thematic map of the analysis.
Defining and naming themes	Refine the specifics of each theme. Name and define each theme.
Producing the report	Produce a scholarly report of the analysis by selecting vivid, compelling extract examples that relate to the research question and the literature.

Source: Braun and Clarke (2006:87)

1.11 VALIDITY & RELIABILITY

Validity and reliability are the two primary criteria for assessing a quantitative study's validity and reliability. It consists of four criteria (Bryman *et al.*, 2014:44-45):

- “Credibility which parallels internal validity: it is the feasibility or credibility of the researcher’s account that will determine its acceptability to others.”
- “Transferability which parallels external validity: qualitative research typically involves the intensive, in-depth study of a small group of individuals sharing certain characteristics in contrast to the breadth of quantitative studies.”
- “Dependability which parallels reliability: researchers should adopt an auditing approach to establish the merit of research in terms of trustworthiness.”
- “Confirmability, which parallels objectivity: is concerned with ensuring that, while recognising that complete objectivity is impossible in social research

such as business research, this can be shown that he or she has not knowingly allowed personal values or theoretical inclinations to influence the research.”

1.12 ETHICAL CONSIDERATIONS

Every researcher must observe ethical considerations to come up with worthwhile and credible research. According to the Global Advocacy for HIV Prevention (2020), research ethics are based on three fundamental principles: respect for persons, beneficence and justice.

1.12.1 Respect for persons

It is important to respect people at all costs when carrying out research. According to the Global Advocacy for HIV Prevention (2020), this principle incorporates two elements that deal with respecting people regarding research, and these are:

- People should be treated as autonomous The term autonomous means that a person can make their own decisions about what to do and what to agree to, and researchers must always respect that individuals should make their own informed decisions about whether to participate in research (AVAC, 2020).
- People with diminished autonomy should be protected. This means that even the people within the society who cannot make informed decisions due to some challenges should be covered and only be included in research under specific circumstances since they cannot make truly informed decisions on their own (AVAC, 2020).

1.13 THE LAYOUT OF THE STUDY

The study will use the following layout:

Chapter 1: This chapter will focus on the introduction of the context of the analyses

- Introduction
- Background
- Problem statement

- Objectives of the study

Chapter 2: This chapter will focus on the study's literature review.

- Impact of North West province on the South African economy.
- Impact of electricity supply on the North West economy.
- Challenges phased by electricity consumers in the North West province.
- Measures for consideration to alleviate the electricity problem.
- Consumers use alternative methods of survival without electricity.

Chapter 3: This chapter will focus on the research methodology.

Chapter 4: The chapter will focus on the presentation of results and discussion.

Chapter 5: The chapter will focus on the findings, conclusion, and recommendations.

1.14 TIMEFRAME

Time			Chapter(s)
1	2022/02/20		Research Proposal
2	2022/03/31		Chapter 1 Introduction
3	2022/05/28		Chapter 2 Literature Review
4	2022/09/10		Chapter 3 Research Methodology
5	2022/09/31		Distribution of questionnaires/surveys
6	2022/10/08		Chapter 4 Results and Discussion
7	2022/11/12		Chapter 5 Findings, Conclusion and Recommendations
8	2022/11/15		Finalise draft document: Abstract, Declarations, Table of contents, References and Appendix
9	2022/11/30		Submission of First Draft

1.15 CONCLUSION

In conclusion, this research sought to look at the challenges arising from the intermittent electricity supply in the North West province of South Africa. Electricity plays a pivotal role in a country's development, allowing businesses to thrive. The demand for electricity in South Africa has been rising due to industrialisation. The North West province, the hub of mining in South Africa, is in dire need of urgent solutions to the electricity outages as these have crippling effects on the economy of the country in general and the province in particular. The research used the quantitative research method and the statistical analysis of the data method. This research aimed to add to the already available research on the electricity problems bedevilling the South African nation but paying particular attention to the North West province.

CHAPTER 2:

LITERATURE REVIEW

2.1 INTRODUCTION

The previous chapter introduced the topic under investigation and outlined the problem statement. For an in-depth analysis of the understudied topic, it is necessary to support its foundations by reviewing literature that has been done before this study.

2.2 HISTORICAL FACTS ABOUT ELECTRICITY IN SA.

It is paramount to trace the historical developments to understand the state and situation of the electric power supply in South Africa. It is an undeniable fact that electricity is essential for economic growth in modern countries. However, South Africa is plagued by constant load shedding due to insufficient capacity that does not meet demand (Hlongwane & Daw, 2022:1). As a result of the load shedding, some households have had to look for alternative energy sources, including fuel wood in rural areas, gas and solar panels (Chidembo, Francis & Kativhu, 2022:8). The authors further claim that it has also led to a decrease in electricity consumption as people switch to alternative energy sources (Chidembo *et al.*, 2022:8). Electricity demand in South Africa has been on the rise since the early 1990s (Barnes *et al.*, 2017). Since the country's democratisation in 1994, the economy has undergone significant structural changes (Bhorat *et al.*, 2020:10).

In South Africa, municipalities took the initiative in supplying energy. In 1882, shortly after the discovery of diamonds in Kimberley, the first electric streetlights were installed in this rapidly expanding mining town (Covary 2020:14). Kimberley municipality established its reticulation service in 1890, Johannesburg in 1891, Pretoria in 1892, Cape Town in 1895, Durban in 1897, East London in 1899 and Bloemfontein in 1900 (Buraimoh *et al.*, 2020). Cole and Broadhurst (2020:87) maintain that the discovery of gold on the Witwatersrand in 1886 and the subsequent development of the mining industry required electricity generation- on a more extensive scale. After the Anglo-Boer War (1899-1902), the demand for electricity by the mining sector rose sharply (Cloete, 2021:12). Mining firms developed several

independent power plants in Kimberley and on the Witwatersrand. The Victoria Falls Power Company, founded in October 1906, was the largest. In 1909 it changed its name to the Victoria Falls and Transvaal Power Company (Covary 2020:14).

According to Horwitz (1993), the electricity supply industry saw four main phases of development. The first stage was from 1906 to 1922 and had a mixture of private and public firms in the industry. After 1922, a national public organisation, the Electricity Supply Commission (Escom), collaborated with commercial and municipal suppliers (Horwitz 1993). The third period came after 1948 when Escom monopolised energy generation and transmission by acquiring Victoria Falls and Transvaal Power Company. After a dismal performance in the fourth and final period, Escom underwent a considerable restructuring in 1985.

Early legislation dealing with electricity supply focused on minimum safety standards (Doggart *et al.*, 2020:5). The earliest law dealing with electricity supply was probably the Municipal Corporations Lighting Law, Natal, No. 22 of 1891 (Doggart *et al.*, 2020:9). Shortly after the Anglo-Boer War, legislation was enacted in the Transvaal, Cape Colony and the Orange Free State that subjected supply of electricity to the consent of local authorities and the colonial administrator (Glücksman, 2010:4). This principle of local government and provincial level (previously colonial) control has survived up until the present time (Glücksman, 2010:4).

In 1909, the Power Companies Commission, set up to “enquire into the desirability of the establishment of large electric power companies in the Transvaal”, reported that the supply of electric power should, as far as possible, be left to private enterprise (Morgan, 2017). However, noting that “the supply of electricity leads to a virtual monopoly in the supply of a commodity which has become practically a necessity of modern civilisation”, the commission recommended that the electricity supply should be placed under government control to ensure the equitable supply of power, public safety and the public interest in general (Morgan, 2017).

In 1910 the Transvaal Colonial Government passed the Power Act of 1910 to affect the recommendations of the Power Companies Commission (Zondi & Robinson, 2021:2). The Act provided that an electricity enterprise may only be founded if the Minister of Mines approved a license. It formed a Power Undertakings Board

composed of public officials who served as the Minister's advisors. Municipalities were not obliged to get a license and were therefore not subject to board and Minister oversight. Applicants for a license were required to submit a schedule of typical rates and their application. The Minister was required to refer a license application to the board, which held public hearings before advising the Minister whether to grant or deny the application. Thus, public members were allowed to object to the licence application (Zondi & Robinson, 2021:5). The Act also specified that companies had to pay all consumers twenty-five per cent of their “surplus profits” at a rate pro rata to the electricity consumption. This principle remained. This was the accepted way to regulate licensed power companies in the Union of South Africa before passing the Electricity Act of 1922 (Lawrence, 2020:7).

The South African Railways and Harbours Administration (SAR&H) played an important role in the development of the E.S.I. as a result of their need to electrify the railways (Covary, 2021:10). The SAR&H commissioned a London firm of consulting engineers, Merz and Mclellan, “to study the general question of electric power supply” (Morgan, 2017). Their report, entitled “Electric Power Supply in the Union of South Africa”, was presented in April 1920. This report reflected concern about the uncoordinated development of the E.S.I., which could potentially impose a high cost on future industrial development. It led to the promulgation of the Electricity Act No 42 of 1922 by the Government of the Union, which established the Electricity Supply Commission (Escom) and the Electricity Control Board (E.C.B.). Escom’s primary mandate was to develop new electricity undertakings and cooperate with existing undertakings to ensure a cheap and abundant supply of electricity (Morgan 2017). Escom was supposed to supply electricity “neither at a profit nor at a loss”.

The Electricity Control Board was established to control the supply of electricity by the commission and private undertakings (Department of Minerals and Energy, 2010:12). The Act stipulated that the electricity supply could not be undertaken without a licence issued by the board (Department of Minerals and Energy, 2010:12). Escom and private undertakings were thus obliged to apply for licences, but local authorities and government departments (including the SAR&H) were once again exempted. The Act also included the profit-sharing stipulations introduced by the Transvaal Power Act of 1910. Escom grew steadily as the bulk supplier of electricity.

In 1948 Escom purchased the V.F.T.P.C. after complaints from the mines about excessive profit-taking, despite the “automatic” profit rebate system (Zondi & Robinson, 2021:10). By finally taking over the V.F.T.P.C., Escom established itself as a national public monopoly electricity generator. The take over coincided with the rise of Afrikaner Nationalism and the election of a Nationalist government.

Until the mid-1970s, Escom progressed successfully as the central electricity supply organisation. It enjoyed the benefits of improving technology and continued demand growth. However, towards the end of the 1970s, inflation, higher financing costs and the reduced financial returns of new technology contributed to poor performance and high tariff increases (De Villiers 1984). In 1984, the State President appointed the “Commission of Inquiry into the Supply of Electricity in the Republic of South Africa” under the leadership of Dr W. J. de Villiers in response to these concerns and the significant share of South Africa’s foreign debt owing to Escom. De Villiers suggested implementing a two-tier control structure consisting of a board of control and a management board and abandoning the notion of operating neither at a profit nor a loss in favour of a solid asset and revenue structure. It was also advocated that the concept of distinct Escom operations is abandoned and that cost-sharing be permitted. This meant that the tariffs for different consumer classes could be built up from national mean pooled costs.

These recommendations should be read in the context of the government’s interest in privatising Escom and other parastatals at that time (Lawrence, 2020:80). Many of the De Villiers recommendations were given effect in 1985 when the Electricity Act of 1958 was amended. The amendment redesigned the Electricity Supply Commission by forming the Electricity Council, whose responsibilities included determining Escom’s policy and appointing and supervising the management board (Eberhard, 2003:5). The Electricity Council was to be composed of stakeholders and impartial experts and was to function like a Board of Directors for a private sector corporation (Baysinger & Butler, 2019).

De Villiers improved the management of Eskom and ensured that the interests of industry, commerce and white municipalities were represented on the Electricity Council. The commission did nothing to change a lot of black households, most of whom were still without any electricity connection. In metropolitan areas, white local

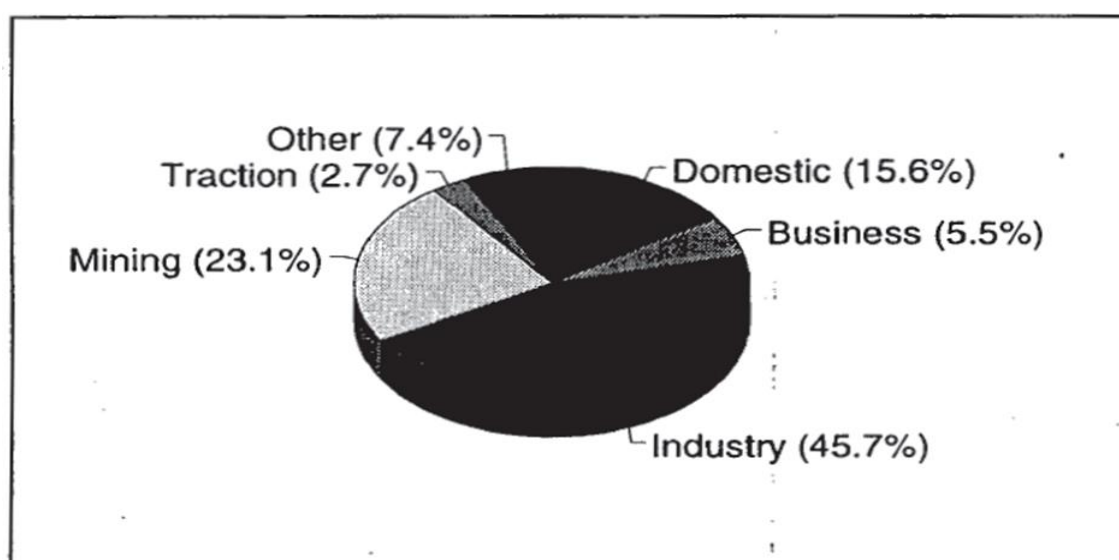
authorities traditionally supplied some adjacent black townships with electricity (Beaufort & West, 2020:10).

In 1973, however, Bantu Administration Boards were established to take over the supply of services to the black townships (Lemon, 2021:5). These Boards did not have access to the revenue base of the wealthier white local authorities, which incorporated local industry and commerce. The immediate consequence was a decline in the standard of service to black townships and an inability to extend services (Lemon, 2021:11). In the early 1980s, with the passing of the Black Local Authorities Act (No 102 of 1982), service provision was taken over by the black local authorities. This change precipitated the current crises in service provision (including electricity) to black areas (Morgan 2017). Given such clear evidence showing the resilience and seriousness of supplying South Africa with electricity, an explanation is needed for the intermittent supply of electricity in South Africa.

2.3 DOMESTIC ELECTRICITY SUPPLY

South Africa has a total net generating capacity of about 37 000 MW and in 1992 produced 149 427 GWh of electricity (Wright *et al.*, 2017:5.). The percentage of electricity use per sector during 1990/91 is illustrated in Figure 2.1.

Figure 2.1: Electricity use in South Africa



Source: Compiled by (Wright *et al.*, 2017:6)

Figure 2.1 shows that mining and industry consume just under 70 per cent of the electricity produced in South Africa, while the domestic sector consumes only 16 per

cent. As a result, total annual domestic electricity consumption is in the region of 23 310 GWh.

2.4 THE PRESENT ELECTRICITY SUPPLY INDUSTRY

South Africa has a long history of depending on the S.O.E.s. The S.O.E.s have contributed significantly to the development of the economy but have been distressed by structural and operational difficulties (Todes & Turok, 2018:6). This has resulted in frequent and unequal patterns of development and an unbalanced service and infrastructure delivery (Todes & Turok, 2018:3). In 1999, because of the problems caused by their traditional ways of operations and outdated management styles, the government called for the reform of these four S.O.E.s.

The current electricity supply structure in South Africa is illustrated in Figure 1. Eskom has the monopoly of being the sole generator of electricity in South Africa. Figure 2 also shows that the transmission sector is under Eskom's complete control (Wright *et al.*, 2017). The distribution sector is dominated by Eskom too, but the municipalities do some distributions. This model has been criticised for allowing too much government intervention (Wright *et al.*, 2017). This is inefficient because it allows special interest groups to utilise the funds earmarked for electricity industry infrastructure development for their interests (Wright *et al.*, 2017).

Furthermore, when government officials are in control, they make decisions knowing they will not bear future consequences, as another ruling party would have taken over. This model has cost South Africa its new path of growth. For instance, a study by Wait (2012:6) observed that the country loses approximately 3.3-3.5% of GDP under the current electricity structure.

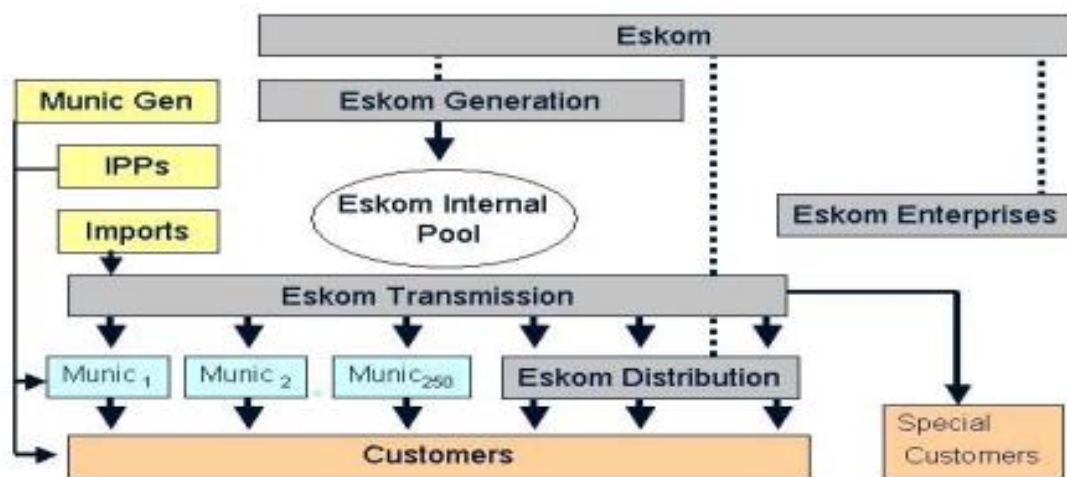


Figure 2.2: Current South African E.S.I. structure

Source: Hlongwane and Daw (2022)

2.4.1 Existing industry Structure

Figure 2.2 shows the growth rates in the electricity supply and consumption for the period between 1981 and 2011. It can be viewed that electricity consumption has been steadily increasing throughout the period. The country has been experiencing a rise and fall in electricity generation (Figure 2). From 2006 the electricity supply showed a declining trend up to 2008, when it was very close to electricity consumption, leaving the utility with small reserves (Hlongwane & Daw, 2022:7). This led to the rationing of electricity in 2008 because the imbalance between electricity supply and consumption nearly led to breakage in the power generators.

In responding to the low supply of electricity, the Department of Energy and Eskom resorted to power conservation, increased electricity prices and constructed new power stations. The power conservation policy harms economic growth in a country that is energy dependent (Adebola, 2011:9). The construction of the new power stations has also cost the nation more than was budgeted. The National Energy Regulator of South Africa (2008) stated that the expected budget for the new expansion was about R343 billion. Construction has been going on for years. However, and to date, not even one of the power stations has been completed. The delays in completing these power stations led to an increased budget to fund them. Prices had to be increased to cover the expense of the expected increase in electricity generation. The power disruptions were anticipated, but Eskom did not

make adequate efforts to increase electrical supplies promptly. The implemented policies cost industrial farming (The National Energy Regulator of South Africa, 2008).

And mining consumers' production, while household consumers lost their leisure time (Matsebula, 2018). These views, therefore, raised many questions for policymakers and the public. What impact did the electricity supply and demand imbalance have on economic growth? Do electricity supply and economic growth have a long-run relationship? Between economic growth and electricity, which one supersedes the other? Has the termination of the restructuring of the electricity supply industry affected the electricity supply? What is the impact of electricity price and trade openness on electricity supply and economic growth? (World Bank, 2022:8).

2.5 THE SCOPE FOR REGIONAL INTEGRATED RESOURCE PLANNING

S.A.P.P. (2017) suggest that the scope for regional development and for optimising the electricity system from a regional perspective is enormous. And the creation of S.A.P.P. clearly marked an important step toward realising the benefits of such regional electricity planning. South Africa's Eskom, which accounts for over 80 per cent of generation in the region, relies heavily on expensive (at least relative to hydro) and polluting thermal power from domestic coal. Trading arrangements between South Africa and the hydro-rich northern countries could be mutually beneficial, providing cheaper electricity for the former and revenue-boosting for the latter (S.A.P.P. 2017).

According to the World Bank (2018), examples of regional cooperation would include the hydroelectric potential of the D.R.C., Mozambique, Zambia and Zimbabwe; the Pande, Temane and Kundu fields in Mozambique and Namibia; and the oil industry and hydroelectric potential of Angola. The magnitude of potential gains from increased regional cooperation and trade is substantial. An important attribute of electricity trade is the improved reliability of supply, mainly when relying on hydropower vulnerable to drought. In the case of Zimbabwe, for example, the 1992 draught caused electricity shortages in 1993 that cost the country's economy US\$ 435 in lost export earnings, nearly 10 per cent of its GDP S.A.P.P. (2001). A joint study by SADC and the World Bank estimated that optimal use of regional resources

and installations could provide savings of US\$ 1.6 billion over ten years compared with a scenario under which each country would pursue its power development plans separately (World Bank, 2018).

Hlongwane & Daw (2021:5) writes that South Africa accounts for the bulk of the power produced in the region but was not included in that study. Thus, the potential gains available now through South Africa's participation in regional planning are likely to be significantly higher (Hlongwane & Daw, 2021:7). Recent studies utilising the optimisation model R.I.E.P. (Regional Integrated Electricity Planning) developed at the University of Stuttgart quantified the benefits of regional cooperation in Southern Africa to savings of at least US\$2.2 billion or 5 per cent of the expected total costs over 20 years. Furthermore, under a high electricity demand growth scenario, savings of over US\$ 4 billion could be realised through regional planning (Hlongwane & Daw, 2021:15).

Monyei (2022:159) suggests that a structural issue that might have significant implications for introducing competition in S.A.P.P. is the extent to which Eskom dominates the regional electricity market. Lawrence and Ballard (2020) noted that in 2005, Eskom accounted for 83 per cent of the installed capacity and 85 per cent of electricity sales of S.A.P.P. member countries. These levels of dominance raise legitimate concerns about monopolisation. Thus, decisions about Eskom's horizontal and vertical structure are likely to have profound implications for future competitive developments in the regional electricity market and the progress towards effective regional integration (Nhleko & Inambao 2021:135). In South Africa, pressing domestic policy concerns about looming power shortages seem to outweigh any regionalisation initiatives far, although regional cooperation could be very effective in resolving Eskom's inadequate generation capacity (Steyn *et al.*, 2021:4).

On the other hand, the smaller countries might view regional integration as a further step towards solidifying Eskom's regional market dominance. Thus, neither the region's large nor the small countries face the proper incentives to accelerate regional electricity integration (Ouedraogo, 2017:471). Whenever utilities produce at different costs, it may be economical for them to agree to trade. However, despite the potential gains from the electricity trade, the wide differential in performance

between Eskom and the other S.A.P.P. utilities may exacerbate the fears of market dominance and regional monopolisation by Eskom (S.A.A.P, 2006:5).

2.6 ENERGY SECURITY CONCERN

With the re-admission of South Africa into the international community in the 1990s, there is pressure on the country to participate in international agreements that promote the adoption of sustainable energy sources (Soko & Qobo, 2021:159). As a result, the current energy policy is dominated by a strategy of promoting alternative energy sources such as wind, solar and hydro energy. Recent reports suggest that the renewable energy industry is growing gradually, driven mainly by private sector investments in both the production of power and the development of renewable energy technologies (DoE, 2015).

2.7 ELECTRICITY POLICY IN SOUTH AFRICA

The political economy of South Africa's electricity policy has been characterised by the country's minerals-energy complex (M.E.C.) (Fine, 2018), a system that is both electricity and carbon-intensive. In descriptive terms, this refers to an evolving system of production and consumption based on the country's historical dependence on cheap and abundant coal supplies and cheap labour to produce cheap electricity for an export-oriented industry based on raw and semi-processed mineral products such as coal, platinum, iron ore, steel, and aluminium. Analytically, the M.E.C. offers a framework that can be used to address the economic legacy of apartheid and the nature of power relations, politics and policy-making in contemporary South Africa (Padayachee 2010:2).

2.7.1 The Apartheid period

Fine, (2018) explained that before 1994, energy policies were designed to provide energy services based on 'separate development', the apartheid government's euphemism for racial discrimination. In the domestic sector, this meant providing modern energy services to the 'white' population group, which comprised 11% of the population and limited or no services to the rest. High priority was given to the needs of the industrial sector because of its role in economic and political security (Gielen *et al.*, 2019:38). In general, this meant concentrating on electricity and liquid fuels, as these were crucial to economic and political interests. Security, secrecy and control characterised most general policies (Rahman, 2017:39).

Inguscio (2017) noted that an important political and economical government decision in the 1950s was to produce liquid fuel from coal through the government-owned Sasol. Security of the liquid fuel supply was the main driver here. At the same time, it was decided to refine crude oil locally. Up to 1954, all refined oil products had been imported and distributed by Lott (2017), but now the growing demand for liquid fuels justified the development of refineries. Liquid fuel production started at Sasol in 1954, and the Moss gas plant was built in 1992. Both plants were subsidised heavily by the government (Lott, 2017).

In 1987, some major changes took place, still significantly affecting power sector reforms today. Two key statutes were introduced: the Eskom Act of 1987 and the Electricity Act of 1987. Eskom (the Electricity Supply Commission, forerunner of Eskom) had been producing electricity for a long time, supplying the industrial structure, including the military complex and a number of several mainly white households (Lewis, 2019). The Eskom Act defined the utility's responsibility as providing electricity most cost-effectively, although it said nothing about supplying electricity to all citizens. The Electricity Act defined the structure, functions and responsibilities of the Electricity Control Board and assigned the sole right of electricity supply within municipal boundaries to the local government (Bowman, 2020:395).

Eskom (now spelt with a 'k') was reformed in 1992 as a new organisation under the Electricity Act, which had been passed five years earlier. The Electricity Council, whose members better reflected Eskom's stakeholder base, was given authority over the utility. Eskom's management board would be chosen by the Electricity Council. (Godinho & Eberhard 2019).

2.7.2 After the 1994 elections

The government that took office after the first democratic elections was committed to democratic governance and a new constitution. It was determined to provide essential services to the poor and disadvantaged majority of South Africans. Modern energy, especially electricity, was considered one of the main components of such services. The government focused its attention on electrification and liquid fuels (Aklin *et al.*, 2018)

2.7.3 Accelerated electrification

Well before the African National Congress (A.N.C.) won the first democratic elections in 1994, many groups had been working with the A.N.C. to formulate an energy programme to address the needs of the poor and disadvantaged (Ramukosi, 2018). To this end, a national meeting on electrification in South Africa was held in 1994 by the Department of Economic Planning of the A.N.C. and organised by the Energy and Development Research Centre (E.D.R.C.) of the University of Cape Town. This meeting aimed to formulate an accelerated electrification programme to serve the underdeveloped urban, peri-urban and rural areas where 80% of the population lived, nearly all black South Africans. The meeting was attended by different stakeholders, universities, municipalities, and non-governmental organisations (NGOs). The results of the Energy Policy Research and Training Project (E.P.R.E.T.) undertaken by E.D.R.C. provided major inputs to this meeting (Ramukosi 2018).

From 1992 to 1994, although a period of political uncertainty, was a time of several negotiating forums between governments, businesses, labour and opposition groups on policy-making and governance in many economic sectors, including energy. E.D.R.C. researchers participated in several A.N.C. policy committees (Ramukosi, 2018). These and other forums led to the developing of an energy section, including an electrification programme, within the A.N.C.'s Reconstruction and Development Programme (RDP). This formed the basis of all energy programmes that followed, including current programmes (Ngeva, 2019:10).

The results of the E.P.R.E.T. research greatly influenced the electrification programme and its targets. Many working groups were formed, covering regulatory framework, structure and policy, financing and tariffs, the electricity supply industry, end use and efficiency (Bacon, 2018:7).

2.7.4 The National Electrification Programme

The National Electrification Programme was implemented between 1994 and 1999. Its objective was to electrify rural and urban low-income households that had been deprived of electricity during the apartheid period (Davidson & Mwakasonda 2004:26). Eskom had already embarked on a programme in 1991 called 'Electricity for All (Dingley, 1990)'. The programme expected that newly electrified households

would switch from using fuelwood, candles and batteries to using electricity for household needs. The Government of National Unity that emerged in 1994 endorsed the electrification programme. Phase 1 of the programme was completed in 1999. This phase aimed to electrify an additional 2.5 million households on top of the 3 million that had already been electrified. This phase aimed to electrify up to 66% of the national households. The government funded the programme with Eskom, which had the advantage of tax-free status (Chirambo, 2018:608).

2.7.5 The White Paper on Energy

Adeleke *et al.* (2021:50). There was a need to scrutinise the White Paper, which recognised national energy and economic demands while accepting the international energy agenda and the need to identify appropriate energy supply and use. It had its objectives laid out, which include the following:

- 1 Increasing access to affordable energy services.
- 2 Improving energy governance by clarifying the relative roles and functions of various energy institutions in the context of accountability, transparency and inclusive membership, particularly participation by the previously disadvantaged.
- 3 Stimulating economic development – encouraging competition within energy markets.
- 4 Managing energy-related environmental and health effects – promoting access to basic energy services for poor households while reducing negative health impacts arising from energy activities.
- 5 Securing supply through diversity – promoting increased opportunities for energy trade, particularly within the Southern African region, and diversity of both supply sources and primary energy carriers.

The significant reforms aimed to improve electricity access to every citizen in South Africa. Many challenges have been met along the way, and possible measures have been introduced to solve these issues, and I.P.P.s were a form of meeting the challenges (Adeleke *et al.*, 2021).

2.7.6 The Independent Power Producer (I.P.P.) Phase

Although the idea of independent power producers was hinted at in the *Energy White Paper* in 1998, it was only after 2010 that this initiative received serious policy attention. Since then, however, the policy has become muddled and highly contested between the different interest groups, including some politicians (Moris & Martin, 2015). What distinguishes this phase from the integration phase is the attention given to renewable energy sources and private energy producers other than conventional energy producers, i.e., Eskom, S.A.S.O.L. and Petrol SA. In this phase, there is a growing realisation that more role players are needed to achieve the twin goals of sustainable energy and equitable access. This phase was also characterised by an increasing sense of the need to move away from the coal-dominated energy system to a system relying on renewable energy sources by promoting renewable technologies (Moris and Martin, 2015:8). This is particularly evident in the efforts to diversify the country's energy mix. The Integrated Energy Planning Report notes that over the 'last few years, various policies have been developed by the Department of Energy (DoE) to increase the diversification of primary energy as well as to reduce over-reliance on fossil fuels for the supply of energy' (DoE, 2013:67). In this new policy framework, the role of I.P.P.s is seen as critical to realising the set goals.

As noted above, while I.P.P.s were envisioned as playing an essential role in the generation of energy in South Africa during the 1990s, I.P.P.s only started to play a prominent role in the energy sector in 2011, with the introduction of the New Generation Capacity Regulation under the Energy Regulation Act of 2006 (SA, 2006). Official reports from the Department of Energy show that in 2011, I.P.P.s were commissioned to produce energy independently and feed into the national grid (DoE, 2015). This number increased to 38 in 2013 and 92 in 2015, with a total production capacity of 6,327 MW in 2014. Most I.P.P. producers generate electricity through wind and solar energy, which is why they are seen as key role players in the new drive to diversify away from fossil fuels. However, not everyone sees the I.P.P.s as a positive development (DoE 2015:68).

DoE (2013:6) noted that there had been resistance to I.P.P.s, even within the A.N.C. and Eskom, mainly because they are coming on board is primarily seen as a form of

privatising the energy sector, and this does not sit well with some constituencies of the A.N.C. who have an anti-private sector ideology (Moris & Martin, 2015). This is one of the reasons why it took ten years between the adoption of the policy and the commissioning of I.P.P.s (2001 to 2011), and there are still dissenting voices which see these initiatives as efforts to disempower the national energy utility, Eskom (Moris & Martin, 2015). Furthermore, because of the high initial capital investment required to start power production, critics have also noted that foreign private investors have mainly dominated this policy process at the expense of small local producers (Greenpeace, 2015). In terms of gender dynamics, it has been observed that while in the earlier period leading to 1994, there were robust discussions about gender politics, 'gender struggles in South Africa became institutionalised and quite quickly women's issues became depoliticised' (Annecke, 2003:7).

DoE (2015:15) noted that as things stand, the generation capacity of I.P.P.s is still small, and the technology is still elementary. However, there are indications that these initiatives could be scaled up in the next 10 to 15 years so that by 2030, renewable energy can contribute more to the energy mix than fossil fuels. It is impossible to predict how the I.P.P.s will develop, but there seems to be strong policy support for promoting these initiatives, especially after the 2015 national blackouts.

2.8 LOAD SHEDDING

In 1998 Eskom generation capacity model and max demand forecast showed problems in ten years. The existing plants, without proper conservation, could not operate for another ten years (Davidson & Mwakasonda, 2010:15). And the pace of population growth in South Africa made it evident that new plants were urgently needed. The first shortages started in 2007. As a result, in the first quarter of 2008, blackouts all over the country became commonplace, damaging the South African economy. According to The National Energy Regulator of South Africa, the economy lost approximately R50 billion (Davidson & Mwakasonda, 2010:15).

Eskom (2021:12) argues that building new power plants can only solve the lack of capacity. After the electricity crisis of 2008, the expansion of electricity production became necessary. However, until today no new generators have been built. At the begging of November 2014, the Majuba power plant lost its capacity to generate

power after its coal storage silos collapsed. Two weeks later, the last silo had a large crack and caused a complete shutdown. In December 2014, Eskom's Duvha Power Station turbine experienced a mechanical failure and shut down. Eskom, with their slogan "powering your world", announced in November 2014 "load shedding" for the whole country (Backer 2015:15).

Despite the policy pursued by the government regarding information about periods and regions of predicted blackouts, the consequences for the country are enormous. The impact on the economy is enormous (Mildenberger *et al.*, 2022:6). Mining operations were shut down. It took several hours for miners to be evacuated from the mines, which caused huge losses. Smelters and refineries take hours to restart after a break in the power supply. Traffic management systems and traffic lights cause considerable congestion and a drop in productivity, offices reliant on internet services and technology have no option but to close, hospitals have come under increased pressure, and many government administration services such as home affairs simply close as a result of load shedding. According to Yelland (2018:2), "the controlled blackouts since December 2014 have had a severe negative economic impact." Stage one costs the South African economy R20 billion per month (10 hours of blackout per day for 20 days a month). Stage two of load shedding costs the economy R40 billion per month, while stage three is estimated to cost R80 billion per month (Mildenberger *et al.*, 2022:37).

These cost to productive economy for load shedding in SA are based on a cost of unserved energy of R100 per kWh (stage 1 is up to 1000MW, stage 2 is up to 2000MW, stage 3 is up to 4000MW)" (Dewa et al., 2020:12). Bureau for Economic Research (BER) (2015) economist Hugo Pienaar said Eskom's load shedding schedule was the main trigger that caused him to revise his 2015 GDP growth forecast from 2.9% to 1.9% just a few days later. The load shedding of power in the country shows a lack of a proper framework to govern electricity production in the country. This has also shown that the country is still dependent on one major electricity source, coal. These issues might be caused by non-functional regulators who reside over a corrupt board (Dewa et al., 2020:12).

2.9 ENERGY REGULATION

National Regulatory Authorities are essential in managing and overseeing a country's electricity regulation market (DoE, 2021:12). These authorities are tasked with creating an environment whereby I.P.P.s can access and effectively participate in national energy sectors. On a regional level, the Regulators Association was established to harmonise policies regarding energy regulation and the participation of I.P.P.s in the energy market. Chirambo (2018:605) suggests that energy regulation in sub-Saharan Africa is still fragmented and lacks a harmonised framework for the roles and responsibilities of National Regulatory Authorities. The regulatory environment for I.P.P. participation in the energy market is discussed below.

2.10 I.P.P. PARTICIPATION IN NATIONAL REGULATORY FRAMEWORKS

Department of Energy (2017:19) stated national regulatory environment in a country is key in either facilitating I.P.P. participation in the regional energy sector or dissuading private investment. Over the past decade, a national and regional policy has been trending toward privatising electricity production. However, the level of I.P.P. participation and the rate at which I.P.P.s are integrated into the regional energy market differs from country to country (Department of Energy 2017:20).

2.10.1 South Africa

Through policy reform, the South African energy regulatory framework has worked to liberalize its energy sector. While the state-owned utility Eskom generates 95% of the country's energy supply (mainly from coal), there is a growing trend toward including I.P.P.s in the energy market. In terms of I.P.P. participation in the energy generation industry, South Africa is now the leading Power Pool member (McDonald, 2018). The state has purchased 6422 MW of power from I.P.P.s as of 2017. The Renewable Energy Independent Power Producer Procurement Programme has procured the vast majority of I.P.P.s in South Africa (R.E.I.P.P.P.P.). The REIPPPP was established in response to many governmental and legislative measures to reform South Africa's energy industry (McDonald, 2018:5).

DoE (2020) postulated that the Energy Regulation Act, The National Energy Regulator of South Africa (NERSA), is a separate legal agency charged with

regulating and monitoring South Africa's electricity supply business. The National Energy Act promotes the diversification of energy supply by obliging the Minister of Energy Resources to create an Integrated Energy Plan indicating the future of South Africa's energy mix (S.A.P.P. 2017:10). The Integrated Resource Plan 2010-2030 was, therefore, enacted to ensure the energy security and sustainability in South Africa's long-term energy supply. N.E.R.S.A. has also played a key role in assisting I.P.P. participation in South Africa's electricity industry. This is evident from the fact that before N.E.R.S.A., South Africa had one of the lowest energy tariffs globally (Adeleke *et al.* 2021:56).

In *The National Energy Regulator of South Africa and Another v Borbet SA (Pty) Ltd and Others*, an appeal was brought against a review application concerning a 1.4 per cent annual tariff increase approved by N.E.R.S.A. However, since the establishment of N.E.R.S.A., South Africa's energy tariffs have increased by 147 per cent. This increase was in addition to an 8% tariff increase already applied by Eskom to consumers during 2013/2014.2.

Mqadi *et al.* (2018:13) examined that the Court noted that during this time, Eskom needed to increase tariffs so that the utility could *inter alia* finance the Power Purchase Agreements entered into with I.P.P.s costing R 580 million. The Court further noted that a diversified energy mix through I.P.P. participation is crucial in ensuring a reliable energy supply. In 2016, South Africa contributed 83 per cent of the Power Pool's regional electricity production. South Africa's connection to the Power Pool totals seven gigawatts and consists of interconnections with Zimbabwe, Mozambique, Swaziland and Namibia (SADC, 2021:5).

Dewa *et al.* (2020:11) noted that in 2008 Eskom experienced a shortage of energy supply, which resulted in intermittent energy cuts known as "load shedding". This has significantly affected regional trade, as South Africa, a historic exporter of inexpensive electricity, could not sell electricity to other Power Pool members during this time. As discussed above, the energy capacity deficit experienced in South Africa led to the emergence of I.P.P.s in the South African energy market. The majority of South African I.P.P.s produce energy from renewable sources and constitute 37 per cent of the Power Pool's new generation capacity (Dewa *et al.* 2020:16).

There has been a shift in the electricity supply in the country since its independence in 1994. The government has struggled to find a grip and solutions to the power challenges experienced in the country. This study wants to dive deeply into the country's electricity supply issue. The study seeks to give a clear picture of what the country is currently experiencing.

2.11 CHAPTER CONCLUSION

The chapter discussed the significant transformations that have taken in the country that concern the supply of electric power in South Africa. The study looked at the demand partially. This chapter also highlighted the objectives of the study: the importance of North West province to the South Africa economy, refer to section 2.2; the importance of electricity supply to the economy of the North West province, refer to sections 2.3 and 2.4; the identification of the challenges faced by electricity consumers in the province, refer to section 2.4; the identification of measures to be considered as alternatives methods of sourcing electricity supply, refer to section 2.9 and 2.10. Lastly, the study looked at the country's policy and how load shedding has affected the economy. The following chapter is the methodology. This will outline the research design chosen by the researcher.

CHAPTER 3:

RESEARCH METHODOLOGY

3.1 INTRODUCTION

Research methodology is a systematic approach to problem-solving. In essence, researchers use methods to describe, explain, and make predictions (Goundar, 2012:10). Research is about answering unanswered questions or creating that which does not currently exist (Goddard & Melville, 2004:1). It is the scientific study of how research should be conducted.

Numerous techniques are employed in various forms of research, and the phrase is typically understood to encompass study design, data collection, and data analysis. Research methodology attempts to answer the following questions: why a research study was conducted, how the research problem was defined, how and why the hypothesis was formulated, what data were collected and what method was used, why a particular technique of data analysis was employed, and a host of similar questions (Goundar, 2012:13).

There are a variety of research methodologies that are used in research, and these include qualitative and quantitative research methods. This study will convene with a non-probability approach and convenience sampling. This study will use a quantitative, non-probability approach with convenient sampling. According to Bryman *et al.* (2014:171), non-probability sampling is a sample that has not been selected using a random selection method; it implies that some units are more likely to be selected than others. Non-probability sampling has four types of sampling: convenience sampling, snowball sampling, quota sampling and judgemental sampling types: convenience, snowball, quota, and judgemental.

3.2 RESEARCH PROBLEM AND PURPOSE

According to the prior discussion, the issue at hand in this investigation boils down to an inconsistent lack of energy supply in the North West province, which negatively impacts a wide range of societal functionalities. The North West province contributes mainly to the South African economy but does not have a consistent electricity

supply. This leads to anger and frustration among the public and handicaps businesses. The alleviation of the electricity crisis is a critical precondition for the country's economic recovery. Despite slow economic activity due to the COVID-19 pandemic, the country experienced 1130 hours of planned power cuts in 2021, the highest ever (Wrinkler, 2022).

The study aimed to determine the importance of curbing the intermittent electricity supply to consumers.

3.3 RESEARCH DESIGN

As previously stated in Chapter 1, section 1.7, paragraph 1, the research design is another vital element. Several research designs work well with a quantitative type of research. These include the following:

- Experimental
- Quasi-experimental
- Descriptive
- Correlational

There are six research design steps to follow when conducting research. Table 3.1 illustrates the research design steps below.

Table 3.1: Research design methods

Step 1	• Consider your aims and approach
Step 2	• Choose a type of research design
Step 3	• Identify your population and sampling method
Step 4	• Choose your data collection methods
Step 5	• Plan your data collection procedures
Step 6	• Decide on your data analysis strategies

Source: Bhandari & McCombes (2021)

However, this research will adopt the descriptive research design, which, according to Bhandari (2021), will allow the researcher to describe characteristics, averages and trends, among other things and permit the researcher to measure variables without influencing them.

3.3.1 Research approach

Quantitative, qualitative, and mixed methodologies are the standard research approaches. Typically, researchers use the quantitative technique to address research issues requiring numerical data, the qualitative approach to address research questions requiring textual data, and the mixed methodologies approach to address research problems requiring both numerical and textual data (Williams, 2007:65).

Quantitative research is the collection and interpretation of numerical data. It can be used to identify patterns and averages, make predictions, examine causal relationships, and extrapolate findings to larger populations. Leedy and Ormrod (2001) argued that quantitative research is specific in its surveys and experiments because it draws on previously established hypotheses. “Quantitative researchers seek answers and predictions applicable to other people and locations. The purpose is to establish, confirm, or validate correlations and build generalisations that add to theory.” (Leedy & Ormrod, 2001:102). Quantitative research begins with a problem

statement and entails the creation of a hypothesis, a review of the relevant literature, and an analysis of quantitative data. Quantitative research, according to Creswell (2013:18), “employs inquiry methodologies such as experiments and surveys, and collects data on specified instruments that generate statistical data” The results of quantitative research can be predictive, explanatory, and corroborative. In this study, we convened with a quantitative research methodology.

3.3.2 Sampling and Target population

A sampling at random is a standard practice in quantitative research. This refers to methods that give each member of the population a fair shot at being included in the final data set. Due to the nature of quantitative research, this is crucial if the results are to be generalised from the sample to the overall population (Saunders *et al.*, 2012:135). Therefore, when conducting quantitative research, selecting a population sample or a sample randomly is normal practice. As a result, every person in the population has an equal chance of being selected.

The study used a non-probability sampling method using convenience involves using respondents who are “convenient” to the researcher. There is no pattern in acquiring these respondents—they may be recruited merely by asking people in the street, public buildings, or workplaces (Galloway, 2005).

The population in the Brits geographic area in the North West province will be the one that will be the focus of this investigation. This specific group can serve as a representative example for the greater North West province. An illustration of the measured populations that will be the focus of the study may be found further down. The urban and rural settlements in the Brits area in the North West province served as the population’s focus area. The targeted population was 169, and the surveys were distributed to 250 respondents throughout the Brits and Maboloka geographical areas through online platforms and site visits to residential areas and shopping centres.

3.3.4 Sample size

The procedure can be based on probability or non-probability (Bryman *et al.*, 2005). Sampling is defined as selecting a portion or subset of the population for inquiry (2014:170). In addition to the selection of the population that has been provided, a

sample frame will be formulated. The listing of all the units in the population from which the sample will be picked is referred to as the sample frame (Bryman *et al.*, 2014:170).

A representative portion of a given population is known as a sample. According to McCombes (2022), when one researches a group of people, it is rarely possible to collect data from every person in that group. As a result, one must select a sample, and this sample is the group of individuals that will participate in the research. In other words, it is rarely possible to collect data from every person in a group when one researches that group. The samplers must be large enough to provide extensive research while still being small enough to be manageable within the allotted time constraints.

This study used a convenience sample constructed as follows: The estimated population is 96,226 (65,113 + 31,113), as was previously mentioned. The same percentage of the entire population corresponds to 67%, rather than 33% if a confidence level of 95% and a margin of error (accuracy) of 0.05% is used. We represented urban communities with 43626 potential respondents and rural communities with 10267 potential respondents, respectively. The total size of the sample was calculated to be 383 according to the methodology of scientific sampling. As a result, the urban sample equals 257 sample respondents, while the rural sample equals 126 sample respondents. Both samples are representative of the chosen geographic area. The survey was distributed to 250 participants; only 132 were received back for analysis.

3.4 PILOT STUDY

A pilot study was executed to ensure that the people answering the questions have a firm grasp of the technicalities involved, especially concerning terminology and units of measurement (Sekaran, 2000:248). Due to this, researchers can learn a lot from a pilot study, and the results are generally used to reword questions and good surveys. In this study, a pre-set self-administered survey questionnaire was developed and designed to ensure that respondents could understand the questions. A total of seven respondents successfully participated in the pilot study. The pilot study revealed that the survey questionnaire was quick, convenient, and easy to follow. It took the respondents about 2 to 5 minutes to complete. However, the 5-point Likert

scale had to be amended to begin with “Strongly agree” to “Strongly disagree” as opposed to beginning with “Strongly disagree” to “Strongly agree” to create a flow throughout all the questions.

3.5 DATA COLLECTION

The collection of data is very significant in the research process. It is the data that helps people evaluate the research. Data collection can refer to the various methods used in the data collection process, including, among other things, open-ended surveys, online analytic tools, interviews and observational data collection. In this study, a questionnaire was used as a tool to collect the data. This research will make use of questionnaires to come up with a comprehensive study.

According to Bhandari (2021), a questionnaire is a series of questions or items that is used to collect data from respondents about their attitudes, experiences, or opinions. The researcher will be able to personalise the questions so that the respondent can answer the research objectives using a questionnaire. Furthermore, questionnaires can be used to collect quantitative and/or quantitative information (Bhandari, 2021).

The questionnaire contained six sections; Section A will be demographic information. Sections B, C and D, had statements to be measured using a Likert scale of 1 to 5, from strongly disagree (1), disagree (2), Neutral (3), Agree (4) and strongly agree (5). Section A with demographic information to determine the sexual identity, age, home language and classification of area classification between urban and rural. Section B will contain statements to assess the impact of the North West province on the South African economy. Section C had statements to evaluate the challenges faced by electricity consumers in the North West province. Section E contained open-ended questions to identify measures taken to alleviate consumers' unavailability of electricity supply. Lastly, Section F contained open-ended questions to discover the consumers' alternative survival methods during the unavailability of electricity supply.

3.6 DATA ANALYSIS

Statistical analysis will be done through the SPSS Statistics 28 program to help ensure high-quality accuracy and quality decision-making. Open-ended (qualitative

questions were analysed using thematic analysis, where applicable themes will be identified).

The data analysis for section A was descriptive, sections B, C and D contained quantitative statements measured with Likert scales, will apply a factor analysis, and sections E and F will be based on qualitative thematic analysis as indicated.

The data were analysed through a thematic analysis for the open-ended questions where applicable themes emerged. According to Bryman *et al.* (2014:350), thematic analysis is a flexible method that is not related to one specific philosophical orientation, “he further states the goal of thematic analysis is to identify, analyse and describe patterns or themes across the data set.”

3.7 RELIABILITY AND VALIDITY

The validity and reliability of the measurement device are two essential qualities, as shown by the existing literature. A study carried out with a measuring device lacking one or both of these characteristics will not produce useful results; because of this, the study’s measurement device needs to be both valid and reliable (Sürücü & Maslakçı 2020:3). Reliability pertains to the credibility of the research study’s conclusions. It is concerned with its findings (Welman *et al.*, 2012:145). Generally speaking, a measuring instrument can be accurate without being valid, but it is also likely to be accurate if it is valid. However, reliability by itself does not guarantee validity.

The reliability of scales used in empirical research is assessed using a variety of methodologies. The techniques that are used are the most common among these are internal consistency tests, alternate forms, and test-retest reliability. There are three techniques to apply internal consistency tests (split-half, item-total correlations, and alpha reliability coefficient). The study results for Cronbach alpha coefficient values for the factors are tabled below in Table 3.2.

Table 3.2: The reliability of the constructs

Construct	Number of Items	Cronbach Alpha
Factor 1	3	0,885
Factor 2	3	0,763
Factor 3	2	0,721
Factor 4	3	-0,320

Based on the results in Table 3.2, factors 1,2 and 3 indicate good to adequate reliability scores. This means that the study conducted is repeatable should the need for further research arise.

3.8 Envisage limitations of the study

There were several limitations of the study identified. First, the sample size was limited to the Brits' geographical area. The questionnaire was designed in one language, which was English. The questionnaire did not cater to illiterate participants; the researcher had to translate it into Setswana and other languages. Finally, the time constraints to collect data due to meeting the deadline for submitting the manuscript.

3.9 ETHICAL CONSIDERATIONS

The researcher was aware of and adhered to the North West University's ethical rules and guiding principles (NWU). The steps to obtain ethical clearance from North-West University were followed successfully. The ethical clearance certificate was issued with a low risk for collecting data. Permission to collect data from residents who resided in a fenced security estate was approved. The Tribal Authority approved authorisation to collect data for the residents of Maboloka village.

3.10 CONCLUSION

The study was conducted using quantitative research. The sample was selected through a non-probability sampling utilising a convenience sample. The data were analysed using SPSS software version 28 for accuracy. The open-ended questions in the survey were analysed using thematic analyses to reduce the data into emerging themes. In the next chapter, the results are discussed in detail.

CHAPTER 4:

RESULTS, DISCUSSION AND INTERPRETATIONS OF FINDINGS

4.1 INTRODUCTION

Since its founding in 1923 for the generation, transmission and distribution of electricity, Eskom has increasingly been facing challenges which have negatively impacted economic growth and the quality of life for the citizens of South Africa.

Data collection, analysis and interpretation, enabled the researcher to arrive at the conclusions outlined in Chapter 5, to make relevant recommendations in Chapter 5 and to answer the research questions outlined in Chapter 1. Data analysis and interpretation helped the researcher assess the effect of intermittent electricity supply on residents in the North West province of South Africa.

This chapter presents and discusses the results and interpretations of the primary study. Data collection, analysis, and interpretation allowed the researcher to reach the stated results, offer applicable recommendations in Chapter 5, and respond to the presented research questions in Chapter 1.

4.2 DATA COLLECTION

Data were collected through structured questionnaires. According to Hussey and Hussey (1997:162), a questionnaire is a cheaper method of collecting data as it is not time-consuming compared to other methods. In addition, it was easier to distribute the questionnaire to many respondents via emails and other secure electronic means.

The Likert scale is a rating scale which seeks respondents to rate the extent to which they agree or disagree with given statements, behaviours, and beliefs on a given

statement. As advocated by (Milondzo, 2003:5), the Likert scale was incorporated into the questionnaire.

An online questionnaire was created using google forms and distributed to two hundred and fifty (250) respondents. The questionnaires were sent through emails and circulation through social media platforms to the residents of Brits and Maboloka in the North West province. Respondents were requested to complete the questionnaires and submit them within a specified time. The questionnaire consisted of closed and open-ended questions. The purpose of the study was explained to the respondents before completing the questionnaires. The researcher also targeted the shopping malls, churches and residential security estates in the Brits area for distribution.

4.3 RESPONSE RATE

The questionnaires were distributed to 250 participants; the researcher received responses from 132 completed online surveys. The study obtained a 52.8% of response rate.

Welman and Kruger (2012) believe that a response rate of less than 50% in a mail survey indicates a minority and may mislead the population. In addition, it is noted that a high proportion of respondents may not be of sufficient value if the demographic from which the received responses originate is not representative of the target community.

4.4 ANALYSES AND INTERPRETATION OF RESULTS

The researcher exported the responses to Microsoft Excel computer software for easy analysis.

In the following section, analysed data will be presented and interpreted.

4.4.1 Demographic profile (Section A)

Figure 4.1 reflect the “sexual identity” of respondents, as follows:

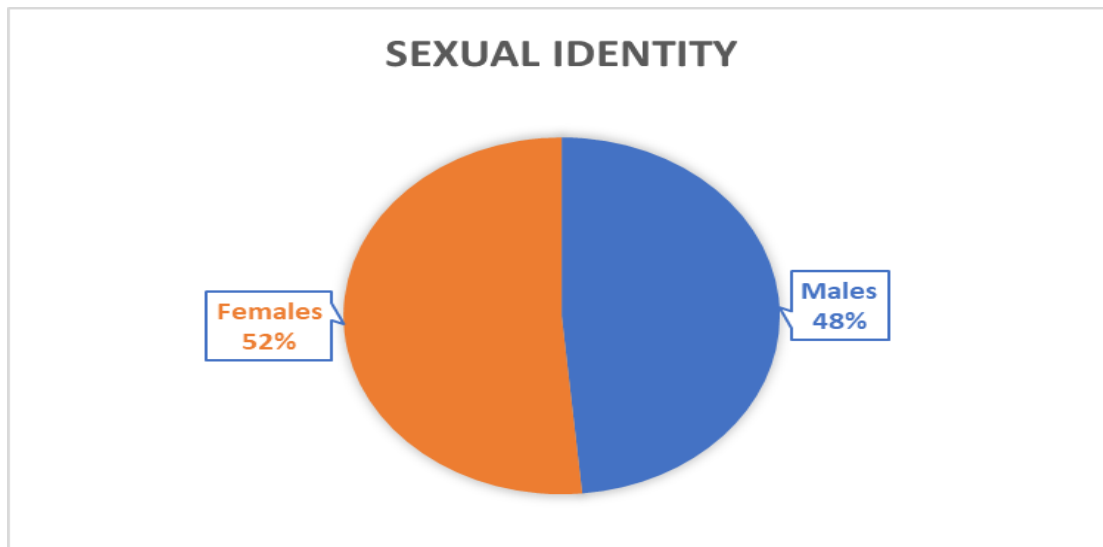


Figure 4.1: Respondents’ sexual identity

The survey participants comprised 52% females and 48% males.

The following Figure 4.2 represent the different age groups of respondents.

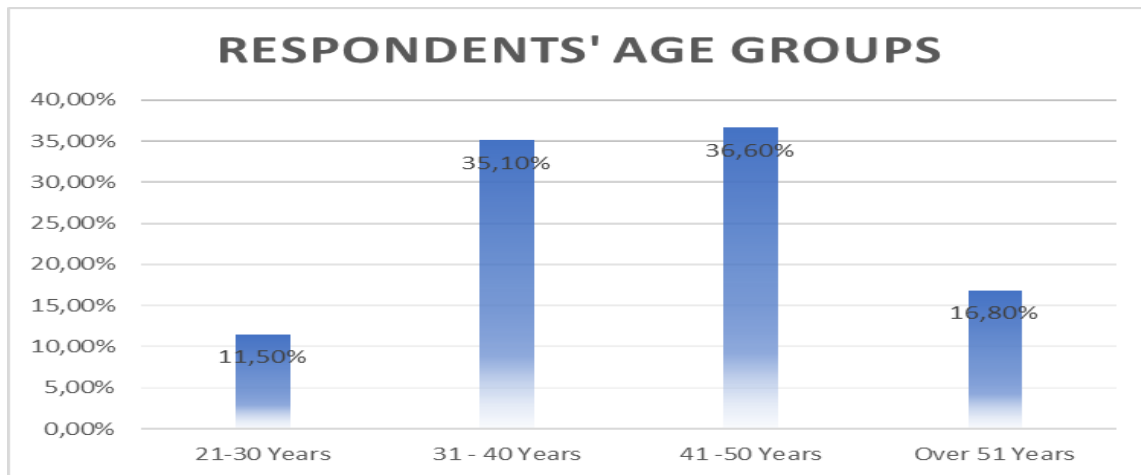


Figure 4.2: Respondents' age groups

Participated respondents are representative off all indicated age groups. 11% of respondents between 21-30 years old. Between the age of 31-50 represented almost 72% of respondents. A relatively small group (17%) was older than 51 years.

The following Figure 4.3 represent the home languages of the respondents

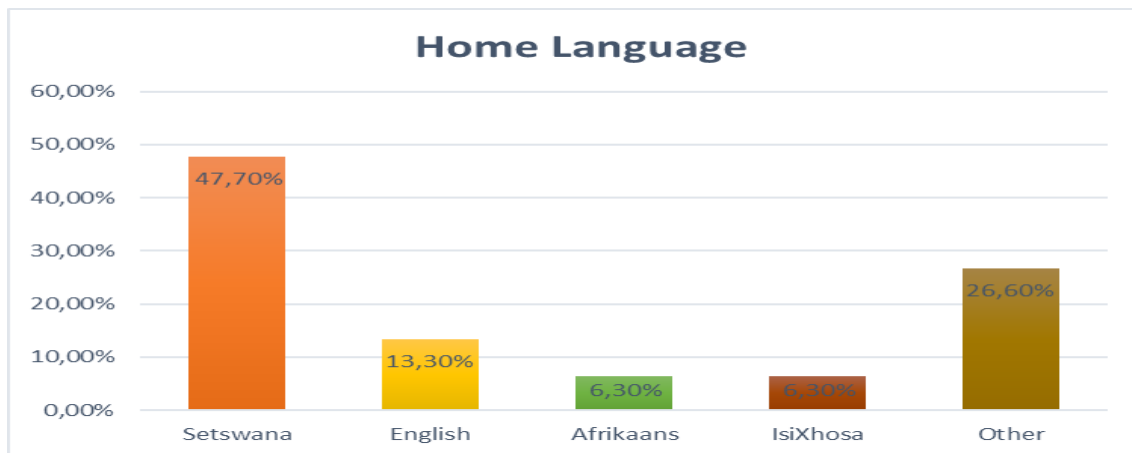


Figure 4.3: Respondents' home language

Based on the results, respondents with Setswana (48%) as their home language. English, Afrikaans and IsiXhosa cumulatively represent 25% of all respondents. Notably, almost 27% of respondents represent the “other” category.

This finding resonates with the outcome of the pilot study, where pilot respondents indicate that it will be beneficial if the questionnaire is presented in Setswana as a communicating language.

Figure 4.4 represent the distribution of respondents based on their geographical location.

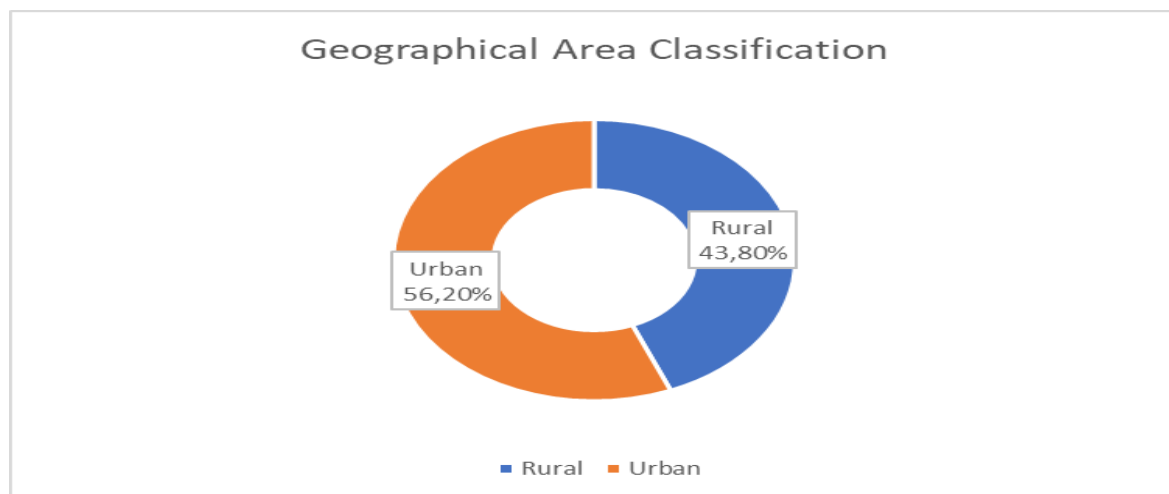


Figure 4.4: Respondents' geographical area classification

In response to the posed question regarding their location – 56% indicated an urban location, while the rest (44%) confirmed the rural area.

4.4.2 Impact on the South African economy (Section B)

This section deals with the impact of the North West province on the South African economy.

In Figure 4.5, Respondents were asked whether the North West province is seen to have a substantial contribution to the South African economy.

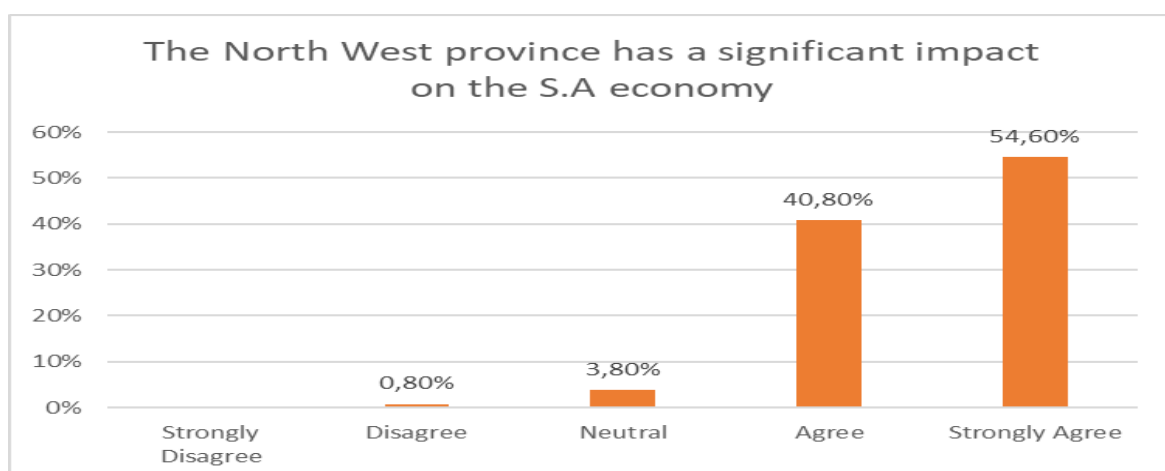


Figure 4.5: Impact on the South African economy

As reflected in Figure 4.5, 95,40% of the respondents strongly agreed and agreed. In comparison, 3.8% were neutral to the statement that the North West province significantly impacts the South African economy. On the other hand, only 0.8% of the respondents disagreed with the proposed statement. Therefore, North West province has been deemed a significant contributor to the South African economy based on the outcome.

Figure 4.6 reflects the North West province's economic impact on South Africa's economic growth.

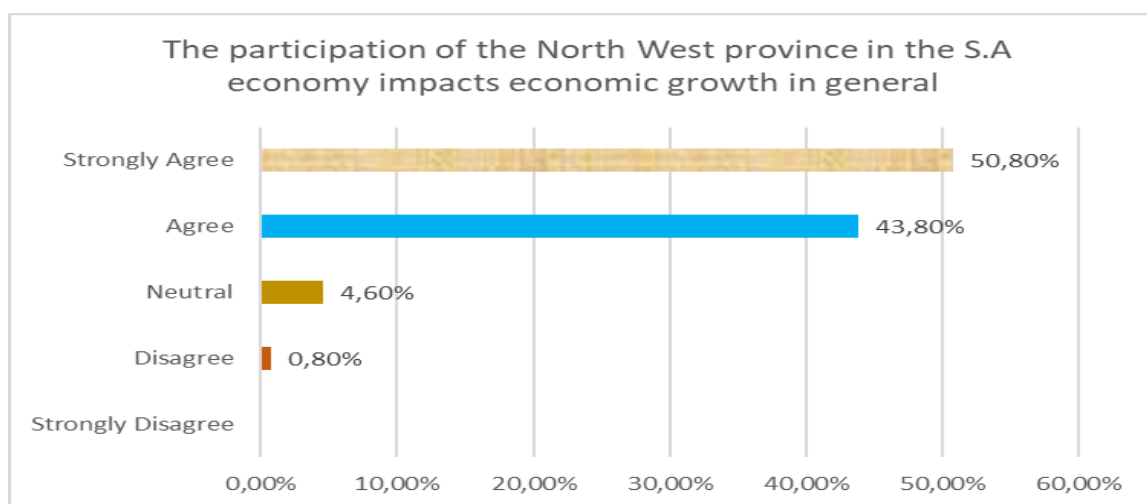


Figure 4.6: Impact on the economic growth

The responses to this question confirm the assertion mentioned. Findings agree that the North West province's participation positively impacts economic growth. Overall, 84.60% of respondents strongly agreed or agreed. Some 5% of respondents were neutral, whereas 0.80% disagreed. Therefore, North West province is believed to substantially impact the country's economic growth based on its performance.

As represented in Figure 4.7, respondents agreed there was a direct correlation between the province's economic development and the nation.

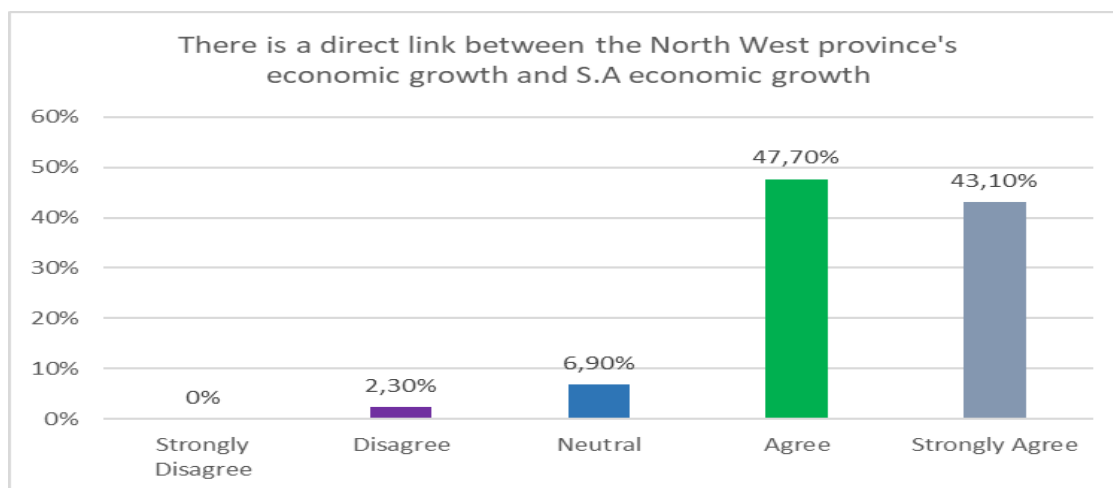


Figure 4.7: Direct link of economic growth between North West province and South Africa

The results represent 90,80% of the respondents strongly agree and agree that there is a direct link between the South African economy and North West province. However, 2.3% of the respondents disagree with the statement, and 6.9% remain neutral.

4.4.2 Importance of electricity to the North West province economy (Section C)

This section deals with the supply of electricity in the North West economy.

Figure 4.8 represents the contribution of electricity to the North West province's economic growth.

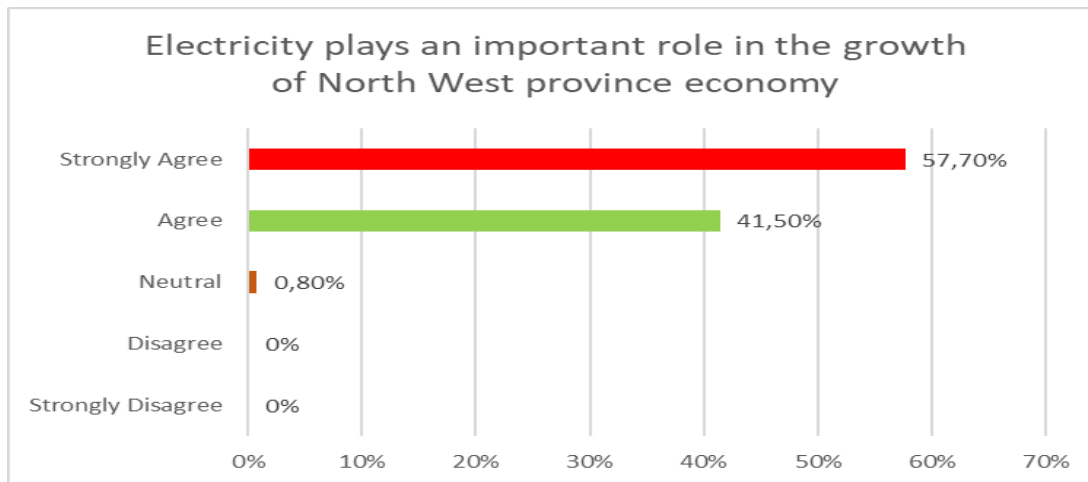


Figure 4.8: Role of electricity in the economic growth of North West province

Based on the results represent, the respondents, 99,2%, strongly agree and agree with the statement that electricity plays an important role in the growth of the North West province's economic growth. Only 0.8% remained neutral about the statement.

Figure 4.9 confirms that an increase in economic growth increases the demand for electricity consumption in the North West province.

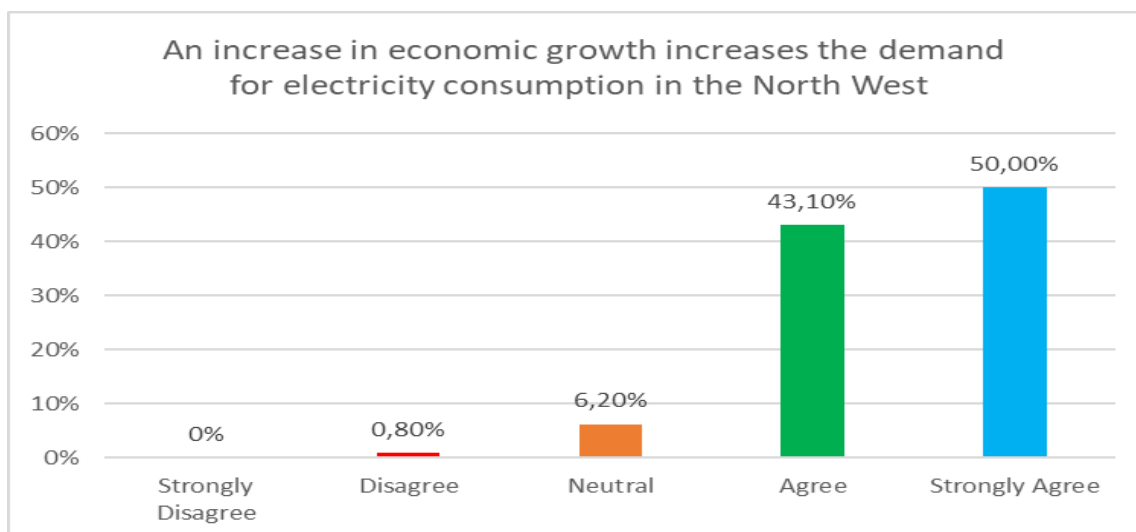


Figure 4.9: Increase in electricity demand consumption

Based on the results, 93.1% of the respondents strongly agree and agree that economic growth also increases the demand for electricity consumption. The rest of the respondents, 6.2%, remained neutral about the statement, while 0.8% disagreed. There is a direct relationship between the economic development of the province

and that of the country. An increase in the economic growth of the nation, therefore, also increase electricity consumption.

Figure 4.10, the respondents disagreed with the statement that intermittent electricity supply has no direct influence on the province.

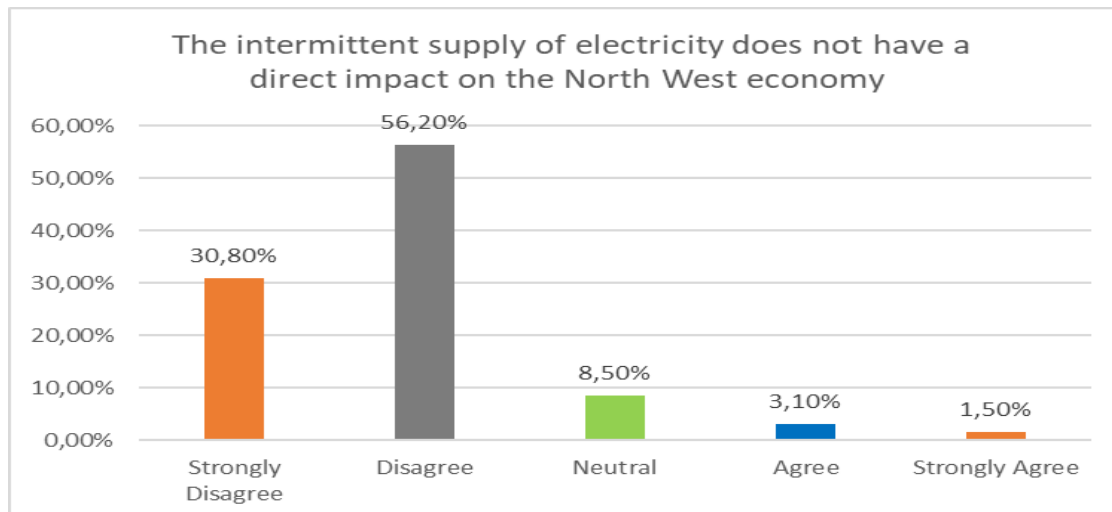


Figure 4.10: Direct impact of intermittent supply on the North West province economy

Based on the results of the respondents, 56.2% disagreed with the statement, 30.8% strongly disagreed, and 8.5% of the respondent remained neutral regarding the statement. Therefore, less than 5% of the participants agreed with the proposed statement.

4.4.4 Challenges faced by electricity consumers (Section D)

This section deals with the challenges phased by electricity consumers in the North West province

Figure 4.11 represents the effects of power failures on livelihoods.

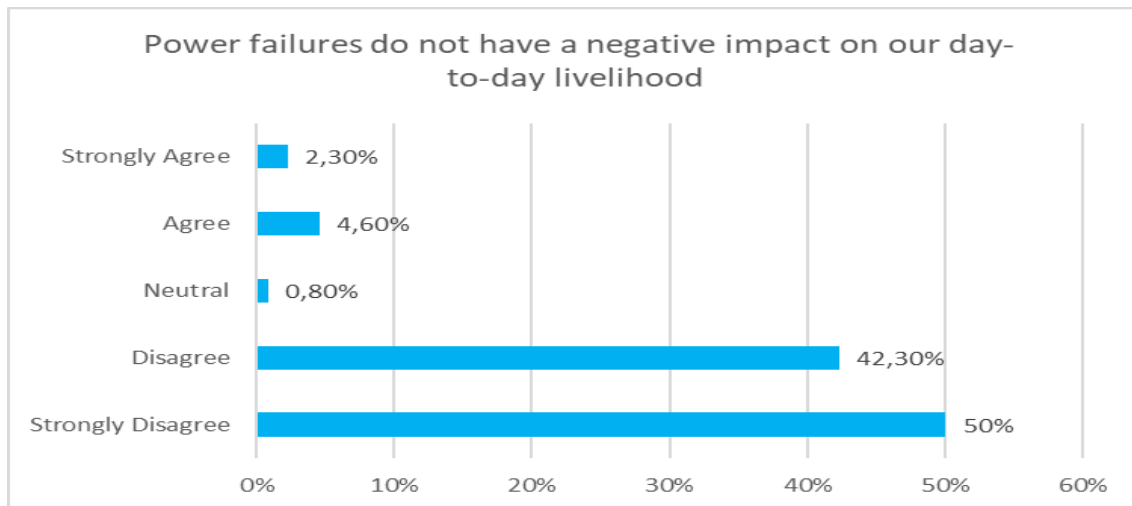


Figure 4.11: Impact of power failure on day-to-day livelihoods

The results indicate that the respondents believed that power failures negatively affect day-to-day livelihoods. Based on the results, 92.3% of the participants strongly disagreed that power failures do not negatively impact their health. On the other hand, 6.9% agreed, and 0.80% remained neutral.

Figure 4.12 shows the direct statement presented to respondents that inconsistent electricity supply causes losses and damages daily livelihoods.

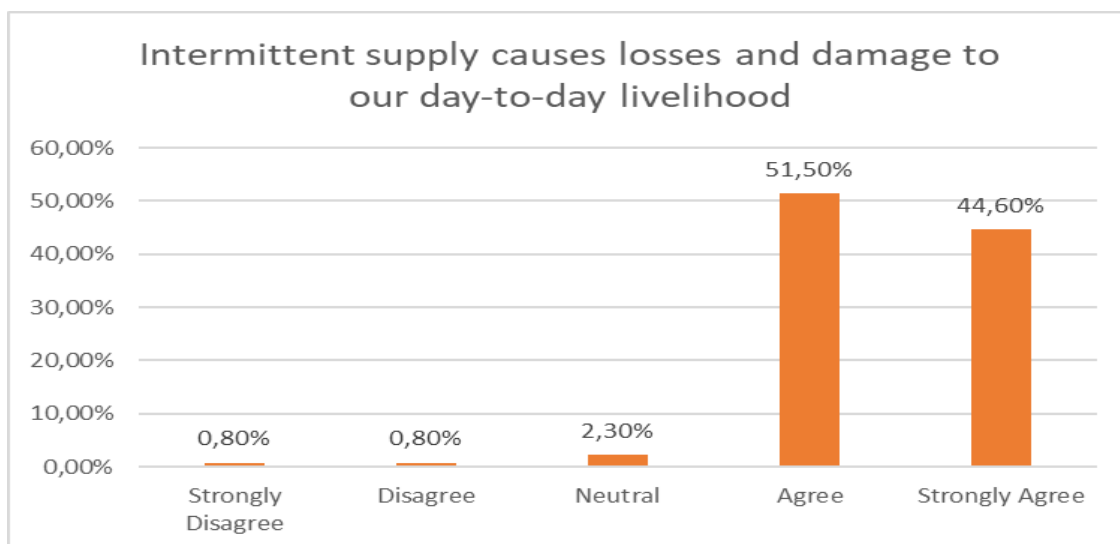


Figure 4. 12: Damage and losses to livelihoods

Some 96.1% of the respondents agreed or strongly agreed with the statement that inconsistent energy supply can lead to losses and damages to livelihoods. The results indicate that electricity has contributed to such losses and damages.

Figure 4.13 represent the results of intermittent electricity supply threatening small businesses and jobs.

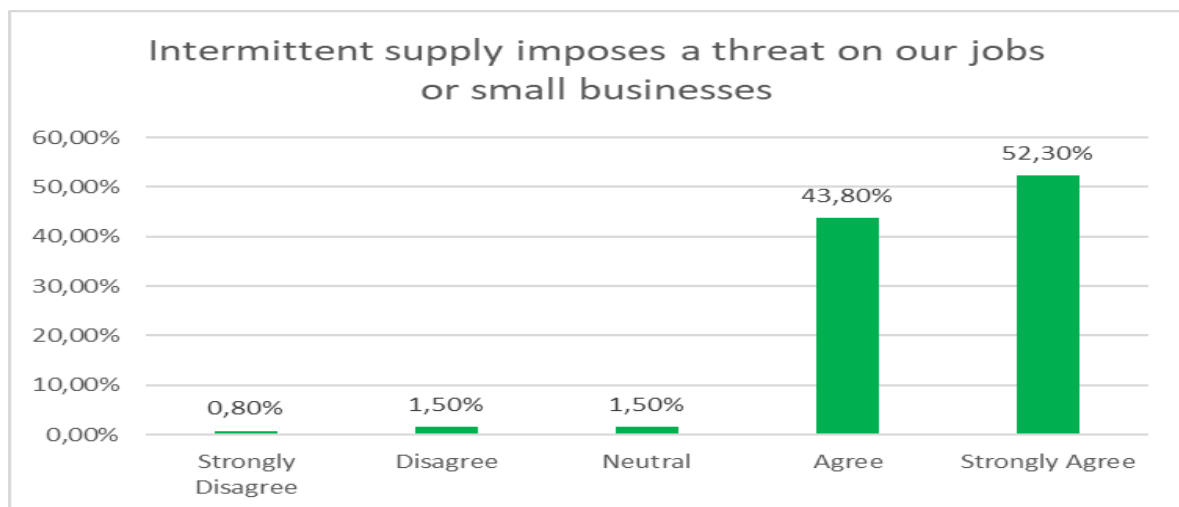


Figure 4.13: Threat to jobs and small businesses

Respondents confirmed that the electricity challenges threatened jobs and small businesses, with over 96% agreeing and only 2% disagreeing with the statement.

In Figure 4.14, the researcher states that the lack of access to electricity encourages theft.

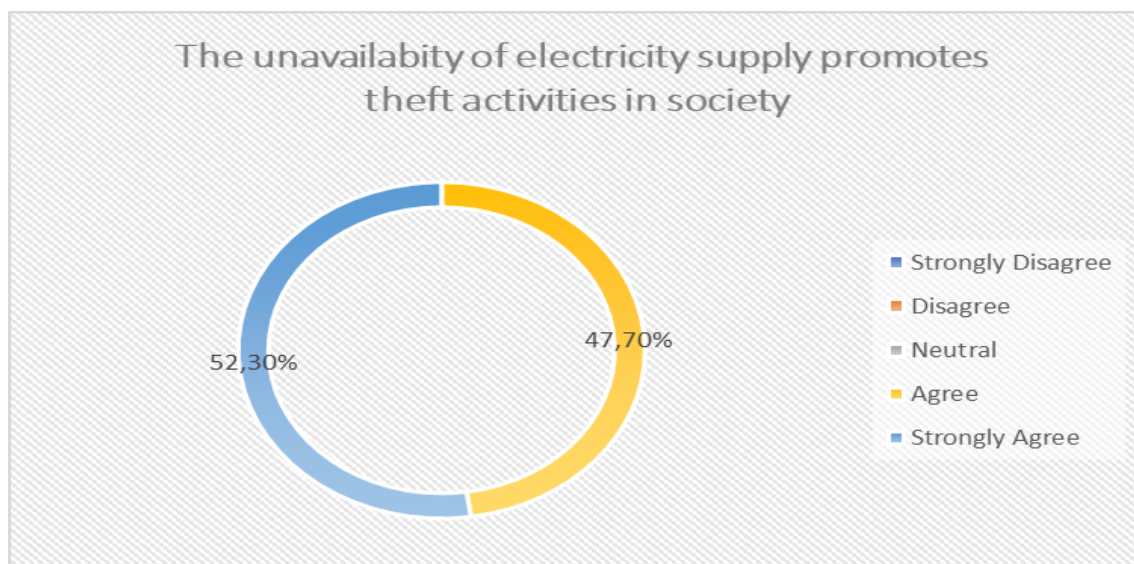


Figure 4.14: Promotion of theft in society due to the unavailability of electricity

All the respondents agreed that the unavailability of electricity promotes theft activities in society.

Figure 4.15 illustrates the impact on urban and rural skill development.

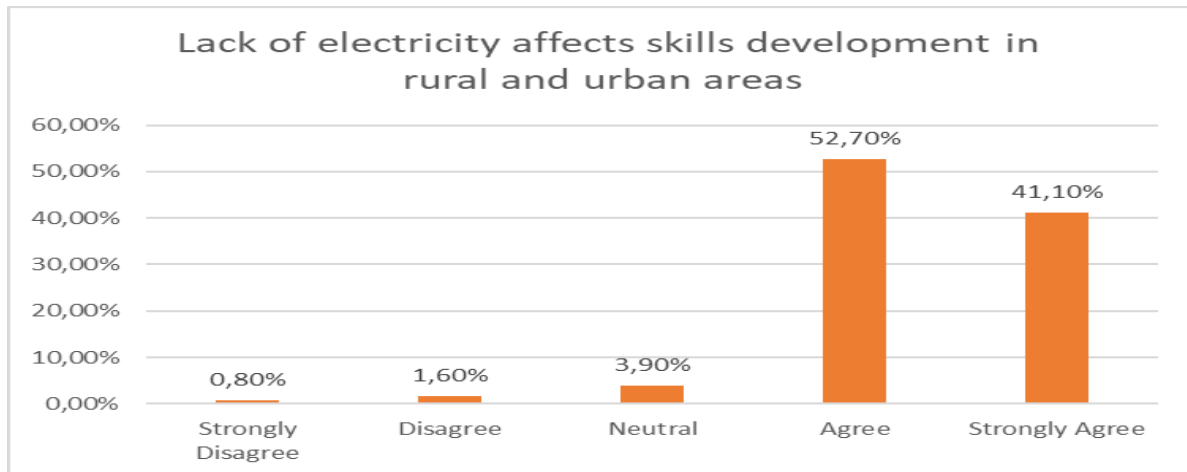


Figure 4.15: Impact on skills development in urban and rural areas

According to the results, a power shortage hinders skills development and training. As a result, 93.8% of respondents agreed that the lack of electricity hinders rural and urban skill development. In contrast, 0.80% and 1.6% of respondents disagreed with the statement.

In the next section, we will present and discuss the statistical analysis to discover the underlying pattern of data through the descriptive statistics method.

4.5 DESCRIPTIVE STATISTICS ANALYSIS

The Medical Subject Headings (MeSH) thesaurus defines statistics as the science and art of gathering, summarising, and evaluating data subject to random variation. (1) Descriptive statistics and inferential statistics are the two primary categories for summarising and evaluating data (Nick, 2007:33). This section presents the normality of the data statistics (skewness and kurtosis), reliability of data (Cronbach's Alpha), sample adequacy (KMO and Barlett's Test), the multivariable data through the factor eigenvalue; scree plot and parallel analysis. The Pearson correlation between the factors is presented to measure the dependences of variables and the relationship between variables.

4.5.1 Normality of the data statistics

The skewness and the kurtosis determine the normality of the data. A perfectly normal data set returns kurtosis and skewness values of zero. Kurtosis refers to the “peakedness” of the data, while skewness refers to the distribution of the data. Positive skewness indicates more data are located to the left of the normal bell curve. While a negative skewness indicates that more values are to the right of the distribution (Pallant, 2016:57). A negative kurtosis value indicates that the data is relatively “flat” compared to the normal bell curve (Pallant, 2016:61). The normality data statistics appear in Table 4.1.

Table 4.1: Descriptive statistics

	N	Minimum	Mean	Std. Dev.	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
B1- The North West province has a significant impact on the South African economy.	130	2	4.49	.613	-.995	.212	1.022	.422
B2- The participation of the North West province in the South African economy impacts economic growth in general.	130	2	4.45	.623	-.866	.212	.722	.422
B3- There is a direct link between the North West province's economic growth and South African economic growth.	130	2	4.32	.705	-.938	.212	1.080	.422
C4- Electricity plays an important role in the growth of North West province economy.	130	3	4.57	.512	-.458	.212	-1.385	.422
C5- An increase in economic growth increases the demand for electricity consumption in the North West province.	130	2	4.42	.645	-.851	.212	.500	.422

C6- The intermittent supply of electricity does not have a direct impact on the North West economy.	130	1	1.88	.803	1.306	.212	2.972	.422
D7- Power failures do not have a negative impact on our day-to-day livelihood.	130	1	1.67	.893	1.901	.212	4.134	.422
D8- Intermittent supply causes losses and damages to our day-to-day livelihood.	130	1	4.38	.652	-1.440	.212	5.236	.422
D9- Intermittent supply imposes a threat on our jobs or small businesses.	130	1	4.45	.683	-1.756	.212	5.582	.422
D10- The unavailability of electricity supply promotes theft activities in society.	130	4	4.52	.501	-.093	.212	-2.023	.422
D11- Lack of electricity affects skills development in rural and urban areas.	129	1	4.32	.696	-1.372	.213	4.130	.423
Valid N (listwise).	129							

Table 4.1 shows that the data in this study has relatively high deviations from the normal distribution because almost all the data points have skewness and kurtosis values above 0.50. In such a case, the suitability and normality of the data are determined by a non-significant Kolmogorov-Smirnov test result ($p > 0.05$) (Field, 2017). (See Table 4.2 for the significance test results).

Table 4.2: Kolmogorov-Smirnov test

Total N		129
Most Extreme Differences	Absolute	.236
	Positive	.236
	Negative	-.167
Test Statistic		.236
Asymptotic Sig.(2-sided test) ^a		.000

a. Lilliefors Corrected

The results in Table 4.2 show significance ($p \leq 0.05$). This means that the data is not normally distributed (Pallant, 2016:63). However, this is quite normal (especially in larger samples) and does not disqualify the data from use (Pallant, 2016:463). Normality is important in calculating confidence intervals, model significance and model parameter estimates (Field, 2017:235). As this study does not use these statistics, the data is suitable for use (Pallant, 2016:63).

4.5.2 Reliability of data

Cronbach's alpha is used to assess a survey's items' internal consistency or reliability. This statistic evaluates whether a group of objects regularly measures the same feature (Frost, 2022) and is a measure of internal stability and reliability (Field, 2017). The reliability results appear in Table 4.3.

Table 4.3: Reliability statistics

Cronbach's Alpha	N of Items
.627	11

The Cronbach alpha coefficient is .627. Although this is below the desired .70, coefficients of .57 and higher are acceptable (Cortina, 1993, as cited by Field, 2017). The data's reliability is acceptable.

4.5.3 Sample adequacy and sphericity

The adequacy of the sample also requires confirmation. The Kaiser-Meyer-Olkin (KMO) test is a statistical method for assessing if the sample is adequate. KMO scores of .70 and higher are acceptable. Table 4.5 shows the sample adequacy calculation and the data's sphericity test. According to Bartlett's test, sphericity needs to be significant ($\leq .05$).

Table 4.4: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.703
Bartlett's Test of Sphericity	Approx. Chi-Square	518.172
	df	55
	Sig.	.000

Table 4.4 shows acceptable sample adequacy (KMO=.703) and significance regarding the sphericity results ($p \leq 0.05$). Furthermore, the results show that the data possess satisfactory reliability as per Cronbach alpha's coefficient ($\alpha \geq 0.60$). According to Nunnally(1978), the sample is adequate (KMO ≥ 0.70), and the sphericity test is significant ($p \leq 0.05$) (Field, 2017:798, 822). Therefore, it is concluded that the data is suitable for multivariate analysis.

4.5.4 Exploratory factor analysis

The Varimax rotated results of the factor analysis appear in Table 4.5.

Table 4.5: Rotation Component Matrix

	Factors			
	1	2	3	4
B2- The participation of the North West province in the South African economy impacts economic growth in general.	.913			
B3- There is a direct link between the North West province's economic growth and South African economic growth.	.853			
B1- The North West province has a significant impact on the South African economy.	.829			
D8- Intermittent supply causes losses and damages to our day-to-day livelihood.		.872		
D9- Intermittent supply imposes a threat on our jobs or small businesses.		.870		
D10- The unavailability of electricity supply promotes theft activities in society.		.594		
C5- An increase in economic growth increases the demand for electricity consumption in the North West province.			.777	
C4- Electricity plays an important role in the growth of the North West province's economy.			.755	
C6- The intermittent supply of electricity does not have a direct impact on the North West economy.				.729
D11- Lack of electricity affects skills development in rural and urban areas.				-.660
D7- Power failures do not have a negative impact on our day-to-day livelihood.				.488

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.^a

a. Rotation converged in 7 iterations.

The rotated factor matrix extracted four factors from the data. This study used three methods to determine if four are the correct number of factors to retain for the rotation component matrix. Firstly, as per the Kaiser criterion, a factor's eigenvalue should exceed

1; secondly, the scree plot needs to show a point of inflexion; and thirdly, the Parallel Analysis engine. Patil *et al.*'s (2008) research indicates that factors can only be retained if both conditions are met. The conditions are:

- 1 the eigenvalue is greater than one, and
- 2 the eigenvalue is also greater than the randomised eigenvalue calculated by the Parallel Analysis software.

The results show that all four factors' eigenvalues are larger than one. These eigenvalues, as required, also exceed the PA eigenvalue. Lastly, the scree plot (Figure 4.4) indicates that either three or four factors can be retained (see the inflexion points in the figure). Given the evidence and the additional variance explained (11.82%) by the fourth factor, this study retains all four factors for interpretation.

Table 4.6: Variance explained and the Eigen Values

Component	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %
1	3.484	31.668	31.668	2.598	23.618	23.618
2	1.944	17.673	49.342	1.983	18.030	41.648
3	1.141	10.372	59.714	1.761	16.006	57.653
4	1.074	9.760	69.474	1.300	11.820	69.474

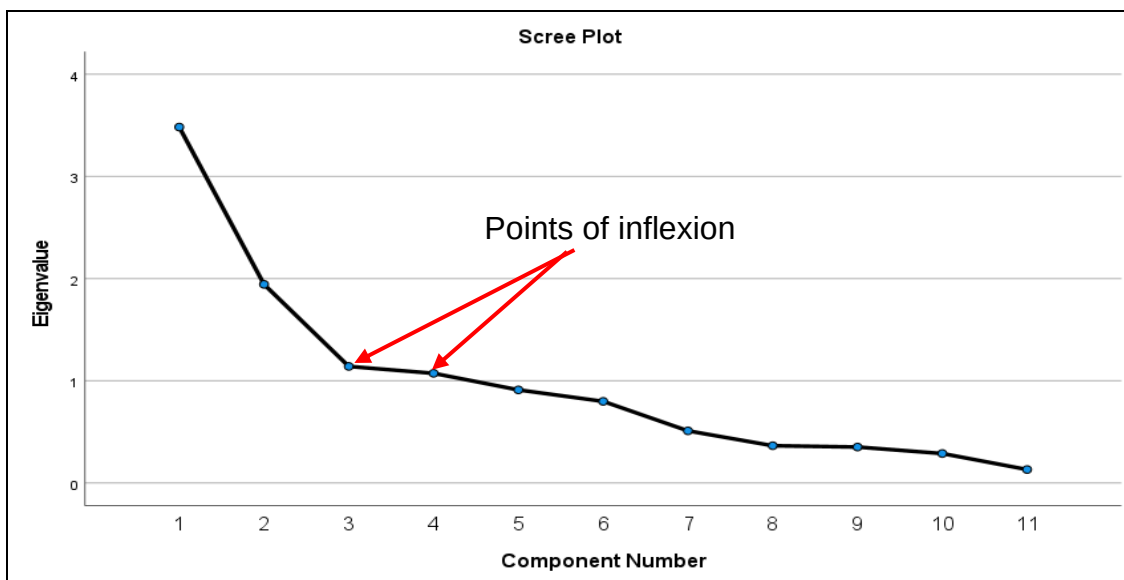
The results in Table 4.7 show that all four factors have eigenvalues higher than one. According to this measure, all four factors should be retained.

Table 4.7: The Parallel Analysis engine test

Component or Factor	Mean PA Eigenvalue	Percentile Eigenvalue
1	1.563068	2.598
2	1.393827	1.983
3	1.259675	1.761
4	1.154745	1.300

Table 4.8 indicates that the eigenvalues are larger than the randomised eigenvalues calculated by the Parallel Analysis engine. As such, this test confirms that all four extracted factors should be retained for analysis.

Figure 4.16: Point of inflexion



There are two points of inflexion in Figure 4.4. They are at Factor 3 and Factor 4. This suggests that either three or four factors could be retained for analysis. Therefore, in support of the evidence of the eigenvalues larger than one and the Parallel Analysis engine, this study retains four factors for analysis.

4.5.5 Factor identification and description of the empirical study

The four factors explain a cumulative variance of 63.47%. This is very satisfactory because Field (2017) explains that a cumulative variance above 50% is satisfactory. Cumulative variance above 60% is regarded as very satisfactory, even excellent, because it provides “a good fit to the data”. The individual factors are discussed next.

Factor 1: Economic factor

Three statements represent the economic factor one: B2, B3 and B1. All three statements represent a factor loading of above 0.80. The statements deal with the impact of the economic growth in the North West province and South Africa in general and how these connect. This factor explains 23.68% of the variance and is the most important factor. The factor explains 16.00% of the variance. The factor is reliable as per Cronbach alpha's coefficient ($\alpha=.885$).

Stern *et al.* (2019:6) suggest that increases in energy availability and energy-enhancing technology have had a much greater impact on economic growth than they do today in developed economies. The author further states that energy is a crucial ingredient of production, and continual energy supplies are required to maintain current economic activity levels as well as grow and develop the economy. This suggests that the participants are in agreement with the statement that economic growth does make an impact on the South African economy.

Factor 2: Social factor

Statements D8, D9 and D10, are all loaded under factor two; statements D8 and D9 both resulted above 0,80, and D10 is above 0,50, representing how the intermittent electricity supply affects social livelihoods in general. The negative impact associated may cause major damage to jobs and small businesses. The factor explains the 18.03% variance. The factor is reliable as per Cronbach alpha's coefficient ($\alpha=.763$).

According to Umar & Kunda-Wamuwi, (2019:28), the unavailability of electricity has caused damage to the daily lives and operations of households and small companies, respectively. The results suggest that the intermittent electricity supply may threaten people's jobs and small businesses. During the eight-hour daily load shedding periods, residents have resorted to utilising charcoal, candles, and in some cases, portable diesel generators to supplement their energy needs. The author further states that this has increased the strain on women, who must transport water outside their homes when the water supply is disrupted by load shedding. Generally, load shedding is also related to interruptions in the water supply for houses having municipal piped water connections.

Factor 3: Electricity consumption demand

Only two statements were loaded on factor three: C5 and C4, and both statements recorded results above 0,70. These statements represent the economy's increase, which

will subsequently affect the electricity consumption demand. The factor explains 16.00% of the variance. The factor is reliable as per Cronbach alpha's coefficient ($\alpha=.721$).

According to Umar & Kunda-Wamuwi, (2019:20), every economy requires a reliable and uninterrupted supply of electrical energy. As economies grow, demand for electrical energy increases with populations, industrialisation, and affluence. Consequently, the rising demand for electrical energy exceeds the supply, resulting in power interruptions and rationing, a phenomenon widely known as load shedding (Umar & Kunda-Wamuwi, 2019:20).

Factor 4: Developmental factor

Three statements are loaded on factor four: C6, D7 and D11. The statements recorded a result of above 0,70 on C6, D7 was 0.488, and D11 recorded a negative outcome of -0.666, which is not significant for future study. However, all the statements represented how the unavailability of electricity may affect the development of human lives. The factor explains 11.82% of the variance. The factor is not reliable as per the Cronbach alpha coefficient. This unreliability can be ascribed to Statement D11's negative factor loading of -.660 (Field, 2017). In practice, this means that although the factor remains important to this study, future comparative studies may not identify the same factor again if Statement D11 is not inverted in future questionnaires.

According to African Monitor (2020), load shedding is a significant problem in developing and growing economies, making it difficult for many small enterprises, such as farmers, to conduct their daily operations efficiently. As a result, products such as poultry and other perishable items that are not refrigerated for a lengthy time are wasted.

4.5.6 Pearson correlation coefficient

Table 4.8: Factor correlations

		FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4
FACTOR1	Pearson Correlation	1	.186*	.452**	-.028
FACTOR2	Pearson Correlation	.186*	1	.298**	.023
FACTOR3	Pearson Correlation	.452**	.298**	1	.011
FACTOR4	Pearson Correlation	-.028	.023	.011	1

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

The correlational analysis showed that there is a significant weak positive relationship between Factors 2 and 3 ($r=0.298$; $p\leq 0.10$) and a significant medium positive correlation between Factors 1 and 3 ($r=0.452$; $p\leq 0.10$). However, there are no significant correlations between the factors and the demographic data, nor are there any between the demographic variables and the other measuring criteria.

4.6 THEMATIC ANALYSIS OF OPEN-ENDED QUESTIONS

Respondents were invited to suggest whether something could be done to alleviate the challenge of intermittent electricity, and 52% of the participants suggested that an alternative energy source was necessary. Specifically, respondents indicated the installation of solar systems. About 30% of the respondents suggested that significant infrastructural upgrades should be performed to alleviate the problem. Some participants believed there could be an absence of skills which may be alleviated by providing relevant training. The issues of policing to minimise illegal connections and efficient collection of debts were also highlighted. See Tables 4.9 and 4.10 below for a demonstration of the results.

Below are the tables presenting the results extracted from the respondents with emerging themes; however, the first two questions are similar.

Table 4.9: Question E10- Is there anything that can be done in the interim to alleviate the problem?

Participants	Participant Response	Reduction of data	Central Theme
P1	The adoption of I.P.P.s can reduce power problems such as load shedding	Alternative energy	Alternative Energy
P2	Renewable energy	Alternative energy	Alternative Energy
P3	Do proper maintenance on the current power-generating units that are currently available.	Maintenance	Infrastructure Maintenance
P4	In my opinion, I think that if the municipality of Rustenburg can do maintenance on their substations and schedule that during the non-peak hours, they can really avoid having power cuts	Maintenance	Infrastructure Maintenance
P5	Alternative energy	Alternative energy	Alternative Energy
P6	Introduction of renewable energy	Alternative energy	Alternative Energy
P7	No, Eskom crises its infrastructure	Maintenance	Infrastructre Maintenance
P8	Investing in other power-generating resources	Alternative energy	Alternative Energy
P9	Smooth transition from coal-generated electricity	Alternative energy	Alternative Energy
P10	Rural areas should not get free electricity. Every consumer of electricity should pay	Illegal connection	Illegal Connections
P11	Renewable energy to assist	Alternative	Alternative

	ageing power stations	energy	Energy
P12	Municipalities to crack down on illegal connections and non-payers to repay outstanding monies. Government to provide incentives to businesses that drive energy-saving initiatives	Illegal connection /collection of debt Government incentive	Illegal Connections
P13	Firstly we need to cut off the power that is stolen by the people living in squatter camps and follow the right procedures for electrical installation	Illegal Connection/ debt collection	Illegal Connections
P14	Yes, Hired a skilled executive to operate the company	Skilled Personnel	Skilled Personnel
P15	Firstly we need to cut off the power that is stolen by the people living in squatter camps and follow the right procedures for electrical installation.	Illegal connection	Illegal Connections
P16	Increase the relevant resources	Skilled Personnel	Skilled Personnel
P17	To employ people with skills and experience	Skilled Personnel	Skilled Personnel
P18	Yes, get properly skilled people	Skilled Personnel	Skilled Personnel
P19	Proper maintenance plan as most of the shutdowns are due to defects of machines	Maintenance	Infrastructure Maintenance
P20	Installation of solar	Alternative energy	Alternative Energy

Table 4.10: Question E11- What would you suggest should be the solution to alleviate the problem?

Participants	Participant Response	Reduction of data	Central Theme
P1	Solar power	Renewable energy	Alternative Energy
P2	As a long-term solution, we should enable the growth of our green energy supplies, such as solar farms etc. To reduce the load of the grids. And ensure proper maintenance can be done On all of the available units that we currently have supplying electricity.	Renewable energy Maintenance	Alternative Energy Infrastructure Maintenance
P3	Green energy and perhaps uranium power and a thorough look at asset management.	Renewable energy	Alternative Energy
P4	Maintain the current electricity generators, not tender coal supply	Maintenance	Infrastructure Maintenance
P5	Renewable energy	Renewable energy	Alternative Energy
P6	Wind and solar	Renewable energy	Alternative Energy
P7	Subsidies to utilise solar energy in the future to alleviate the need for Eskom-powered energy	Renewable energy	Alternative energy
P8	Renewable energy to reduce the load from Eskom	Renewable energy	Alternative energy
P9	They can speed up the renewable energy wind and solar	Renewable energy	Alternative Energy
P10	Work on a permanent and more sustainable power alternative	Renewable energy	Alternative energy

	like solar power.		
P11	Eskom needs to improve its maintenance and Increase supply to Meet the demand	Maintenance	Infrastructure Maintenance
P12	Give experienced people a chance to maintain the systems properly	Skilled Personnel	Skilled Personnel
P13	Hire skilled staff	Skilled Personnel	Skilled Personnel
P14	they should hire skilled people to do the right job	Skilled Personnel	Skilled Personnel
P15	Provide electricity as promised. Maintain plants to avoid blackouts	Maintenance	Infrastructure Maintenance

Based on the reduction of data process, four central themes emerged from Table 4.9 and Table 4.10 - Alternative energy, Infrastructure Maintenance, and Skilled Personnel. Secondary to the central theme for infrastructure maintenance, the illegal connection theme emerged. Below we discuss in detail the emerging central themes.

4.6.1 Alternative energy

Alternative energy refers to sources other than fossil fuels (such as coal, petroleum, and diesel). It encompasses all forms of renewable and nuclear energy (Schlager & Weisblatt, 2006:5). Alternative energy is being recommended by the respondents as a solution to alleviate the inconsistent supply of electricity. P2 from Table 4.10 is quoted as follows “As a long-term solution, we should enable the growth of our green energy supplies such as solar farms etc.”. As well as P8 from Table 4.9 states, “Investing in other power-generating resources.” The respondents’ statements advocate a need for alternative energy as a solution.

4.6.2 Skilled Personnel

According to Iredale (1999:90), skilled or highly skilled workers are defined usually as having university degrees or extensive experience in a given field. It includes highly skilled specialists, independent executives and senior managers, specialised technicians or tradespeople, investors, physicians and sub-contract workers. The respondents suggested that the utility should employ skilled personnel to improve consistency in the electricity

supply. To substantiate the suggestion, P14 of Table 4.9 highlights “ hire a skilled executive to operate company”. Table 4.9, P12 states, “give experienced people a chance to maintain the system properly”. According to the respondents’ feedback, acquiring skilled personnel in Eskom will resolve the intermittent electricity supply.

4.6.3 Infrastructure Maintenance

Public infrastructure has been established as the basis for a country’s productive operations. Road and rail networks, water systems, power generation and distribution systems, and telecommunications are important to creating products and services in an economy. The state of a country’s public infrastructure is just as important as the quantity of infrastructure it possesses. Infrastructure deteriorates with time and uses, so periodic maintenance undertaken required on time (Rioja, 2013:347). Maintaining the infrastructure appears to be one of the emerging themes to sustainably provide a stable electricity supply. P2 in Table 4.9 indicates that “ to reduce the load of the grids and ensure proper maintenance can be done on all of the available units that currently supply electricity”.

In the next section, respondents were also asked to indicate how they manage the intermittent electricity supply, to which some indicated the following:

- Gas stoves for cooking.
- Generators for lighting and plugs.
- Coal stove for cooking.
- Paraffin stove for cooking.
- Inverters back up lighting and plugs.
- Solar backup for lighting and plugs.
- LED lights for lighting.
- Candles for lighting.
- Firewood/charcoal for cooking.

Table 4.11 represents the results of the alternative methods used for generating power.

Table 4.11: Question F12- How do you survive without electricity? Please also indicate alternative methods for generating “power”.

Participants	Participant Response	Reduction of data	Central Theme
P1	Generator	Generator	
P2	Use inverter and gas stove for cooking	Inverter Gas Stove	
P3	Gas seems to be the most viable option at the moment, hydropower.		
P4	Wood paraffin and solar	Paraffin Solar	
P5	Coal stove for cooking. Led lights	Coal Stove LED Lights	
P6	Use the UPS in my house. Our government can resort to solar systems as a backup	Inverter Solar	
P7	Gas stove for cooking, candles for lighting and sometimes Led light	Gas Stove Candles LED Lights	
P8	Solar systems and generators	Solar Generator	
P9	Use of gas stove, gas lights and gas geysers. Use of solar with battery and inverter.	Gas Stove Solar Inverter	
P10	Paraffin stove for cooking, a candle for lights	Paraffin stove Candle Light	
P11	Cook with Paraffin stove and led light	Paraffin Stove LED Light	
P12	Using candles and firewood to cook	Candles Firewood	

P13	By using pre-charged lights and use gas for cooking Alternative methods are: 1. Installation of Solar Power 2. Generators 3. wind power 4. making fire with wood	LED Lights Gas stove Solar Firewood Generator	
P14	we use coal stoves to burn wood for boiling water and cooking and use led lights	Coal Stove LED lights	
P15	Paraffin stove and candles	Paraffin Stove Candles	

According to the discussion with responders, it is quite difficult for many households to live without electricity. While it is possible to seek out alternatives to the lack of electricity, some of these alternatives may be harmful or incapable of doing everything respondents could do with electricity.

4.5 CONCLUSION

Electricity is a crucial economic driver and facilitates human existence. This chapter highlighted the significance of electricity in the North West province and South Africa. The communities were affected by numerous elements, including economic factors, social factors, developmental factors, and electricity demand. These reflected the communities' perspectives on the difficulties posed by intermittent electricity. In light of these findings, it is necessary to investigate other energy sources to supplement electricity. The findings, recommendations, and conclusion are reported in the next chapter.

CHAPTER 5:

RECOMMENDATIONS AND CONCLUSIONS

5.1 INTRODUCTION

This chapter includes an overview of the study, findings, recommendations and conclusion. The discussion in this section will provide an outcome analysis of the effect of intermittent electricity supply on livelihoods and the economic impact thereof. It further recommends to authorities how to improve the situation.

5.2 PROBLEM REVISITED

In Chapter 1, the researcher noted that Eskom had been confronted with many difficulties that have significantly impacted economic growth and the quality and standard of living for South African citizens. Based on the identification of the problem, the study objectives were developed. In the following section, we compare the findings to the objectives to determine whether they were met.

5.3 KEY FINDINGS FROM THE SECONDARY OBJECTIVES OF THE STUDY

5.3.1 Objective 1: To determine the importance of the North West province to the South African economy.

The study's first objective was to determine the importance of the North West province's participation in the South African economy. Figure 4.5 indicated that more than 95% of respondents agreed that the North West province's participation favourably impacted South Africa's economic progress. As a result, the respondents' contributions indicate that objective 1 of the study has been achieved.

5.3.2 Objective 2: To determine the importance of electricity supply to the economy of the North West province.

Over 95% of respondents stated that electricity plays a significant role in the economic development of the North West province; refer to Figure 4.8 for the demonstrated results. Objective 2 of the study has been achieved to determine the importance of electricity in the North West province.

5.3.3 Objective 3: To identify challenges that electricity consumers face in the North West province.

More than 92% of respondents disagreed that power outages have no negative influence on the health of communities, refer to Figure 4.11. As per Figure 4.12, 95% of respondents believed that inconsistent electricity supply causes losses and damages to social lives. The respondents' results indicate that the inconsistency of electricity supply issues poses a massive disruption in the day-to-day livelihood. The objective of identifying challenges faced by consumers due to load shedding has been achieved.

5.3.4 Objective 4: To identify measures that can be considered to alleviate the electricity problem.

More than 50% of respondents to a survey about the future of electricity in the North West believed that an alternate energy source is required. Furthermore, approximately 30% of respondents recommended that considerable infrastructure enhancements should be implemented to resolve the issue. In addition, the respondents emphasised the challenges of enforcement to minimise unlawful connections and debt collection. A few extractions from the participants' responses towards the questions posed to them to identify measures to be considered in alleviating the electricity problem are listed below:

- Participant 10, in reaction to Question E11 in Table 4.10, "Work on a permanent and more sustainable power alternative like solar power."
- Participant 2, in reaction to Question E11 in Table 4.10, "To reduce the load of the grids. And ensure proper maintenance can be done On all of the available units that we currently have supplying electricity."
- Participant 14, in Table 4.10, "they should hire skilled people to do the right job."

The objective has been met based on the participant's responses to the questions.

5.3.5 Objective 5: To identify alternative methods of consumer sourcing electricity supply.

Respondents were asked how they manage the inconsistent electrical supply, to which some responded as follows: Gas stoves used for cooking; Generators for electricity; Cooking stove fueled by coal • Inverters provide backup power for lighting and outlets. •

LED lighting is used for lighting. A few extractions from Table 4.11 advocate the methods used by the respondents.

- Participant 2, in Table 4.12, “*Use inverter and gas stove for cooking.*”
- Participant 10, in Table 4.12, “*Paraffin stove for cooking, a candle for lights.*”
- Participant 13, in Table 4.12, “*By using pre-charged lights and use gas for cooking*”

Many households would experience a difficult time surviving without electricity. While it is possible to find alternatives to the lack of power, some of these options may be hazardous or incapable of doing all the tasks that could be accomplished with electricity.

5.4 KEY FINDINGS FROM THE PRIMARY STUDY

The purpose of the study was to analyse the effect of intermittent electricity supply on consumers living in both urban and rural areas. The survey was conducted on 52% of females and 48% of males of age groups above 21 years. The survey was conducted in Brits in the North West province of South Africa. The following finding came out of the study:

- Over 95% of the respondents believed that North West province is significant in making an economic impact on South Africa.
- 49% of the participants believed in its participation. The North West province positively improved the economic growth of South Africa. However, full participation can be achieved if electricity, which is one key economic driver, is available for farming, industrial, small business and all sectors that require electricity to participate fully.
- Over 90% of the respondents indicated the existence of a direct relationship between North West province and South Africa when it comes to economic development. South Africa can only prosper as a nation if provinces, including the North West province, grow. Accordingly, anything that details the economic growth of the North West province also describes that of South Africa.
- 93% of participants acknowledged that increased economic growth arising from productivity requires more electricity as an energy source. Electricity is required throughout the value chain from learning, training, production, hospitals, hospitality and even the defence industries.

- 87% of participants disagreed that the intermittent electricity supply in the province does not have any bearing on economic growth.
- Over 92% of participants rejected that power failures do not have a negative impact on citizens' health. 95% believed that intermittent electricity supply causes losses and damages daily livelihoods.
- 96% of the participants confirmed that electricity challenges threatened jobs and small businesses.
- There was not a convincing buy-in on the statement that the unavailability of electricity promotes theft and harmful activities, as this was rejected by 52% of respondents.
- 93% of the respondents agreed lack of electricity affects skills development in rural and urban areas.

5.5 CONCLUSION

The study concluded that electricity supplies have a negative impact on economic growth in the North West province, which would also affect the country's economic growth. In the process, households, small businesses and productivity are impacted in rural and urban areas. The study found intermittent electricity negatively impacts livelihoods as some alternatives without electricity pose health hazards. The study concluded that better alternative sources of renewable energy must be planned and invested in to supplement the current supplies of electricity.

5.6 RECOMMENDATIONS BASED ON THE LITERATURE

- To provide an alternative source of energy to accommodate the increased electricity supply.
- To conduct proper maintenance on the current generation infrastructure.
- Consider gradually expanding the renewable energy industry, primarily due to private sector expenditures in energy production and the development of renewable energy technologies.

- The power supply in developing countries is frequently unreliable and inefficient, resulting in business interruption expenses; policymakers should consider alternative energy sources to alleviate the inconsistency of electricity supply.

5.7 RECOMMENDATIONS BASED ON EMPIRICAL FINDINGS

5.7.1 Quantitative findings

Based on the findings from the study, there were four extracted factors listed in their priority order: economic factor, social factor, electricity consumption demand and developmental factor:

- **Economic factor:** a sufficient electricity supply is necessary to sustain a high rate of economic growth in the future. In addition to increased generation facilities, such as solar, energy supply adequacy can be maintained through efficiency improvements. The researcher recommends further research to understand the connections and causal relationship between economic growth and energy use.
- **Social factor:** the study indicates a direct relationship between the social factor and electricity supply; the management should consider conducting further research into the relationships to make better decisions and improve the lives of communities by providing a consistent electricity supply.
- **Electricity consumption demand:** The policymakers should promote the implementation of increasing generation capacity faster to meet the required demand by the consumers to foster increased electricity consumption demand.
- **Developmental factor:** the findings indicate a relationship between the development of the country and the electricity supply; Eskom management needs to learn more about the correlation between the country's development and the electricity supply to make better decisions in alleviating the electricity supply problem.

5.7.2 Qualitative findings

Based on the outcome of the study, the following recommendations may help the national government and North West provincial authorities; these were based on the emerged themes:

- To upgrade its infrastructure, specifically the ageing power stations, to improve the electricity supply.

- Consider partnering with private service providers to supplement its power supply. In so doing, Eskom should consider opening up to other players with the financial capacity to contribute to power generation.
- Provision of training to personnel to run the affairs of the entity better to minimise disruptions.

Based on the findings from the study, the following recommendations are made for Eskom as the sole provider of electricity:

- Since Eskom is a Schedule 2 company administered in terms of the Public Finance Management Act, No.1 of 1999, the national government, through the National Treasury, should intervene to ensure efficiency and adequate controls are in place to economically and effectively run the affairs of Eskom.
- North West Provincial government should consider engaging services providers who can provide alternative energy sources, such as solar systems, to ensure the current load shedding and electricity outages do not disrupt key services.
- The national and provincial governments should promote and disseminate the message to residents to use electricity sparingly while other energy sources are being explored.
- The national and provincial governments should consider investing in power generation infrastructure to replace the ageing plants and equipment.

5.8 LIMITATIONS OF THE STUDY

In correlation with the study's limitations in Chapter 3, section 3.8, following the empirical study, the following limitations were considered:

- Due to scheduling constraints, the study surveyed a much smaller sample of the Brits' geographical area participants.
- The survey was presented in English, and the researcher had to interpret it in other languages for some participants to understand.
- This study was affected by the willingness of respondents to complete the questionnaire, as some were preoccupied when approached.

5.9 FUTURE RESEARCH

The research method used in this study is recommended for future studies because the methodology extracted various factors contributing to alleviating the electricity supply problem.

5.10 OVERALL STUDY CONCLUSION

The purpose of the study was to analyse the effect of intermittent supply of electricity on the residents, the economy and livelihood. The electricity outages have had some negative impacts on the standards of living. The study established that national and provincial governments must explore alternative energy sources in light of ongoing and unsustainable situations that devastate economic growth and livelihood. The situation is terrible, and residents have been downgraded to using unhealthy alternative energy sources, such as coal and paraffin, which may negatively impact human health. The study concluded that the national and provincial governments have a role in alleviating the challenge.

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ADDENDUM A: INFORMED CONSENT

NORTH-WEST UNIVERSITY: MBA Research project

RESEARCHER: BP Jele
Cell: 0765602779
Email: Portia.Maseko57@gmail.com

STUDY SUPERVISOR Prof JJ Prinsloo
Email: Hein.Prinsloo@nwu.ac.za

Dear Respondent,

Research Topic: Analyse the effect of intermittent supply of electricity to consumers in the North-West

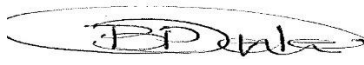
The purpose of the study is to determine the importance of curbing the intermittent supply of electricity to consumers. The study will explore the challenges and opportunities of intermittent supply of electricity in the North-West province.

The research will be conducted through a questionnaire. The estimated time to complete the questionnaire will be 20 minutes. Your willingness to participate in the study is much appreciated. Your participation is voluntary, should you feel uncomfortable at any point, you may withdraw from participation in the completion of the questionnaire. The questionnaire will be conducted online, a link will be distributed to the participants.

The completed questionnaire will be safeguarded. The information will be used to capture and analysed using SPSS Statistics to ensure accuracy at the North-West University. The researcher will ensure that results are kept confidential. Only the researcher, the

Supervisor and the Statistician will have access to the results. The information will solely be used for academic purposes.

Researcher Signature:



Subject Consent

I voluntarily agree to participate in this study. I have read the contents of this consent form, have been encouraged to ask questions, and have is consent form's contents, been encouraged to ask questions, and received satisfactory answers to my questions. I understand that my participation is voluntary and that I may withdraw my participation at any time without penalty.

I..... hereby declare that I have read and understood the content of the Informed Consent Statement and give my full consent to Buhle Jele 29931576 to use the information from the survey in her MBA research project.

Signature:.....

Date:.....

ADDENDUM B: QUESTIONNAIRE

Section A: Demographics Section

Sexual identity

		Response
1	Male	
2	Female	
3	Other, please specify	

Age

		Response
1	20 – 30 years old	
2	31 – 40 years old	
3	41 – 50 years old	
4	Over 51 years old	

Home language

		Response
1	Setswana	
2	English	
3	Afrikaans	
4	IsiXhosa	
5	Other	

Geographical area classification

		Response
1	Rural	
2	Urban	

SECTION B: South African Economy

This section deals with the impact of the North-West province on the South African economy

Please indicate the extent to which you agree or disagree with the following statements by placing an X in the appropriate box.

Importance of the North-West province to the South African economy	1	2	3	4	5
	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
1. The North-West province has a significant impact on the South African economy.					
2. The participation of the North-West province in the South African economy impacts economic growth in general.					
3. There is a direct link between the North-West province's economic growth and South African economic growth.					

SECTION C

This section deals with the supply of electricity in the North-West economy.

Please indicate the extent to which you agree or disagree with the following statements by placing an X in the appropriate box.

Importance of electricity to the North-West province economy	1	2	3	4	5
	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
4. Electricity plays an important role in the growth of North-West province economy.					
5. An increase in economic growth increases the demand for electricity consumption in the North-West province.					
6. The intermittent supply of electricity does not have a direct impact on the North-West economy.					

SECTION D

This section deals with the challenges faced by electricity consumers in the North-West province

Please indicate the extent to which you agree or disagree with the following statements by placing an X in the appropriate box.

Challenges faced by electricity consumers	1	2	3	4	5
	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
7. Power failures do not have a negative impact on our day-to-day livelihood.					
8. Intermittent supply causes losses and damages to our day-to-day livelihood.					
9. Intermittent supply imposes a threat on our jobs or small businesses.					
10. The unavailability of electricity supply promotes theft activities in society.					
11. Lack of electricity affects skills development in rural areas.					

SECTION E: Open-ended Questions (Measures considered to alleviate the problem)

This section deals with gathering the views or opinions of the respondents on possible measures to alleviate the electricity problem.

Please answer the questions as truthful as you can. Should you not feel comfortable at any point, you are to withdraw from participation.

E-10. In your view, is there anything that can be done in the interim to alleviate the problem?

.....
.....
.....
.....
.....
.....

E-11. What would you suggest should be the solution to alleviate the problem?

.....
.....
.....
.....
.....

SECTION F: Open-ended Questions

This section deals with gathering the views or opinions of the respondents on alternative methods of survival without electricity.

F-12. How do you survive without electricity? Please also indicate alternative methods for generating “power”.

.....

.....

.....

.....

.....

.....

Thank you for your contribution.



Student: Buhle Jele

ADDENDUM C: ETHICS CERTIFICATE



Private Bag X1290, Potchefstroom
South Africa 2520

Tel: 018 299-1111/2222
Fax: 018 299-4910
Web: <http://www.nwu.ac.za>

Senate Committee for Research Ethics
Tel: 018 299-4849
Web: Feziwe.Mseleni@nwu.ac.za

25 October 2022

ETHICS APPROVAL LETTER OF STUDY

Based on approval by the **Economic and Management Sciences Research Ethics Committee (EMS-REC)** on 30/9/2022, Round Robin, the Economic and Management Sciences Research Ethics Committee hereby **approves** your study as indicated below. This implies that the North-West University Senate Committee for Research Ethics (NWU-REC) grants its permission that, provided the special conditions specified below are met and pending any other authorisation that may be necessary, the study may be initiated, using the ethics number below.

Study title: Analyse the effect of intermittent supply of electricity to consumers in the North West Province, South Africa
Study Leader/Supervisor (Principal Investigator)/Researcher): Prof JJ Prinsloo / MBA
Student: Jele, BP (29931576)

N	W	U	-	0	0	7	3	4	-	2	2	-	A	4
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Institution Study Number Year Status
Status: S = Submission; R = Re-Submission; P = Provisional Authorisation; A = Authorisation

Application Type:

Commencement date: 25/10/2022

Risk: LOW

Expiry date: 25/10/2023

Approval of the study is initially provided for a year, after which continuation of the study is dependent on receipt and review of the annual (or as otherwise stipulated) monitoring report and the concomitant issuing of a letter of continuation.

Special in process conditions of the research for approval (if applicable):

•

General conditions:

While this ethics approval is subject to all declarations, undertakings and agreements incorporated and signed in the application form, the following general terms and conditions will apply:

- The study leader/supervisor (principle investigator)/researcher must report in the prescribed format to the EMS-REC:
 - annually (or as otherwise requested) on the monitoring of the study, whereby a letter of continuation will be provided, and upon completion of the study; and
 - without any delay in case of any adverse event or incident (or any matter that interrupts sound ethical principles) during the course of the study.
- The approval applies strictly to the proposal as stipulated in the application form. Should any amendments to the proposal be deemed necessary during the course of the study, the study leader/researcher must apply for approval of these amendments at the EMS-REC, prior to implementation. Should there be any deviations from the study proposal without the necessary approval of such amendments, the ethics approval is immediately and automatically forfeited.
- Annually a number of studies may be randomly selected for an external audit.
- The date of approval indicates the first date that the study may be started.

n the interest of ethical responsibility, the NWU-SCRE and EMS-REC reserves the right to:

- request access to any information or data at any time during the course or after completion of the study;*
- to ask further questions, seek additional information, require further modification or monitor the conduct of your research or the informed consent process;*
- withdraw or postpone approval if:*
 - any unethical principles or practices of the study are revealed or suspected;*
 - it becomes apparent that any relevant information was withheld from the EMS-REC or that information has been false or misrepresented;*
 - submission of the annual (or otherwise stipulated) monitoring report, the required amendments, or reporting of adverse events or incidents was not done in a timely manner and accurately; and / or*
 - new institutional rules, national legislation or international conventions deem it necessary.*

The EMS-REC would like to remain at your service as scientist and researcher, and wishes you well with your study. Please do not hesitate to contact the EMS-REC or the NWU-SCRE for any further enquiries or requests for assistance.

Yours sincerely,

Mark
Rathbone

Digitally signed by Mark Rathbone
DN: cn=Mark Rathbone, o=North-
West University, ou=Business
management,
email=mark.rathbone@nwu.ac.za,
c=ZA
Date: 2022.10.26 08:02:45 +02'00'

Prof Mark Rathbone
Chairperson: NWU Economic and Management Sciences Research Ethics Committee

ADDENDUM D: LANGUAGE EDITOR'S LETTER



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

Tuesday, 13 December 2022

To whom it may concern

Re: Confirmation of language edit

The MBA dissertation "An analysis of the effect of the intermittent supply of electricity to consumers in the North West Province, South Africa" by **BP Jele (29931576)** was edited for language precision.

Final, last-minute corrections remain the responsibility of the author.

Antoinette Bisschoff

BA Languages (UPE – now NMU); MBA (PU for CHE – now NWU); Translation and Linguistic Studies (NWU)

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

Precision ... to the last letter