

Exploring the viability of marketing renewable energy in South Africa

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List of abbreviations

NERSA – National Energy Regulator of South Africa

MYPD – Multi – Year Price Determination

Eskom – Electricity Supply Commission

HYSA – Hydrogen South Africa

DTS – Department of Science and Technology

CAHSGCC - African Heads of State and Government on Climate Change

C02 – Carbon Dioxide

CCTV – Closed-circuit television

GDP - Gross domestic product

IPP - Independent power producers

DWF - Darling Wind Farm

MW – Megawatt

GWh – Gigawatt hours

CHAPTER 1: INTRODUCTION AND BACKGROUND OF THE STUDY

1. Introduction

Fossil fuels and renewable energy play a vital role in the modern age as well as in what nature offers us to live in a better world. Respecting the resources that are available to us for use, as well as using it wisely in regard to the earth and where we get the resources, remains vital. Fossil fuels are harming the world we live in and switching to renewable energy is the best route possible (UN, 2022). Energy derived from renewable sources is replenished faster than it is consumed, because it is derived from natural sources (UN,

2022). For example, sunlight and wind are constantly replenished. We are surrounded by renewable energy sources. Carbon dioxide is one of the most harmful greenhouse gases produced when fossil fuels are burnt to produce energy. In contrast, fossil fuels such as coal, oil, and gas, which take hundreds of millions of years to form, are non-renewable resources (United Nations, n.d). Exploring the feasibility of renewable energy versus fossil fuels in South Africa is an especially important task at hand, in order to guarantee a healthy and safe place to live and protect natural elements. The use of renewable energy will also contribute to the recent loadshedding and electricity shortages that we face in this country.

A reliable power supply ensures the effective operation of core health programme management systems. With the usage of renewable energy, we are getting more natural energy and with climate change being a massive factor in years to come, it can help reduce this factor. Clean energy technologies can be deployed quickly in regions with no electricity networks or unreliable electricity networks. Instead of relying on candles and phone flashlights, health centres can operate continuously and efficiently using reliable energy. (Marcel, 2020:15).

In addition to having a significant impact on how the rest of Africa views these issues, South Africa's position on the improvement of fossil fuel use is essential to the country's energy security, growth trajectory, and moral commitment to address climate change. The recent events marked the end of President Ramaphosa's leadership of the Committee of African Heads of State and Government on Climate Change (CAHSGCC), an organization responsible for leading Africa's climate negotiations. South Africa is not only the most polluting nation in Africa, but it is also the world's 12th highest producer of carbon dioxide (Clarke, 2022:03). It is possible to argue that we cannot afford to stop investing in hydrocarbons without widening the 4,000 MW capacity gap. However, the situation has improved in some ways. Several concepts in the 1998 White Paper on Energy Policy, which were never implemented, have finally begun to gain traction, according to energy analyst Chris Yelland. Eskom transmission is restricted/unbundled, and the Electricity Regulation Act is amended to allow private producers to sell electricity which are only two examples. (Clarke, 2022:03).

1.1 Literature study

A literature review is a piece of academic writing that contextualises and demonstrates knowledge of the academic literature on a given subject (The University of Edinburgh, 2023). In the literature study, there will be a look at the current electricity problems, solar possibilities as well as the effect of load shedding (electricity 'blackouts', referred to as loadshedding) in South Africa.

1.2 Current electricity problems

According to Trace (2023), rotating load shedding has been practised by South Africa's state-owned utility Eskom for years, but between December 2019 and the start of January 2020, it became a daily occurrence. Eskom provides more than 90% of the country's electricity (Trace, 2023). The situation is a result of insufficient generating capacity (South Africa produces around 47,000 MW against an installed generation capacity of 52,000 MW), operational failures, maintenance issues, and breakdowns at ageing, poorly maintained power stations (Trace, 2023).

1.3 Effect of these problems

Severe load shedding and associated battery theft are also hitting large network providers from all sides, endangering their dependability and driving up costs (Businesstech, 2022). Farmers all over the country have been forced to adjust to a "new normal," with workers often forced to water farms at night, reschedule time slots for operations, and struggle to maintain cold storage facilities that are essential for maintaining the freshness of crops (Businesstech, 2022). Included in the economy's silent costs are:

- Load shedding that caused the loss of tens of thousands of jobs
- The international reputation of South Africa
- a decline in public confidence in the government (Businesstech, 2022).

1.4 Possible solutions

Install solar panels on the roof (residents produce electricity for self-use and sell excess electricity to the municipalities). For this, municipalities and Eskom must create attractive tariff arrangements (Mathe, 2023). Additionally, it is important to explore and expedite the

development of state policies that will encourage this, such as tax credits or refunds for individuals who install rooftop solar panels (Mathe, 2023).

Repurpose, modernise, improve, and digitalise existing generation infrastructure while retiring old inefficient coal-fired power plants (Mathe, 2023). By making sure that the retired capacity is replaced (megawatt for megawatt) by new dispatchable capacity, ageing power plants must be decommissioned in a way that does not leave a capacity hole (Mathe, 2023).

As the government now imposes a green tax on buildings that cannot verify a 20% decrease in energy and water use, green retrofitting is becoming necessary in South Africa. Owners of certain sizes and types of buildings must get an Energy Performance Certificate by December 2022, otherwise they risk an R5 million fine and possible jail time (Nedbank, 2022).

1.5 Solar as a possibility

There are many uses for solar energy. You can produce heat or electricity (photovoltaics) (solar thermal) (Vourvoulas, 2023:14). Solar energy can be used to distil water in locations with a shortage of clean water, generate electricity in places without access to the electrical grid, and run spacecraft in space (Vourvoulas, 2023:14). The technology in the solar energy sector is always improving, and advancements will accelerate in the next few years. Advancements in nanotechnology and quantum physics have the potential to boost solar panel efficiency and double or even triple the electrical input of solar power systems (Vourvoulas, 2023:14).

1.6 Definitions of terms

Renewable energy: Refers to energy that comes from natural processes or renewable resources. Sunlight and wind, for example, remain available and flow, even if they depend on the time and weather for their availability (Shinn, 2022).

Greenhouse gases: any gas with the ability to absorb thermal energy (net heat energy) generated from the Earth's surface and reradiate it to the surface, thereby enhancing the greenhouse effect (Mann, 2022).

Disinvestment: When a state government chooses to give private companies control and management of undertakings, disinvestment takes place as a result of that decision (Sweta, 2022).

Low-carbon economy: The phrase "low-carbon economy" refers to a clean, environmentally friendly economy built on minimal energy use and minimal emissions (Chen & Wang, 2017).

Sustainable future: Sustainability is the capacity to consistently support or maintain a process across time. Sustainability aims to stop the depletion of natural or physical resources in business and policy contexts so that they will be accessible in the long run (Mollenkamp, 2022).

Global warming: When carbon dioxide (CO₂) and other pollutants in the air build up in the atmosphere, they absorb sunlight and solar rays that have already reflected off the surface of the earth. Normally, this radiation would escape into space, but because these pollutants may linger in the atmosphere for many years or even decades, they trap the heat and make the planet hotter (MacMilan & Turrentine, 2021).

Fossil fuels: Because they were generated from the petrified, buried remnants of plants and animals that once lived millions of years ago, coal, crude oil, and natural gas are all referred to as fossil fuels. Fossil fuels have a high amount of carbon due to their origins (Denchak, 2022).

1.7 BACKGROUND OF THE PROBLEM

There is a disconnect between South Africa's transnational climate commitments and its Department of Mineral Resources and Energy's views on its energy future. Despite his loyalty to coal as South Africa's primary energy resource until at least 2030, the Minister of Mineral Resources and Energy, Gwede Mantashe, has been branded a "coal fundamentalist" by the media (Winkler, 2022:12). According to the department's 2019 Integrated Resource Plan, he promises a transition to a low-carbon economy by developing new, more "efficient" coal power plants to comply with environmental and climate regulations. Currently, South Africa has the world's most carbon-intensive electricity generation. It's not by accident. Tyler and Hochstetler's (2021) research reveals

that South Africa's dependence on coal is the result of a complex set of institutional, political, and corporate interests tied to existing infrastructure and vested interests (Winkler, 2022:12).

Renewable energy encompasses all technologies that do not consume non-replaceable fossil fuels. Coal, oil, gas, minerals, and uranium, which are used in nuclear energy, are fossil fuels. South Africa has some of the best solar and wind resources in the world (Winkler, 2022:12). Many environments with more cloud cover and less wind than South Africa already produce electricity with solar and wind plants. It takes less than two years to build solar and wind power plants. It will take at least another year to complete the preconstruction processes, bidding, approvals, and other requirements. Since fuel is not purchased, running costs are extremely low. During the past decade, solar and wind technology prices have dropped dramatically (Winkler, 2022:12). With solar and wind power, the cost – including construction and other expenses – has fallen well below those for gas, nuclear, and coal power (Winkler, 2022:12).

The significance of this study is to understand the cost of renewable energy and the ways it can be implemented in South Africa, the benefits renewable energy has on the impact of the land and deep dive into the effects fossil fuel has on the environment. The data collected from this research study will help people and organisations understand the impact of fossil fuels on the environment and the negative role that they play in the industry and try to see that renewable energy is the way forward to make the country and the earth a better and healthier place for us all (Winkler, 2022:12). In researching the feasibility of renewable energy versus fossil fuel, it will make readers aware of the pros and cons of the financial implications both have, as well as the benefits renewable energy will have on the future of the country. This study will also educate readers on the different types of renewable energy South Africa is capable of executing and will contribute greatly to job creation and improving the economy.

According to Ember (2075:102), a global energy think tank, South Africa produces the most solar and wind energy per terawatt hour (TWh) in Africa. However, the share of renewable energy in our energy mix is very small. In 2021, solar contributes only 2% and wind contributes 3% (Ritchie, 2022). Building renewable energy makes sense for us in

South Africa. We have a fairly developed grid, so all that is necessary to generate solar or wind electricity is to link those sources to the grid. There is enough land in South Africa to build these power plants (Holmes, 2022). And perhaps more importantly, because South Africa has such excellent solar and wind resources, we can essentially build them everywhere in the nation without greatly reducing their efficiency (Holmes, 2022).

1.8 PROBLEM STATEMENT

The energy mix in South Africa contains very little renewable energy. This needs to be improved because the nation still depends heavily on coal. Increasing the use of renewable energy will reduce carbon emissions and move the nation toward a more sustainable future. But for the energy mix to include more renewables, research and development are crucial (Msimang, 2016).

As economies have advanced and populations have grown, global energy demand has also increased. Additionally, the energy mix has changed, with a shift towards sustainable sources. South Africa's energy mix is to be improved by 30% clean energy by 2025, all within a transformed and sustainable energy sector, according to the Department of Energy emissions (Abedian & Tsoanamatsie, 2021).

Global warming is primarily caused by fossil fuels. The burning of these fuels releases enormous quantities of greenhouse gases into the atmosphere, including carbon dioxide (CO₂). As a result, CO₂ traps an unnatural amount of heat in the atmosphere, leading to hotter temperatures, more droughts, more erratic rainfall, and an overall less hospitable environment (Nicoles, 2022).

Fossil fuels worldwide and in South Africa are causing issues and problems in the world that we live in. Fossil fuel prices are getting increasingly expensive, especially with the war that is going on between Russia and the Ukraine. Therefore, going the renewable energy route would be deemed best for the future. Through different types of gases and air pollution, global warming is becoming more and more a problem globally and locally. The problem is that fossil fuels are a lot more expensive to buy than to implement renewable energy. It has a negative impact on the environment, as well as a high influence on the carbon dioxide levels that are implicated (Marsh, 2018).

Thus, based on the aforementioned literature discussion, the identified problem cumulates to: the current lack of consistent electricity supply to South Africa at large – are renewables the solution? By implementing renewable energy in South Africa, increasing the share of renewable energy, additional research and development is required. Using renewable energy will reduce carbon emissions and lead to a more sustainable future for the country. The local government should implement new ideas and plans to ensure that renewable energy plays a major role in the unforeseen future of South Africa (Winkler, 2022).

1.9 RESEARCH OBJECTIVES

1.9.1 Primary objective

According to the problem statement, the primary objective of this study is exploring the viability of marketing renewable energy in South Africa to positively impact the inconsistent energy supply problem.

1.9.2 Secondary objectives

To achieve the primary objective, the following secondary objectives are set:

- Determine the different costs involved with the implementation of renewable energy.
- Identify different measures on how South Africa can capitalise on renewable energy.
- Identify alternative types of renewable energy to capitalise on
- Determining how marketing renewable energy can benefit South Africa in the long term

1.10 RESEARCH QUESTIONS

1.10.1 Primary question

Will it be viable to explore the marketing of renewable energy in South Africa?

1.10.2 Secondary questions

- What would the different costs involved be with implementing renewable energy?
- How can different measures be implemented on how South Africa can capitalise on renewable energy?
- What types of renewable energy can South Africa capitalise on?
- How can marketing renewable energy benefit South Africa in the long run?

1.11 RESEARCH METHODOLOGY

1.11.1 Research paradigm

Research paradigms are approaches or models that have been validated and applied for a long period of time and are considered the standard by a substantial number of researchers in the field (n.a, 2020:31). The paradigm that is being used in this study is interpretive (qualitative research). It is important to understand paradigm-specific assumptions, as they provide insight into how science is operationalised and what constitutes legitimate problems, solutions, and criteria for evidence. The roots of interpretivism are found in idealistic philosophy. The general phrase has also been used to combine schools of thought that disagree with the idea that meaning exists in the world independently of people's consciousness and interpretation, such as social constructivism, phenomenology, and hermeneutics (Nickerson, 2023). To better understand social interactions, interpretivism employs qualitative research techniques that place emphasis on people's beliefs, motivations, and reasoning rather than on quantitative data (Nickerson, 2023).

1.11.2 Research approach

Data that are not scaled down to mathematical figures are compiled, collected, and decoded as part of qualitative research (Anderson, 2010). By identifying the phenomena's socially constructed meanings and the context in which it happens, qualitative research aims to get a thorough understanding of a particular occurrence (Hennick *et al.*, 2010:84).

1.11.3 Methodological Choice

According to McCombes and George (2019:25), this section of a research methodology discusses and explains the method you use to collect and analyse your data. A methodology chapter is a crucial component of any thesis, dissertation, or research paper since it explains what you did and how you did it. Readers can use the methodology chapter to assess your research's reliability and validity.

1.11.4 Research strategy

A semi-structured interview guide was used. According to DeJonckheere & Vaughn (2018), this approach usually entails a conversation between the researcher and the participant, aided by a flexible interview methodology and enhanced by follow-up inquiries, inquiries into further information, and comments. The technique enables the researcher to obtain open-ended data, investigate participant thoughts, feelings, and opinions regarding a specific topic, and delve deeply into private and occasionally delicate matters.

1.11.5 Study population and sampling

A significant group of people or objects that are the focus of a scientific investigation is known as a research population. The goal of this research is to help the broader public. However, due to extremely large population sizes, it is occasionally impractical and costly for researchers to look at every member of the community. Because of this, researchers use sampling techniques (explorable, 2019:15). The population to be studied will be farmers in the North West Province who have a type of renewable energy on their farms.

Non-probability sampling is the practice of selecting people for inclusion in a sample without a guarantee that they will be chosen (Quinlan *et al.*, 2011; Tansey, 2007:322). The sample's main objective is to give researchers access to members of the population so they may do research on them and derive conclusions about the community as a whole. It is a lot like a give-and-take negotiation. The "provided" sample is from the population, which then "takes" implications from the sample's results (explorable, 2019:15).

Qualitative research will be conducted with a non-probability approach with purposive/convenient sampling. Non-probability sampling is the process of randomly choosing elements for which the likelihood of inclusion in the sample is unknown and possibly zero for some population elements (Wiśniowski, 2021). Costs are a major advantage of non-probability sampling over probability sampling. There are several reasonably priced approaches to draw and field non-probability samples. The most popular method is through volunteer web panels, where survey companies encourage many volunteers to participate in ongoing surveys (Wiśniowski, 2021).

In this study, the term "data saturation" will be used to describe the accumulation of qualitative data to a point where there is a feeling of closure due to new data that provide information that is repeated. Based on the saturation of data, this research will use a qualitative sample until it reaches saturation. This small sample size will help to create a more thorough description of the phenomenon being studied. The inclusion criteria consistently, dependably, uniformly, and unbiasedly identify the study population. The researcher will accept individuals of both genders, from different racial groups, and with different tenures. It will take around 16 individuals to reach data saturation. If throughout the interviews the saturation level is not reached, the process will be repeated till saturation point plus one. The researcher intends to recruit people who are diverse but not restricted because the major inclusion criterion will be developed according to the stated criteria. The exclusion criteria comprise elements or traits that exclude the population recruited for the study. These elements could affect the result parameter (Anaesth, 2016:640–645). The researcher will send an email or call the respected participants and ask permission for an interview. The accessibility to get data at the farms will be easy as the researcher lives in Potchefstroom so that will not be a problem.

1.11.6 Collection of data

Interviews can be done through Zoom and Microsoft Teams or in person. The interview guide can also be personally brought to the business and/or participants. Interviews can also be conducted face to face. This would be the best personally because of the

interactions you will have with the industry or the manager. Telephone interviews can also take place, sometimes participants can get very busy, and this is a quick and effective way to communicate. Fully analyse the data, every conversation will be recorded during the semi- structured interviews. After the study, documents such as informed consent forms and notes from the semi-structured interview will be kept on a Google drive. Transcribed data and electronic tape recorders are included in the electronic information that will be stored on encryption key computers with access limited to the study team using the data. On password-protected PCs, data will be downloaded, saved, and backed up as soon as is practical.

1.11.7 Data Analysis

Qualitative research frequently uses thematic analysis. It places a strong emphasis on identifying, deciphering, and understanding qualitative data patterns. Making sense of the data is an active reflexive process where the researcher's personal experience is crucial (Villegas, 2023). Figure 1 reflects a practical execution of the thematic analysis.

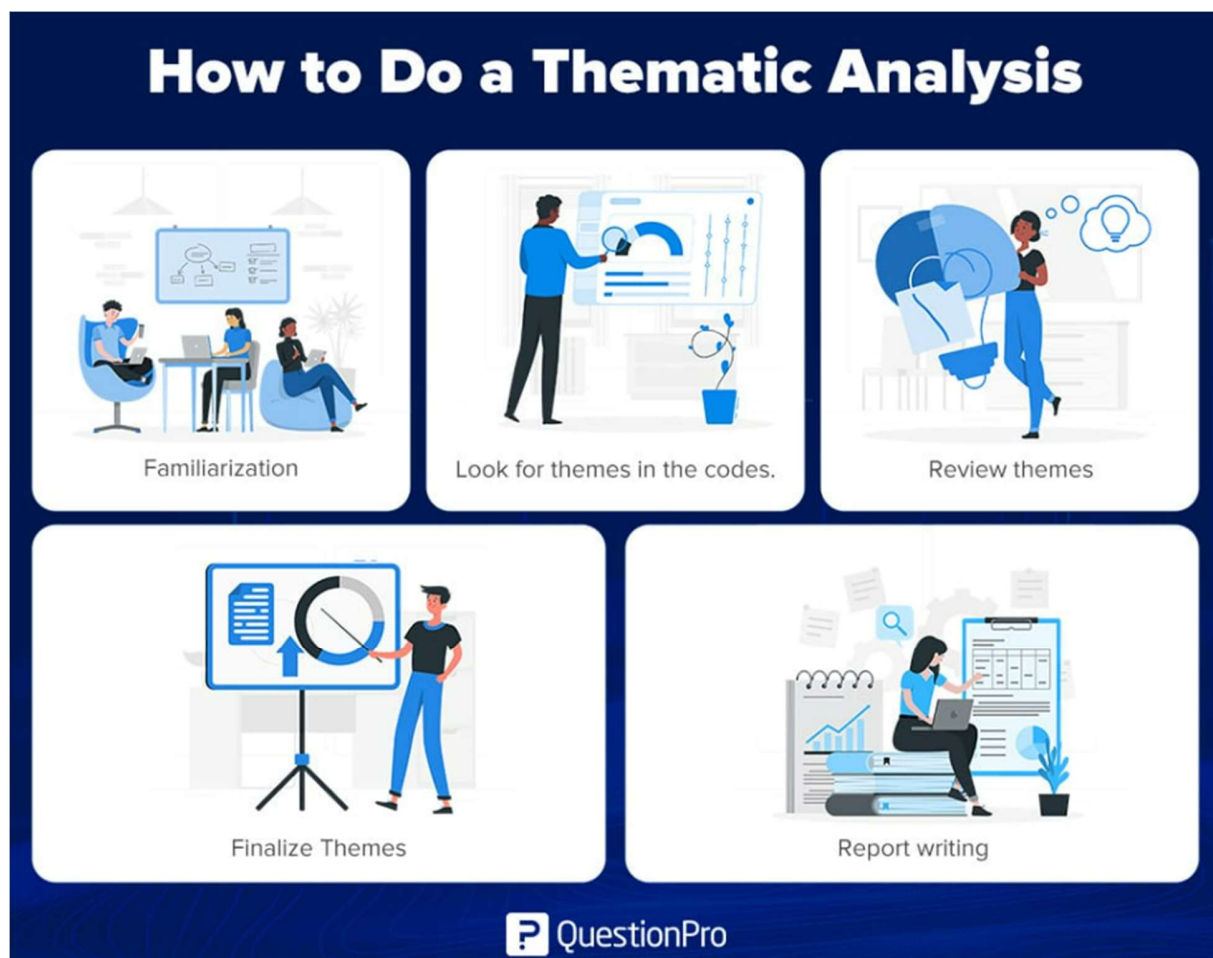


Figure 1: How to do a Thematic Analysis (Villegas, 2023).

1.11.8 Data rigour (Trustworthiness)

Research quality is assessed using concepts such as validity and reliability. Methodologies, methods, and tests demonstrate how well they measure something. Reliability is concerned with a measure's consistency, whereas validity is concerned with its correctness. Should consider reliability and validity when developing your study design, selecting your methodology, and summarising your findings, especially in quantitative research (Middleton, 2022:21).

When utilising scores or ratings to evaluate variability with something, it is crucial that your results appropriately reflect the real differences (including psychological qualities, degree of aptitude, or physical properties). Validity should be taken into account when

selecting data collection method from the very beginning of your research. Pick the most appropriate measurement methods. Validity is determined by how well a method evaluates what it is supposed to measure. High validity means that the findings of a study accurately reflect the characteristics, traits, and variability of reality. Valid measurements are characterised by high dependability. In most cases, an approach is invalid if it cannot be trusted (Middleton, 2022:21). The dependability of a procedure is measured by how frequently it makes assessments. If the measurement can consistently get the same result by using the same methods under the same circumstances, it is said to be dependable (Middleton, 2022:21).

According to the procedures and standards used to ensure rigour, trustworthiness is defined by four philosophical concepts that will serve as criteria to increase the value of research findings in this study (Cope & Amp, 2018; Kalantzis, 2014).

- Conformability - to check for consistency, compare the researcher's transcripts and coding to those of the supervisor. Meetings with the supervisor, transcriptions of the recordings, and independent coding are used to achieve this (Creswell & Amp; Creswell, 2018:314).
- Transferability - the ability of a study to be applied in different contexts and evaluated against other studies (Creswell & Amp; Creswell, 2018:314).
- Credibility - A capable study supervisor will analyse the study proposal before it is submitted for peer evaluation. Member - checking techniques will be used to ensure credibility, ensuring that the study's findings were reliable or credible (Creswell & Amp 2018; Creswell, 2018:314).
- Dependability - to reach consensus on the study's issues, data analysis and talks with the research leader will be conducted. The study will evaluate consistency and check to see if the findings can be repeated (Creswell & Amp 2018; Creswell, 2018:314).

1.12 Ethical Considerations

The protection of the rights of all the people involved in the study is one of the most important parts of the research. To protect participants from unjustified deceit, researchers must ensure that data are acquired fairly and ethically.

1.13 Informed consent

According to Bryman and Bell (2007), the arguments characterise some of the most significant values related to ethical considerations in dissertations.

All affiliations, funding sources, and any conflicts of interest must be disclosed. Any form of communication on the study should be done in an honest and open manner. Avoiding false information of any kind and biased reporting of primary data findings is essential. It is necessary to ensure that the privacy of the research participants is protected. Remove any identifying information and use pseudonyms or codes to anonymise the data. Keep people and organisations' identities hidden by using generic terminology or identities when referring to studies or research participants. Don't divulge any private or delicate information that can jeopardize their privacy. The confidentiality of the study data should be adequately protected. It is necessary to ensure the anonymity of people and organisations participating in the research. To be sure the information is reliable, check the writers' credentials and the publication venue. Avoid lying or exaggerating the research's goals and objectives in any way. It is crucial that respondents participate voluntarily in the study. Additionally, if they choose to, participants are free to leave the research at any time.

1.14 SCOPE OF THE STUDY

1.14.1 Field of study

The field of study will be environmental science and renewable energy to see if renewable energy will be more practical compared to fossil fuels. Investigating the use of different types of renewable energy by companies and the progress in South Africa.

1.14.2 Sector under investigation

The sector under investigation will be the energy sector. The focus will be on how South African companies and the government can adapt to renewable energy, how each can implement the use of renewable energy and reduce the use of fossil fuels.

1.14.3 Geographical demarcation

Renewable energy in rural commercial activities plays a huge role in how farmers can take advantage and, at the same time, be a role player for the environment and local suburbs. The North-West province in South Africa will be looked at and how the province with some local and national industries will tackle renewable energy. Farmers in the North-West with renewable energy will be looked at.

1.15 CONTRIBUTION OF THE STUDY

The theoretical contribution of the study will be the focus on new and adapting technology changes within the country. However, there are new and modern ways in the renewable energy route, for example, hydro solar power. The new adaptive technologies will also simplify tasks at hand for the different sectors. Second, the industry contribution of the study will greatly affect different businesses that apply renewable energy in their workspace, since they will not have load shedding in the future and will be a supplier of power to themselves. Furthermore, workers need to be educated on how to work/manage these technological changes and how to operate the different factors as well. In this way, organisations will remove the fear of load shedding and will have the power to operate daily without the hassle of time and money going down the drain.

1.16 LIMITATIONS OF THE STUDY

First off, the research approach that is being used is qualitative, and will employ non-probability sampling, which will yield outcomes that are representative of the whole population and can limit the research in some intent. With only farmers in the North-West province being taken into consideration. Weather factors (geographical demarcation) can also be included as a limitation, because, for instance, in Cape Town the wind is stronger as in Gauteng, and that can include that more wind turbines are installed in the western Cape as for Gauteng. Furthermore, the study will only be focused on the North-West

province, that limits more info that could be attained in the whole of South Africa with its different regions.

1.17 LAYOUT OF THE STUDY

Chapter 1 – Nature and scope of the study as well as an overview of the introduction.

Chapter 2 – Literature review.

Chapter 3 – Research methodology as well as the research paradigm, approach and strategy will be discussed.

Chapter 4 – Empirical study, such as the study results and the overview of data representation.

Chapter 5 – Conclusion & recommendation.

1.18 TIME FRAME

Table 1: Suggested Timeframe of the Study

Task name	Duration
Scope and nature of the study must be completed	14 days
Apply for ethical clearance	22 days
Literature review on renewable energy vs fossil fuels must be completed	50 days
Evaluate the success of the literature study	52 days
Produce research measurement instruments	40 days
Completion of the empirical study	30 days
Distribution of the questionnaires to participants	22 days
Waiting for the answer of the participants	30 days
Conduct meetings	34 days

Send interviews to the respondents for statistical analysis	60 days
Recommendations & conclusions must be completed	40 days
Submitting of the dissertation	100 days
Total	524 days

CHAPTER 2: LITERATURE STUDY

2.1 INTRODUCTION

In this chapter, the impact of electricity in South Africa through the years will be evaluated, considering the different effects it has on the country. How load shedding started, will be visited, the causes it has on society as well as new projects the country is boasting with renewable energy. The diverse types of alternative energy and how it can better impact South Africa in the future will be contemplated as a means to understand the implication of electricity.

2.2 SOUTH AFRICAN ELECTRICITY INDUSTRY

According to the International Trade Administration (2023), coal-fired power stations generate approximately 85 percent or 42,000MW of South Africa's electricity. Despite environmental concerns, coal will continue to provide most of South Africa's electricity for the next decade (*circa 2023 – 2033*), although the share of renewables will grow rapidly. In terms of greenhouse gas emissions, South Africa ranks 14th in the world in 2023 and it seeks to improve its poor environmental performance (International Trade Administration, 2023).

In order to meet social, economic, political, and environmental demands, South Africa's energy policy, with a particular emphasis on the electricity policy, has undergone constant change (Thopil, 2021:254). South Africa is frequently viewed as a paradox because of its high rates of unemployment, income inequality, and slow economic growth, as well as its first-class transportation and infrastructure (Thopil, 2021:254). The burden of this paradox has fallen on the shoulders of the nation's government, which must simultaneously meet the demands of an energy-intensive economy while addressing the socioeconomic needs of a sizable population (Thopil, 2021:254).

Eskom's coal supply has degraded in recent years, resulting in a decline in the annual average energy availability factor (EAF) from 94% in 2002 to 53% in 2022 (Greencape, 2023:26). According to the utility's most optimistic scenario, this can be increased to 69% by 2030, but it is more likely to remain at 60% for the remainder of the decade. As a result of historic underperformance and delayed commissioning of new generation, there has

been a supply and demand imbalance and load shedding across South Africa (Greencape, 2023:26).

In the next sections, the electricity industry in South Africa will be discussed, with a view at the origins of electricity and electricity through the decades (*circa* 1806) up to the current period of 2023 in South Africa.

2.2.1 Origins of the electricity industry in SA

The development of the diamond and gold mining industries in South Africa fuelled the growth of the electricity industry (Ebhard & Mtepa, 2003:80). Kimberley, the first largest diamond mine, had electric streetlights in 1882 (before London, England), and most of South Africa's major cities were reticulated during the 1890s (Ebhard & Mtepa, 2003:80). The Victoria Falls Power Company Ltd. (VFP) was founded in 1906 with the goal of harnessing the Victoria Falls' hydroelectric potential, to supply the demand for energy in Johannesburg and Southern Rhodesia (Zimbabwe) (Ebhard & Mtepa, 2003:80). Due to technical and budgetary constraints, the business focused on coal-fired power plants, which eventually became the major electricity generator in the region (Ebhard & Mtepa, 2003:80).

Even though Eskom's main purpose was to deliver cheap electricity (early 1900's) to railways and mines, its mandate was not to make money. It made cheap power available to the growing mining, transport, and manufacturing sectors of the South African capitalist economy through Eskom (Brink, 2022). In 1948, Eskom became a vertically integrated state utility, responsible for generating, transmitting, and distributing electricity after gradually taking over private, independent power stations (Brink, 2022).

Serve as the contextualisation of the history of electricity: According to Lennon (2007), South Africa developed its first electric power plants more than a century ago in order to support the mining industry. Victoria Falls Power Company was established in 1909 after most of the mines used generators on site. Eskom began supplying electricity to the country's railroads and non-mining industries in 1923 (*circa*). Since 1948, Eskom has been the country's main power producer. It was bought by the Victoria Falls Power Company in 1948 (Lennon, 2017). It took until the 1960s for a national grid to replace the

high-voltage transmission lines that connected the undertakings in the late 1950's and 1960's (Llyod, 2012:02). Consequently, the various undertakings were able to centralise their operations. Furthermore, Eskom discovered that it could service many rural customers, thus establishing a diverse distribution system. Municipalities distributed power to the cities, while Eskom serviced rural areas and transmitted power to the cities, as well as a few major industries whose electricity demand was similar to a city's (Llyod, 2012:02).

2.2.2 Evolution of the industry

Renewable energy sources and sustainable practices have been increasingly emphasised in a concerted push for diversification. An efficient, inclusive, and environmentally friendly electrical industry is undergoing a similar evolution in South Africa.

2.2.2.1 Early 1900's

Businesspeople and engineers began to embrace the idea of a central electrical project. On October 17, 1906, the Victoria Falls Power Company Limited (VFP) was founded. This business was established in Southern Rhodesia, which is now Zimbabwe. To meet the growing electricity needs of the burgeoning industries of Witwatersrand and southern Rhodesia, the VFP planned to harness the power of Victoria Falls. This plan was withdrawn due to technical and economic issues. The Victoria Falls and Transvaal Power Company Limited was given a new name three years after the VFP was founded. The newly renamed business, which continued to operate under the name VFP, focused all its activities around the extraction of coal from the Transvaal Colony (Eskom, n.d).

Expert opinion suggested that large central power plants would provide more reliable and affordable electricity than tiny, specialised power plants shortly after the Anglo-Boer War. In 1906, The Rand Central Electric Works Ltd. and The General Electric Power Co. Ltd. were acquired by the VFP. The VFP established a subsidiary firm in 1908 called the Rand Mines Power Supply firm. This business would provide the Herbert Eckstein Group and the Rand Mines Group with energy and compressed air (Eskom, n.d) The combined

installed capacity of the four VFP thermal power plants at Brakpan, Simmerpan, Rosherville, and Vereeniging by 1915 was more than 160 megawatts. A system control center was set up in Simmerpan. This now serves as the national command center for Eskom's entire transmission system (Eskom, n.d)

According to du Toit (2019), a requirement for affordable electricity is at the center of the company's mission in its first annual report dated August 9, 1924. The Commission believes that cheap power is one of the most important factors in promoting industrial development and has devoted and will continue to devote the highest level of attention to this aspect of its duties and responsibilities under the Electricity Act (du Toit, 2019).

2.2.2.2 1950 to 1980

Early in 1950, Eskom bought the Kimberley Central power plant from De Beers, and it started serving the new Cape Northern Undertaking as its only supplier. This project proved that Eskom had a duty as a national power utility to provide electricity to rural areas because it covered an area of 40 000 km², which is nearly the size of Switzerland (Eskom, n.d). Thus, the Rural Electrification Department was founded in December 1951 to offer electricity to small clients beyond municipal supply regions. The Vaal Power Station's commissioning was postponed due to World War II. By 1952, it was finally operational (Eskom, n.d). Due to the disruption of commercial shipping, Eskom was forced to operate without critical equipment. A German submarine attacked a ship carrying a triode generator set bound for the Congella power plant. Numerous initiatives must be permanently halted. The Free State's Klerksdorp/Kimberley region and the Free State goldfields were both served by the first power plant, which was inaugurated in 1953. Three generators were devoted to the former, and the rest (nine) to the latter. When Salt River 2 began to operate in 1955, Cape Town's supply increased. West Bank 2 in East London increased the town's supply by 85MW in 1956 (Eskom, n.d).

During the mid-1970s, Eskom's costs began rising due to developments in the international economy, such as the global energy crisis. At the same time, Eskom continued to build massively to meet the growing demand for electricity. Another motivation was the government's determination to build South Africa's energy as self-sufficient at a time when international sanctions were imposed against apartheid South

Africa. New coal-fired plants, as well as Koeberg, South Africa's only nuclear plant, were included in the new build program (van Niekerk, 2021).

Technology was the big X factor in solving difficulties and realizing aspirations, as is typically the case for a power provider. For Eskom, the idea of a national grid finally materialized in the late 1960s and early 1970s. Transmission technology was sufficiently advanced. Now, 275kV and 400kV long transmission lines were feasible. In order to create the ideal pool, Eskom took considerable measures to develop an interconnected network. The huge price gap between coal in the Eastern Transvaal and the Cape (R2 per ton versus R7 per ton) played an important role in the progress. Eskom started building the network in 300 km segments in 1969 (Eskom, n.d).

2.2.2.3 1981 to 2000

In the early 1980s, Eskom planners estimated that the demand for energy would increase by 7 to 8% annually. Due to the nature of compound growth, at such a rate, the capacity must be doubled approximately every ten years. Eskom planned three large power plants, Matimba, Majuba and Kendal, were planned by Eskom in order to meet the anticipated demand. Even though in the early 1980s everything was slowing down. According to Eskom Chairman, Jan H Smith, it was just transitory, therefore, construction of massive power plants continued unabated. The situation for Eskom hit rock bottom in 1983 when its power plants had an average availability of 72% and supply disruptions were widespread (Eskom, n.d)

In 1987, Eskom officially changed its name from ESCOM to Eskom, but the 1990s were an era of unprecedented growth. South Africa had one of the lowest electricity prices in the world in 1994 due to ESKOM's "spare" capacity of 31%. In addition to not being involved in a new build program, ESKOM was able to access cheap coal through long-term supply contracts (Brink, 2022). The provision of electricity to rural and previously underserved populations was emphasised. Eskom was involved in more projects in the developing world and took on a bigger role in Africa as a result of the formation of Eskom Enterprises (Thopil, 2021:254).

There was also progress being made there. The first Koeberg unit was synchronized with the grid in April 1984, and unit 2 did likewise in 1985 (Eskom, n.d). The southernmost nuclear power facility in the world, Koeberg, boasts the largest turbine generators in the southern hemisphere. Eskom worked incredibly hard in the 1990s to do its bit in providing power to the populace. In 1993, three-hundred-thousand homes across the nation were electrified (two thirds by Eskom and the remaining third by local municipalities). Eskom and municipalities had a total of 450 000 connections by 1995, and there were 500,000 by 1997 (Eskom, n.d). By estimation, a household has six members on average, then around three million South Africans were joining the grid each year and benefiting from the rise in living standards that came along with it (Eskom, n.d).

2.2.2.4 2001 to current

Eskom's Board of Directors made "a final decision" to restart Camden, Grootvlei, and Komati in 2003 after determining that South Africa will certainly experience an electrical crisis. This decision was made at the worst possible time since peak demand increased from 31,928 MW in 2003 to 34,195 MW in 2004. However, the political trend at the time was toward adding more people to the grid rather than boosting generation. By 2004, millions of South Africans were living better lives because of this electrification campaign (Eskom, n.d).

New York's Global Energy Awards Ceremony named Eskom the Financial Times Power Company of the Year in 2001. As part of this program, low-grade coal is burned in economic, efficient, and safe methods, providing the world's lowest-cost electricity (du Toit, 2019)

Ankerlig (Atlantis, close to Cape Town) and Gourikwa (Mossel Bay), two gas turbine plants, entered commercial operation (first phase) in 2007, although this was not nearly enough to compensate for the shortage. The stations used an open-cycle gas turbine (OCGT) that ran on diesel, a highly pricey fuel source, and were built to handle Western Cape peak demand (Eskom, n.d).

The first 765kV line structure between Majuba and Umfolozi was completed in July 2010. Malusi Gigaba, the minister of public enterprises, and Brian Dames witnessed a

significant boiler erection milestone at Kusile Power Station on November 19, 2011. The final stage of the pressure test on the boiler of the first unit of the Medupi power station was started by President Zuma on June 8, 2012, and on October 31, the energy minister, Dipuo Peters, announced that her department had signed 20-year contracts with 28 preferred independent power producers (IPPs) for the supply of 1 425 MW of renewable energy into the grid (Eskom, n.d).

Unit 5 of Komati was commissioned on the 3rd of February 2012. On March 5th, 2012, its unit 6 was commissioned. Unit 5 of the Arnot power station's capacity increase was also put into service, adding an additional 255 MW to the grid. Eskom's plea to reduce the planned April 2012 rate hike from 25.9% to 16% was granted by NERSA in March. Eskom submitted its MYPD 3 proposal to NERSA on October 18th, 2012, proposing a five-year period for price setting starting on April 1, 2013 (Eskom, n.d).

In the following section, loadshedding and its impact on the South African economy will be discussed.

2.2.3 South African “Loadshedding”

Load shedding is a technique used by energy utilities to reduce demand on the energy generation system by momentarily turning off the energy supply to specific geographic areas (Western Cape Government, 2019 – 02). Load shedding is only used when the system cannot meet all energy demands and is done to manage the energy that is still available as efficiently as possible to keep the system stable. To spread the effects, it is done in a rotating fashion (Western Cape Government, 2019 – 02). Load shedding happens because of unanticipated plant malfunctions, frequently while other generating units are offline for scheduled maintenance. Eskom starts up emergency power generators to generate electricity using pricey diesel as the gap between demand and supply starts to close and may ask large users to start cutting back (Cronje, 2019).

2.2.3.1 Initial loadshedding implementation (2008)

According to (Joffe, n.d:32) as much as loadshedding was created by policy and regulatory uncertainties during the previous decade, the 2008 power crisis was also the result of flaws in power system management. According to government policy in the late

1990s and early 2000s, Eskom should not build any new power stations since the electricity supply industry should be open to competition. However, private sector participation was not supported by policy and regulatory frameworks. Additionally, electricity tariffs were not at levels that would have made investment in the sector attractive to private investors (Joffe, n.d:32).

Crime has an impact through loadshedding, with businesses and households being concerned because it is known that there is a correlation between power outages and an uptick in crime (Egan, 2023). Higher-income areas have seen an increase in crime, but lower-income areas are also seeing an increase in crime. Without backup power systems, homes or businesses are particularly vulnerable because their alarm and/or closed-circuit television (CCTV) systems are not always operational. Security firms have also claimed that thieves might be exploiting security systems that have been harmed by ongoing power outages (Egan, 2023).

2.2.3.2 Post 2008 load shedding's effect on the South African economy

Load-shedding has lowered the potential size of South Africa's gross domestic product (GDP) by about a fifth. Eskom, the state-owned energy company, implemented rotational blackouts on more than 200 days in 2022 and nearly every day of the year 2023, due to the inability of its outdated and badly maintained plants to meet demand. The central bank predicts that the energy crisis will reduce growth in the year 2023 by a rate of 2 percentage points (News 24, 2023).

Since 2008, Eskom has made significant progress toward stabilising the power system due to the economic recession that initially provided space for recovery. Coal stockpiles have been rebuilt, some new capacity has been added to the grid, and a Demand Side Management program has been implemented, which has resulted in electricity usage reductions. The grid has also gained some capacity from independent power producers (IPPs) (Joffe, n.d:32). Both the quality and availability of the telecommunications network have been impacted. While MTN has deployed more than 2,000 generators and uses more than 450,000 gallons of diesel each month, Vodacom has spent more than 2 billion rand on batteries (Bloomberg, 2023).

According to Lungile Mashele, sector specialist for energy and infrastructure at the Public Investment Corp., outages can be expected every week in 2023 and the prospects for economic growth will be bleak if the situation with inadequate electricity generation is not addressed. Because its outdated and badly maintained plants cannot keep up with demand, state-owned utility ESKOM has enforced rotational blackouts on more than 200 days in 2022 and nearly every day in 2023. (News24, 2023).

2.2.3.3 Electricity demand and population growth

According to (IEA, 2023) there are many options for changing the country's electricity mix, one major concern and potential barrier to diversification is the cost of the electricity supply. With the richest 20% of the population accounting for more than half of the total, consumption and electricity spending are skewed toward higher income groups. In a recent survey by the Department of Energy, three-quarters of South Africans said that lowering electricity prices should be the top priority for the government's energy policy. Economic considerations outweighed other priorities by a significant margin (IEA,2023).

Increasing electricity generation is necessary to meet the growing demand for electricity caused by economic growth due to the positive relationship between economic growth and electricity generation. To grow an economy, electricity is necessary. Electricity is the backbone of an economy. As economic growth increases, firms, households, and other sectors of the economy expand their activities. Almost every industry in the economy depends on electricity for its daily operations, including primary, secondary, and tertiary (Daw & Hlongwane:374).

2.2.3.4 Correlation with industry

According to (Lawlor, 2023) since ESKOM's energy availability factor (the difference between the maximum availability and all unavailability's) dropped to 50.4% in December 2022, there have been more days of load shedding than ever before (Lawlor, 2023). In the third quarter of last year (2022), load shedding decreased quarterly GDP by 2.1%, with agriculture, forestry, and fisheries suffering the greatest losses, according to the most recent Reserve Bank data (Lawlor, 2023). Estimates for the fourth quarter have not yet

been made public but given that load shedding took place on all but three days in that quarter of the year, the impact may probably be greater.

2.2.4 Alternative energy

2.2.4.1 Contribution/use of alternative energy

Households

The large decrease in electricity prices is one of the most important advantages of solar energy for South African households. The cost of traditional power has been continuously increasing, straining household budgets. Homeowners can generate their own electricity and offset a sizable percentage of their energy consumption from the grid by installing solar panels. Solar energy systems harness the power of the sun to turn sunlight into usable energy for your home. This implies that during the day, when the sun is shining, your solar panels generate electricity to power your home's electronics, including lighting and appliances. Your dependence on electricity from the grid is reduced as a result, which lowers your energy costs (GC Solar, 2023).

With recent technological advancements, solar panels are now even more reliable and long-lasting. Tempered glass and premium metal frames, two components utilised in the production of solar panels, add to their durability and resilience to environmental elements. The efficiency and dependability of solar panels have also grown due to advances in cell technology and manufacturing procedures, increasing their energy output (GC Solar, 2023).

Mining

Since miners were obliged by ESKOM to reduce electricity usage by 15% when ESKOM imposed intermittent Stage 5 and Stage 6 load-shedding throughout the nation late 2022, the sector has reportedly performed reasonably well throughout the current load-shedding crisis, according to the Minerals Council (Lawlor, 2023).

For example, the mining industry's output decreased by 3.7% in the final quarter of 2022. Representatives from the platinum industry stated at the recent Mining Indaba in Cape Town 2023 that they were able to manage the effects of load shedding up to level six, but

that after that it would become a significant problem with the danger of shaft closures and job losses. The difficulties faced by mining enterprises have increased as a result of heavy rainfall in the fourth quarter of 2022 (Lawlor, 2023).

Production

10.5% of the total electricity produced in South Africa in 2020 came from renewable sources. As more Eskom coal plants reach their production phase, after maintenance, this will have increased to roughly 11.5%. Coal continues to be the main energy source in the nation, it lags the worldwide trend toward clean energy by a wide margin (Winkler, 2022).

Farming

Load shedding may also influence the storage, transportation, and production of food in South Africa. The Agricultural Business Chamber of South Africa (Agbiz) claims that ongoing load shedding has already harmed production. In a January article, Agbiz Chief Economist Wandile Sihlobo noted that load shedding's effects are being felt across a wide range of sectors, including irrigation-dependent field crops, fruits, and vegetables. Irrigation is used to generate approximately 20% of maize, 15% of soybeans, 34% of sugarcane, and almost half of the wheat crop. (Lawlor, 2023). Production of red meat, poultry, pigs, wool, and dairy products requires constant power for routine operations. Similar difficulties are encountered in downstream activities such as milling, bakeries, abattoirs, wine processing, packaging, and animal vaccine manufacture (Lawlor, 2023).

Short-rotation coppice biomass production ideas include the testing of new techniques and the development of innovative harvesting and conditioning equipment. Testing small-scale options for the self-consumption of energy from woody side streams on farms on a small scale, exploring technological options for mobile heating units (for seasonal grain drying, for example), testing and assessing energy storage and control systems for farm operations that require energy consumption (heating, ventilation, lighting, feed preparation, etc.), based on farm type (epi-agri, 2019:1).

"Exporting agribusinesses, especially those with products highly sensitive to delays, such as fruits, red meat, and wine, are also concerned about port activities, which, fortunately,

have not been primarily affected," Agbiz said. Due to the delay in agricultural production phases, there are also concerns about food security. The effect of load shedding will likely be visible in the quantity of items to be harvested or produced in the upcoming months of October, November, and December 2023 (Lawlor, 2023).

2.2.5 Current application

2.2.5.1 Cape Town as a case study

Cape Town has established itself as South Africa's main hub for green technology. Companies that manufacture solar panels, wind turbines, electrical equipment, fuel supplies, professional services, and support organisations all have their headquarters in Cape Town. Between 2008 and 2017, there were R5 billion in foreign direct investment in the renewable energy sector, including 18 new projects. AEG Power Solutions, Siemens, and IBC Solar are a few of the well-known businesses having regional offices (WECP, n.d).

The three Hydrogen South Africa (HYSA) institutes, Hydrogen Catalysis at the University of Cape Town, HySA Systems at the University of the Western Cape, and HySA Infrastructure at North-West University are located in the city and provide local research and development capacity. These were established by the Department of Science and Technology (DST) in 2007 to support South Africa's involvement in the emerging international fuel cell and hydrogen platform market. They focus on finding ways to utilise South Africa's mineral resources to advance the hydrogen economy and the utilisation of renewable energy sources (WECP, n.d).

Cape Town now allows electricity users who own small-scale embedded generators (like rooftop solar PV systems) to contribute power back into the grid. You will sell the city the extra electricity and the city will give you a credit against your future electricity bills. Learn more about the use of solar power and the redistributing of electricity (City of Cape Town, 2023). The technology to produce electricity from wind is quite advanced, and increasingly grid-connected wind farms are popping up all over the nation. When the City joined the Darling Wind Farm (DWF) in 2002, it started looking at wind energy. The

strategy for renewable energy has been shaped by the lessons learnt from Darling Wind Farm (City of Cape Town, 2023).

2.2.5.2 Frankfort

During a record-breaking energy crisis, the Free State town of Frankfort is furious after a court dispute with a state-owned utility prompted its solar facility to dump desperately needed electricity. To alleviate the effects of severe statewide power outages that can last up to 12 hours per day, the farming town of approximately 5,800 inhabitants, 140 km south of Johannesburg, began using locally produced energy in February 2023. However, it did not sit well with the troubled monopoly ESKOM, leading to a legal battle that the company won in February 2023 on a technicality, forcing locals to suffer through power outages alongside everyone else (News24, 2023).

Hans Pretorius, a local cereal farmer who cultivates cereals and depends on electricity to run the irrigation system, said: "If they are not going to let us use the solar... or to use our own electricity, we have no choice; we will have to take the law into our own hands." (News24, 2023)

2.2.6 Renewable energy projects planned for South Africa

2.2.6.1 Hydrogen Valley

According to Jackwell Feris of Cliffe Dekker Hofmeyr (CDH), a commercial specialist, the "Hydrogen Valley" initiative is a shining example of how to move toward a low-carbon economy (BusinessTech, 2023). Over the next five years, R1.5 trillion will be invested in the South African economy through the Just Energy Transition Investment Plan in innovative sectors such as electric vehicles, green hydrogen, and renewable energy (BusinessTech, 2023). A planned integrated hydrogen ecosystem known as the "hydrogen valley" will run from Mokopane, where platinum group metals are extracted, to Johannesburg and conclude in Durban. Several feasibility assessments were carried out in 2021 after it was first proposed in 2020. The valley, which will eventually cover 835 kilometres, will offer enormous job and investment prospects, and contribute to the overall goal of reducing the reliance on coal (BusinessTech, 2023).

Green hydrogen has the potential to decarbonise a number of industries, including transportation, business, and power generation. Green hydrogen is a zero-emission fuel created through electrolysis using renewable energy sources. Because renewable energy sources such as solar or wind are used to fuel the electrolysis process, hydrogen is considered to be "green." Feris asserted that the South African Hydrogen Valley project has the potential to considerably strengthen the nation's economy. According to an independent feasibility analysis, the project may increase South Africa's Gross Domestic Product (GDP) by anywhere from \$4 billion to \$9 billion (about R70 billion to R160 billion at the current exchange rate) (BusinessTech, 2023).

By generating new jobs and possibilities in the renewable energy sector, this increase in GDP could not only give the economy an immediate boost, but also long-term, sustainable growth, according to Feris. However, according to market research, South Africa would need to make investments totaling over \$14 billion to develop the sector. Many of us first heard about green hydrogen in 2022, and as we move into 2023, we anticipate the need to offer additional details on the myriad legal and regulatory issues pertaining to an industry that is fast expanding. The Hydrogen Valley has been discussed since 2020. Precedence Research projects that the market for green hydrogen would reach an estimated value of \$89 billion by 2030, growing at a compound annual growth rate of 54% between 2021 and 2030. The construction of a new Sasol facility at Boegoebaai in the Northern Cape, the Prieska Power Reserve in the Free State, and the Hydrogen Valley initiative in Limpopo, Gauteng, and KwaZulu-Natal are just a few of the ongoing projects, according to Feris (BusinessTech, 2023).

2.2.6.2 Seriti coal mine wind farm project

In order to build Seriti Green's bigger renewable energy project aspirations, which include developing the capacity for 3000 MW of renewable energy (including wind and solar energy) over the course of the next ten years, the signing of the PPA and the creation of this first wind farm represent a significant initial step (Seriti, 2023).

The 155 MW Wind Energy Facility is the initial component of the Ummbila Emoyeni renewable energy complex, which spans 900 MW and is situated in Mpumalanga between Bethal and Morgenzon. 750 MW of wind energy facilities and 150 MW of solar

PV plants make up Ummbila Emoyeni. The Department of Public Works and Infrastructure has classified the entire project as a Strategic Integrated Project (Seriti, 2023)

Once built, the wind farm will convert more than 75% of Seriti's current coal operations' energy needs into renewable energy, reducing the company's Scope 1 and 2 Greenhouse Gas (GHG) emissions and moving it one step closer to carbon neutrality. Scope 2 relates to indirect emissions, such as those caused by the purchase of energy from ESKOM, while Scope 1 refers to emissions from processes at the mine site. (Seriti, 2023).

2.2.7 Current status with alternative energy

2.2.7.1 Hydro Coastline

Roughly 90% of South Africa's technically possible hydropower potential, or roughly 14,000 GWh / year, has previously been harnessed. 4,750 GWh of electrical energy, or about 2% of the country's supply, are produced annually by 3,586 MW of hydropower, including 2,832 MW of pumped storage capacity. New pumped storage power feasibility studies are now available, and 100 MW of small hydropower can also be created. Along the shore, there is also the opportunity to use marine energy for tidal turbines in the east and wave power in the south and southwest (Andritz, n.d).

2.2.7.2 Hydro electricity

Gariep Dam and Vanderkloof Dam are hydroelectric power stations operated by Eskom. This power station is most important in South Africa because it provides electricity when unexpected demand arises, or when one of the regular power stations experiences sudden operational disturbances. Peaking power stations are hydroelectric plants that produce electricity at times when demand is high. A major source of energy in mountainous countries is hydroelectricity (Centre for Renewable & Sustainable energy studies, 2018:04).

During periods of low electrical demand, a reversible/two-way pump turbine pumps water from the lower reservoir to the upper reservoir. To pump water to a mountaintop reservoir, surplus electricity is available at night or on weekends during low-demand periods. Besides stabilizing the grid, these dams also contribute to its stability. In addition to peak

periods, off-peak periods must also be maintained (Centre for renewable & Sustainable Energy Studies, 2018:04).

2.3 CONCLUSION

In conclusion, the South African electricity industry has had its fair share of difficulties throughout the years and decades. From Eskom being a powerhouse in the 1900s, to loadshedding from 2007 onwards. Eskom surely has taken its toll. There is, however, a positive aspect, as South Africans (households, farmers, production factories, and the mining industry) are implementing different measures in how they can stop loadshedding that is causing problems in their respective lives. That is through renewable energy.

Alternative energy sources have played a critical role in lowering the industry's dependence on fossil fuels and mitigating environmental concerns. Solar and wind farms, as well as measures to harness hydropower and biomass, have not only increased grid capacity but also established South Africa as a regional leader in renewable energy production.

Eskom is trying to regulate the usage of electricity in South Africa, and they are busy with projects such as the Seriti Coal Mine wind farm project and the Hydrogen Valley project, in order to promote the long-term usage of renewable energy in South Africa.

CHAPTER 3 – RESEARCH METHODOLOGY

3.1 INTRODUCTION

The purpose of the research methodology was to solve a problem in a systematic scientific manner. A research methodology describes how researchers do their work of explaining, describing, and making predictions. (Goundar, 2012:10). It also refers to the study of methods for gaining knowledge. Its aim is to provide the research work plan (Goundar, 2012:10). According to (Indeed, 2023), research methodology provides scientifically sound findings and legitimacy to research. In addition to keeping researchers on track, it makes the process smooth, effective, and manageable. By understanding the researcher's methodology, the reader can gain a better understanding of how the researcher reached the conclusions he did (Indeed, 2023).

The primary research objective of this study was to explore the viability of marketing renewable energy in South Africa.

To achieve the primary research objective, the following secondary research objectives were established: determine the different costs involved with the implementation of renewable energy, implement different measures on how South Africa can capitalise on renewable energy, types of renewable energy on which South Africa can capitalise, and determine how marketing renewable energy can benefit South Africa in the long term.

3.2 RESEARCH PROBLEM AND PURPOSE

The purpose of the research was to promote the effective marketing of renewable energy in the North-West Province of South Africa. Solar, wind, and biomass resources are abundant in the North-West Province of South Africa. However, renewable energy sources have been underutilised and under adopted in the region compared to their potential. Electricity shortages and loadshedding also play a role in the daily lives of people and leave them frustrated and angry. Having loadshedding daily on the farms, causes some farmers a setback in productivity. Thus, with the help and proper usage of renewable energy, farmers can rely on their own use of power, and so forth contribute to an environmentally friendly atmosphere.

3.3 RESEARCH DESIGN

The design emphasised in this study is qualitative design. Research design refers to the framework used by researchers to choose methods and techniques for a study. Researchers can refine research methods suited to the subject matter and set up their studies for success by using the design (Bhat,2023). There are five steps to follow when conducting a research design. Table 3.1 illustrates the steps of a research design below.

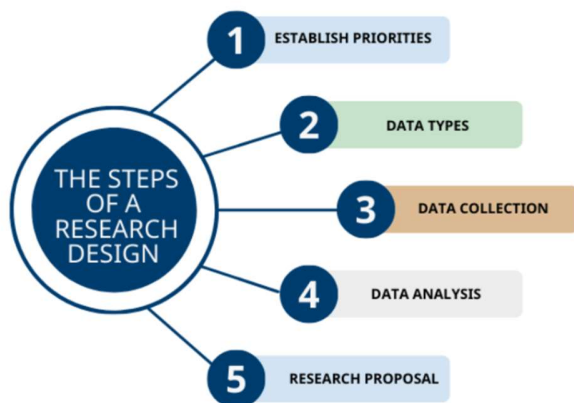


Table 3.1 The steps of a research design

Source: Bets (2023).

3.3.1 Research approach

In qualitative research, data that are not scaled down to mathematical figures, but rather assembled, collected, and decoded (Anderson, 2010). Qualitative research tries to gain a full understanding of a specific occurrence by identifying the phenomenon's socially constructed meanings and the context in which it occurs (Hennick, Hunter, & Bailey, 2010:84).

Focused on multiple techniques, qualitative research takes an interpretive, naturalistic approach to its subject matter (Aspens & Corte, 2019:142). Accordingly, qualitative researchers investigate phenomena in their natural environments with the goal of explaining or interpreting occurrences in terms of the meanings that individuals assign to them. A range of empirical materials, including case studies, first-hand accounts,

introspective narratives, life stories, interviews, observational data, historical accounts, interactive texts, and visual materials, are examined in qualitative research (Aspens & Corte, 2019:142).

Qualitative research excels at explaining processes and patterns of human behaviour that are difficult to quantify. A qualitative approach allows participants to explain how, why, or what they were thinking, feeling, and experiencing during a particular time or during a specific event.

3.3.2 Population and sampling

Population

A research population is a large group of people or items that are the subject of a scientific investigation. The purpose of research is to benefit the general public. However, because of extraordinarily large population sizes, it is sometimes impractical and expensive for researchers to examine all members of the community. As a result, researchers employ sampling strategies (Explorable, 2019:15). The population targeted in this study is farmers in the North-West province who use renewable energy on their farms in some way. The participants that participated in the interviews and Microsoft Teams meetings were farmers all around the North-West Province (Potchefstroom, Viljoenskroon, and on the fence of Bothaville) and they helped the researcher tremendously in achieving the objectives as well as the goal of the study.

Sampling

According to (Fleetwood, 2023) samples are smaller sets of data that a researcher chooses or selects from a larger population based on predefined selection biases. A sample point, sampling unit, or observation is one of these elements. Research can be carried out efficiently by creating a sample. It is often difficult, time-consuming and expensive to research the entire population. By examining the sample, the researcher gains insights that can be applied to the entire population (Fleetwood, 2023).

Non-probability sampling is the method of selecting persons for inclusion in a sample with no certainty of selection (Quinlan *et al.*, 2011; Tansey, 2007:322). The primary objective of the sample is to provide researchers with access to individuals of the population so

that they can study them and draw conclusions about the community as a whole. It is similar to a give-and-take negotiation. The "provided" sample is drawn from the population, which then "takes" the sample's findings (Explorable, 2019:15).

This study used a purposeful / convenient sample until saturation was reached. The formulation of a more complete description of the phenomenon under study will be aided by the limited sample size. The study population is reliably, uniformly, and unbiasedly identified using the inclusion criteria. Farmers from the north-west province with some sort of renewable energy were interviewed. To achieve data saturation, about 8 interviews were required. Because the main inclusion criterion will be created according to the specified criteria, the researcher recruited people who are diverse but not limited. Meetings were arranged via phone call and WhatsApp with respected participants, as well as obtaining their consent before collecting the data.

3.3.4 Sample size

Sample size was based on saturation, which was reached after 8 interviews. A non-probability approach was used for qualitative research, utilising purposive/convenient sampling. Non-probability sampling is the practice of selecting elements at random whose likelihood of inclusion in the sample is uncertain and may be zero for some population elements (Winiowski,2021). Non-probability sampling has a significant cost advantage over probability sampling. There are various low-cost methods for drawing and fielding non-probability samples. The most common way is through volunteer web panels, in which survey businesses urge a large number of volunteers to engage in continuous surveys (Winiowski,2021). Up until saturation, data were collected for empirical investigation. This small sample size helped to provide a more complete description of the phenomenon being studied.

3.4 PILOT STUDY

According to (Lowe, 2019:117), the purpose of a pilot study is to test various aspects of methods intended for a larger, more rigorous or confirmatory investigation. Pilot studies are designed not to answer specific research questions, but rather to prevent researchers from conducting large-scale studies without proper knowledge of the methods proposed.

Pilot studies are conducted to prevent a fatal flaw from occurring in expensive and time-consuming studies. To evaluate the effectiveness of their proposed methods and procedures, researchers use pilot studies (Lowe, 2019:117).

The questions in the informed consent were tested with two typical participants. After completing the pilot study, the participants clearly understood all the questions. Furthermore, there were no faults recognised in the pilot study as well. The two participants that were used in the pilot study were not included in the final interview.

3.5 DATA COLLECTION

Scheduled online interviews were conducted through Microsoft Teams, whilst the interview guide was distributed to participants, in the case of face-to-face interviews. Seven of the interviews were conducted face to face; this was the better option to have personal conversations and interactions with farmers.

Microsoft Teams meetings also took place, sometimes participants can get very busy, and this was a quick and effective way to communicate. All conversations were recorded during online interviews. Documents such as informed consent forms and voice notes from the semi-structured interviews are kept on Google drive/Nextcloud. Transcribed data and voice note recordings are included in the electronic information that will be stored on encryption key computers with access limited to the study team using the data.

The questions asked in the interview contained four sections. Section 1 with information about different costs involving implementing renewable energy. Section 2 comprised different measures implemented on how South Africa can capitalise on renewable energy. Section 3 contained what types of renewable energy South Africa can capitalise on. Lastly, Section 4 entailed how long-term marketing of renewable energy can benefit South Africa.

3.6 DATA ANALYSIS

Qualitative research frequently uses thematic analysis. It places a strong emphasis on spotting, deciphering, and understanding qualitative data patterns. Making sense of the data is an active reflexive process, where the researcher's personal experience is crucial (Villegas, 2023).

Getting to know the data - Going through the transcripts and materials pertaining to the research several times over. This facilitates learning the subject matter. The use of qualitative research as well as interviews was done in the research. Transcribing the interviews is the next stage after recording them. The transcription process involves writing down the spoken words from the interviews. This makes it easier to analyse the data and to make references to it. The interviews will be transcribed, and codes and themes will be used to analyse the data. Determining any recurring themes, patterns, or notions that show up in the coded data, referring to these as themes. Themes are the main ideas or topics that emerge in various interviews and offer significant new information about the study question. First, categorise the codes and then find general themes. Higher-level ideas known as themes capture the essence and significance of the material. They offer a simplified and more abstract representation of the data.

3.7 REALIBILITY AND VALIDITY

A study that uses a measurement device that lacks either of these characteristics will not produce useful results; for that reason, the measurement device for the study must be valid and reliable (Sürücü & Maslakçı 2020:3). It is true that a measurement instrument can be accurate without being valid, but it is also likely to be accurate if it is valid. Validity, however, does not rely solely on reliability.

Trustworthiness: Precise and open information of promotional materials must include precise details regarding renewable energy options, covering their advantages, drawbacks, and expenses. Refrain from making inflated or misleading statements regarding the capabilities or effects on the environment of renewable technology (Gunawan,2015). Standards and Regulations Compliance - ensure that marketing initiatives follow all applicable laws and guidelines, as well as any regulations imposed by organisations like the South African Department of Energy. (Johnson, Adkins & Chauvin, 2020:138). This covers adherence to environmental laws and advertising guidelines. Reputable Sources and References - Any statements or figures made in marketing materials are backed up by reliable sources and references. Data from official publications, scholarly investigations, trade associations, and reputable research groups may be included in this (Johnson, Adkins, & Chauvin, 2020:138).

3.8 LIMITATIONS OF THE STUDY

The questionnaire was constructed in one language which was English. In the study the researcher needed to translate to Afrikaans if the participant did not understand English. The sample size was also limited to the North-West Province. Data analysis as well as data collection time constraints for meeting the deadline for submission of the script. Weather factors (geographical demarcation) can also be added as a limitation because the wind is stronger in Cape Town than in Gauteng, which can mean that more wind turbines are installed in the Western Cape than in Gauteng. Furthermore, the study will only be focused on the North-West province, limiting the amount of information that could be obtained throughout the entire country of South Africa with its many areas.

3.9 ETHICAL CONSIDERATIONS

To conduct this study, the researcher required approval from the research ethics committee of North-West University. The delegated experts were able to judge the procedures to be followed and ensure that they were in accordance with university standards. Upon receiving the approval, data collection began. Permission to collect data from farmers in the North West Province area was approved. An ethical clearance certificate with a low risk of collecting data was also issued. Ethics number: NWU-00708-23-A4.

3.10 CONCLUSION

This study was conducted using qualitative research, using a non-probability approach, utilising purposive/convenient sampling. The interviews with the farmers were conducted online, through Microsoft Teams, as well as in person. Promoting the use of renewable energy for a brighter and greener future for South Africa.

CHAPTER 4: RESULTS, DISCUSSION AND INTERPRETATIONS OF FINDINGS

4.1 INTRODUCTION

Throughout the years Eskom has had its fair shares of ups and downs. Eskom keeps on facing challenges, such as the load shedding crisis, which is impacting South Africans on a negative level. In the following chapter there will be taking a look at the different questions asked for the participants, with their results analysed and discussed in tables below. Data collection with codes and themes were identified out of the answers.

Question 1 - How long have you been using renewable energy?

Table 4. 1

Participants extract	Codes
Participant 1: Approximately three years	0 – 1 years
Participant 2: Eight months	0 – 1 years
Participant 3: Approximately ten years	5 – 10 years
Participant 4: Approximately ten months	0 – 1 years
Participant 5: One year	0 – 1 years
Participant 6: Approximately three years	2 – 4 years
Participant 7: Six months	0 – 1 years
Participant 8: Seven months	0 – 1 years

Based on the findings in table 4.1, the majority of the participants are still early users of renewable energy with 0 – 1 years of experience.

Question 2 - How would you describe your experience with renewable energy?

Table 4. 2

Participants extracts	Codes
Participant 1: It was difficult in the beginning. It had a large input cost , and the changes in terms of generators and the sizes to implement it, had to be considered. It required some administrative input, and you need the right people	Increased cost
Participant 2: It is sufficient in terms of load-shedding. 8kw system, with two 5kw batteries and eight sun panels. It has the ability to maintain the power in my house during load-shedding.	Power consistency
Participant 3: I have no issues since the power is always working .	Power consistency
Participant 4: Excellent. You don't have any interruptions and can plan your day. Planning can be according to farming and not according to Eskom.	Power consistency
Participant 5: Absolutely amazing. It allows me to farm without any interruptions	Power consistency

Participant 6: Much better than Eskom	Power consistency
Participant 7: It is very nice because I don't get load-shedding	Power consistency
Participant 8: Convenient and cost saving	Power consistency

Codes	Themes
Increased cost Power consistency Power consistency Power consistency Power consistency Power consistency Power consistency	Power consistency (7) Increased cost (1)

Emerged themes: Question 2

Power consistency

According to (Lumenlearning, n.d) many people associate electricity with power. When it comes to electric power, what is the expression? Power is the rate of energy consumption or energy conversion. The first thing that comes to mind is power transmission lines. Additionally, lightbulbs are rated in watts based on their power. (Lumenlearning, n.d). Most of the farmers has a good experience with the consistency of power because they do not get loadshedding and it does not interrupt the work they do on the farm.

Participants responses regarding power consistency:

Par 2 – *“It is sufficient in terms of load-shedding. 8kw system, with two 5kw batteries and eight sun panels. It has the ability to maintain the power during load-shedding”.*

Par 4 – *“Excellent. You don’t have any interruptions and can plan your day. Planning can be according to farming and not according to Eskom”.*

Par 5 – *“Absolutely amazing. It allows me to farm without any interruptions”.*

Increased cost

A product or service's input cost is the set of costs involved in creating it. General and administrative costs are the other costs incurred by a business. As a percentage of total costs, input costs tend to be relatively low for businesses (Accountingtools, 2023). Cost of implementing renewable energy is quite high if you take a look at factors such as having the correct people install for instance solar power or wind turbines as well as having backup storage such as batteries to store the extra energy.

Participants response to increased cost:

Par 1 – *“It was difficult in the beginning. It had a large input cost, and the changes in terms of generators and the sizes to implement it, had to be considered. It required some administrative input, and you need the right people”.*

Question 3 - How does renewable energy save money?

Table 4. 3

Participants extract	Codes
Participant 1: It does not make an immediate difference; however, it becomes profitable over some time. If you have a five-year plan, the numbers consolidate in terms of saving, and we have seen profit in the three years that we are using it. Cost of power decreases, and any area where you can save on dependency.	Cost of power decreases
Participant 2: My electricity account was reduced by approximately 25%.	Cost of power decreases
Participant 3: Your monthly amount turns out to be a very low amount, it does take a few years to pay off the setup completely.	Cost of power decreases
Participant 4: Time. If you have loadshedding, time must be planned, and overtime paid. Employees must come in earlier and even when they are at work, they still receive payment. Loadshedding result in large expenses in this regard.	Time saving

Participant 5: So how it helps us to save money is that we're not paying such exorbitant transformer fees anymore because some of the points we are able to cancel. And for the points that we are not able to cancel. The electricity is reduced by reducing the load in the peak time and that is helping us to save money or that is how renewable energy is helping us to save money.	Cost of power decreases
Participant 6: Firstly, you have power the whole time and therefore, do not lose production time, and everything works.	Improved production
Participant 7: Costs of power is reduced	Cost of power decreases
Participant 8: Panels provide energy for the house during the day and battery supply energy during the night	Cost of power decreases

Codes	Themes
Cost of power decreases Cost of power decreases Cost of power decreases	Reduced cost (8)

Cost of power decreases Time saving Improved production Cost of power decreases Cost of power decreases	
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Emerged themes: Question 3

Reduced cost

There are many benefits to cost reduction, including improved profitability, cash flow, and competitiveness. By reducing costs correctly, quality and service levels can also be maintained or improved while maintaining or improving bottom line results (DealHub, 2023). Having the luxury of renewable energy helps farmers reduce costs in the long run. Having renewable energy will save costs and stop load shedding, which is beneficial for farmers, because their machinery will keep on working.

Responses from some of the participants:

Par 1 – *“It does not make an immediate difference; however, it becomes profitable over some time. If you have a five-year plan, the numbers consolidate in terms of saving, and we have seen profit in the three years that we are using it. Cost of power decreases, and any area where you can save on dependency”.*

Par 3 – *“Your monthly amount turns out to be a very low amount, it does take a few years to pay off the setup completely”.*

Par 5 – *“So how it helps us to save money is that we're not paying such exorbitant transformer fees anymore because some of the points we are able to cancel. And for the points that we are not able to cancel. The electricity is reduced by reducing the load in the peak time and that is helping us to save money or that is how renewable energy is helping us to save money”.*

Question 4 - How will renewable energy benefit South Africa?

Table 4. 4

Participants extract	Codes
Participants 1: I am not sure. I don't know how profitable it will remain, but there are initiatives out there in terms of renewable energy. There is enough competition, but it could become a money-making exercise as many people are relying heavily on the need for energy due to load-shedding. They will be taking initiatives and new methods of generating energy. It is still, however, in progress and I think it may enhance new ideas and initiatives.	New ideas of generating energy Generation of revenue
Participant 2: The public may benefit; however, the government will not receive any benefits. People will have to apply their own renewable energy; however, it is very expensive. It has become more affordable recently.	Affordability
Participant 3: I think regarding how it is now with Eskom, there will be a lot more productivity	Increased productivity

Participant 4: Economy is measured in terms of time spend to earn money. Its time is halved, and we can get Eskom to plan better, we may have better planning ourselves.	Effective planning
Participant 5: That our renewable energies are benefiting South Africa because people, grew up paying or getting absolutely smoked by ESKOM's high prizes, and they don't have to pay that anymore. They can be self-generators and the people that aren't paying are just not going to have electricity.	New ideas of generating energy
Participant 6: I think the economy would be better, there would always be water. There should be a lot more jobs available for people.	Increased productivity
Participant 7: It will sort out load-shedding, but it is too expensive, and only a few people can afford it.	Affordability
Participant 8: Reduce loadshedding	Increased productivity

Codes	Themes
New ideas of generating energy Generation of revenue Affordability Increased productivity Effective planning New ideas of generating energy Increased productivity Affordability Increased productivity	Alternative energy sources (4) Revenue increase (5)

Emerged themes: Question 4

Alternative energy sources

According to (Ferrovia, n.d) alternative energy is energy obtained from natural or renewable sources, such as the sun or wind. It is presented as an alternative to conventional energy sources, which rely on non-renewable fossil fuels. As greenhouse gas emissions are being reduced worldwide and more environmentally friendly practices are being adopted, alternative energies are emerging and being implemented. Being able to have more than one option to generate energy can be an effective way to implement different sources of energy on the farm/workplace.

Responses from some of the participants:

Par 1 – “They will be taking initiatives and new methods of generating energy. It is still, however, in progress and I think it may enhance new ideas and initiatives”.

Par 5 – *“That our renewable energies are benefiting South Africa because people, grew up paying or getting absolutely smoked by ESKOM’s high prizes, and they don’t have to pay that anymore. They can be self-generators and the people that aren’t paying are just not going to have electricity”.*

Revenue increase

The amount of revenue a business generates includes income from sales and interest or investment income. Revenue can be increased by increasing sales, adding other sources of income, and increasing each sale's amount (Indeed, 2023). There can also be some competition between fellow renewable energy marketers with different prices playing a role.

Responses from some of the participants:

Par 3 – *“I think regarding how it is now with Eskom, there will be a lot more productivity”.*

Par 4 – *“Economy is measured in terms of time spend to earn money. Its time is halved, and we can get Eskom to plan better, we may have better planning ourselves”.*

Question 5 - How can the employment rate benefit from renewable energy?

Table 4. 5

Participant extract	Codes
Participant 1: Less expenditure on power which will save cost to recruit and appoint more people. I cannot see how it won't be a benefit as it is creating more work.	Job creation Less expenditure
Participant 2: There are more people who can install renewable energy, which will create more jobs. It will keep businesses open during load-shedding.	Job creation

Participant 3: Obviously, it will be a benefit because people will be able to work and production can continue, and more people will have job opportunities.	Job creation
Participant 4: If there is enough energy, there will be enough jobs. This will increase jobs. The more renewable energy, businesses will be more successful.	Jobs creation
Participant 5: I honestly don't think it can improve the employment rate because once again, the thing that we're seeing, labour's very expensive, labours unskilled. The problem you're sitting with is you are paying a large amount to someone who doesn't know what to do. So, I don't think it can generate employment further than a certain point.	Unskilled expensive labour
Participant 6: Well, there will always be work to be done because if a business has power, it can function, whereas if it doesn't have power, we have to wait.	Job creation

Participant 7: If load-shedding is sorted out, more people will benefit from renewable energy as there will be more jobs . Many farmers had to retrench staff because of load-shedding. For example, in the Northern Cape, farmers rely on centre-pivot irrigation, and they need energy.	Job creation
Participant 8: Installers will employ more people . Companies can keep existing employees.	Job creation

Codes	Themes
Job creation Less expenditure Job creation Job creation Job creation Unskilled expensive labour Job creation Job creation Job creation	Job creation (7) Cost implications (2)

Emerg ed themes: Question 5

Job creation

According to (Eurofound,2021) the process of creating new jobs, particularly for those who were previously jobless or inactive, is referred to as job creation. Having renewable

energy available in South Africa will inspire entrepreneurs to build renewable energy businesses and thus will create and implement more and more job opportunities.

Participants response to job creation:

Par 6 – *“Well, there will always be work to be done because if a business has power, it can function, whereas if it doesn't have power, we have to wait”.*

Par 7 – *“If load-shedding is sorted out, more people will benefit from renewable energy as there will be more jobs. Many farmers had to retrench staff because of load-shedding. For example, in the Northern Cape, farmers rely on centre-pivot irrigation, and they need energy”.*

Cost implications

Low-wage workers make up a sizable portion of the labour market overall, carrying out routine production tasks that don't require specialized knowledge or expertise. Unskilled labour professions typically include menial or repetitive duties (Kagan, 2023). Low-wage work is frequently associated with jobs that may be learnt completely in less than thirty days. There are people with less education or experience who work in low-paying labour positions than others. In such circumstances, companies might exploit these workers by paying them little or nothing at all (Kagan, 2023).

Participants response to reducing cost:

Par 5 – *“I honestly don't think it can improve the employment rate because once again, the thing that we're seeing, labour's very expensive, labours unskilled. The problem you're sitting with is you are paying a large amount to someone who doesn't know what to do. So, I don't think it can generate employment further than a certain point”.*

Less expenditure

Cutting back on expenses or minimizing the total amount of money used or consumed for different reasons. It typically refers to spending money more wisely or efficiently, or actively trying to save money.

Par 1 – *“Less expenditure on power which will save cost to recruit and appoint more people”.*

Question 6 - Are you pleased with your decision to buy renewable energy?

Based on the findings, all participants answered conformity on this question.

Question 7 - How can renewable energy benefit farmers in South Africa?

Table 4. 6

Participant extract	Codes
Participant 1: Financially and saving time. When you consider mines that have to close completing during load-shedding, on our farms the silos can remain switched on as a result of renewable energy. We also have continuous power in the household.	Continues power Financially and saving time
Participant 2: A lot of farmers experience challenges in terms of safety. Renewable energy will keep security, pumps, etc. running instead of using diesel.	Safety Continues power
Participant 3: I think it would benefit them a lot since they will not have interruptions, and everything can go on as usual	Continues power

Participant 4: Time. Renewable energy can assist in planning work.	Continues power
Participant 5: it provides constant power. So, you never have to go without electricity. You can water when you need to water. Can help the farmers and it gives it gives a better yield because the power is first of all consistent. So, your pumps, your motors aren't blowing.	Continues power
Participant 6: I think it would benefit them a lot since they won't have interruptions and everything can go without, they will be able to use the water tanks, and they can produce what they need to produce.	Continues power

Participant 7: It is expensive but at least you will have power. As I've mentioned, the centre-pivot irrigation needs power. A chicken farmer did not have power for almost a week and his generators were operating for this time, which must have been very expensive. He got a quotation to consider renewable energy, however, the cost was extremely high.	Continues power
Participant 8: All electrical pumps can be operational as well as watering of crops.	Continues power

Codes	Themes
Continues power Financially and saving time Safety Continues power Continues power Continues power Continues power Continues power Continues power Continues power	Consistent electricity (10)

Emerged themes: Question 7

Consistent electricity

By providing an uninterruptible power supply (also known as UPS) that can take over in the event of a power outage, continuous power supply solutions can mitigate some risks like when Eskom is implementing load shedding. The power supply can also be regulated to maintain a consistent level of power, even when the primary source fluctuates (EFOY, 2023). It is very important to have a consistent source of power for farmers in order for daily tasks to commend.

Participants response to consistent electricity:

Par 2 - *“A lot of farmers experience challenges in terms of safety. Renewable energy will keep security, pumps, etc. running instead of using diesel”.*

Par 1 - *“Financially and saving time. When you consider mines that have to close completing during load-shedding, on our farms the silos can remain switched on as a result of renewable energy”.*

Par 3 – *“It is expensive but at least you will have power. As I’ve mentioned, the centre-pivot irrigation needs power. A chicken farmer did not have power for almost a week and his generators were operating for this time, which must have been very expensive. He got a quotation to consider renewable energy, however, the cost was extremely high”.*

Question 8 - What is the challenge regarding renewable energy in your regard?

Table 4. 7

Participant extract	Codes
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Participant 1: There are many things that still have to be discovered. Theft and certain services and deliveries that are not efficient and some people who are only trying to make money. There is also the question of sustainability and the implications it may have on the environment. The equipment will have to be replaced at some stage.	Theft of renewable energy Implications on the environment Replacement of material
Participant 2: I am not sure how long it will last and whether the guarantees will still be applicable. It is still a new way of using energy, and not all the problems have become evident yet.	Replacement of material
Participant 3: The biggest challenge is to keep your renewable energy safe because it is usually at risk of being stolen.	Theft of renewable energy

Participant 4: Cost. If you can afford it, it is not a challenge. If you start small, management of renewable energy is a factor. We enlarged our storage however did not increase the system. Management is there for important.	Cost implications
Participant 5: first of all, it's way too expensive and It's in high demand for thieving.	Cost implications Theft of renewable energy
Participant 6: The biggest challenge was the cost of implementing renewable energy	Cost implications
Participant 7: Cost is the biggest thing. You must be able to afford what you buy. This is a luxury.	Cost implications

Participant 8: Costs, and finance on projects	Cost implications
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Codes	Themes
Theft of renewable energy Implications on the environment Replacement of material Replacement of material Theft of renewable energy Cost implications Cost implications Theft of renewable energy Cost implications Cost implications Cost implications	Replacement of equipment (5) Purchase cost (5) Environmental effect (1)

Emerged themes: Question 8

Replacement of equipment

In South Africa, electricity theft is a major problem. The result has been a yearly loss of billions of rands for Eskom, the government-owned electricity distribution business. Another factor in South Africa's load-shedding, which jeopardizes the nation's development potential, is electricity theft (Mujuzu, 2020). Theft in South Africa is a reality and unfortunately farmers suffer the most in this regard. The stealing of renewable energy damages the farmers workflow and at the end of the day can be very cost effective.

Participants response to the replacement of equipment:

Par 1 – *“Theft and certain services and deliveries that are not efficient”.*

Par 2 – *“I am not sure how long it will last and whether the guarantees will still be applicable. It is still a new way of using energy, and not all the problems have become evident yet”.*

Par 3 – *“The biggest challenge is to keep your renewable energy safe because it is usually at risk of being stolen”.*

Purchase cost

This includes different ways of cost implications when you are buying renewable energy. Most of the time farmers don't buy renewable energy because of the expensive cost it drives. Very expensive to start buying renewable energy but saves money further down the line.

Participants response to purchase cost:

Par 4 – *“Cost. If you can afford it, it is not a challenge. If you start small, management of renewable energy is a factor. We enlarged our storage however did not increase the system. Management is there for important”.*

Par 6 – *“The biggest challenge was the cost of implementing renewable energy”.*

Par 7 – *“Cost is the biggest thing. You must be able to afford what you buy. This is a luxury”.*

Environmental effect

Any change to the environment brought about by a facility's operations, goods, or services is referred to as an environmental impact, regardless of how positive or negative the change may be. Stated in various ways, it refers to the impact that human behaviour has on the natural surroundings (University of Calgary, n.d).

Participant response to environmental effect:

Par 1 – “There is also the question of sustainability and the implications it may have on the environment”.

Question 9 - What happens if the sun isn't shining, or the wind isn't blowing?

Table 4. 8

Participant extract	Codes
Participant 1: We use generators as backup that can maintain the silos, for when it is overcast	Backup generators
Participant 2: My system also charges from the Eskom system . Renewable energy is only in cases when there is load-shedding. It does, however, reduce energy use. When there is not enough sun or wind, it uses Eskom electricity and vice-versa.	Eskom power
Participant 3: The benefit is that we have battery backups ; you just have to ensure that they are working properly	Battery backups

Participant 4: We do have a generator and inverter. The new generation inverters can maintain any energy. The new panels have an efficiency of 30% and you can use 300w per hour. And we enlarged our tanks for water and when the sun is shining, we ensure that the tanks are full, and planning ensure that the household remains working.	Backup generators
Participant 5: of course, the power dips, but you combat that by installing extra solar panels to so when you do the solar design, it really depends on who does the design. The low PV output and then the battery compensates for that and that's how we get that right. But it is an issue.	Battery backups
Participant 6: Luckily, we have a backup battery system that also charges while we have electricity or when our alternative energy is being used	Battery backup
Participant 7: Extra generators	Backup generators

Participant 8: Use battery backup and Eskom to charge if available	Backup generators
---	-------------------

Codes	Theme
Backup generators	Alternative backup power (7)
Backup generators	Eskom power (1)
Battery backup	
Battery backup	
Backup generators	
Battery backups	
Eskom power	
Battery backup	

Emerg ed themes: Question 9

Alternative backup power

In addition, you can lower your electricity price by using a battery backup system if you have a time-of-use utility plan. You can use the energy from your battery backup to power your home during peak usage hours, saving you money on expensive electricity bills. You can use your electricity normally during off-peak hours, but at a reduced cost (Freitas, 2023). You will be able to store any extra electricity your solar panels produce if you have them. at the night and at times when the panels are not as efficient, you can use the stored electricity to power your home (Freitas, 2023).

Participants response to alternative backup power:

Par 2 – *“My system also charges from the Eskom system. Renewable energy is only in cases when there is load-shedding. It does, however, reduce energy use. When there is not enough sun or wind, it uses Eskom electricity and vice-versa”.*

Par 4 – *“We do have a generator and inverter. The new generation inverters can maintain any energy. The new panels have an efficiency of 30% and you can use 300w per hour. And we enlarged our tanks for water and when the sun is shining, we ensure that the tanks are full, and planning ensure that the household remains working”.*

Par 5 – *“of course, the power dips, but you combat that by installing extra solar panels to so when you do the solar design, it really depends on who does the design. The low PV output and then the battery compensates for that and that's how we get that right. But it is an issue”.*

Eskom Power

Some people make usage of both Eskom power and renewable energy. When natural factors won't occur, such as the sun is not shining or wind is not blowing, there is an alternative in using Eskom power in times of need.

Participants response to Eskom power:

Par 2 – *“My system also charges from the Eskom system. Renewable energy is only in cases when there is load-shedding. It does, however, reduce energy use. When there is not enough sun or wind, it uses Eskom electricity and vice-versa”.*

4.2 CONCLUSION

Farmers need electricity in order to work effectively on a daily basis. Load shedding causes work to stop on the farm and could become a very big problem. Having renewable energy ensures that there is power on the farm and work can continue without any interruptions. There is massive potential for renewable energy in the Nort West and implementing the correct measures to sustain and develop green energy.

With different ways of alternative energy, job creation would become more and more and thus will benefit the economy in South Africa.

CHAPTER 5: RECOMMENDATIONS AND CONCLUSIONS

5.1 INTRODUCTION

In the following chapter there will be a look at the study's results, conclusions, and recommendations. The discussion in this chapter will provide clear evidence on recommendations to the problems that farmers are currently facing.

5.2 PROBLEM REVISITED

Back in Chapter 1, the researcher observed that the energy mixture in South Africa contains very little renewable energy. This needs to be improved because the country is still heavily dependent on coal. South Africa also sits with the problem of load shedding daily. On the basis of the discovery of the problem, the objectives of the study were established.

5.3 KEY FINDINGS FROM THE SECONDARY OBJECTIVES OF THE STUDY

5.3.1 Determine the different costs involved with the implementation of renewable energy

In table 4.1 we can see that two participants stated that it is an expensive journey to implement renewable energy because of administrative costs, as well as having the correct people to assist with and install the renewable energy. Reduced cost also plays a role, with participant 5 stated that *"The electricity is reduced by reducing the load in the peak time and that is helping us to save money or that is how renewable energy is helping us to save money"*.

5.3.2 Identify different measures on how South Africa can capitalise on renewable energy

Having alternative energy sources as well as revenue plays a role on different measures to capitalise on renewable energy. Having new ways of generating energy can play a major part in the sustainability of energy power. According to participant 2 "people will have to apply their own renewable energy; however, it is very expensive. It has become more affordable recently". Five participants also agreed that revenue increase has its part on how to capitalise on renewable energy where increase productivity, would better the economy and would ensure more jobs available for people.

Participant 4 stated – *“If there is enough energy, there will be enough jobs. This will increase jobs. The more renewable energy, businesses will be more successful”.*

Participant 7 said – *“If load-shedding is sorted out, more people will benefit from renewable energy as there will be more jobs. Many farmers had to retrench staff because of load-shedding. For example, in the Northern Cape, farmers rely on centre-pivot irrigation, and they need energy”.*

5.3.3 Identify alternative types of renewable energy to capitalise on

7 out of 8 participants agreed there will be consistent electricity and thus will benefit farmers in South Africa. Having continuous power will ensure that functions in and around the farm are working, pumps that's running, silos that is switched on etc.

Participant 7 – *“It is expensive but at least you will have power. As I've mentioned, the centre-pivot irrigation needs power. A chicken farmer did not have power for almost a week and his generators were operating for this time, which must have been very expensive. He got a quotation to consider renewable energy, however, the cost was extremely high”.*

Participant 1 – *“Financially and saving time. When you consider mines that have to close completing during load-shedding, on our farms the silos can remain switched on as a result of renewable energy. We also have continuous power in the household”.*

5.3.4 Determining how marketing renewable energy can benefit South Africa in the long term

Some of the respondents stated that theft plays a role when you have renewable energy, and it can become expensive if you need to replace the material over time. Costs is also an issue because it is quite expensive to buy renewable energy. Also having alternative backup power like generators and battery backup systems for in case Eskom decides to implement load shedding.

Participant 5 – *“Of course, the power dips, but you combat that by installing extra solar panels to so when you do the solar design, it really depends on who does the design. The low PV output and then the battery compensates for that and that's how we get that right. But it is an issue”.*

Participant 4 – *“We do have a generator and inverter. The new generation inverters can maintain any energy. The new panels have an efficiency of 30% and you can use 300w per hour. And we enlarged our tanks for water and when the sun is shining, we ensure that”.*

5.4 KEY FINDINGS FROM THE PRIMARY STUDY

The primary objective of this study was exploring the viability of marketing renewable energy in South Africa to positively impact the inconsistent energy supply problem. The survey was conducted to farmers in the North West province of South Africa, with some sort of renewable energy on their farms.

- 75% of participants believed that there is a power consistency when describing their experience with renewable energy.
- 100% of participants stated that renewable energy also saves money through reduced cost. By having renewable energy, farmers are not paying Eskom anymore and that saves a lot of money in the future.
- 50% of participants opted that renewable energy in South Africa will benefit through alternative energy resources. This can enhance new initiatives as well as thinking outside of the box.
- 87.5% of participants believe that the employment rate in South Africa can benefit from renewable energy through job creation.
- 100% of the participants was happy with their chose of buying renewable energy and implementing it on their respective farms.
- 100% of participants also state that consistent energy can benefit farmers in South Africa. This ensures continues power throughout the whole day, even the household, as well as it saves a lot of time and money.
- 50% of the participants believe that cost implications play a big part in buying renewable energy. It can be expensive to start but saves a lot of money in the future. As well as ensuring a sustainable environment.
- 87.5% of the participants believe that through alternative power such as, backup generators and backup batteries, for when the sun isn't shining, or the wind isn't blowing.

5.5 CONCLUSION

This study concluded that there is a huge market for renewable energy in South Africa. With the rainbow nation boasting with opportunities for renewable energy supply with its sun, wind, and water. Renewable energy will stop the current load shedding factor as well as creating more and more jobs which will impact the economy growth positively. The study also found that to start with renewable energy it will be quite costly with theft also playing a role which can cause customer to replace their source of power. The study concluded that alternative energy resources can be implemented, thus benefitting the country and can be utilized to stop the current load shedding factor.

5.6. RECOMMENDATIONS BASED ON THE LITERATURE

- Motivating fellow engineers and entrepreneurs in the country to implement alternative energy sources in the country which will upsurge the electrical energy supply.
- Applying better security sources to stop thieves from stealing renewable energy.
- Working with the local government to support renewable energy infrastructure, that will support the local communities as well as create job opportunities. Thus, will reduce /stop infrastructure from getting damaged and robbed.
- Building solar and wind farms. This can include expanding renewable energy to different areas of South Africa where it can be better utilized.
- Building better quality solar power/ wind turbines which will hold longer.

5.7 RECOMMENDATIONS BASED ON EMPIRICAL FINDINGS

5.7.1 Financial considerations

Famers must not focus so hard on the financial implications when buying renewable energy. Yes, it will be expensive at first, but when you have the renewable energy, you will have consistent power and then your day-to-day operations can continue without having to worry about when load shedding will happen.

5.7.2 Authority collaboration

Farmers can partner with local government and Eskom to give back in the grid where they can possibly receive money from Eskom for supplying energy. Farmers can also make use of new alternative ways of renewable energy, maybe some form of hydro energy in the future if you have a big supply of water, this will also create more job opportunities in South Africa and help within the local community. Having renewable energy ensures a greener footprint and helps to mitigate climate change as well as reduces the use of fossil fuels. Government needs to promote renewable energy on a greater scale and should consider investing in renewable energy.

5.7.3 Data-Driven Decision Making

To improve energy use, use data analytics and monitoring technologies. According to the empirical research, data-driven approaches can assist farmers in tracking energy use patterns, identifying inefficiencies, and making educated decisions to enhance energy usage and eliminate waste.

5.7.4 Bioenergy and biomass

Make use of bioenergy obtained from organic materials such as crop waste, manure, or energy crops. According to research, bioenergy production on farms can not only provide a sustainable energy source but also effectively manage trash, lowering environmental impact.

5.8 LIMITATIONS OF THE STUDY

Following Chapter 3, section 3.8, the following limitations was considered.

- The interview/ informed consent was done in English. The researcher needed to translate to another language if need be.
- Sample size was limited to the North-West Province
- Weather factors can play a role in the success of the study.

5.9 FUTURE RESEARCH

The method of research used in this study is recommended for future research, as the methodology extracts various factors that contribute to alleviating electricity problems.

5.10 OVERALL STUDY CONCLUSION

The main goal of this study was exploring the viability of marketing renewable energy in the North West Province, South Africa. Load shedding has negative outcomes on not just the farmers but businesses and households in South Africa. The study provided information that there is a massive market for renewable energy in South Africa, with towns such as Frankfort making a success of implementing renewable energy in their town. Implementing renewable energy can be expensive in the beginning but can benefit South Africa hugely in the years to come. The study also determined that farmers are happy with their choice of getting renewable energy and can create more and more jobs for the people of South Africa. Let's go green and do our part in making the world a better place!

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Addendum A: Informed Consent

2 March 2023

DEAR PARTICIPANT

INFORMED CONSENT LETTER TO INTERVIEW PARTICIPANTS

You are invited to take part in a research study that forms part of a Master of Business Administration (MBA) degree. Please take some time to read the information presented here, which will explain the details of this study. Please ask the researcher or person explaining the research to you any questions about any part of this study you do not fully understand. You must be fully satisfied that you clearly understand this research and how you might be involved. Also, your participation is entirely voluntary, and you are free to say no to participating. If you say no, this will not affect you negatively in any way whatsoever. You are also free to withdraw from the study at any point, even if you agree to participate now.

This study proposal has been submitted for approval by the NWU Economic and Management Sciences Research Ethics Committee (EMS-REC) and will be conducted according to the ethical guidelines and principles of the North-West University and other international ethical guidelines applicable to this study.

Title of the project: Exploring the viability of marketing renewable energy in South Africa

Institution: NWU Business School

Ethics Reference Number:

Names and contact details of project staff

	Supervisor	Researcher
Title, name & surname	Prof J J Prinsloo	Mr E de Villiers
Full Names	Hein	Eric
Function in Project	Principle Investigator	Researcher
Telephone	082 904 0977	0720313119

What is this research study all about?

This study aims to explore the viability of marketing renewable energy in South Africa

Why have you been invited to participate?

You have been invited to participate in this research study because you fall into at least one of the following categories:

- Being a farmer in the North-West province.
- Having some sort of renewable energy on the farm.

What will be expected of you?

You will be expected to:

- Participate in a 25-50 min semi-structured interview with the researcher at a suitable time and private area without interruptions that is convenient for both parties via in-person or through an online platform. This will be scheduled by the researcher once approved by the NWU ethics committee.
- Respond to the questions in an open and honest manner.
- Inform the supervisor should you feel or experience any discomfort or distress during the research process and inform the supervisor if you sometimes feel the need to terminate your involvement in the research process.

Will you gain anything from taking part in this research?

This research study intends to give you a voice to reveal, explain and reflect on your experience as a farmer with renewable energy to help other farmers to implement renewable energy on their farms for the better.

Are there risks involved in your taking part in this research, and what will be done to prevent them?

Participation in this study does not create any physical risk to you as the study does not involve any physical activities or experiments. Participation carries no expected hazards. Only the student and the professor will have access to personal information such as name, surname, and location of the farm.

How will we protect your confidentiality and who will see your findings?

You'll receive a unique participant ID. However, the information gathered will be treated as confidential and won't be disclosed to anyone who isn't directly involved in the study process. Our conversation will be recorded and preserved with a reference to the ID. Participants' direct contributions to the research study as well as their personal information must remain confidential. All research records must be retained for a set amount of time before being properly destroyed. The study's conclusions will be made public, but they don't include any unprocessed information that would implicate specific people. Only the student and the professor will be aware of your identity or the information you submit.

What will happen with the findings or samples?

The findings concluded in the study will be for academic purposes and will only be utilized to add to the current body of available knowledge.

How will you know about the results of this research?

Participants in the study, should they require, will be made aware of the results of the research, through a two-page communique, by means of electronic mail. The electronic final version of the dissertation will also be made available if requested.

Will you be paid to take part in this study and are there any costs for you?

There is no payment connected with participation in this interview and is completely voluntary.

Is there anything else that you should know or do?

You can contact the student:

- Eric de Villiers telephonically - 0720313119
- Email - 28634128@mynwu.ac.za

Supervisor

- JJ Prinsloo (Email) - Hein.Prinsloo@nwu.ac.za

DECLARATION

Declaration by participant

By signing below, I () agree to take part in the research study titled: Exploring the effective transitioning of elite South African athletes into a career after sport.

I declare that:

Your signature below signifies that you are voluntarily participating and that you have read and understand the information provided above, which was presented in an understandable manner. You are aware that you have the freedom to leave the interview at any time without penalty and the right to ask any questions before, during, or after it. You will receive a copy of this informed consent.

Signed at: _____ On: _____

Signature of participant _____

Declaration by researcher

I Eric de Villiers declare that:

- I explained the information in this document to ()
- I encouraged them to ask questions and took adequate time to answer them or I was available should they want to ask any further questions.
- I am satisfied that they adequately understand all aspects of the research, as described above.
- I am satisfied they had time to discuss it with others if they wished.

Signed at: _____ On: _____

Signature of researcher

Signature of supervisor

E de Villiers

Prof JJ Prinsloo

Addendum B: Interview Guide

ANNEXURE B
Farmers with renewable energy, semi-structured interview - questions
This interview guide aims to evaluate: Exploring the viability of marketing renewable energy in South Africa
Your assistance would be greatly appreciated.
Please state your name: _____
Interview date and time _____
The interview will ideally be completed in 25 – 35 minutes, and it consists of a background and four sections: Section 1 - What would the different costs involved be with implementing renewable energy? Section 2 - How can different measures be implemented on how South Africa can capitalise on renewable energy? Section 3 – What types of renewable energy can South Africa capitalise on? Section 4 - How can marketing renewable energy benefit South Africa in the long run?

Addendum C: Interview Questions

Section 1 - What would the different costs involved be with implementing renewable energy?

- How long are you using renewable energy?
- How would you describe your experience with renewable energy?
- How does renewable energy save money?

Section 2 - How can different measures be implemented on how South Africa can capitalise on renewable energy?

- How will renewable energy benefit South Africa?
- How can the employment rate benefit from renewable energy?

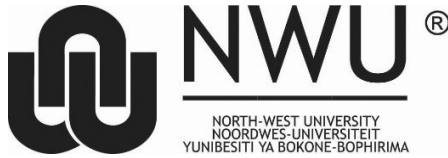
Section 3 – What types of renewable energy can South Africa capitalise on?

- Are you pleased with your decision on buying renewable energy?
- How can renewable energy benefit farmers in South Africa?

Section 4 - How can marketing renewable energy benefit South Africa in the long run?

- What is the challenge regarding renewable energy in your regard?
- What happens if the sun isn't shining, or the wind isn't blowing, regarding your energy generation?

Addendum D: Ethics Certificate



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Senate Committee for Research Ethics

Tel: 018 299-484

Feziwe.Mseleni@nwu.a
c.za

10 August 2023

ETHICS APPROVAL LETTER OF STUDY

Based on approval by the **Economic and Management Sciences Research Ethics Committee (EMS-REC)** on, 23/05/2023 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: Exploring the viability of marketing renewable energy in South Africa

Study Leader/Supervisor (Principal Investigator)/Researcher): Prof JJ Prinsloo

Student: E de Villiers

N	W	U	-	0	0	7	0	8	-	2	3	-	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: 10/08/2023

Risk:

Minimal

Expiry date: 10/08/2024

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. In 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,

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: 2023.08.10 14:19:05 +02'00'

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



Psychmetrica

CERTIFICATE: LANGUAGE EDITING

Herein, confirmation that the following document was edited:

MASTER'S DISSERTATION

Title

Exploring the viability of marketing renewable energy in the North West Province, South Africa

E DE VILLIERS

orcid.org/0000-0001-6688-3887

The following was edited according to the NWU requirements, subject to Harvard Guidelines:

Clarity and coherence, grammar, punctuation, consistency of style, citations and references, formatting and layout, word choice and clarity, consistency of terminology, and readability

(Academic integrity of the document was upheld and final changes and suggestions must be made by the student. Editing check sheet annexed as page 2 of this certificate)

W Smith

Registered Psychometrist
HPCSA: PMT0097012

R du Plessis

Ethical Editing Advisor

EDITING CHECK SHEET

Clarity and coherence	EDITOR REMARKS
Paper was presented clearly and in a coherent manner Logical flow of information	Revisit suggestions
Grammar and punctuation	
Grammatical errors, subject-verb agreements, grammar consistency and punctuation	Checked
Consistent Style	
Writing style, consistency in tone, voice and formatting	Checked with suggestions
Citations and References	
Harvard Referencing style applied	Checked with suggestions
Formatting and Layout	
According to specific formatting guidelines (Arial 12pt, Line Spacing 1.5, Justified)	Checked with amendments. The layout should be amended once suggestions are reviewed.
Word choice and clarity	
Precise and appropriate use of words	Checked
Consistency in Terminology	Checked with suggestions
Objective and Tone	Checked
Review Figures and tables	
Check the accuracy of placement and alignment Ensure properly labelled	Checked with suggestions
Abstract and Conclusion	

Grammar, spelling, flow and layout	Checked with suggestions
Readability	
Overall readability Headings, subheadings and bullet points Use of paragraphs	Checked with suggestions
Total Editing Suggestions	414