Rural Electrification and Energy Poverty in Thabana-Morena.

BY

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Declaration

I hereby certify that this dissertation is an original work that has never been submitted anywhere and has been submitted to the National University of Lesotho for the degree of Master of Arts in Development Studies. All references used throughout the d have been thoroughly cited.

Supervisor…………………. Supervisee………………………

Date……………………….. Date…………………………….

Dedication

This work dedicated to my family, who made significant sacrifices for me while I worked on this project, as well as to my dear friends and colleagues who encouraged and helped me the entire time I was pursuing my Master's degree. This work is also devoted to the National University of Lesotho which was my home throughout my studies.

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Furthermore, I would like to express my gratitude to the Thabana-Morena community for voluntarily participating in my research and serving as the sample; by spending their valuable time responding to my questions. This great job is the consequence of their involvement. I should also express my gratitude to the Project Manager at the REU Lesotho for fitting me into his hectic schedule to answer the questions I had.

May the Good Almighty bless my dearest mother for all that she did to shape who I am today as a result of her unwavering passion for education. She gave everything she had, and now that this research has been completed, I know she is proud of me. Once more, I want to express my gratitude to my siblings for being my constant source of strength and for looking out for me when I needed it most—when I was struggling and tempted to give up.

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Abbreviations and Acronyms

BC	Black Carbon
BMFs	Biomass Fuels
CC	Community Council
EPC	Electric Pressure Cooker
HRES	Hybrid Renewable Energy System
IAP	Indoor Air Pollution
IEA	International Energy Agency
LEC	Lesotho Electricity Company
LPG	Liquefied Petroleum Gas
PV	Photovoltaic
REM	Rural Electrification Model
REU	Rural Electrification Unit
SDGs	Sustainable Development Goals

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Abstract

The decrease of energy poverty serves as the foundation for responding to the appeal of achieving the SDGs, notably Goal 7. Most of the rural population in underdeveloped and developing nations, including Lesotho, is distinguished by a heavy reliance on unclean energy sources. Different nations have started rural electrification projects and programmes to try stop this, but people still use unclean fuels to cook. This dissertation presents the findings of a study on the Thabana-Morena community's persistent reliance on unclean energy sources for heating and cooking despite having access to electricity. Data from ten communities in the two community councils in Thabana-Morena was gathered to obtain a comprehensive picture. Five villages from the Koti-Se-Phola Community Council: Ha-Lekoatsa, Ha-Bofihla, Machafela, Ha-Konote, and Majakaneng; and five villages from the Malumeng Community Council: Malumeng, Ha-Sebaki, Ha-Sekhele, Ha-Tutupu, and Ha-Tjoobe. Semi-structured interviews were used in these communities for data collection. Due to the study's qualitative nature, the obtained data was evaluated and analysed utilising a thematic approach. Owing to a variety of social, economic, and cultural factors, the research showed that households in Thabana-Morena still do not use electricity as their primary source of energy for heating and cooking. Therefore, the study concluded that expanding the electricity grid to the rural areas is somewhat a gamble because it is impossible to for forecast whether people will choose it as their source of energy for cooking.

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CHAPTER 1

THE PROBLEM AND ITS SETTING

1.0 Introduction

This dissertation examines the availability and use of electricity in rural households, using a case study of a number of villages in the Thabana-Morena area. In particular, this study looks as the paradox of why households that have been provided with access to electricity continue to utilise dirty fuels.

This chapter presents the background to the study and the problem statement. The research objectives of the study are also stated with the help of research questions. Furthermore, it analyses the study's delimitations, significance, assumptions, and hypothesis. Last but not least, it highlights a summary of everything that was discussed.

1.1 Background to the Study

Energy is a very important factor facilitating the well-being of individuals, households and communities (Murshed and Ozturk, 2023). It is therefore no wonder that it is included in the Sustainable Development Goals (SDGs). SDG7, in particular, calls upon governments to "ensure access to affordable, reliable, sustainable and modern energy for all". This goal has been articulated against the realisation that in developing world, many individuals, households and communities still experience energy poverty as part of their overall existence in poverty. Murshed and Ozkurt (2023) suggest that energy poverty is the state of inadequate supply of energy resources to bridge the corresponding human demand for energy. They also note that the lag in transition towards cleaner forms of energy, particularly electricity can also be taken to characterise energy poverty (Murshed and Ozturk, 2023). It is within this imperative of ensuring physical access to cleaner forms of energy that governments have embarked on rural electrification schemes. This endeavor, however, has led to a new paradox wherein governments have provided physical electricity yet local communities continue to rely on traditional sources of energy. This has led to some authors to argue that electrification schemes are not an influencer in reducing energy poverty (Zhang, Jiangtao, and Weng, 2019).

Citing the case of China, Zhang, Jiangtao, and Weng (2019) argue that China reached 100 per cent electrification in 2014 yet a large proportion of the population, particularly in rural areas continues to rely on dirty energies such as firewood and coal. This paradox seems to be equally experienced in many developing countries and in sub-Saharan Africa specifically. Countries such as Ghana, Kenya, and Rwanda are predicted to reach their full access by 2030, but their consumption and reliance on energy clean sources is still low (Mbaka, Gikonyo, Kisaka, 2019). For example, in Kenya, up to 95 per cent of the energy consumed in rural areas is thought to be derived from wood, agricultural waste, and animal waste and 65 per cent of the population depends on BMF (biomass fuels) for cooking and heating (Ochieng et al., 2020; Adane, Alene, & Mereta, 2021).

According to estimates, in 2018, 90 per cent of the world's population had access to electricity, up from 83 per cent in 2010 (ESMAP, 2020). However, 2.6 billion people are still thought to be cooking with biomass yet they have access to electricity (IEA et al., 2021; ESMAP, 2020). With an estimated 4.3 million annual deaths linked to dirty energy sources, the usage of such sources has a harmful effect on human health (Phogole, Kelso, and Langerman, 2022). As a result, it is recognised that using these fuels (firewood, animal dung, and crop residues) has a negative impact on people's health. Additionally, when these fuels burn in open fires, they release pollutants and chemicals that are harmful to people's health (WHO, 2022). This provides proof that greater human health is associated with the consumption and use of clean fuels, in this case electricity. The primary cause of indoor air pollution (IAP) in the poor countries is the use of solid fuels for cooking and heating. Numerous health issues have been linked to exposure to the by-products of the wasteful burning of these fuels (Shezi and Wright, 2018; Qui, Yan, and Lai, 2019). Burning solid fuels for domestic uses like cooking and heating can result in high concentrations of toxic pollutants like carbon dioxide and particulate matter (PM), whose exposure greatly raises the risk of acute respiratory infections, a leading cause of death in children under the age of five in South Africa (Tatham, 2021).

When measured in terms of adolescent children's likelihood of attending school, years of schooling, and age-appropriate grade attainment, the use of dirty energy sources, particularly solid fuels, has considerably negative consequences on their educational development (Biswas and Das, 2022). They continue by stating that the majority of households that do not cook with electricity set aside a sizable portion of their time to gather resources that they use for their cooking (Biswas and Das, 2022). Children who attend school are frequently given the responsibility of gathering firewood and other cooking-related resources; as a result, they may potentially substitute school time with activities involving the collection of these resources, which can negatively affect their academic performance (Levison, DeGraff, and Dungumaro, 2018). Notably, these educational impacts are likely to be gendered because women spend an excessively higher amount of time gathering firewood due to the customary division of labour and expected household tasks (Biswas and Das, 2022). This implies that school-age children, especially girls, frequently devote the majority of their time to gathering firewood, which causes them to spend less time in class and dedicate a very small amount of time to complete their homework compared to their male counterparts.

Women and girls are also exposed to excessive levels of indoor air pollution as a result of doing more housework and using polluting, unhealthy traditional domestic energy sources (Li et al., 2021). The health of both women and children is significantly harmed by prolonged exposure to this pollution. Indoor air pollution, a major cause of heart disease, stroke, chronic obstructive pulmonary disease, lung cancer, and other non-communicable illnesses, is a key environmental health threat factor for women; they make up more than 60 per cent of all premature fatalities brought on by indoor air pollution, just like children do (Verma and Imelda, 2022). This is due to the fact that they frequently do the cooking for their families as part of home duties.

A variety of gases and pollutants that contribute to global warming are produced during the inefficient burning of solid fuels, which is often done over open fires and inefficient stoves (Clean Cooking Alliance, n.d). This indicates that cooking in this manner also emits short-lived climate pollutants (SLCPs), in addition to greenhouse gases (GHGs) like carbon dioxide. Black carbon, a particulate matter emission, is the main SLCP produced by conventional cooking methods. This shows that using the kinds of fuels that emit these pollutants instead of electricity for cooking, is a global warming problem. Additionally, unsustainable wood harvesting for fuel is a significant contributor to climate change as well as the deterioration of forests and the ecosystem.

Electricity-powered cooking can provide households a disruptive value proposition by enabling multitasking, safer cooking, the elimination of harmful indoor emissions, and a cleaner cooking environment (ESMAP, 2020). Given that the power source is already present in the residents' houses, electricity offers the ability to quickly transition all urban and peri-urban areas that are already grid-connected from traditional fuels. As outdoor air pollution from cooking with biomass has been demonstrated to have major health implications for the entire community, doing so would increase the effectiveness of addressing household air pollution at the local level (Das et al., 2018).

A number of scholars have written about the impact of rural electrification programmes and projects on eradicating energy poverty is specific countries without putting any emphasis on the dependence on dirty energy sources for cooking (see Mekonnen and Sarwat, 2017; Akintunde, 2018; Yadav, Davies, and Sarkodies, 2019; and Joshi and Yennet, 2020). However, the majority of these scholars examined the impact of these projects and programmes on the reduction of energy poverty where solar energy initiatives were implemented rather than standard electricity (see Mekonnen and Sarwat, 2017; Yadav, Davies, and Sarkodie, 2019; and Joshi and Yenneti, 2020), while others such as Akintunde (2018) examined the role of rural electrification on energy in both on-grid and off-grid rural communities. Unlike these studies, the current has taken a different approach by focusing on rural electrification via standard grid extension electricity provision rather than solar energy in order to discover the role of rural electrification in energy poverty eradication in Lesotho, putting much emphasis on the reliance on dirty energy sources for meeting the cooking and heating needs.

1.2 Statement of the Problem

Lesotho's energy sector is distinguished by a reliance on traditional biomass (wood and dung) to meet the energy needs of rural households, imported coal and petroleum to meet the needs of the economic sector (Government of Lesotho, 2015). This is also the case in Thabana-Morena where wood and cow dung are still the primary sources of energy for cooking and heating. To ensure or promote a transition from these sources to cleaner sources, in this case electricity, especially in the rural areas, the government of Lesotho implemented various rural electrification projects throughout the country, including Thabana-Morena so that people abandon these dirty sources and use electricity. However, households in Thabana-Morena continue to use biomass fuels as their primary source of energy for cooking and heating, regardless of this effort by the government to promote clean cooking through improved electricity access provision.

In 2004, Lesotho introduced the rural electrification scheme which was administered through the Rural Electrification Unit (REU). At the time access to electricity, by rural households was estimated at 6.80 per cent throughout the country (Mpholo et al., 2018). The scheme aimed to spread out the grid to rural areas not serviced by the national power utility, Lesotho Electricity Company (LEC), as to improve the access rates in the rural areas and reduce the reliance on wood and biomass for cooking and heating needs. This scheme has now reached 18 per cent of the rural population, whilst 82 percent of the population has not yet been reached (World Bank, 2020)**.** A similar paradox has been observed where electricity has been physically extended to rural households yet many of those households do not use electricity for many of the functions where it would otherwise be expected to be used. The critical question is therefore as why this is not happening, which is what the current study intends to unpack. Furthermore, it unpacks the key implications of this paradox.

1.3 Statement of Objectives

The objective of this study is to assess how rural electrification contributes in the community's acceptance and adoption of electricity as a cooking and heating source of energy.

1.4 Objectives of the Study

- To investigate how rural electrification has improved access to electricity in Thabana-Morena.
- To investigate why Thabana-Morena households continue to rely on dirty energy sources, particularly for cooking and heating, despite rural electrification.

- To assess how rural electrification affects the community’s cultural and taste preferences in Thabana-Morena regarding the use of dirty fuels for cooking specific food.
- To assess how rural electrification promotes the adoption of the use of electric cooking appliances by the Thabana-Morena community.

1.5 Research Questions

- How has rural electrification improved access to electricity in Thabana-Morena?
- Why do Thabana-Morena households continue to rely on dirty energy sources, particularly for cooking and heating, despite rural electrification?
- How does rural electrification affect the community’s cultural and taste preferences in Thabana-Morena regarding the use of dirty fuels for cooking specific food?
- How does rural electrification promote the adoption of the use of electric cooking appliances by the Thabana-Morena community?

1.6 Hypothesis

- Rural electrification improves access to electricity in Thabana-Morena.
- The Thabana-Morena community continues relying on dirty fuels for cooking and heating because they cannot afford to buy enough electricity to use even for cooking and heating.
- Rural electrification affects the Thabana-Morena community’s cultural and taste preferences regarding the use of dirty fuels for cooking certain food.
- Rural electrification promotes the adoption of the use of electric cooking appliances by the Thabana-Morena community.

1.7 Significance of the Study

The study may discover how access to electricity has improved in Thabana-Morena across the Koti-se-Phola and Malumeng Community Councils (CCs) as a result of rural electrification, and thus contribute to policy by assisting responsible stakeholders, particularly within government through the REU, in determining whether or not to expand the rural electrification programme's coverage to include more rural villages, so that more of them benefit from the programme by gaining access to electricity.

This study may also assist the government, through the REU, in understanding why rural communities may continue to use dirty fuels even after being provided with electricity, and this will inform the government to consider engaging with communities through meetings in order to hear the people's views on electricity before rolling it out in the villages.

It may also provide important information on how rural electrification affects people's cultural as well as taste preferences regarding the use of solid fuels for cooking specific foods, allowing future researchers who want to do research on electrification and cultural and taste preferences when cooking, especially in Lesotho, to refer to the study, thus contributing to the currently very limited literature on this issue.

It may also be important in determining whether rural electrification actually encourages community adoption of electric cooking or not. This may be useful to scholars who wish to conduct research on electric cooking in the country and wish to refer to the findings of this study.

1.8 Assumptions of the Study

The current study makes the assumption that rural electrification does not encourage the Thabana-Morena community to use electricity as a source of energy for cooking and heating and that this might be one of the reasons for their continued dependence on dirty energy sources for their cooking and heating needs.

1.9 Delimitations of the Study

The REU has implemented several projects aimed at bringing electrical power to various rural and remote areas across Lesotho through its different projects. Nonetheless, this research has concentrated on the rural electrification project that was implemented in Thabana-Morena, specifically in the villages of the Koti-Se-Phola and Malumeng community councils. Furthermore, it has highlighted the usage of dirty fuels for cooking as one of the components of energy poverty as defined in developing countries, while not touching more on the lack of access to electricity as another component of energy poverty.

1.10 Summary

This chapter has covered the background of cooking and heating with dirty fuels even when electricity is available. Four research questions that have assisted the researcher in addressing the research objectives have also been listed to provide a clear direction for the current study, with the goal of assessing how rural electrification contributes to the community's acceptance and adoption of electricity as a cooking and heating source of energy.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

The aim of this chapter is to unpack collected works on why households continue to use energy sources such as biomass and cow dung for cooking and heating despite having access to a clean cooking fuel, in this case electricity, as a result of the rural electrification programmes and projects. To accomplish this goal, it is divided into seven sections: the first examines the definitions of key words used in the study, the second examines the theoretical framework that has explained the theory that underpins the current study, with the third section on the conceptual discussion as determined by the research questions. The concept of access to electricity is discussed first in this section, which then discusses the reliance on dirty energy sources for cooking, followed by the discussion of the cultural and taste preferences when cooking, and finally the adoption of electric cooking appliances. The final section examines the conclusion and the identification of the specific gap that this study seeks to fill, with the summary of the chapter following last.

2.1 Definition of Key Terms

Dirty fuels: fuels that increase global warning and the occurrence and severity of life-threatening weather events. They are solid-state fuels that produce a large amount of harmful smoke and fumes. They include charcoal, animal dung, firewood, crops, grasses, biomass resources which comprised of residues from agriculture harvests from forests in the form of firewood, charcoal residues, crop residues, energy crops, animal manure, residues from agro-industrial and food processes, municipal solid wastes, and other biological resources (Karakara and Osabuohien, 2020).

Energy Poverty: lack of access to electricity coupled with the dependence on dirty fuels when cooking and heating. It is well known that this issue is complicated, has many facets, a variety of drivers, and can lead to many forms of susceptibility (Bouzarovki and Petrova, 2015; Middlemiss et al., 2019). A growing body of research on the lived experience of energy poverty has been done from a range of disciplinary perspectives, and it documents the daily lives of persons who cannot access energy services (Longbhurst and Hargreaves, 2019). This literature also tends to show that vulnerability to energy poverty is complex and systemic: not just a function of people's circumstances (for example, being poor, being older, having a disability, or having small children), but a function of complex intersections of life circumstances, social circumstances, infrastructure availability, and political climate (Middlemiss et al., 2019).

Fuel: material burned to generate heat or power. Fuel is a combustible material with carbon as its primary component that, when burned properly, produces a significant amount of heat that may be used economically for both residential and industrial applications. Examples include wood, charcoal, Kerosene, petrol diesel, and oil gas (Sachdeva, 2014).

Grid expansion: expanding the network of national electricity transmission systems to different areas. The traditional method for ensuring that everyone has access to electricity, but with the rise of sustainable technologies, using local renewable energy (RE) resources in a decentralised electricity system appears as an alternative choice for remote areas (Yaqoot, Diwan, and Kandpal, 2016), which were previously either not supplied at all or with insufficient diesel generator power (Rodriguez-Gallegos et al., 2018).

Indoor Air Pollution: the deterioration of the quality of the interior air caused by dangerous chemicals and other substances, typically as a result of the combustion of dirty fuels. Since most individuals spend 90 per cent of their time inside, mostly at home or at work, indoor environmental factors have a significant positive impact on human wellbeing (WHO, 2020). IAP can be produced by occupant activities such as cooking, smoking, using consumer products, or emissions from building materials inside of dwellings or structures (Tran, Pak, and Lee, 2020).

2.2 Theoretical Framework

The type of data that is gathered and how it is analysed are both influenced by the theoretical framework. The theoretical framework that guided this study is thus presented in this part. In this part, the theories that have been employed to evaluate and better comprehend the idea of continuing to rely on unclean fuels for cooking despite electrification have been discussed. These theories include the diffusion of innovation theory, the energy stacking theory, the theory of change, and the theory of rational choice. But the energy stacking theory, which has been used as a critique of the energy ladder model, was the one that served as the theoretical framework for interpreting the data. The energy stacking theory has been developed as a critique of the energy ladder theory, which asserts a positive correlation between socio-economic status and modern fuel consumption.

According to this theory, rising income is positively correlated with the adoption and switch to more expensive, cleaner, and efficient sources of energy (Treiber, 2019). This theory can be broken down into three stages: the first stage is marked by the widespread ignition of biomass, which includes agricultural waste, dung, and wood; the second stage is marked by the switch to so-called transitional fuels like charcoal or kerosene; and the third stage is marked by the adoption of "clean" forms like LPG, natural gas, or electricity.

According to the energy ladder concept, as money rises, people will switch from traditional energy sources like biomass to cleaner, more practical modern energy sources like LPG and electricity (Trac, 2011). This indicates that the model is heavily reliant on the relationship between household income and the cost of contemporary fuels (Kowsari, 2011). Nearly free energy sources or those that might require very little income, like firewood, which frequently causes significant indoor pollution and is connected to very poor households, form the basis of the model (van der Kroon et al., 2013). Nonetheless, as household income rises, these conventional fuels are entirely given up, and in the second level, a change to superior fuels is made. These fuels at the second level are referred to as traditional fuels (Nlom and Karimov, 2015), possibly to denote the fact that a household has moved on from basic fuels and is moving towards more sophisticated fuels. Households might buy pricey electricity-using gadgets as their income rises even higher.

Energy ladder's fundamental shortcoming is that it presupposes that all fuels are readily available and that household income is the primary constraint on the adoption of clean, contemporary fuels (Kowsari, 2011). According to Trac (2011), van dee Kroon et al. (2013), and Masera, Saatkamp, and Kammen (2000), the choice of a certain fuel can be influenced by a variety of patterns and variables, regardless of the household's financial situation. According to a research conducted in China, although the region has had access to electricity since at least 1980, some meals are still prepared through the use of firewood (Trac, 2011), despite the fact that it is thought in the communities that energy is affordable and dependable. As fast food like noodles is prepared with electricity and slow-cooked meat with firewood, culture may have an impact on this. Similar incidents were also reported in Thailand (Nansaior et al., 2011) and Mexico (Masera, Saatkamp, and Kammen, 2000). In Bhutan, Rahut, Behera and Ali (2014) claim that income is a very essential driver for picking a fuel for lighting, but the influence of income on the choice of fuel for cooking and heating is unclear. Not all of the reported households appear to have completely switched to alternative fuels; rather, some use different fuels for the same purpose, depending on their preferences. This introduces the idea of fuel stacking.

Masera, Saatkamp, and Kammen (2000) assert that the idea of fuel switching is actually fuel stacking based on their research in rural Mexico. They contend that complicated economic, social, and cultural considerations have made the full switch to contemporary cooking fuels difficult. Increased household income is the outcome of fuel stacking, although new fuels only serve as partial replacements for traditional fuels rather than being a perfect match (van der Kroon et al., 2013). Fuel stacking makes the crucial point that switching to cleaner fuels is a two-way street, allowing homes to switch back and forth between fuels as necessary thus mix fuels for different household purposes. In essence, the household's fuel alternatives only get more plentiful as income rises (Kowsari and Zerriffi, 2011).

Fuel stacking asserts that not every situation exhibits an uninterrupted association between energy transitions and household income; rather, certain households have a tendency to stack fuels as money rises. The factors that influence households to use a specific fuel range from those that are reliant on the household itself, or those that describe the characteristics of the household, to those that are external and have no connection to the household whatsoever (Rahut, Behera, and Ali, 2014).

Fuel stacking corresponds to various use patterns, in which households select several energies from both the lower and upper levels of the energy ladder (Abdissa, 2021), particularly in developing countries. Indeed, it is contended that households in developing nations do not switch to modern energy sources, but as an alternative, consume a combination of fuels, which may include combining solid fuels with non-solid fuels as energy sources. That is, rather than moving up the income ladder step by step, households select different energy sources from a menu; depending on their budget, preferences, and needs, they may select a combination of high-cost and low-cost energy sources (Mika et al., 2020). Traditional fuels, according to Kowsari and Zerriffi (2011), provide security when modern energy supplies fail and prices fluctuate (Mika et al., 2020). Furthermore, new sources may be inapplicable to habitual and traditional cooking techniques and preferences, and these modern sources are frequently perceived to be costly, preventing people from fully relying on them (Phoumin et al., 2020).

Moving away from the idea that income is the only factor influencing energy choice, social and cultural variables are crucial. For instance, it has been discovered that the gender of the leader of the home is crucial. In a study conducted in Bhutan by Rahut, Behara, and Ali (2014), it was discovered that households headed by women were more inclined to switch to cleaner fuels. This is likely due to the fact that women typically perform the majority of cooking in most nations, and they are more likely to choose fuels that require little manual work (Behera et al., 2015). There is also the opportunity cost associated with gathering conventional fuels. Modern energy sources are perhaps more appealing to a female household head because they free up more time for other tasks that may generate income or just more time for the family. Nlom and Karimov (2015) used ordered probit and logit models to evaluate the factors influencing fuel choice in Northen Cameroon. The fuel types taken into consideration were firewood, kerosene, and LPG, and they were ranked according to comfort, usability, and efficiency from 1 through 3 in that order. The findings specify that, among all other variables, the household head's education degree had the greatest impact on the fuel choice. It is commonly believed that persons with greater levels of education are more conscious of the health implications of using dirty energy sources. Additionally, as greater education levels typically lead to more formal types of employment, less time may be spent gathering firewood, which could ultimately affect the fuel choice, proving the importance of education.

The amount of conventional fuels that can be collected will depend on how long it takes to collect them. Due to physical limitations, this would place a load on the home of elderly individuals. As a result, age is a significant factor in determining the fuel type used in a home (Mothala, 2020). Senior household leaders favour to use firewood only if it is obtained within the garden in South Asia (Nepal, India, and Bangladesh), confirming physical restrictions. However, it is important to keep in mind that Nlom and Karimov (2015) contend that a transition away from biomass is less likely to happen the older the senior leader of the household is. The explanation for this is because older people resist change. Additionally, families with a lot of kids are more likely to continue using biomass since kids appear to be able to labour efficiently enough to collect biomass (Behera et al., 2015).

Other variables are influenced by cultural standards, while others are motivated purely by convenience (Guta, 2018; Mothala, 2020). For instance, practically all households in Cauxio, China use electric rice cookers to prepare their rice, while the same home chooses to cook their meat over a fire (Trac, 2011). This may be due to flavour, as it is often believed that meat cooked with firewood tastes better. Similar to this, it has been claimed that in Jaracuaro, Mexico, cooking tortillas on an open flame over a clay comal as opposed to an LPG burner results in a perceived improvement in flavour (Masera, Saatkamp, and Kammen, 2000).

The household may not have any influence at all on the choice of fuel; national policy and macroeconomic considerations, and distance to the market, for instance, may be crucial. As with any commodity, household energy choices are also influenced by supply and demand (Mothala, 2020). Energy security can be seriously impacted by supply reliability; households typically rely on or select the most convenient energy source to meet their fundamental needs. This is supported by a research conducted in Pakistan that used descriptive statistics to indicate that respondents preferred gas over biomass, but that there was only a limited amount of gas available.

The above discussion gives evidence that among factors found to explain a household fuel stacking behaviour, a preference for and knowledge of traditional fuels as well have a trend to create a sense of energy security, that is, dodging being susceptible to price instabilities or unpredictable energy services (see Alem et al., 2016). Moreover, modern fuels were regarded as unsatisfactory alternatives for traditional fuels as a result of the latter’s association with certain cultural and traditional aspects of the household’s lifestyle; these factors therefore affect a household’s energy choice decisions (Ruiz-Mercado and Masera, 2015).

The energy stacking theory proposes that households blend different fuels depending on their various needs rather than abandoning traditional fuels when modern fuels become available. This hypothesis is pertinent to the current study since it aims to determine how the electrification project’s supply of electricity influences the community’s adoption of electricity as a source of energy for cooking. Additionally, it aims to explain why the community continue to use different fuels for cooking rather than using the available electricity. This theory's hypotheses were used in this study to give an interpretation of why the community continued to cook with dirty fuels while using electricity for other purposes.

2.3 Conceptual Discussion as Determined by Research Questions

This study is centred on the issue of the Thabana-Morena Community's continued reliance on dirty energy sources for cooking and heating despite having access to electricity through the rural electrification project. This reliance is often seen in the use firewood, charcoal, dung, or kerosene to cook which exposes half of those who use these fuels to indoor air pollution (Afridi, 2022). This health burden is borne disproportionately by women, who are the primary cooks in their households. Owing to these factors and the effects of climate change, controlling carbon dioxide emissions has grown in importance in determining the energy policy of many nations which has since influenced the concept of energy security. However, there have been efforts to shift households to cleaner, more energy efficient fuels have gained traction since the 2000s, and some countries are seeing significant progresses in health outcomes (for evidence from Indonesia, see Verma and Imelda, 2022).

Energy security is defined in a way that takes many factors into consideration. Energy security is "the uninterrupted availability of energy resources at a reasonable price" (Huang, Chung, and Wu, n.d). The Asia-Pacific Economic Cooperation (APEC) unit, the Asia Pacific Energy Resource Centre (APERC), developed the four-dimensional/4As concept of energy security, which includes acceptability, affordability, accessibility, and availability. It may be observed that the definition's components fall into two primary categories: technology and economics. Environmental concerns including clean air, clean water, and a healthy landscape were taken into consideration while defining energy security, in response to the issues posed by climate change and excessive carbon dioxide emissions (Paravantis, 2019).

In order to examine and structure energy security, APERC (2007) created the A-framework, which combines the classical availability, affordability, accessibility, and acceptability as aforementioned. Availability of the supply of energy resources, mostly categorised by steady and uninterrupted supply of energy; this dimension points to how an energy source is able to be sufficiently supplied to users without any restrictions. Affordability refers to the availability of sufficient supplies at an affordable price; how supplies are priced in a way that the people who need and use those are able to afford them at a reasonable and stable energy price. When a given energy source becomes less affordable, it becomes less accessible to individuals, which means their energy needs cannot be satisfied (Tongsopit et al., 2016). Accessibility, on the other hand, simply means the ability by people to access energy resources. Last but not least, the acceptability dimension covers the energy source's social and environmental factors from a sustainability perspective. The traditional 20th-century approach to energy security is embodied in the first two As (availability and affordability), whereas the latter two As (acceptability and accessibility) represent some 21st-century issues, such as energy poverty and climate change (Paravantis, 2019).

2.3.1 Access to Electricity

It is defined as an end user's ability to consume electricity for desired services (World Bank, 2020). The number of people gaining access to electricity each year is increasing as a result of strong success in some countries, such as Bangladesh, Ethiopia, India, Kenya, and Tanzania, and thus progress toward universal energy access by 2030 appears feasible (IEA, 2018). The IEA (2018) further states that off-grid solar electricity is being provided by public programmes and private-business models, and many countries are utilising their renewable potential in the centralised electricity mix.

Nonetheless, grid electrification was the source of nearly all energy access gained in 2002, and it is likely to remain the most advantageous option for large households, particularly in more densely populated areas (IEA, 2017), due to the economies of scale associated with centralised power grid extension with grid expansion. IEA (2017) also adds that grid extension is also expected to play a larger role as power demand, urbanisation, and economic activity rise. Decentralised access solutions are currently small but growing; the IEA estimates that more than 33 million people have access to electricity through decentralised renewables (excluding pico-solar, which IRENA estimates benefits 114 million users), with connection rates increasing (IEA, 2020). Renewable energy sources appeared to be the most expensive way to achieve universal electricity access in many areas; in addition to increasing grid-connected renewable electricity generation, declining costs of small-scale solar photovoltaic (PV) for stand-alone systems mini-grids are critical in helping deliver affordable electricity access to millions. This is especially true in remote rural areas of African countries, where many people remain without access to electricity (IEA, 2020).

The role of mini-grids, which is presently partial, is expected to expand, particularly as access initiatives aim to provide electricity for productive and commercial activities as well as households; an enabling environment is required for sustainable mini-grid development and operation, which includes committed policies and regulations, tailored financing mechanisms, and enabling institutional frameworks, with a focus on capacity-building and adapted technology (IEA, 2016). Within such an enabling environment, appropriate policies and regulations for mini-grids include a clear rural electrification strategy, a tailored licensing and permitting framework, and a mechanism to address compensation or integration of mini-grids when the main grid arrives, clear tariff-setting rules that encourage investment and enable long-term operation, as well as systems to ease access to finance for both developers and end-users (IEA, 2016; IEA, 2017).

In their comparison of three rural electrification options, Mainali and Silveria (2013) took into account: (i) off-grid renewable energy technologies for individual households, (ii) grid extension, and (iii) micro-grids (with diesel and hydroelectric generators). These were examined while taking into account a variety of technical and socioeconomic factors in the cases of Nepal and Afghanistan. According to the analysis, individual household technology should only be promoted in areas with dispersed households where there is no chance of a mini-grid solution because micro-hydro based mini-grids are the most competitive alternative for electrifying remote and isolated rural areas in both countries to improve access to electricity.

From a cross-sectional study of 605 rural households and a direct field inspection of 137 solar PVs or lanterns, Wassie and Adaramola (2021) investigated the causes and effects of rural electrification with solar Photovoltaic (PV) systems in Ethiopia. Findings demonstrated that the use of solar PV systems in rural Ethiopia is expanding, and that there has been a noticeable decrease in kerosene use as a result. Additionally, the study discovered that solar PV systems could give rural households access to electricity for 3 to 5 hours per day, lessen the risk of health problems caused by kerosene lamps, and enable microbusinesses to make more money. However, the study also discovered significant obstacles to the use and efficacy of solar PV systems in rural or off-grid Ethiopia, including high costs for quality-verified solar products and a lack of after-sales maintenance.

In order to power a small village in Iran with renewable resources, Rad et al. (2020) concentrated on identifying the best renewable energy system. To increase accessibility in the village, a hybrid photovoltaics, wind turbine, biogas generator, or fuel cell renewable energy system was suggested. The findings showed that the most cost-effective method is to use solar, wind, and biogas; adding a fuel cell to this configuration would increase costs and decrease system flexibility.

Eras-Almedia et al. (2019) conducted research on the promotion of off-grid electrification, which heavily relies on photovoltaic (PV) technology. Third Generation Solar Home Systems (3G-SHSs) were introduced to support off-grid initiatives, and it evaluated the successful projects created in Bolivia, Mexico, and Peru. According to the findings, rural electrification is primarily driven by confidence, commitment, and flexibility. Additionally, it is shown that combining 3G-SHSs with different business models—including an energy service company, free-for-service, pay-as-you-go, and micro-franchising—is incredibly effective in terms of sustainability.

Odou, Bhandari, and Adamou (2020) used the case study of Fouray village to analyse the techno-economic viability of a hybrid renewable energy system (HRES) for sustainable rural electrification in Benin. According to their analysis, diesel generators reduce the need for batteries by 70 per cent and guarantee a dependable power supply. This study showed that the most cost-effective HRES strongly depends on the potential energy sources accessible at a location and the distance of power plants from the beneficiary.

2.3.2 Use of Dirty Fuels for Cooking and Heating

Dirty energy sources are sources of energy that cause indoor air pollution as well as outdoor pollution in the form of black carbon emissions (Kapsalymova et al., 2021). Solid biomass fuels, for example, are a widely available, renewable energy source that blends with the local diet, making them the firewood of choice for most households in rural Sub-Saharan Africa and South

East Asia (Bagozzi, 2013). The most common type of biomass energy used by households is firewood, which is primarily derived from agricultural waste and crop residues (Odongo, 2019).

In Sub-Saharan Africa, the use of biomass-based cooking fuels accounts for 6 percent of global black carbon (BC) emissions; BC contributes to local climate change and may be a major anthropogenic driver of global warming (Bond et al., 2013). It also increases individuals' direct exposure to household air pollution, which contributes to respiratory diseases and other health problems (particularly women and girl children who are responsible for cooking and collecting fuels) (IEA, 2017). These traditional cooking fuels are also labour-intensive to obtain, requiring several hours of effort each day in some places, and the sourcing of solid fuels like wood and charcoal can lead to forest degradation, particularly in East Africa and South Asia (Bails et al., 2015).

Wood fuels can come from a variety of sources, including the felling of live trees, naturally dying trees, and trees cleared for agricultural land (Wright, Sathre, and Buluswar, 2020). As a result, it is frequently difficult to directly attribute forest degradation or deforestation to the collection of wood fuels (Bails et al., 2015). Furthermore, charcoal production is a significant cause of forest degradation and possibly deforestation, with studies indicating that wood harvesting for charcoal manufacture is a significant cause of forest degradation (see Sedano et al., 2016).

Burning these fuels in cooking stoves directly contributes to black carbon emissions (as a combustion by-product) mentioned above; household cookstoves burning solid fuels account for approximately 25 percent of total anthropogenic black carbon emissions (Wright, Sathre, and Buluswar, 2020). Although black carbon is a short-lived particle, it has a very high global warming potential and has significant short-term, regional climate impacts. Accounting for the climate effects of black carbon can significantly improve the mitigation effectiveness of clean cooking initiatives (Freeman and Zerriffi, 2014).

In their investigation of the potential causal relationship between electrification and the acceptance of contemporary (and cleaner) cooking fuels, specifically Liquefied Petroleum Gas (LPG), Gupta and Pelli (2021) discovered that electrification increases the adoption of (free) biomass fuels while decreasing the likelihood of adopting contemporary (expensive) cooking fuels. Only the poorest households have statistically significant results, while the richest households have statistically insignificant results. They appear to be saying that electrification moves households down the energy ladder by putting more financial strain on them. The use of multiple fuels for a single purpose, such as cooking, suggests that people mix energy sources rather than forgoing other sources when other sources are available, according to Abdissa (2021), who studied the factors influencing household demand and choices in important Ethiopian cities. Additionally, Abdissa (2021) discovered that households opted for solid fuels (charcoal and wood) or a mix of solid and non-solid fuels (kerosene and electricity) as a result of rising kerosene prices and electricity prices.

Sadik-Zada, Gatto, and Blick (2021) used a case study of Kanyegaramire and Kyamugarura solar mini-grid energy in Uganda to study rural electrification and the transition to clean cooking. They discovered that, despite significant efforts to electrify rural areas and ensure everyone has access to reliable energy, most developing nations still rely on dangerous, polluting kerosene stoves, animal manure, and primitive tools for cooking. According to their analysis, households' cooking habits have not significantly changed as a result of electrification. They later found that, in addition to behavioural and aesthetic factors, affordability and educational attainment also have a significant impact on how efficiently households transition their energy.

Kafle et al. (2019) undertook a study in order to analyse a possibility for clean cooking access in Nepal. They discovered that even though the country's access to electricity was expanding, adoption of and access to clean cooking facilities remained minimal, with 85 per cent of the population still relying on solid fuels for daily cooking.

2.3.3 Cultural and Taste Preferences When Cooking

Regardless of the environmental and health risks associated with wood smoke exposure, wood fuels continue to be the most commonly used domestic fuel among households in many low-income countries (Akintan, Jewitt, Clifford, 2017), and their use is sometimes culture-related. So, it is necessary to consider not only the technical, economic, social, and political contexts, but also locally specific cultural influences, in order to understand energy choices (Hancock, 2015). Because domestic wood fuel uses are frequently localised, they are frequently associated with cultural heritage with local wood harvesting practices reflecting and influencing ethnically and culturally specific norms and preferences regarding food preparation (Mittlefehldt, 2016). Some of this knowledge reflects more pragmatic factors related to the functions of various types of wood fuel, whereas others are more closely related to taboos associated with the use of specific species (Akintan, Jewitt, and Clifford, 2017). Akintan, Jewitt and Clifford (2017) also add that intercultural and intra-cultural differences, as well as ethnicity, can influence plant selection and use based on factors such as familiarity, local abundance, combustion properties, and suitability for multipurpose uses such as drying and fermentation.

Some households believe that food cooked on biomass burning stoves tastes better than food prepared on LPG stoves, while collecting firewood and cooking are regarded as important normal chores that promote social interaction (Hollada et al., 2017). Because of taste preferences, some people in Kenya believe that traditional meals cannot be prepared using LPG (Josenthal et al., 2018).

In their study, Mazzone, Cruz, and Berezza (2021) noted that some of the food available in the village of the Brazilian Amazon needs a particular energy source to prepare. For instance, some game or fish have thick skin and are large and powerful predators. Locals must use particular techniques to prepare this kind of food, typically using firewood as opposed to electricity. Frequently, locals claim that cooking food in the traditional manner makes it more viscous.

According to studies, the practices of consuming a certain food cooked in a particular manner have assisted families from giving up their traditional fuels. For instance, despite having access to LPG, people in Mexico continued to use wood and charcoal to cook local cuisines such as Tortilla (Masera, Saatkamp, and Kammen, 2000). It could be argued that it is a habit of eating specific foods cooked with specific fuels that has been ingrained in their cooking practices for several generations. Another similar example comes from India, where people refused to give up using firewood because they enjoyed the taste of Chapati cooked on a wood stove (Trieber, Grimbsy, and Aune, 2015).

2.3.4 Adoption of Appropriate Electric Cooking Appliances

Electric appliances, particularly cooking appliances, consume a significant amount of energy in the home; examples include electric stoves (including induction stoves), electric kettles, microwave ovens, and so on (Parikh et al., 2020). Most of these devices are highly efficient for their specific tasks (for example, kettles for boiling water) and must thus be combined with other appliances to cook a variety of food that comprise of a full list of options (World Bank, 2020). Induction stoves are becoming more popular due to their versatility for a wide range of dishes and their ability to heat a large amount directly through magnetic induction, making the heat source as responsive as gas (Parikh et al., 2020). Large-scale programmes have been established to facilitate the adoption of induction stoves and other electric appliances in a variety of developing country contexts, including India and Ecuador; however, uptake has not been as promising as initially hoped in many of these trials (Banerjee et al., 2016; Gould et al., 2018).

Until recently, the development community did not consider electricity to be a viable option for increasing access to clean cooking due to issues with reliability, safety, access, affordability, and sustainability (World Bank, 2020). Blackouts and brownouts on weak grids make it impossible for people to cook when they need to, and collecting usage causes peak load on already stressed grids to spike, exacerbating underlying problems. The World Bank (2020) adds that there is also concern about poor quality wiring, which could short out and spark a fire if insufficient cooking devices draw high currents.

Cooking with electricity and using electric cooking appliances can be a truly clean cooking solution in terms of direct emissions in the kitchen, which affect both ambient and household air quality, as well as environmental sustainability (assuming electricity is produced from how-to zero-emission sources); electricity has the potential to rapidly transition entire urban and peri-urban communities that are already grid-connected from traditional fuels. This would make local efforts to combat household air pollution more effective, as outdoor pollution from biomass cooking has also been shown to have significant health consequences for the entire community (Das et al., 2018).

In developing countries, insufficient biomass or coal-based cooking devices account for roughly three-quarters of global greenhouse gas emissions. Upgrading to energy-efficient and low-carbon modern electric cooking appliances with extremely low costs and significant net benefits could save approximately 50 per cent of the energy used in solid fuels (Asok Rose, 2021).

In a study conducted in rural India, induction stoves were examined as a potential option for clean cooking. They discovered that induction stoves were installed in nearly 4000 households in Himachal Pradesh, one of the few highly electrified states in the nation, as part of a programme on access to clean cooking alternatives in rural India. The key usage data from 1000 rural households was analysed, and the results showed that although electricity significantly replaced LPG and was typically used as a secondary cooking fuel, it had no similar impact on the primary cooking technology of traditional mud stoves. The study's overall findings show that induction stoves will have limited potential to reduce the consumption of firewood and LPG if included in energy access programmes, and that too only in areas with high levels of electrification. Similarly, the study found that 5 per cent of the households studied had switched from using firewood to electricity as their primary cooking fuel.

In Rwanda's Nyagatara district, Sanchez-Jacob et al. (2021) used a computer model called the Rural Electrification Model (REM) to demonstrate the effects of including electric cooking in electrification planning. Three household scenarios were examined: one for basic electricity provision, one for electric cooking, and one for cooking a meal with electricity and another fuel in alternate portions while stacking the fuels cleanly. Results after using the REM revealed that electric cooking significantly alters the combination of technologies and the overall cost of the least-expensive electrification plan. This case study also demonstrated that, in grid-connected households, electricity can be cost-competitive with LPG and charcoal while lowering greenhouse gas emissions.

Through the Access to Energy Institute (AEI), Kweka et al. (2021) established a pilot project in six different Tanzanian mini-grid locations and provided 100 households with an electric pressure cooker (EPC) to use at home. To gather information on how the EPCs were being used, each one was connected to a smart meter. It was discovered that there were only a few technical problems with operating the EPC during adoption of the appliance, despite the fact that the analysis showed that cooking with an EPC cuts meal preparation time by 12 per cent and traditional fuel use, which may also yield associated time, financial, and health benefits to the household. Additionally, it was found that the use of EPC was decreased as a result of power outages after backup generators were no longer commercially viable to operate.

2.4 Conclusion

The above literature review established that the inclusion of electric cooking in larger electrification strategies which provide standard electricity rather than electricity generated from solar panels is frequently ignored by energy policies, and the promotion of clean cooking frequently neglects electrification in its initiatives. This indicates that there has not been much progress in electrifying cooking. Thus, despite the fact that SDG7's aims at achieving universal access to electricity and clean cooking technologies, there is a lack of research on why people may continue to use dirty fuels even after being provided with electricity and are reluctant to adopt electricity as their cooking fuel. This demonstrates that there is an evidence gap regarding households switching to electricity and accepting it as their cooking energy source and abandoning dirty fuels. This means that the current study has provided new evidence on the specific issue of continued reliance on other sources of energy after access to electricity has been provided.

2.5 Summary

The chapter has provided a discussion on the works that are relevant to the study's problem. In accordance with the research questions, it has thus highlighted the concepts that explain the issue to be addressed by the study. It has also covered the theories that conceptualise the problem, and it concluded by highlighting the precise knowledge gaps that this study aims to fill.

CHAPTER 3

METHODOLOGY

3.0 Introduction

This chapter entails the methodology that was used for this study. It clearly demonstrates the research methodology and paradigm, study area and the description of the research design, which are succeeded by the discussion of the units of analysis for the study and sampling techniques. Discussions of the data collection techniques and the organisation of how data was analysed was done in the section that followed. It concludes with a discussion of the study's reliability and validity (rigour) as well as ethical considerations, with the summary immediately following.

3.1 Research Paradigm and Research Methodology

3.1.1 Research Paradigm

According to Siddiqui (2019), Kuhn's "The Structure of Scientific Revolutions" introduced the concept of paradigm. A paradigm, according to him, is an integrated bunch of applicable concepts, variables, and problems that are linked to corresponding methodological approaches and tools. A research paradigm, in this view, is essentially a set of beliefs that commands what ought to be studied, how research should be conducted, and how results should be interpreted. Siddiqui (2019) adds that a paradigm also entails the logical positions of researchers regarding the nature of matter, what can be known, and how this knowledge can be accomplished.

Creswell (2015) identifies four research paradigms, which he refers to as "worldviews", and defines them as general philosophical directions about the world and the nature of research that brings to a study. These worldviews are Post-positivism, Constructivism, Transformativism, and Pragmatism (Creswell, 2015). Post-positivism, in his opinion, is a deterministic philosophy in which causes decide effects or outcomes, whereas constructivism believes that individuals pursue understanding of the world in which they live and work, and develop meanings from their experiences and the experiences of those around them. In this view, the goal of the research becomes to rely on the participants' viewpoints of the situation being studied as much as possible, with questions asked broad and general so that participants can create the meaning of the situation.

In the transformative worldview, according to Siddiqui (2019), research must be intertwined with politics and a political change agenda in order to contest social oppression at whatever level it transpires; thus, the research includes an action agenda for restructuring that may change the lives of the participants, the institutions where people work or live, as well as the researcher's life. It focuses on the needs of marginalised and excluded groups and individuals in society. Finally, rather than precursor conditions, the pragmatic worldview rises from actions, situations, and consequences. Instead of focusing on certain methods, researchers emphasise the research problem and employ all available approaches to understand and solve it (Creswell, 2015).

These worldviews inform different research approaches: constructive and transformative worldviews inform a qualitative approach, post-positivism informs a quantitative approach, and pragmatism informs a mixed approach. This study, however, followed the qualitative approach as informed by the constructivism paradigm. According to Siddiqui (2019), a qualitative research approach seeks to understand and clarify what is occurring in a social context as in the matter of the present study where the researcher sought to uncover how rural electrification affected the community's adoption of electric cooking. Additionally, this approach enables the researcher to interact personally with the group being studied and conduct the study in its natural environment as interviews are normally used in this approach (Siddiqui, 2019). With regards to this study, the researcher was able to network personally with the community of Thabana-Morena about their experiences of the electrification project and their utilisation of electricity provided as a result of the electrification project.

3.1.2 Research Methodology

On the one hand, research methodology is essentially a method for systematically solving a research problem; it can be thought of as a science that studies how research is carried out scientifically. On the other hand, research methods are all the methods and techniques that researchers use to answer research questions, and they are part of the research methodology (Kothari and Garg, 2020). This means that the choice of research methodology is slightly broader than the scope of research methods. Thus, when discussing research methodology, not only research methods are considered, but also the logic behind the methods used in the context of each research study, as well as the explanation of why one method or technique was chosen over others.

In the context of the current study, research methodology has assisted the researcher in explaining why the study was conducted, how the problem was defined, what type of data was collected, and what specific methods the researcher has used to collect that data. Research methodology has also assisted the researcher in explaining why a specific data analysis technique was used.

3.2 Study Area

The research was carried out in Lesotho's Mafeteng district. Lesotho is a landlocked mountainous country in Southern Africa, enclaved within the Republic of South Africa. It has a land area of over 30 000 km^2 and a population of slightly more than 2 million people (according to the latest estimates). The country is divided into ten districts, each of which is led by a district administrator. Furthermore, these ten districts are further sub-divided into eighty constituencies which have 129 local community councils in total. Among these districts is the Mafeteng district where the study was conducted. More specifically, the study was conducted in the Koti-Se-Phola and Malumeng community councils which are among the 129 community councils in the country and are found in the Mafeteng district's Thabana-Morena constituency.

The Koti-Se-Phola community council (CC) has approximately thirty-six villages, while the Malumeng community council has approximately forty villages; in both community councils, five villages per council were connected to electricity in 2017 during the implementation of the rural electrification project in Thabana-Morena. These councils were chosen because they are where rural electrification was implemented by providing standard electricity, rather than solar panels, which the research is interested in. They are also where the researcher became aware of the problem of relying on dirty fuels for cooking, and she became interested in delving deeper into the issue to discover why this continues even when electricity is available.

These community councils are situated in the rural foothills of Thabana-Morena, located in the south region of Mafeteng district, one of the lowlands districts of the country. Because of its altitude, this area usually experiences very cold winters, sometimes charaterised by heavy snowfalls, and warm-humid summers. In this area, Thabana-Morena, there is a clinic which is situated in the ha-Konote village of the Koti-Se-Phola community council and people from across all the villages from both councils go to that clinic. There are several small shops around the clinic, most of which sell fast food and secondhand clothing. In addition, a number of households also run general dealers within their yards for income generation. The Ministry of Home Affairs established a Resource Center in the vicinity of the area to assist with the profiling of resource center animal identification markings since many households in the area are involved in wool and mohair production, so the center helps in providing identification marks for the sheep and goats.

The villages of Ha-Konote, Ha-Bofihla, Ha-Lekoatsa, Majakaneng, and Machafeela found in the Koti-Se-Phola community council were used in this study. For the Malumeng community council, on the other hand, the villages which were used in this study are Malumeng, Ha-Turupu, Ha-Tjoobe, Ha-Sebaki, and Ha-Sekhele.

3.3 Research Design

This refers to a plan or structure that shows how a study should be carried out; it is a blueprint for carrying out a study. The two most common research designs are cross-sectional and longitudinal research designs which are both types of developmental research design (Leedy and Ormrod, 2020. However, Thomas (2022) defines cross-sectional design as a design based on observations made at a single point in time, whereas Malter, Mooman, and Granesan (2017) define longitudinal design as a design in which researchers conduct several observations of the same subject over a period of time, sometimes lasting many years.

In the case of the current study, the researcher has evaluated the significance of a research design through the use of a cross-sectional design which has permitted the researcher to collect data from multiple subjects at the same time, making it the best choice for practical reasons because it is less expensive and takes less time. This cross-sectional design, in this context, is a design that has allowed the researcher to select the population of the study at the time of the research, and such population has similar characteristics such as being members of the Thabana-Morena community who benefited from the rural electrification project that was implemented in the rural areas of the Koti-Se-Phola and Malumeng community councils.

Following a cross-sectional research design, the study has employed a case study design which falls under cross-sectional study designs to focus on the case of Thabana-Morena households in the Koti-se-Phola and Malumeng community councils that benefited from rural electrification. A case study examines specific cases in their natural progression for in-depth analysis; it looks at a social unit as a whole and seeks to understand the causes of events and the relationships among the contributing factors. Because of this, the current study used the Thabana-Morena community (as a social unit) as an example of a rural electrified community to investigate why they continue to use unclean fuels for cooking despite having access to electricity and to identify any associated barriers to switching entirely to using electricity as a source of energy for cooking.

Using the case study of the Thabana-Morena community, the study further employed the pre-test and post-test design. In this type of design, a single group is chosen and evaluated in terms of particular variables at a particular period before the intervention. Then the intervention happens. The same chosen variables are subsequently the subject of a second set of observations after the intervention (Leedy, et al., 2020).

The rationale behind this research design is that the community was at a specific developmental stage previous to the intervention, and then there was an intervention that may or may not have caused a visible change in the circumstance.

The researcher undertook an objective assessment of the situation of various types of fuels that were used by the community in Thabana-Morena for different purposes (cooking, water heating, space heating, and lighting) before the intervention, in this case prior to the start of the electrification project, while applying this design to the current case study. This project has been referred to as an intervention since it had an impact on the communities in which it was implemented. Additionally, the researcher also performed a second objective assessment of the situation on the same variables of the fuels that the Thabana-Morena community used for the same various purposes that were all evaluated before the intervention, which is now became the second observation. The main presumption in this situation is that the electrification project, as the intervention, is what caused the changes shown in the mentioned variables between the observation before the project and the observation after the project.

The ten villages from the two CCs in Thabana-Morena that benefited from the project were thus used in the current study to gather these two sets of information: the first set concerned the types of fuels that were utilised for various purposes and types of fuels that are now used by households after the implementation of the project. This was done in order to obtain the pre- and post-implementation situation surrounding the types of fuels used for different purposes by the communities in these villages.

3.4 Units of Analysis

A unit of analysis is essentially the "who" and/or "what" of the research; it is an entity under investigation. Individuals, groups of individuals, organisations, and geographical locations are all examples of this entity (Schwester, 2015). According to Schwester (2015), the unit of analysis is identified by identifying the relationship within the research question(s) and to whom or what the relationship applies, which serves as the foundation of the unit of analysis. In the current study, it was discovered that, across all the research questions, the relationship that was identified was that of rural electrification and cooking and heating, which applies to the Thabana-Morena community, particularly those in the community councils of Koti-Se-Phola and Malumeng, making the households in these communities the units of analysis in this study.

3.5 Sampling Techniques

With a sample being a subset of a population that represents the characteristics of the entire population (Kabir, 2016), sampling is the act, process, or technique of selecting a suitable sample for use in the study (Rakotsoane, 2012). Sampling techniques are typically classified as probability or non-probability. According to Showkat (2017: 4-5), “probability sampling is a procedure in which each element of the sample has an equal chance of being chosen to participate in the study, whereas non-probability sampling is a procedure in which a researcher chooses a sample based on his or her judgment”. As a result, in a non-probability sampling, elements do not have an equal chance of being chosen.

Purposive sampling was used in the study to choose a sample of the villages that were included. Purposive sampling, according to Shaheen et al. (2016), is based on the idea that information-rich samples should be chosen in order to get a thorough understanding of the phenomenon. As a result, in purposive sampling, the researcher chooses specific components from the population for purposive sampling that will be indicative of or instructive about the topic of interest. This shows that decisions about which subjects should be chosen to provide the best information to address the purpose of the research are made based on the researcher's familiarity of the population (Rakotsoane, 2012).

The researcher employed purposive sampling by selecting specific villages in Thabana-Morena that have benefited from the rural electrification project as her sample. Due to their status as project beneficiaries, these were the communities that could provide the most information about rural electrification. In this way, the researcher used her judgment to choose the villages that were used in the study after studying the population and figuring out the population and characteristics of the sample she wanted.

A snowball sampling technique was then used to select households which were involved in the study. This is a sampling technique that has gotten its name from the fact that one collects a sample just like a snowballs do when they accumulate snow (Rakotsoane, 2012). A snowball sample is created by requesting a participant to recommend another person who might be suitable or willing for the study. The subjects are chosen at random from the general population.

Following the selection of the ten villages, those were used as sub-groups and ten households from each village was chosen as potential study subjects. The first household in each village was then randomly chosen to be contacted by the researcher to see if they were interested in taking part in the study. When they were, they were encouraged to suggest other households that have also benefited from rural electrification and were aware that they were available on the day the researcher was collecting data. This was done until the researcher had reached her sample size of ten households per village, and was done repeatedly in all the villages that were used in the study.

3.6 Data Collection Techniques

The systematic process of collecting observations or measurements that allows the researcher to obtain primary information and the original depth of the research problem is referred to as data collection (Bhandari, 2021). Data collection methods or techniques are thus methods for collecting data; tools and methods for gathering information.

The study used personal semi-structured interviews to collect data, with no fixed wording or ordering of questions. Instead, the researcher, who is also the interviewer in this case, had a list of the main themes or topics to cover, as well as some open questions called probes, to ensure that the interview does not deviate off course. Respondents in this type of interview have a lot of flexibility in how they answer the questions. However, the researcher ensured that all participants are asked the same questions so that any bias is avoided during data collection. Furthermore, the interviews were named after the number of households in each village, with the interviewer using the villages' names to separate each household's answers and those responses were recorded using a cellphone recorder, with the entire interviewing process conducted in Sesotho so that the respondents, who are First Language speakers of the language, can respond with full understanding. For confidentiality, participants were labelled according to their respective villages and the sequence in which they were interviewed; Participant 1 Ha-Lekoatsa as P1L and Participant 4 Malumeng as P4M, for instance.

Semi-structured interviews were conducted in the ten villages, five villages per council. The community members, village chiefs, and village councillors were interviewed during one day-long visits per two villages from June 5 to June 9, 2023. The REU employee's interview, however, took place on June 26, 2023.

The interview guide for the community members was made up of two sections (see Appendix 4). The first section had questions regarding the situation of energy use before and after the project in order to provide an objective assessment of that situation in the area in question. The second section, which was further divided into four parts in accordance with the research questions, contained sub-questions that assisted the researcher in answering the main research questions regarding access to electricity and the utilisation of that electricity.

In addition to the interview guide for the community members, the researcher also had a guide for interviewing village chiefs and councillors (see Appendix 3). This guide had questions regarding the roles and responsibilities of those chiefs and councillors. These questions focused on community-level issues, particularly those related to the creation of the village electricity schemes. In addition, the last interview guide was for a professional working at the REU (Appendix 2) and contained practical questions on the unit's roles in rural electrification projects. Both of these guide had only one section and they have also been included as appendices of this study.

3.7 Data Analysis

Following data collection, the data must be processed and analysed in accordance with the routine established for the purpose when developing the research plan (Kothari and Garg, 2020). Data analysis is the process of examining data to see if it answers the research questions and objectives. This is done to ensure that no inappropriate claims about the people in question are made (Rakotsoane, 2012). In this study, the collected data was analysed qualitatively using thematic analysis which is a method of analysing qualitative data that is primarily derived from conducted interviews (Warren, 2020), with the researcher looking for themes that emerge from the data and inform the research questions. The researcher then classified and analysed the data collected through interviews by transcribing, classifying, and categorising such data.

The researcher has performed this analysis by following the steps outlined by Braun and Clarke (2006): familiarisation with the data by repeatedly listening to the interview recording, generation of initial codes, searching for themes, defining and naming themes, and finally producing the report. Thematic analysis is important when conducting research to learn about people's experiences, perspectives, and choices (Warren, 2020), as in this study, where the researcher interviewed rural electrification project beneficiaries to learn about their perspectives on electricity.

In order to start coding and looking for categories as per each predetermined theme, the researcher first became familiar with the data by transcribing the recordings and carefully reading over the transcriptions. Making a list of potential data items of interest and the connections between them, she then began allocating codes. The information was then coded, with each code linking to a brief summary of what the interviewees had said. This means that the researcher never attempted to read the transcripts; instead, if something fascinating appeared, it was recorded as a code. In this manner, the data were arranged into appropriate categories to start the analysis process. They were categorised according to the villages, matching the code to the appropriate interview segment. Following the coding of the data, all of the portions that matched each code had to be assembled.

Following a review of the generated list of codes, the researcher made an effort to classify them to observe if they are in accordance with the themes that were established themes as per the study's four research questions, while also noting if any new emerge. The researcher then went over the transcriptions for each theme she had developed, examining whether there was a distinct coherence within each theme as well as a distinct difference between them. She grouped themes that seemed to be similar and divided themes that did not meaningfully cohere. This made it easier for the researcher to assess if the themes adequately covered the most intriguing elements of the data or whether anything was lacking, enabling her to add or remove topics as necessary.

The findings were presented in accordance with these themes that were pre-determined with reference to the research questions listed in Chapter 1, and one theme that emerged during data collection. The replies of the research participants were grouped according to these categories based on how they used electricity in their daily lives and in reference to the literature. As a result, the answers of the community members were examined to see how they use and react to the provision of electricity in their separate communities.

3.8 Validity and Reliability or Trustworthiness and Credibility: Rigour of the Study

While validity assesses whether the research actually measures what it was intended to measure or how accurate the results are, reliability is used in qualitative studies as a concept to evaluate quality with the goal of generating understanding (Noble and Smith, 2015). However, qualitative researchers aim to design and incorporate methodological strategies to ensure the trustworthiness or credibility of the results, in contrast to quantitative studies that frequently employ these concepts through the application of numerical methods and creating validity and reliability of the findings (Williams and Kimmons, 2020).

Generally speaking, qualitative studies often need to adhere to a set of rigour requirements, with this rigour referring to the methods used to build trust or confidence in the research study's findings (Williams and Kimmons, 2020). It gives an accurate representation of the population under study and enables the researcher to demonstrate methodological consistency over time. This rigour is explained in relation to these studies by four individual elements: truth-value (credibility); applicability (transferability); consistency (dependability); and neutrality (confirmability).

3.8.1 Credibility

How closely do the findings line up with reality, is the question of credibility. This means that in order for findings to be credible, it is important to understand how they "hang together," or how they relate to one another (Stahl and King, 2020). To make sure of this, the research has employed the data triangulation technique by first using secondary data to try and understand the idea of using dirty fuels for cooking even when there is electricity, and then going out into the field to gather primary data relating to the same concept in the chosen study location in order to establish any observable patterns between the two.

3.8.2 Transferability

Transferability in qualitative research refers to the capacity to apply research techniques or conclusions to new contexts in order to deepen understanding (Stahl and King, 2020). To do this, the researcher has provided a thorough explanation of the study area's location, the factors that led to its selection, and the factors that led to the case study of Thabana-Morena being included in the study.

3.8.3 Dependability

The capacity to ensure that the research process is logical, traceable, and clearly documented is known as dependability (Stahl and King, 2020). To do this, the researcher provided a discussion of how and why the study participants were chosen, as well as a clear description of the study's specific aim. She has also provided descriptions of the data collection and analysis processes.

3.8.4 Confirmability

It is necessary for the researcher to provide evidence for how conclusions and interpretations were arrived at in order to establish that the research's interpretations and findings are clearly derived from the data (Nowell et al., 2017). Credibility, transferability, and dependability all have to be attained for this to be the case. In order for others to understand how and why conclusions and recommendations were reached, the researcher has ensure that the other three elements of rigour were met. Then, the researcher has made sure that the justifications for all theoretical, methodological, and analytical decisions made throughout the entire study are clearly stated.

3.9 Ethical Issues

Most ethical issues in research, according to Leedy and Ormond (2020), fall into one of four categories: protection from harm, informed consent, right to privacy, and openness with colleagues in the field. In order to advance the goals of the research, share trustworthy knowledge, the truth, and prevent errors, researchers must abide by these issues, which are a key component of research. In the current study, the researcher has followed ethics as discussed below.

3.9.1 Informed Consent

The terms “informed” and “consent”, which can be thought of as the agreement between the researcher and the participants, each contain two crucial components that must be carefully considered (Fleming, 2018). Participants were fully informed of the requirements, the intended use of the data, and any potential negative effects. The participants were required to give explicit and active consent to participate in the study, as well as acknowledge that they are aware of their right to access their own information and their right to withdraw at any time.

The researcher, therefore explained the outline of the nature of the research and the terms of one's participation in it during the data collection process. She provided a brief summary of the study's purpose and methodology, presented in Sesotho so that participants could understand it clearly. She also stated that participation in the study is completely voluntary meaning they could withdraw from the study at any time without incurring any consequences. The researcher also presented the letter of introduction (see Appendix 1) as to confirm her status as a student in National University of Lesotho's Department of Development Studies.

3.9.2 Confidentiality

It is crucial that participant identities remain private or anonymous. The researcher made sure that the responses of the participants are kept anonymous and private in order to accomplish. The researcher gave each participant a distinctive arbitrary code number so as to protect the participants' names rather than using their names to identify the interviews. Additionally, the researcher refrained from using any statements or data that could be used to identify participants.

3.9.3 Protection from Harm

All actions done to ensure the physical security and human dignity of research subjects or participants are taken into account in this discussion. A variety of precautions were taken to safeguard participants from any harm that might result from their involvement in the study. First off, all interviews took place in open settings throughout the day at the participants' houses, with the exception of the one with the REU professional which was held in his workplace, where he felt most comfortable.

3.10 Summary

The chapter has outlined the methods and tools that were used to solve and understand the problem of continued reliance on dirty fuels for cooking and heating needs for the Thabana-Morena community. It has also stated the location of the study and why it was chosen. It has also given discussions on the methods of data collection and analysis that were used, and provided components of the rigour that the study has ensured. Lastly, the chapter has touched on the ethical considerations that the researcher has abided by during the time of the research, especially when collecting data.

CHAPTER 4

DATA PRESENTATION AND ANALYSIS

4.0 Introduction

In order to better understand why the community continues to use dirty fuels for cooking despite having access to electricity, this chapter presents data gathered from various stakeholders in the rural electrification project carried out in Thabana-Morena. The responses from participants that were recorded throughout the data collection process are presented below. These responses were collected during the fieldwork in Thabana-Morena in the villages listed in Tables 2 and 3, and at the REU national offices. Tables 4 and 5 present the fuels that households used for various purposes across the ten villages before and after the rural electrification project respectively. In the beginning, the bulk of the data was taken into account as explained in Chapter 3 and was then coded and systematically structured in themes and categories for thematic discussion as shown in Table 6. The findings are then presented in accordance with these themes that emerged, keeping in mind the research questions listed in the first chapter.

The aim of the study and the research questions presented in Chapter 1 serve as a framework for a relevant discussion of the research findings. Each research finding is strengthened by a description of how it relates to the relevant literature review and theoretical background, enhancing the study's thoroughness and clarity as well as enabling it more to fully address each research question. The results allowed the researcher to learn how the electrification in Thabana-Morena has improved access to electricity there and to learn what the community thinks about using electricity for cooking, giving up dirty fuels, and adopting suitable electric cooking appliances.

In order to do this, the chapter is divided into five sections; the demographic data of the study's key participants is shown in the first section, which is followed by a data presentation of an objective evaluation of the energy use situation both before and after the project. The framework that has described the themes and categories that have evolved throughout data analysis is then presented after that. Each theme is presented and analysed in detail in the sections that follow, using categories created during the data analysis. To demonstrate how numerous study participants contributed to the topics and categories that have been outlined, quotes from diverse study participants have been used, with each category supported by two quotes from one village per council in order to provide a convincing analysis. This is then followed by the section on the discussion and interpretation of the results, with reference to the study's research questions. A summary of the entire chapter is provided in the final section of the chapter.

4.1 Demographic Characteristics of Participants

During the data collection process, the researcher gathered information on the demographic characteristics of the main research participants, including gender, educational background, and occupation. The responses are shown in Table 1 below. These characteristics allowed the researcher to develop an analysis of the sex, occupation and educational backgrounds of the research participants in connection to their awareness and knowledge for the electrification project in Thabana-Morena. The key participants were given the labels Key Participants 1(KP1), KP2, KP3, KP4, KP5, and KP6 for the sake of confidentiality and anonymity.

Table 1: Demographic Information of Key Participants

Key Participants	Gender	Institution or Village	Occupation	Highest Level of Education
KP1	Male	Rural Electrification Unit (REU)	Project Manager	N/A
KP2	Male	Ha-Konote	Chief	Standard 7
KP3	Male	Majakaneng	Chief	Junior Certificate (JC)
KP4	Male	Khubetsoana	Community Councillor	Cambridge Overseas Schools Certificate (COSC)

KP5	Male	Malumeng	Chief	JC
KP6	Male	Ha-Turupu	Community Councillor	COSC

In addition to the key participants, the study also gathered data from five other villages in the Koti-se-Phola CC and five in the Malumeng CC. The majority all of the participants from the villages of Koti-se-Phola were unemployed (twenty-nine), self-employed (ten), or pensioners (eleven) with one or more sources of income. For Malumeng CC villages, however, most participants indicated to have jobs in the public (thirty-two) or private sectors (sixteen), as well as additional sources of income including shop sales and room rentals in Mafeteng town. Additionally, participants in Koti-se-Phola were more likely to have completed Standard 7, although there was no apparent difference in the educational backgrounds of participants in Malumeng. There were not many male (eight) participants in either CC, and the majority (ninety-two) were female. This was probably because the majority of men, rather than women, are the ones employed in these villages as the researcher collected data during the week when they were most possibly at work. This could also be because most of the households are in these villages are headed by women. However, all key participants were males, which could reflect that men, rather women, are still entrusted with leadership positions.

Most houses (forty-five) in the Malumeng CC villages were modern houses and households had enterprises such as shops (seven shops in the CC) that also needed electricity. In Koti-se-Phola villages, however, most houses (thirty-nine) were thatched houses and corrugated iron roofed houses, and very few households (two shops in the CC) in these villages were not engaged in any enterprises that require electricity.

Table 2: Koti-se-Phola CC Villages

Koti-Se-Phola Community Council	Number of Households in the village	Number of Households interviewed	Total Population of the village
Ha-Konote	24	10 (6 Females, 4 males)	268
Ha-Lekoatsa	44	10 (7 Females, 3 males)	186
Ha-Bofihla	17	10 (6 Females, 4 males)	59
Majakaneng	11	10 (9 females, 1 male)	41
Machafela	13	10 (8 Females, 2 males)	55

Table 3: Malumeng CC Villages

Malumeng Community Council	Number of Households in the village	Number of Households interviewed	Total population of the village
Malumeng	88	10 (9 Females, 1 male)	386
Ha-Turupu	72	10 (10 females)	251
Ha-Tjoobe	59	10 (8 Females, 2 males)	227

Ha-Sebaki	44	10 (6 Females, 4 males)	193
Ha-Sekhele	18	10 (7 Females, 3 males)	89

4.2 An Objective Assessment of the Situation of Energy Use before and After the Project (Both CCs)

4.2.1 Fuels used before the project

Table 4 below lists the household replies about the primary uses of various energy sources in each of the ten villages prior to the electrification project. According this table, a total of twenty-two households throughout all villages used gas as their primary fuel for cooking, while seventeen households used paraffin, and a whooping total of seventy-one households cooked with either cow dung or firewood. Fifty-four households cooked with other sources such as cow dung, firewood, and corn cobs. No household utilised gas to heat their water, and twenty-nine relied on paraffin instead. In addition, seventy-one households in the ten villages used firewood or cow dung the purposes of water heating, while twenty-seven used paraffin for the purposes of space heating. Last but not least, ninety-seven households relied on paraffin for lighting, as opposed to none that used gas or firewood. The use of candles rather than paraffin for lighting was indicated by some households (three), nevertheless.

Generally, according to these findings, paraffin was infrequently used for cooking and that gas and dirty energy sources like firewood, cow dung and corn cobs were used by practically all households across all of the villages. While no household used gas for this reason, the majority of houses heated their water using paraffin and other types of energy. Additionally, the majority of houses in the villages used firewood and other dirty energy sources for space heating. In contrast to those households who used paraffin for space heating, nearly no household used gas for this reason. According to the findings, practically every household utilised paraffin for lighting. This they used for powering glass paraffin lamps and the *nkuke* lamps. However, other illumination options like candles were also an option for some households in the ten villages.

Table 4: Fuels Used before the Implementation of the Electrification Project

Villages	Activity (Per 10 households a village)	Electricity	Gas	Paraffin	Other Energy Sources (Firewood, cow dung, corn cobs)	Totals
Ha-Konote	Cooking	-	3	2	5	10
	Water heating	-	-	3	7	10
	Space heating	-	-	-	10	10
	Lighting	-	-	10	-	10
Ha-Lekoatsa	Cooking	-	2	3	5	10
	Water Heating	-	-	4	6	10
	Space heating	-	-	3	7	10
	Lighting	-	-	9	-	10
Ha-Bofihla	Cooking	-	3	2	5	10
	Water heating	-	-	3	7	10
	Space heating	-	-	2	8	10
	Lighting	-	-	10	-	10
Majakaneng	Cooking	-	1	2	7	10
	Water heating	-	-	1	9	10
	Space heating	-	-	3	7	10
	Lighting	-	-	8	-	10
Machafeela	Cooking	-	2	2	6	10
	Water heating	-	-	6	4	10
	Space heating	-	-	3	7	10
	Lighting	-	-	10	-	10
Malumeng	Cooking	-	4	1	5	10
	Water heating	-	-	3	7	10
	Space heating	-	-	5	5	10
	Lighting	-	-	10	-	10

Ha-Turupu	Cooking	-	3	3	4	10
	Water heating	-	-	2	8	10
	Space heating	-	-	4	6	10
	Lighting	-	-	10	-	10
Ha-Tjoobe	Cooking	-	1	1	8	10
	Water heating	-	-	3	7	10
	Space heating	-	-	4	6	10
	Lighting	-	-	10	-	10
Ha-Sebaki	Cooking	-	3	-	7	10
	Water heating	-	-	2	8	10
	Space heating	-	-	1	9	10
	Lighting	-	-	10	-	10
Ha-Sekhele	Cooking	-	-	1	9	10
	Water heating	-	-	2	8	10
	Space heating	-	-	2	8	10
	Lighting	-	-	10	-	10

4.2.2 Fuels used after the project

The table below shows the responses of the community regarding the primary uses of various energy sources by households in all the villages following the electrification project. Twenty-three families use electricity for cooking in total. However, these houses also said that they use electricity for cooking in an emergency; none of the homes indicated that they use electricity for cooking exclusively. However, only eighteen homes still use gas for cooking, and none of them use paraffin. A total of fifty-five households reported using energy sources such firewood, corn cobs and cow dung for cooking. Additionally, no family uses gas or electricity for space heating; instead, eighteen households use alternative energy sources and nineteen use paraffin. Out of all the families surveyed, sixty-two reported using electricity for water heating, whereas none used gas or paraffin, and thirty-seven used firewood sources. Every home stated that they used electricity for lighting.

The findings in this table show that despite having access to electricity, the majority of households continue to cook with firewood, cow dung and corn cobs. The findings do nevertheless show that some households continue to cook with gas. Even yet, some households now occasionally utilise electricity for their cooking, although not usually doing so. Only a small number of households said they also cook using gas. Additionally, no household now uses paraffin or gas to heat water; instead, the majority of houses use electricity and firewood for this purpose. Despite having access to electricity, practically all households still use alternative forms of energy except electricity for space heating, whereas today all households use electricity for lighting.

Table 5: Fuels Used after the Implementation of the Electrification Project

Villages	Activity (Per ten Households a village)	Electricity	Gas	Paraffin	Other Energy Sources (Firewood, cow dung, corn cobs)	Totals
Ha-Konote	Cooking	2	4	-	4	10
	Water heating	7	-	-	3	10
	Space heating	-	-	3	7	10
	Lighting	10	-	-	-	10
Ha-Lekoatsa	Cooking	1	3	-	6	10
	Water Heating	7	-	-	3	10
	Space heating	-	-	3	7	10
	Lighting	10	-	-	-	10
Ha-Bofihla	Cooking	3	3	-	4	10
	Water heating	8	-	-	2	10
	Space heating	-	-	3	7	10
	Lighting	10	-	-	-	10
Majakaneng	Cooking	1	3	-	6	10
	Water heating	6	-	-	4	10

	Space heating	-	-	-	10	10
	Lighting	10	-	-	-	10
Machafeela	Cooking	2	2	-	6	10
	Water heating	5	-	1	4	10
	Space heating	-	-	2	8	10
	Lighting	10	-	-	-	10
Malumeng	Cooking	3	-	-	7	10
	Water heating	4	-	-	6	10
	Space heating	-	-	-	10	10
	Lighting	10	-	-	-	10
Ha-Turupu	Cooking	3	3	-	4	10
	Water heating	6	-	-	4	10
	Space heating	-	-	2	8	10
	Lighting	10	-	-	-	10
Ha-Tjoobe	Cooking	2	1	-	7	10
	Water heating	6	-	-	4	10
	Space heating	-	-	2	8	10
	Lighting	10	-	-	-	10
Ha-Sebaki	Cooking	3	2	-	5	10
	Water heating	6	-	-	4	10
	Space heating	-	-	2	8	10
	Lighting	10	-	-	-	10
Ha-Sekhele	Cooking	2	-	-	8	10
	Water heating	7	-	-	3	10
	Space heating	-	-	2	8	10
	Lighting	10	-	-	-	10

4.3 Thematic Discussion as Influenced by Research Questions

Each predetermined theme and one that developed during data analysis are sub-divided into different categories. The themes and categories are outlined in Table 6 before being broken down into other sections for in-depth examinations and interpretation.

Table 6: Analytic Strategy- Research Themes and Categories

THEME 1	
Improved access to electricity	
Category 1	Reduced costs of individual connection.
Category 2	Connection was possible regardless of the distance of the villages from the LEC distribution line.

THEME 2	
Reasons for continued use of dirty fuels for cooking despite electrification	
Category 1	Electricity supply is not reliable.
Category 2	Electricity is expensive.
Category 3	Dirty fuels are easily accessible.
Category 4	Electric appliance are fragile, needing frequent replacements.

THEME 3	
Cultural and taste preferences when cooking	
Category 1	Some food tastes different when cooked with electricity.
Category 2	Some are traditional dishes so they have to be cooked using traditional fuels.
Category 3	Food cooked in open fires has great nutritional value.

THEME 4	
Adoption of electric cooking appliances	
Category 1	Appliances owned before the project.
Category 2	Appliances owned after the project.

THEME 5	
Challenges of the Thabana-Morena Project	
Category 1	The scheme took too long to produce desired results.
Category 2	Excluded households still do not have access to electricity.
Category 3	The community got fewer units when buying electricity.
Category 4	Food cooked in traditional pots possess a great nutritional value.

The results are also discussed with an eye towards addressing the study's main objective, which is to determine how Thabana-Morena's rural electrification influences the use of electricity as a source of heat and cooking.

4.4 Theme 1: Improved Access to Electricity

In Thabana-Morena, it is discovered through this research into how rural electrification affects access to electricity that access is enhanced by rural electrification. According to the respondents, the rural electrification project that was executed in their region has assisted them in lowering the cost of connecting individually because they are able to access energy through the electricity scheme at a relatively lower rate; comparatively speaking to what a person would be expected to pay when connecting individually, the amount paid was minimal. One key participant (KP2) points out that, *"While about M2000 is required to connect to the electricity individually, only M500 was required for each household to join the electricity scheme and eventually get connected to the* *electricity grid" (KP6).* This implies that even individuals who could otherwise not afford the individual connection costs in the past were able to connect.

One participant says:

> *Unlike people in the urban areas, we are unemployed, therefore we would not afford connection fees if we tried to connect separately, one participant remarked. Therefore, the project's plan truly assisted us by giving us the opportunity to electrify our homes for such small amounts of money we paid through the scheme (P1K).*

Sharing similar sentiments, another participant says, *"I was able to pay the scheme and got connected to the grid with this little money I get as my pension money. I do not think I would have been able to afford connecting if it was not because of the scheme" (P3M).*

When asked when and how they signed up for the electricity scheme, they respond that they did so in 2015 after their community councillor informed them of it at a public gathering. Additionally, the majority of them remember connecting in about 2017. One person in particular remarks, "*I believe it was around 2017, even though I do not remember the exact month, but it was after some time since we had joined the scheme" (P5T)*. Another respondent adds that, *"We got the much-anticipated electricity, I think it was in 2017" (P2B).*

Other public institutions, such as schools, are said to have also gained access to electricity as a result of the project, according to the participants. They state that because these institutions lacked access to electricity prior to the project, they had difficulties providing the services with which they had been entrusted. They also state that these institutions benefited from the project's implementation and completion. One key participant says, "*This project's presence has also made it possible for our institutions to get access to electricity, which helps them give services to the community as a whole. We have a police station and four schools, all of which now have access to electricity. In addition, since the project, we have also been built a clinic*" *(KP4).*

Another participant shares the same sentiments by adding that:

> *Even though when had to wait for some time to finally get connected, honestly this project has brought positive changes in our area in that our schools now have electricity*

connection, even the police station. We also no more have to travel to Mafeteng when we are not well since there is a clinic over there" (KP6).

The majority of respondents from villages in both councils also note that the project helped them by bringing the electricity even when they were far from the LEC transmission lines, which is something they were always told when they enquired about being brought electricity in the past. They emphasise that this project allowed them to connect to the electricity grid regardless of how far their communities were from these LEC transmission lines. "*The distance between our communities and the LEC transmission and distribution lines has long been cited as the reason why we would not be able to connect, yet this project made that which seemed impossible possible* ", according to P3L. A second participant adds that, *"Through this project, we were able to be connected even though we are outside the LEC area; if it was not because of this project, I believe even today we could still be without any access to electricity" (P7T)*.

Key participants point out the exact process of how schemes are created. They state that the REU, which they depicted as exclusively serving these areas through organised village electricity schemes and not on an individual basis, is the only entity in charge of providing electricity connection to rural and remote locations in the country. The only way to determine which communities are eligible for connection is through consulting with the REU. According to a particular participant, *"Since it is mandated to serve rural and remote areas which are far from the LEC transmission lines, the REU draws the map after being approached by villages, to indicate which villages are eligible to get electricity connection based on their distance from those LEC transmission lines and then informed about the price that should be paid to get connected" (KP4).*

4.5 Theme 2: Reliance on Dirty Fuels for Cooking Despite Rural Electrification

The study finds that people may still use dirty fuels for cooking even if they have access to electricity because electricity supply is frequently unreliable, especially in rural areas. Various reasons are stated for this. Evidence gathered in the study indicates that the following factors are the most important, i) reliability of supply, ii) cost of electricity, iii) accessibility of dirty fuels, and iv) fragileness of electric appliances. This is illustrated in the following responses by the participants

Respondents state that they cannot afford to rely on electricity for cooking because they occasionally go without power for several days, especially during extreme weather conditions. This brings up the issue of the availability of a certain fuel as one the 4As discussed in the energy security concept. They emphasise that if they were to rely on electricity for their cooking, they would have to be prepared to face the possibility of having to go to bed without food because the supply of electricity in their area is unreliable. One participant who expresses the same sentiments notes that, "*Electricity supply here is not reliable; we now know that once we see clouds we are to sleep without electricity, so we have opted to depend on electricity for other purposes not cooking, for which we have chosen other reliable fuels" (P3B).*

Sharing the same sentiments, another responds by pointing out that, *"Personally, my main challenge of using electricity for cooking is reliability, here electricity supply is not reliable at all so it is very risky to depend entirely on electricity for cooking. Some days we would be forced to sleep without eating" (P3S)*.

However, several respondents admit that they occasionally use electricity for cooking though they only do so in emergencies, such as when their major source of energy for cooking, LPG, runs out and they do not have the money to buy more right away. "*We mainly use LPG for cooking, and use electricity as back-up for when it (LPG) runs out. However, we still cook other food such as beans which we believe take long to cook using traditional fuels as our way of saving the electricity" (P4S).*

"The only time you can find me cooking with electricity is when it has rained and my wood is wet, from there I always use wood to cook" (P2M) indicates.

In addition, the majority of respondents note that despite having access to electricity, they still persist to use unclean fuels for cooking because electricity is expensive. This brings up the issue of affordability as discussed by the energy security concept. Different households indicate that they prefer to use electricity for other purposes rather than for their cooking because electricity is very expensive to use for cooking so they cannot afford to use it for cooking, proving the energy stacking theory's hypothesis that households may choose to stack energy sources for reasons such as affordability of a certain fuel compared to the other fuel. One participant (PK6) asserts that, "*Electricity is so expensive lately; a M20 token is now about eleven units which are few to use* *electricity even for cooking, so honestly we cannot afford cooking with it, we would rather use it for purposes that do not consume much of it such as lighting and charging phones*", they assert, claiming that cooking requires and consumes a lot of electricity. Another participant explains, saying, *"Electricity is very costly, its arrival has just been an increase of expenses for us, so we have decided to cut costs by using electricity for lighting only, not cooking" (PS2).*

They further assert that even simply purchasing it is expensive since they must travel to Mafeteng town to purchase it or use mobile money transfer services like M-Pesa, EcoCash, or My Wallet, all of which are pricey because getting to town requires transportation and using the services takes more money for transaction fees and charges. They also think that electricity purchased through these mobile services provides fewer units that also finish quickly. *"When we opt for these modern entities to buy electricity from our phones, we are charged lots and lots of money above the amount we will be paying for the electricity"*, *(P9L*) complains.

When asked further why they still use dirty fuels to cook even if they have access to electricity, another category—that these dirty fuels are readily available therefore they do not see the need to give them up for electricity—emerged. In this way, they state that it is quite simple for them to locate the dirty fuels, particularly cow dung, because many of them are farmers and the substance is practically everywhere. The elderly participants also mention that their grandchildren also help with the collection of these fuels so it is never a problem for them to have these fuels for use. They also claimed that these fuels are simpler to access that they do not even require purchase, in contrast to electricity, which must be purchased. Here, the issue of accessibility as discussed in energy security issues also comes into play. "*I have cattle and I always plant maize, so I have cow dung and these corn cobs to cook with; I do not even have to buy or travel far to get them, so it is more convenient for me to just use them instead of electricity also to minimise costs and my children also help with the collection of these when they return from school*", says one participant from Malumeng in reference to the idea that dirty fuels are accessible compared to electricity.

Sharing the same sentiments, another respondent echoes that, *"You see that forest?, I do not need a vehicle to travel there to obtain the firewood, and even though I do not have any animals of my own, my neighbour does, and she never has any trouble providing me cow dung. When it comes to electricity, I cannot say the same" (P4M*).

The majority of participants also state that they continue to use dirty fuels for cooking because they constantly need to replace defective electric appliances, particularly hotplate stoves. They say that these appliances are fragile and sometimes not resistant to weather events like lightning; they sometimes get damaged when lightning strikes while they are plugged in, necessitating the purchase of replacements. One participant (P8S) remarks, *"Before I decided to give up cooking with electricity, I think I bought a stove three times, they just kept on getting destroyed".* The majority of them even mentioned having two-banner hotplates that only have one burner operating.

"These appliances do not last, they break easily, needing us to keep going back to the shop to replace them. The hotplates are worse, you try to cook, then you realise that it is no more working, and you have no idea what caused that"(P5B).

They continue by stating that cooking with electricity is a very difficult procedure due to the appliances needed, thus they would prefer to remain with cooking over open fires, which does not require any appliances to complete.

When asked if they still thought using these fuels for cooking is safer than using electricity, they said no, claiming that electricity was already dangerous, with a number of precautions to take when using it. They have been warned not to use appliances with wet hands because they would burn, and they thought that if they used it intensively, especially for cooking, their metre boxes might burst, causing them a lot of trouble. However, they claim that using unclean fuels to cook does not endanger them.

A participant explains:

> *You cannot trust these European things; after all, we do not even know what they are made of. We have heard horror stories about how these stoves have exploded and injured children when they were plugged in, so we do not want to become other victims. Due to this, we have continued to cook with traditional fuels" (P3L)*

Another one also explains that, *"We have heard numerous stories from the radio of people who got electric shocks and even succumbed to injuries brought by the shocks, so we now fear to cook with electricity because we are afraid we could be also get these shocks" (P3T).*

4.6 Theme 3: Cultural and Taste Preferences When Cooking

According to the study, the community has food that they felt tastes better when it is prepared using traditional fuels rather than electricity. These include pap, beans, bean and grain stew (*likhobe*), corn, porridge, beef entrails and steamed bread. They claim that cooking food in electric stoves destroys its exquisite flavour and that for them, food only becomes appetising and well-cooked only when done over an open fire, in three-legged pots. Additionally, they claim that cooking outside imparts a delightful aroma to food that is usually lost when the same dish is prepared using electricity. "*The best way to cook maize is over an open fire, and the same is true even for cooking pap. These food taste better when prepared this way rather than using these modern energies*", according to P7B. Similar opinions by P2M saying, *"The only pap that is well-cooked is when cooked over open fires, no argument, it is so delicious".*

Additionally, the participants emphasise that because some of these dishes are traditional, they need to be prepared traditionally rather than using modern energy. Steamed bread, porridge, and grain stew are a few of these foods. Some participants say that they believe that only traditional fuels can be used to produce traditional foods. Even though they now have access to electricity, the participants claim that they are unable to prepare these traditional foods using it because it feels uncomfortable. *"Even if you can compromise and just cook some food using these new energies, you cannot compromise for porridge and steamed bread; I always find it very weird to cook those on the stoves. We grew up seeing our parents cook these food in open fires" (P2S).*

"As a Mosotho, I always find it awkward to cook my grain stew on these modern fuels, honestly it not cultural to do that. Imagine being in the kitchen, and there is a pot boiling on the stove, then you check you find grain stew in that pot, it is really awkward", another participant (P4L) laments.

Still on the topic of culture when cooking, it is noted that because cooking and gathering firewood are considered to be significant everyday tasks that encourage social interaction, local wood harvesting practices reflect and have an impact on ethnic and culturally specific norms and preferences regarding the preparation of particular foods. Participants acknowledge that there are practical considerations relating to the various types of firewood's functions; they gather and cook with a particular fuel based on their awareness of such considerations and, most crucially, on the type of food to be prepared. This implies that people gather those fuels especially based on the type of food they wish to prepare, just as they cook using specific fuels rather than electricity. *"As a Mosotho child, I know these fuels, and I grew up watching my parents cook with them, and they did not use any fuel for any food,"* one participant emphasises. *"Because it lasts, cow dung is used for foods like beans that take a long time to cook. Crop residues are utilised to prepare foods such as vegetables that require fires to cook" (P6S).*

When asked how the availability of electricity affects the way they prepare their favourite foods, some people say that since it sometimes rains and they are unable to get firewood, they are compelled to use electricity. "*Sometimes we experience rains, and so we are unable to collect firewood, then we are left with no choice but to cook with electricity, even food that we prefer when cooked using our traditional methods*," one of them (P2M) states. Some participants, however, counter that they cannot give up cooking their favourite food over open flames for anything; they claim that if and when they are unable to use their three-legged pots, they do not cook such food at all, preferring to prepare other food instead. One person from Ha-Turupu stresses, "*I would rather cook everything else using electricity, not my steamed bread or pap if I have no other means of energy to cook, such as when the gas has run out and when it is raining" (PL3).*

The last category that emerged is that food cooked in traditional pots is more nutritious. The participants say that the food cooked over dirty fuels in three-legged pots is high in iron since the iron comes from the pots themselves because they are constructed of iron. They claim to think that because these pots impart nutritional ingredients to the food being cooked, their bodies also benefit from them. They say that by cooking food slowly, the nutrients are retained without the food being burned. They emphasise that the iron they obtain from eating such food helps them in term of their health. A respondent from Ha-Sebaki says, *"Fook cooked in our traditional pots is the reason some of us are this old and alive since we get natural nutrients from the food cooked in these pots, not these stainless steel ones that burn food and kill their nutrients" (P7M).*

4.7 Theme 4: Adoption of Electric Cooking Appliances

The majority of participants admit that before to the experiment, they had never owned any electric appliances, including kitchen appliances. Nevertheless, a few people, who seem a bit well-off, admitted to owning televisions that they had previously powered using generators and refrigerators which they powered using LPG. However, they point out that the refrigerators they only used during peak seasons when they had plenty of food. They claim that since they lacked access to electricity but felt the need to have these appliances as they sometimes needed them for mentioned purposes. A participant indicates that, *"You know in Christmas there is food everything including those that are perishable, and we sometimes even slaughter a sheep or a cow, so they would rot if not put in the fridge thus this food would go to waste" (PL6).* Another participant also indicates this by saying, *"Despite not having electricity, I still had my television so that my children could not get bored, at least they had something to watch. Still, we could not play this television every time because we could not afford the petrol for the generator" (P8M)*.

Moreover, the participants who said they never owned any electric appliances indicated that they never saw a need to own those appliances as they never even thought that one day they would have access to electricity. One respondent said, *"Before the project, I only used my gas cooker and three-legged pots which I used to cook. I did not possess any electric appliances" (P2T).*

The participants, however, say that they started purchasing electric appliances including kettles, hotplates, microwaves, and refrigerators following the project. They emphasise the fact that when they use electricity to cook, they utilise hotplates, but not a majority of them have the hotplates. However, those that had appliances such as refrigerators and televisions indicate that as a result of the project, they now never switch off the refrigerators and televisions due to having access to electricity; they no more use the refrigerators only during Christmas holidays.

4.8 Theme 5: Challenges of the Thabana-Morena Project

A new category of the challenges of the project surfaced during the data collection. Participants bemoans the fact that the scheme took too long, about a year and a half year, to produce the desired results of linking the villages to the electricity grid. They stated that they were informed about the scheme towards the end of 2015, and they started paying then, but they were connected only in 2017. A participant from Ha-Lekoatsa says, *"We were informed about the electricity scheme in October or November 2015, I cannot recall the exact month and that is when most of us started* *paying because we were excited about the whole issue. However, we waited until 2017 to finally get connected even though we ensured that we paid what we had to in time*" P3B.

Some of them state that they were even beginning to have doubts about the whole idea, thinking that it was merely a plot to con people out of their money. One person remarks, "*When we finally got connected, we were beginning to get frustrated with the whole thing; we had paid our last monies hoping to be connected but time kept passing without any connection" (P9L).*

Another participant also complains about that, saying:

> *We waited a very long time to receive the electricity we had paid for. When we questioned about the situation, there was no clear response as to why we were not being connected, and we even started to suspect the councillor had conned us. At that time, we had given up and acknowledged that perhaps things like electricity were not made for people like us (P7M).*

Another category that surfaced in relation to the project's challenges is that some households were excluded because they did not fit the REU map, while others were excluded because they could not afford the required payment to join the scheme. Even now, those households are still not connected.

A concerned respondent says:

> *Some of our neighbours who were informed that they did not fall within the map and those who were unable to raise the money required for joining the village scheme still do not have access to electricity even today, and no one knows when or if they will ever get connected. Imagine not having access to electricity while your neighbours do and not knowing when you will ever be connected (P3K).*

As a result of receiving an electricity connection through the rural electrification project, some participants also state that they received fewer units than usual when they purchased electricity because they were informed that the amount they paid for the scheme was insufficient and that they would need to pay the balance each time they did so. One respondent grumbles that, *"After being connected, we used to get very few units when we bought electricity. When compared to how* *many our urban colleagues received for comparable amounts at the time, we would receive just approximately 10 units with M20 (P1T).*

Some homesteads were left vulnerable, particularly those that were already too old and poorly constructed. The explanation was that some homes were constructed with stones and mud, which meant they were already weak owing to oldness and the various weather conditions that have been prevalent in the area. These houses ran the risk of being hammered throughout the electrification procedure as a result. They stated that during the implementation, the contractors had to install electrical necessities like meter boxes, therefore they used equipment to make room for such necessities, damaging several homes in the process. A participant from Malumeng stresses this, saying, *"You see that crack?, it formed as a result of the installation and I have not been to afford to close the crack, and it keeps worsening; I think soon I will be able to see a person walking outside" (P2M)*.

4.9 Interpretation and Discussion of Results

According to the literature (Taele, Mokhutsoane, and Hapzari, 2012; Mpholo et al., 2021), the REU is required to service rural and remote locations that are more than 3 km from the LEC transmission and distribution lines. In other words, the REU assists in bringing power to places that are far from the LEC transmission lines; areas whose houses cannot be served by the LEC through individual connection due to their distance from those lines. Therefore, the study's findings demonstrate how the project assisted the communities in Thabana-Morena in gaining access to energy regardless of their remoteness to the LEC grid. Additionally, they have shown how the project helped people avoid the exorbitant individual connection fees by fostering the development and formation of the electricity schemes that finally led to electricity connection in the villages.

Data collected also showed that many communities in Thabana-Morena were linked to the electricity grid through the implementation of the rural electrification project, which they were not connected to prior to the initiative. This indicates that before the project, the villages did not have access to power, but as a result of the project, access to electricity was made better by the connection of these communities to the energy grid. Thus, rural electrification does improve access to electricity.

Moreover, despite having access to electricity, the community's reasons for continuing to use dirty fuels for cooking support hypotheses put out by the energy stacking theory. It postulates that there are a number of variables, such as regular modern fuel shortages and volatile commercial energy prices that affect consumers' use of a variety of fuels (Abdissa, 2021; Mothala, 2020; van der Kroon et al., 2013; Trac, 2011; Masera, Saatkamp, and Kammen, 2000). This idea emphasises how important it is for households to be able to switch between fuels as needed. Due to the cost and reliability issues associated with using electricity for cooking, households continue to cook using dirty fuels. Instead, they use electricity for other things like lighting. This idea argues that households are free to switch between fuels as they see fit, as several people have mentioned that they occasionally utilise electricity for cooking only during emergencies. It implies that this approach does not force people to utilise a specific fuel or one specific sort of fuel for a particular purpose.

According to the literature (Amoah, 2019; Hou et al., 2017), the ease of access to a certain fuel is most of the times characterised by the distance travelled to the market to obtain such fuel; hence, the choice of energy source may depend on how simple it is to reach the market. This has been in line with the responses of some participants, particularly in regards to their continued use of dirty fuels for cooking. They indicate that purchasing electricity is expensive as they must drive to the market in Mafeteng town. As a result, the community choose those fuels, cow dung, firewood, and corn cobs, as they are easiest to get because they do not have to travel long distances to get them. Moreover, the energy stacking theory hypothesis contends that under certain conditions, households use the fuel that is most practical at the time rather than switching to a new fuel altogether (Mothala, 2020). The findings of the study are supported by several participants who mentioned that they use electricity in times of need, such as when their gas runs out and they do not have money to immediately refill. As a result, they only use electricity during those situation where it is most practical and convenient fuel to use.

The aforementioned information has identified a variety of factors that, despite increased access to electricity, explain why the community continues to rely on unclean fuels for heating and cooking. This indicates that the researcher is able to answer the second study question by using the data mentioned above, which is taken from the responses of diverse participants. These factors include the area's unreliable electricity supply, the high cost of electricity, the simplicity with which dirty fuels may be obtained, and the fragility of electric cooking appliances.

Furthermore, in accordance with the literature and the energy stacking theory, wood fuels continue to be the most popular fuel among households in low-income nations, with their use occasionally being influenced by culture (Akintan, Jewitt, Clifford, 2017; Mittlefehldt, 2016). The study also shows that due of cultural preferences, particularly when preparing particular food, households continue to use wood fuels. Additionally, it is discovered that taste preferences play a significant effect in households' decision to cook using traditional fuels rather than electricity. As Mazzone, Cruz, and Berezza (2021) pointed out that different food require specific energy sources to make them, the findings of this study also discovered that households in Thabana-Morena are aware of the best fuel to use when preparing various foods.

According to the data above, it is determined that the community still has food preferences that are best prepared using dirty fuels rather than electricity because of cultural and taste preferences. This means that despite having access to electricity, the community in Thabana-Morena continues to cook food with dirty energy sources such as firewood and cow dung because they believe this food is somewhat tastier than cooking it with electricity. The participants also state that they do not use electricity to prepare some meals since they are traditional meals and they must be prepared using traditional fuels. As a result, in attempting to address the third research question, the researcher draws the conclusion that access to electricity does not change people's cultural or taste preferences for cooking particular food because people still continue to use their traditional fuels despite having access to electricity, which they could use to cook rather than using unclean fuels, as evidenced by the data presented above.

Although the literature suggests that using electric cooking appliances and cooking with electricity can be accurately a clean cooking solution in terms of emissions in the kitchen, which affect both ambient and household air quality, the study's findings have found that households do buy these appliance but are hesitant to use them and cook with electricity. They think doing so is complicated, and that electric appliances uses a lot of energy (Parikh et al., 2020).

Following the implementation of the rural electrification project, the majority of the villagers in Thabana-Morena began purchasing electric appliances, particularly cooking appliances, according to the responses. This indicates that more community members started buying electric appliances as a result of the project, whereas only a small number did so prior to the electrification project. Accordingly, the rural electrification project has contributed to the adoption of electric appliances by the community members in Thabana-Morena, although they are hesitant to use them to their full capacity, answering the fourth research question.

4.10 Summary

The findings from the study's semi-structured interviews with project stakeholders were reported in the chapter. The study's themes and categories, as well as the demographic data on the study's participants, have all been presented. Extracts from the participants' writings have been used to support these themes and categories in order to address the study questions. Five themes emerged from the data analysis, which are summed in the framework that was provided. Four of these themes were established using the research questions for the study, and one additional theme that wasn't anticipated during data collection was discovered and included in the thematic analysis.

CHAPTER 5

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

The results of this research were presented and discussed in Chapter which leads this chapter. In relation to the study's objectives, this chapter presents the summary, conclusions, and recommendations of the study which are based on the findings and objectives described in Chapter 1 of the study. It also sets out on the limitations of the study and areas for future research. The objectives listed in Chapter 1 were:

- to investigate how rural electrification has improved access to electricity in Thabana-Morena,
- to investigate why Thabana-Morena households continue to rely on dirty energy sources, particularly for cooking and heating, despite rural electrification,
- to assess how rural electrification affects the community's cultural and taste preferences in Thabana-Morena regarding the use of solid fuels for cooking specific food, and
- to assess how rural electrification promotes the adoption of electric cooking appliances by the Thabana-Morena community.

5.1 Summary

It has been established that Thabana-Morena's access to electricity has improved as a result of rural electrification. Thus showing that the rural electrification project as carried out in Thabana-Morena has actually improved the community's access to electricity by connecting them to the grid, as literature suggests that one way to improve access to electricity in rural areas is through rural electrification projects. This was made clear by the first theme, where the majority of participants said that under the project, they were able to access electricity regardless of how far their villages were from LEC transmission lines through the electricity scheme. They were also asked to pay a little amount of money through the scheme, which they would not have had to if they had connected individually; they would have paid more if they were connecting individually. However, even with the reduced costs, some households still could not afford to pay the required amounts to join the scheme hence were left out during connection.

The study also determined why, in spite of having access to electricity, the community continued to use dirty energy sources for cooking. The finding of this research through the second theme, revealed that the community still uses these fuels for cooking rather than electricity because the latter is unreliable in their area. The majority of participants indicated that they occasionally go without electricity for several days, especially during extreme weather conditions. The participants added that they prefer to use electricity for other purposes because they feel that cooking consumes too much of it and that it is too expensive for them to utilise it even for cooking. Additionally, they said that dirty fuels are easier to get than electricity because they do not even need to be purchased. Since they identified themselves as farmers, obtaining materials like cow dung and corn cobs after harvest should be simple. The energy stacking theory, which asserts that households frequently select or use the most economical and easily accessible fuel to use for numerous functions, provided support for the findings.

The findings also showed that despite the electrification project, the community still uses dirty energy for cooking since electric appliances, particularly cooking appliances, are fragile and require regular replacement. The participants indicated that they were tired of constantly having to buy new appliances, so they decided to cease using electricity for cooking and returned to using dirty fuels. However, the results also showed that some participants occasionally continued to cook using electricity, but they only did so in dire situations, such as when their primary cooking source, LPG, ran out and they were unable to instantly refill it.

The study also showed that some food have distinct tastes for the Thabana-Morena people depending on the source used to prepare them, with food prepared using dirty fuels tasting better than food prepared with electricity. Additionally, it was discovered that some of these food must be prepared traditionally, utilising traditional fuels rather than modern-day fuels like electricity. The fuel stacking theory, which contends that cultural and taste preferences are also among the factors that may lead households to stack energy sources and cook without electricity, supports these findings. The results also showed that the people in the village believe that cooking their food in three-legged pots somehow improves their health because they think the iron from the pots can transfer to the food while it is being cooked, and they then absorb that iron when they consume that meal.

The study also revealed that after the project, the majority of participants began purchasing electric appliances, including cooking appliances. This indicates that they had no appliances before starting the project. However, quite a few participants claimed that they already owned certain appliances like refrigerators and televisions that they powered with LPG and generators, respectively, before the project even began. However, they acknowledged that they did not frequently utilise these devices; for instance, a refrigerator was typically only used during festive seasons when there was an abundance of food.

The fifth theme of the study further demonstrated that there were difficulties brought on by the project. It was found through the findings that the electricity scheme created to bring electricity to the villages took far too long to actually supply electricity to these villages. They then started to question the entire electrification issue at this point. Additionally, the participants mentioned that they only received a small number of units while purchasing energy and that some of the houses were demolished as a result of the project.

5.2 Conclusions

Based on the results, the study draws the conclusion that access to electricity in the area was improved thanks to the rural electrification project in Thabana-Morena since the community was linked to the electricity regardless of their distance from the LEC transmission and distribution lines. This means that the results of the study have made it possible for the researcher to assess how rural electrification improves access to electricity, responding to the first objective of the study. However, based on additional findings, the study comes to the conclusion that despite having access to electricity as a result of the project, the community has yet to adopt electricity as their primary source of energy for cooking and heating, instead continuing to rely on dirty energy sources. According to the findings, the community in Thabana-Morena continues to rely on dirty fuels for cooking despite electrification due to a number of reasons, including the unstable nature of the electrical supply, the ease with which dirty fuels may be obtained, the high cost of electricity, and the fragility of electric cooking appliances.

Based on additional findings, the study comes to the conclusion that despite having access to electricity, the community continued to prepare meals with dirty fuels because they thought it tasted better than food cooked with electricity. This implies that choosing a cooking fuel is influenced by taste preferences. Furthermore, the study comes to the conclusion that cultural preferences also play a role in the household's decision to keep using dirty fuels for cooking. This is because some participants' responses to the research indicated that they use these fuels to cook some foods because they are customary to do so and find it strange to cook them using electricity. This indicates that rural electrification does not affect taste and cultural preferences when cooking certain food.

The study's findings showed that the community began purchasing electric appliances, especially cooking appliances, following the project's completion, indicating that the project had pushed the community to adopt electric appliances, even though they indicated to be reluctant in using them to the fullest. Additionally, it is concluded that the project encountered some difficulties since participants complained that it took too long for the initiative to materialise and that they only received a limited number of units when purchasing electricity. The fact that some homes were harmed as a result of the project was also shown by the findings.

5.3 Recommendations

The relevant shareholders with regard to rural electrification are taken into account while categorising the study's recommendations. These recommendations are directed at the government, through several ministries across the country in charge of energy-related matters. These recommendations are presented below.

The Ministry of Natural Resources, through the Department of Energy's REU, should review their practice of using a map to identify the homes in various villages that need to be electrified in order to ensure that no homes are overlooked when these projects are implemented. Once they have decided to bring electrification to a specific region, they should simply electrify all the homes there. This will contribute to resolving the issue of excluding other households in the name of those who don't fit the map.

Furthermore, it is advised that the Ministry of Natural Resources stakeholders inform populations, particularly those in rural regions, about the risks associated with using dirty energy sources. This might inspire these communities to switch from utilising these fuels to using the electricity that has been provided.

In order to prevent the community from losing patience when the implementation of the project seems to be taking too long to begin, the REU should also inform the community where the rural electrification project is to be implemented of all the procedures that must be followed for the project to finally be implemented in an area. By being informed of these procedures, the people will maintain optimism and be patient in the knowledge that the project will eventually materialise, regardless of how long it may take.

To ensure that no family is left behind when connection is implemented, the government may offer grants to those who cannot afford to join in the electricity schemes. To identify the poor homes who should receive those grants, the government might collaborate with the village chiefs and council members.

Instead of needing to employ methods that cause damage to people's houses, the contractors should discover other ways to wire so that even individuals whose houses look to be in poor shape can still receive electricity and not damage any houses.

Finally, in order to avoid having to travel to towns to buy electricity and to give the community other options besides having to use mobile money transfer services, the government could also subsidise the building of electricity-selling facilities in rural areas.

5.4 Limitations of the Study and Recommendations for Future Studies

In the methodology, the researcher stated that she would choose to record the interviews as they were conducted. However, because some interviewees were uncomfortable with this, the researcher was forced to settle with taking notes as the participants spoke. As recording is a much more convenient process that gives the researchers all the information they need straight from the source, taking notes was a little difficult because the researcher had to do it quickly, which may have caused her to leave out important details that might have made the findings and results more convincing; some individuals completely declined to be interviewed. Moreover, in some institutions, the researcher needed to make an appointment in order to speak with the responsible official, and it took an extended time for the appointment to be granted, which slowed down the study's well-timed progress. Villages used for data collection varied in their number of households; some had very few households, while others had many. As a result, even though the researcher used a uniform sample for all villages, the results may still be somewhat skewed given that in some villages, the sample of ten households was just below a total of eighteen households in the village, while others, the sample was for over twenty-five households or more in such a village.

Based on the results and conclusions of the study, the researcher advices other researchers to further evaluate steps that may be implemented to make electricity user-friendly so that people might embrace it as their source of energy for cooking and abandon dirty fuels. The researcher also recommends selecting a sample based on the populations of each village for scholars who intend to conduct studies on the implementation of rural electrification projects and use of electricity thereafter. This will be helpful since these studies will employ a methodical selection of households to be included in the study by adhering to a standard sample size so that the sample is chosen based on the total population of each village. This will prevent having an equal number of households in villages when the number of remaining households is large in some villages and low in others.

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Appendix 1: Letter of Introduction

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DEPARTMENT OF DEVELOPMENT STUDIES

Dear Sir/Madam,

Re: Letter of Introduction Palesa Sebata (201502555)

Palesa Sebata, whose student number is 201502555, is a Student at the National University of Lesotho where she has enrolled in the Masters Programme in Development Studies. She is currently undertaking her research for her dissertation which is entitled "Rural Electrification and Energy Poverty in Thabana Morena". The National University of Lesotho, through the Department of Development Studies, herein kindly requests that you assist her with information that she needs for the completion of her research dissertation.

Please do not hesitate to contact me as her research supervisor if any further clarification is required.

Yours Sincerely,

Setsabi Setsabi (Senior Lecturer, Development Studies and Research Supervisor)

Appendix 2: Professional Working at the REU (Interview Guide)

a) What is your position in the unit?
b) What are the functions of the REU?
c) What are the key challenges faced by the REU in delivering on its mandate?
d) How was the Thabana-Morena Project initiated?
e) To how many households is electricity supplied?
f) Are there any households that have been left out, and if so why were they left out?
g) What were the challenges in implementing the Thabana-Morena Project?
h) From a perspective of REU, what are the challenges that are currently being faced by the project (if any)?
i) How can those challenges be overcome?
j) What are the steps taken in order to come to the conclusion of bringing rural electrification project to a certain area? Are there any applications involved?
k) What are the challenges that are usually faced when implementing these projects?

Appendix 3: Chiefs and Councillors (Interview Guide)

a) How many households are there in the village?
b) How many households have access to electricity?
c) How many households do not have access to electricity?
d) Why do some households not have access to electricity?
e) What are some of the institutions that are located in the area that also use electricity? e.g. Clinics, schools, police station, post office
f) When was the electricity scheme implemented?
g) What are some of the key challenges that accompanied the implementation of the project? E.g. public participation
h) What are some of the key challenges that the community now faces now that the project has been implemented?

Appendix 4: Community Members (Interview Guide)
Section 1: Improved Access to Electricity

a) When did you get connected to the electricity?
b) When did you join the scheme?
c) How did you join the scheme?
d) What problems did you encounter with the scheme? (after joining)
e) What energy sources did you use before being connected?
f) Why did you wait for the electrification project and not simply connect the electricity yourself?

Section 2: Cooking with Dirty Fuels

a) Do you still use dirty fuels (mention) for your cooking needs? If yes,
b) How easily are these accessible are these fuels to you?
c) Between using these fuels and using electricity for cooking, which is more affordable?
d) Do you think continuing to use these fuels for cooking is safer than using electricity? Elaborate for both answers (Yes/No)

Section 3: Cultural and Taste Preferences When Cooking

a) Do you have any favourite food to cook with electricity or other fuels? Mention them
b) What influence has the availability of electricity have on your cooking of such certain food?
c) What difference does cooking such foods with electricity rather than with solid fuels make?

Section 4: Adoption of the Use of Electrical Cooking Appliances

a) What electrical appliances did you own as a household before the project?
b) What appliances do you own now (after the project)?
c) Which of these appliances do you use for cooking?
d) Before being connected, what appliances did you use for your cooking?

Objective Assessment of the Situation Before and After the Project

a) Before the project, what types of fuels did you use for:
    i) Water heating
    ii) Cooking

iii) Space Heating

iv) Lighting

What types of fuels do you now use for these purposes? i.e. after the project.

b) What were the challenges that you faced with accessing the fuels you used before the project?

c) What are the advantages of using the fuels that you used before the project?

d) What do you consider advantageous with using the new fuels that you now use after the project?