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Tanyaradzwa Edith Whande

Energy Sources, Access and Women's Livelihood Strategies: A Case Study of Micro- Hydroelectricity Access in Chipendeke Village, Zimbabwe

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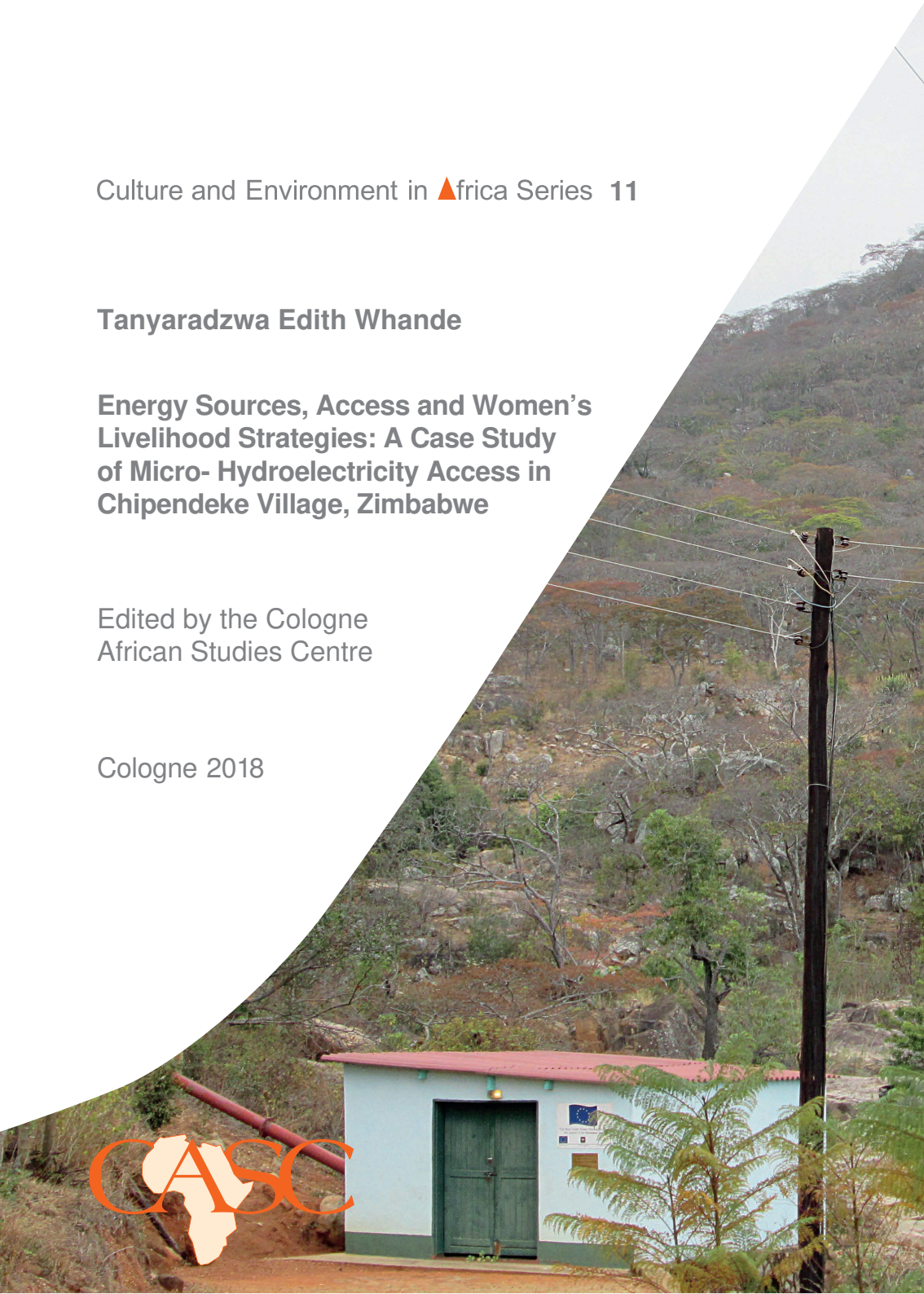

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Preface

How access to energy affects the lives of rural (or urban) people has not been dealt with adequately in the social sciences. This is odd as electrification is frequently seen as a precondition for economic development and the sustainable development of non-agricultural income generating strategies. Electricity supply infrastructures were habitually not dealt with by anthropologists. They only dealt with energy production once it lead to the built up of dams and concomitantly to resettlement. However, what happened with the energy produced once the dam or plant was built was not really a topic for anthropological inquiry. Whande's MA thesis is innovative in two aspects. It first of all scrutinizes the establishment of a micro-hydroelectricity plant in a remote rural area in Zimbabwe. The specific technology allows the partial electrification of the village. Households which are able to pay the fees are linked directly to the grid. A large percentage of the villagers however does not have sufficient money to pay for that. Hence, electrification and a reification of status and wealth go hand in hand. Whande also deals with the use of electricity by local women. Do they succeed in gaining access to productive income generating activities and counter certain disadvantages in patriarchal society?

Abstract

The relationship between women and energy is more apparent in energy poor communities that use biomass fuel to meet their household energy needs. Women in energy poor communities often have the responsibility of suppling and using energy in their homes due to socially assigned roles such as cooking. A significant number of these women reside in rural areas and deal with the daily constraints of poverty. Hence, access to modern energy such as electricity is an asset that enables women to expand their livelihoods and social status. Micro-hydroelectricity generation is one of the innovative and sustainable ways of using natural resources to provide electricity access to remote and inaccessible communities. This study explores how access to electricity through a micro-hydroelectricity scheme has influenced the socio-economic wellbeing of women in Chipendeke village. Different methods of data collection were used during fieldwork. These include participant observation, interviewing, focus group discussions, free listing and pile sorting. The results show that, electricity access enables women to engage in or improve different livelihood strategies such as chicken rearing projects and refrigerating produce for sale. The value of these activities is evident in their ability to enable the financial independence of women and widen the net of sustenance for households within a rural agricultural based economy. Electricity also plays a major role in improving maternal health services at local clinics and women's use of communication technologies such as cell phones. In addition, the lighting provided by electricity extends the domestic work hours of women.

Key Words: Energy Access, Women, Micro- hydroelectricity, Livelihoods

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1. Introduction

This thesis focuses on the relationship between energy access and gender. The main goal of the research is to understand how women in energy poor communities respond to the introduction of modern energy such as electricity. The focus is on women because reviewed studies acknowledge that energy poverty, like poverty in general, disproportionally affects women more than men (Clancy et al., 2002; Munien and Ahmed 2012). The study was conducted in Chipendeke village, a remote rural village in the eastern highlands of Zimbabwe. The village has access to electricity since 2011 through a stand-alone micro-hydroelectricity scheme. The location of the village is significant as it exemplifies the notion that most energy poor communities are located in rural or inaccessible areas, away from a major electricity grid.

In this first chapter, an introduction of the thesis is given. This includes a brief outline of the structure of thesis and the content found in the different chapters. A brief background of the context is presented, discussing micro-hydroelectricity in Chipendeke, gender and energy access, and the state of electricity access in Zimbabwe. The research questions are also given with their supporting explanations.

Chapter two consists of reviewed literature on topics such as energy access and livelihood strategies; energy sources; gender and energy. The literature review reveals the various sources of energy and highlights how electricity is considered as modern energy. The chapter also shows how the lack of electricity in rural areas affects women more than men and how access to electricity is an asset for the creation of livelihoods. The third chapter provides a description of the methodology, a mixed methods approach, which includes free-listing and pile sorting, participant observation, interviewing and focus group discussions.

The fourth and fifth chapters outline the research findings. The study revealed that there are different sources of energy in Chipendeke namely, hydropower and biomass. Hydropower generates electricity that villagers mainly use for lighting, charging cell phones and refrigeration, while the wood fuel is mainly used for cooking and ironing. Some of the female members of the community have taken advantage of electricity by using it to create livelihoods such as chicken rearing and sewing garments for sale. They also use electricity to refrigerate crop and livestock produce for sale. Chapter six discusses the research findings and gives a better understanding of electricity access in Chipendeke Village. Chapter seven concludes the study with a summary of the study and recommendations.

1.1 Green Energy and Rural Livelihoods

The United Nations designated 2012 as the *International Year of Sustainable Energy for All* (Sovacool, 2012: 272), to promote the access to a sufficient supply of energy to countries experiencing energy poverty. This came at the realisation that energy access is an

important element in achieving the Millennium Development goals such as the eradication of poverty and improving maternal health. Globally, total energy access is yet to be fully attained, particularly in many developing countries. The burning of fossil fuels for energy characterized the industrialization period of countries such as Britain and North America. Today high-energy consumption continues to present similar opportunities for national economic growth, however with more caution given the risk of climate change. On a smaller scale, energy access provides individuals and local communities with better services such as electricity for water consumption, health and education.

Access to modern energy such as electricity is therefore a major factor that contributes to both economic and social development. This is because energy is a key productive asset for national economic growth and a vital necessity to human welfare and income generation possibilities at the household level (Winkler et al., 2011: 1037; Davidson and Mwakasonda, 2003: 1). Furthermore, a relationship between energy and gender can be identified within the context of household energy use, because the supply and use of household energy differs between men and women. Specifically, in the context of energy poor countries, women bear the burden of supplying and using biomass fuels such as firewood.

This study examines women's access to modern energy services with a focus on off grid micro-hydroelectricity generation. In 2011, Chipendeke Village completed the installation of an off-grid micro hydroelectricity scheme that generates 25kVa of electricity. Although the scheme is donor funded by the ACP-EU Energy Facility and Practical Action, it is owned by the community through a share ownership scheme. The introduction of off-grid electricity services such as mini-solar home systems and micro-hydro grids are alleged to be more convenient particularly for remote inaccessible areas. This is because micro-hydroelectricity schemes are decentralized solutions that are established where the grid has not reached or is unlikely to reach soon (Bhattacharyya, 2013a: 8). Such is the case of Chipendeke village, located in a mountainous area.

Apart from the economic cost of establishing off-grid services to remote areas, decentralised systems offer an environmentally friendly alternative. According to Jonker-Klunne (2011: 68), large-scale hydropower development is becoming a challenge due to environmental and socio-economic concerns, and more recently its vulnerability to changing climates. Hence, micro-hydropower development continues to be an attractive resource for electricity generation especially in remote parts of Africa because it is environmentally friendly.

The gender focus of the study recognizes the notion that the relationship between energy and poverty has distinct gender characteristics. An estimated 70% of the 1.3 billion people living in poverty are women, many of whom reside in rural areas where there is limited access to electricity (Clancy et al., 2002: 10). Studies have shown that in most developing

countries women bear the burden of supplying and using wood fuel in their households, a task that is physically taxing, time consuming and potentially hazardous to health (Clancy et al., 2007).

This highlights that the relationship between women and household energy use is not far apart. Clancy states that "in rural and low income urban households in developing countries, energy is women's business, both in terms of collecting fuel, and in using that fuel for domestic chores and productive activities" (Clancy et al., 2007: 241). During the planning phase of the Chipendeke micro-hydro scheme, the Gender and Energy Network of Zimbabwe (GENEZ) was part of the technical unit. They conducted a socio-economic survey with both male and female members of the community. They also included a Gender Action Plan and Gender sensitization workshop (Shakya, 2011).

Lastly, to put things in context, a brief overview of the national energy situation in Zimbabwe highlights the background in which Chipendeke village is found. Zimbabwe has five major power stations with a total electricity generation capacity of 1961 MW. These include coal plants with a capacity of 1295 MW and Kariba hydropower plant that generates 666 MW (Davidson and Mwakasonda, 2003: 29). The Zimbabwe Electrical Supply Authority Holdings (ZESA), a parastatal, manages these power stations. ZESA is also responsible for generating, importing and distributing electricity in Zimbabwe except for a few private generators such as micro-hydro schemes (Mbohwa, 2002: 86).

Apart from the national power stations, Zimbabwe also imports electricity from its neighbouring countries. According to Mbohwa (2002), Zimbabwe is one of the most interconnected and electricity import dependent countries in Africa, importing from South Africa, Mozambique, Democratic Republic of Congo and Zambia (Mbohwa, 2002: 84). Currently ZESA Holdings imports 35% of the national electricity requirement (ZESA website). Although ZESA holdings' mandate is to generate and distribute electricity across Zimbabwe, it struggles to meet the demands of urban areas and the need to provide electricity access to rural areas.

The 2012 national census report reveals that 56% of households in Zimbabwe have dwelling units without electricity and 63% of the households use wood as the main source of fuel for cooking (ZimStat, 2012). Most of these households are in rural areas. This suggests that Zimbabwean households are largely dependent on traditional energy fuels and modern energy such as electricity is yet to be fully employed. Efforts to provide rural areas in Zimbabwe with access to electricity have evolved over the years to the recent establishment of the Rural Electrification Agency (REA) in 2002. The agency is solely responsible for the electrification of rural areas in Zimbabwe.

Historically, a rural electrification program, which began in 1985, was abandoned in 1990 due to cash flow problems and the lack of comprehensive policy on rural electrification

(Davidson and Mwakasonda, 2003: 33). In 1999, the government began power sector reforms that included the establishment of a rural electrification fund based on 1% of all electricity bills collected. The fund helped in the extension of grid electricity to rural households by contributing towards the initial capital investments (Davidson and Mwakasonda, 2003: 32). By April 2000, the government had completed fourteen of the fifty-four targeted projects. A new Electricity Act and Rural Electrification Act passed in 2002 established the Rural Electrification Agency (REA). According to REA, 7854 rural institutions have been electrified to date (Personal communication).

Given the background surrounding, the current energy situation in Zimbabwe, and the recent local establishment of a micro-hydroelectricity scheme at Chipendeke village, it was of interest to study women's relationship with energy access. To study how women in Chipendeke have received the installation of electricity and how their lives have been impacted by the change, considering their use of biomass fuels in the household prior to electricity.

1.2 Research Question

The study is guided by one main research question:

- ***How does access to electricity impact the socio-economic wellbeing of women in Chipendeke Village?***

This research question comes with the recognition that there is a strong relationship between energy and gender. Moreover, that men and women have different roles regarding household energy supply and consumption. The introduction of electricity has the potential to influence such relationships by freeing women from the use of biomass fuels and providing opportunities for livelihood creation.

The following sub-questions are used to answer the main research question:

- ***What are the energy sources in Chipendeke Village?***

Answering this question seeks to determine the energy sources that residents used prior to the micro-hydroelectricity scheme and whether micro-hydroelectricity has replaced other sources of energy in the village.

- ***What role does electricity play in women's social roles?***

This question intends to explore whether electricity access has influenced the day-to-day roles and responsibilities of women in the village. It will focus on their responsibility of collecting and using wood fuel for cooking.

- ***What role does electricity play in improving women's healthcare needs?***

The answer to this question is important, considering that studies show that biomass fuel in contrast to electricity has adverse health effects such as respiratory infections, premature infant mortality and poor maternal health (Munien and Ahmed, 2012: 114). Women and children in energy poor communities are more susceptible to these health threats, which affects their productivity capacity.

- ***What livelihood enterprises are women engaged in in response to electricity access?***

This question seeks to explore whether the women in Chipendeke village are engaged in any activities that provide sustenance to their households using electricity.

2. Literature Review

In this chapter a critical review of the literature pertaining to the topic is given. The chapter is a discussion on energy access and defining electricity access. This is followed by a review of literature on energy sources, focusing on micro-hydropower and biomass fuel. Last, a discussion on the relationship between energy access and gender is given.

2.1 Energy Access

The relationship between energy access and livelihood strategies centres on the view that access to sufficient and affordable energy impacts human social and economic wellbeing. Energy access refers to the "ability to use energy namely electricity, LPG, charcoal or some other form of energy" (Brew-Hammond, 2010: 2291). Further analysis puts electricity at the centre of the energy access discourse. According to the International Energy Agency, the lack of access to electricity and reliance on traditional biomass fuels for cooking is energy poverty (Sovacool, 2012: 273). However, access to electricity is identified in different ways and this influences the way in which electricity access is measured in different countries.

According to Chambers and Conway (1991), a livelihood comprises people, their capabilities and their means of living, including food, income and assets. Electricity access can be viewed as a valuable means of creating a living. If one considers how the light generated from electricity provides for an extended day of working or learning hours; or how electricity translates into convenience when it comes to household work such as cooking as opposed to the use of wood fuel; and how electricity access is also the gateway to which information technologies function.

Unfortunately, many people still lack access to electricity and rely heavily on traditional biomass, burned plant or animal material such as wood, charcoal, dung and crop residues (Fullerton et al., 2008: 844), for cooking. Energy poverty is a challenging feature for most developing countries because a large percentage of them lack access to electricity. According to the International Energy Agency, Sub-Saharan African countries have an overall electrification rate of 30.5%, comprised of 59.9% in urban areas and 14.2% in rural areas (Bhattacharyya, 2013a: 4). Consequently, this low rate of electrification is often correlated to regions of low economic development.

Mauritius is the only African country which is considered to have achieved universal electrification (Bhattacharyya, 2013b: 132), or 94% depending on the source of data used (Brew-Hammond, 2010: 2293). North African countries such as Tunisia, Algeria, Egypt and Libya have high rates of electrification, above 96% (ibid). Sub-Saharan African countries on the other hand have the lowest rates of electrification. Countries such as Uganda, Chad, Somalia, Sierra Leone and Rwanda have low rates of 5% or below (ibid). Mauritania, South Africa and Ghana have demonstrated higher levels of electrification, above 50%. Although

countries like Ghana and South Africa have significantly higher levels of electrification, the data does not show that they also experience poor quality of electricity supply characterized by blackouts and brownouts (ibid).

Sub-Saharan African countries experiencing energy poverty face various challenges in meeting the energy needs of their citizens. The IEA estimates that, there are about 585 million people in the region without access to electricity (Bhattacharyya, 2013a: 4). The question concerning how sub-Saharan African governments will meet the energy needs of their populations and their ability to put together the adequate resources to do so remain in doubt (Brew-Hammond, 2010: 2291). African organizations such as New Partnership for Africa's Development (NEPAD), The Forum of Energy Ministers of Africa (FEMA), the Economic Community of West African States (ECOWAS), the East African Community (EAC), and the Economic Community of Central African States (CEMAC), have made efforts to address the energy needs of the region. This is in addition to international organizations such as the Global Network on Energy for Sustainable Development (GNESD) and the World Bank (ibid).

However, factors such as the cost of financing electrification projects remain a problem. The World Bank estimated that sub-Saharan Africa, with a population of 725 million people in 2010, requires $11 billion per annum to meet its target of 100% electrification or $ 4 billion per annum to meet its target of 48% electrification by 2030 (Brew-Hammond, 2010: 2294). Meeting the financial need will have to be incurred not only by the governments and international community but also by independent private investors.

The sole focus on the relationship between energy access and economic development presents a rigid view on how energy access relates to the GDP of a country, hence ignoring the relationship between electricity and human development. Bhattacharyya (2013a: 7) notes that, in contrast to income, the Human Development Index (HDI) presents a better correlation with electricity access. Citing that better HDI scores are generally associated with higher levels of electricity access as well as mean schooling years. Thus, having access to electricity transcends national economic development to the local and individual sphere.

Furthermore, Bradbrook and Gardam (2006) highlight a more socio-economic dimension by arguing that energy has no value, only the access to products and lifestyle that it provides are valuable:

> *"It is not a particular source of energy or energy in itself that society requires, as energy has no intrinsic value, but rather the access to the products and lifestyle changes that the availability of adequate modern energy services provide" (Bradbrook and Gardam, 2006: 392).*

These views suggest that the lack of access to energy affects human development and restricts access to other products and services that are valuable to human wellbeing.

A notable problem within the energy access discourse is that of the lack of a universal definition of electricity access. The International Energy Agency acknowledges that defining electricity access is complicated because there is no single internationally accepted definition (Brew-Hammond, 2010). As Brew-Hammond describes:

> *"Quite often there is a differentiation between household access where one is able to use electricity in the home and access to the grid, sometimes described in terms of "penetration rate", which simply refers to the proportion of a geographical area covered by the grid, regardless of how many households are connected. Access to electricity also refers to the availability of electricity in areas not reached by the grid. In this case, electricity is provided by a decentralised or stand-alone power source (petrol or diesel generator), or a renewable energy device (solar PV, wind turbine or biomass gasifier)" (Brew-Hammond, 2010: 2292).*

This suggests that electricity access is identified according to more than one attribute. One attribute concerns the geographic proximity of households to the grid[1]. Another indicator of electricity access is the presence of a decentralized or standalone system in areas where the grid is not able to reach. According to Bhattacharyya (2013a: 9), a decentralized solution that is not connected to the grid is known as an off-grid standalone solution. These systems can include individual or collective solutions. Individual solutions are small ready-to-use kit based systems, such as Solar Home Systems, solar lamps or battery-operated systems. Collective systems on the other hand, are either local grid systems, which often rely on diesel generators or hydropower; or stand-alone systems which include photovoltaic systems and Solar Home Systems (Bhattacharyya, 2013a: 10).

Electricity access is also recognized in relation to affordability, as access can also refer to "a household's ability to obtain a modern energy service, should it decide to do so" (Brew-Hammond, 2010: 2292). This definition suggests that the means to have electricity access relies on a household's financial capability. Access entails that energy is available if the household can afford the cost of connection and supply (Winkler et al., 2011). According to Winkler et al., (2011: 1038), defining affordability of electricity is complicated. This is because affordability of electricity is a politicized concept considering the role of energy as a basic household good which is nearly impossible to live without, therefore strict quantitative definitions are difficult to outline. However, one can distinguish between the "affordability of access (e.g., related to the costs of connection) and the affordability of using electricity" (ibid).

[1] The term grid refers to the electrical transmission system, which moves the electricity from power plants to substations located close to groups of users.

Therefore, having access to electricity does not guarantee that people will use it, especially if they cannot afford to pay for connectivity or consumption. However, Mehlwana (1997: 8) cautions against making one-sided assumptions of energy use, arguing that apart from economic factors there are other factors that influence the choice and use of certain household fuels; factors such as gender of the purchaser, socialization and ideology.

These variations can affect the comprehensive picture about the overall extent of electrification of a given area. The lack of an absolute definition for electricity access therefore questions the celebrated notion that an area has achieved electricity access. A community may have a standalone generator or be located near a national grid and this is noted as having access to electricity however, it is possible that not all the households are connected and able to use electricity due to financial or social factors.

2.2 Energy Sources

This section provides a description of some of the common sources of energy. It is important to identify different energy sources that are available because without them access to energy is not possible. Energy sources are any material that generate energy to produce heat, light or power. Furthermore, there are renewable or non-renewable energy sources. For example, fossil fuels such as oil, coal and natural gas are non-renewable sources of energy due to their inability to be quickly replenished once consumed. Renewable sources such as wind, solar and hydropower are an infinite resource base. Renewable sources can generate energy such as electricity, with less harm to the environment. Electricity is 'modern energy', a phrase used to distinguish traditional energy like firewood or agricultural residues from commercial forms of energy like electricity or LPG (Brew-Hammond, 2010: 2292).

At the household level, the factors determining the transition from biomass to modern energy are yet to be clearly understood. In the past, the transitional model of energy formed the basis of energy research. This model, "is a spin-off of the modernization theory…that sees societies all over the world "developing" from ´traditional´ to ´modern´ forms of organization" (Mehlwana, 1997: 7). In some cases, the expected transition from traditional to modern energy is very slow and it is common to find that a household uses more than one form of energy during an in-between stage, transitioning to modernity (ibid). However, Mehlwana (1997: 6) argues that, one cannot explain the transition from traditional energy to electricity as a process of 'unlinear' stages solely influenced by urbanization and income. This is because there are other factors such as the gender of the purchaser, socialization, cultural ideology and many other non-economic factors that contribute to a household's choice of fuel use (Mehlwana, 1997: 5).

2.2.1 Biomass

Biomass is the most commonly used source of energy by countries experiencing energy poverty. Fullerton et al., (2008: 844) state that biofuels "account for more than one-half of domestic energy in most developing countries and for as much as 95% in lower income countries". The use of burnt plant or animal material for cooking is argued to be harmful to the environment and human beings.

The cutting down of trees and use of wood for cooking consumption raised concerns over its level of contribution towards deforestation. However, Marufu (1997: 54) disputes this view, claiming that the use of wood fuel for domestic consumption is a minor contributor to deforestation when compared to other uses such as clearing land for agriculture. There are also health risks that are associated with the use of wood fuels for domestic use. For instance, women and children are at a high risk of contracting pneumonia and lung disease due to their daily exposure to burning wood fuel indoors through indoor air pollution (Fullerton et al., 2008).

2.2.2 Micro-hydropower

Considering the negative consequences that are associated with the use of wood fuels, renewable resources such as hydropower have become an increasingly popular alternative to provide energy. Hydropower refers to the power produced by harnessing energy from the flow of water in rivers, streams or canals (Kishore et al., 2013: 42). A micro-hydro system generates 5-100kW of electricity and systems that produce less than that are called pico-hydro systems (ibid). Micro-hydroelectricity systems are not only environmentally friendly but also a cost-effective alternative solution for providing electricity to isolated communities, particularly those located in mountainous regions where extension of the electricity grid is not possible or extremely costly (ibid). These systems are mostly "run-off-river", meaning that no dam or water storage is required for their operation. One of the major advantages of micro-hydro power schemes is their level of longevity as most can operate for up to 50 years without requiring any major refurbishment (Kishore et al., 2013: 44).

Apart from its longevity, there are other benefits of a micro-hydropower system. According to Kishore et al., (2013: 45), the operational costs of the plant are very low, and its operation is simple with minimal training required. However, one of the limitations is that micro-hydro schemes are highly sight specific technology that require an extensive assessment of resources and site characteristic before installation (ibid). Hence, "the best geographical areas for harnessing micro-hydropower are those where there are perennial rivers and streams flowing through steep hills and mountains" (Kishore et al., 2013: 42).

Bradbrook and Gardam (2006: 391), anticipate that in the future, standalone systems based on renewable energy resources will provide access to electricity services in most developing

countries. Such a development supplements or challenges the traditional grid mode of electrification making way for an alternatively decentralized mode of supply (Bhattacharyya, 2013a: 8). The popularity of stand-alone decentralized micro-hydroelectricity schemes has grown and like solar home systems, the promotion of micro-hydroelectricity schemes suggests that decentralized systems are able to meet the demands of remote and inaccessible areas.

However, Mbohwa (2002: 83) cautions that economic growth through industrialization would be limited if micro-scale and localized energy production systems are pursued. He further explains that although small-scale hydroelectric plants can bring about positive social and economic benefits, they have a more limited capability to address the future energy requirements in Zimbabwe or reduce the current energy import bill. He states that:

> *"While large-scale hydroelectricity schemes are very economic mini-hydro schemes do not offer the same levels of scale economies. In Zimbabwe, these micro-hydro schemes can be adversely affected by drought. This underlines the need to look at complementary electric energy sources in future" (Mbohwa, 2002: 84).*

Furthermore, residents can have negative perceptions toward the renewable energy projects in their communities. Bhattacharyya (2013b: 133) notes that, renewable technology is sometimes unsuccessful because the public views it as rural energy and this creates a negative image. In South Africa for instance, alternative off-grid solutions are viewed as a temporary solution to be replaced when grid extension becomes feasible thus making them seem inferior (Bhattacharyya, 2013b: 151). This creates a sense of discrimination or isolation in the minds of the users. These negative perceptions can affect the success of electricity access projects due to low acceptability and attractiveness among community members (ibid).

Overall, micro-hydroelectricity schemes are an alternative option of providing electricity to the remote and inaccessible areas. It is environmentally friendly and economical. However, there are some challenges that still hinder successful implementation. Firstly, there are concerns about their ability to provide sufficient electricity to propel national economic development. Secondly, the perceptions of the beneficiaries of such projects play a role in how communities will receive and maintain them.

2.3 Gender and Energy

When focusing on household energy sources and use, other factors need to be considered apart from the financial costs and environmental issues. According to Mehlwana (1997: 7), household fuels are social commodities and should be treated as such, hence domestic energy especially in low-income households should be studied in its social context. This rationale recognises the significance of human social relationships when it comes to

household fuel choice and use. It suggests that the economic rationale of energy use should be explained within the social context and pay attention to how households are managed in terms of who makes the decisions and the different relationships between members of households (ibid). Relationships, which at times are influenced by gender stereotypes.

The extent to which energy development practitioners incorporate gender within its programs evolved over the years given the recognition of women as active users and collectors of household biomass fuel. Energy-poverty has distinct gender characteristics especially in rural areas (Clancy et al., 2002: 10). As mentioned earlier most of the rural households in Africa do not have access to electricity and they rely on biomass fuel to fulfil their household energy needs. A survey conducted of households in four rural areas in Zimbabwe observed that, 74% of the households undertake biofuel combustion three times per day, in the morning, at noon and in the evening, mainly for cooking. Space heating and lighting are only desirable by-products of the combustion process (Marufu et al., 1997: 58). Therefore, the use and supply of fuel to meet such daily demands relies heavily on women considering that cooking is a responsibility that is assigned to women through socialisation. Thus, it is important to consider women's role in the use of energy services and technologies because of women's significant role as managers of natural resources and producers of biomass fuels (Clancy et al., 2002: 12). This also affects their time for other economic and personal development activities such as education.

The gender distinctions of energy use are further illustrated for example when Clancy et al., (2007) assessed energy technologies for water, noting that women had more interest in technologies which matched drinking water needs while men favoured technologies which could provide sufficient water for irrigating crops. This suggests that the different household responsibilities between men and women influence how they perceive and use energy. In studies conducted of villages in Tanzania, Vietnam and Bolivia, Kooijman and Clancy (2010: 16) found that compared to men, women tend to make less use of electric technologies in their enterprises. This is due to the gender differences between sectors. Typical female enterprise sectors such as tailoring and home brewing mainly make use of lighting from electricity, unlike male dominated sectors such as carpentry or metal works that have a stronger dependence on electric appliances (ibid).

Research conducted of women in Nepal showed that, the introduction of electric-operated grinding mills within twenty minutes from their household played a significant role in reducing the labour for women when compared to spending long hours leaning over a stone mill (Shrestha, 2012: 19). However, Shrestha notes that even though the access to electricity reduced the drudgery there are limited opportunities for women to engage in any income generating activities or other personal development activities, because the community lacks the relevant resources (ibid).

This reveals that access to electricity does free up women's time from performing lengthy laborious tasks, however, electricity alone is not sufficient to ensure the development of women, especially if the community does not have any connections to economic markets or educational facilities. As expressed by Practical Action (2012: x), energy access alone, is not a guarantee of an improved livelihood, the success of enterprises is influenced by factors such as reliability, quality, and cost of energy supply coupled with access to markets, social networks, and a business proposition that has sufficient demand influences.

Kavita (2000: 31) on the other hand, notes that electricity gave women the opportunity to connect to the television. This is an important medium for gaining access to information about political, social, cultural and economic issues. It helped them to widen their understanding particularly because they did not travel out of the village. This highlights that although women may not engage in any income-generating activities, electricity provides access to valuable information technologies and social media that can significantly empower them.

In some situations where rural electricity projects have been implemented, it is noted that women are the ones who are more likely to benefit to the extent that they become as interested as men, if not more so in the success of the utilities (Batliwala and Reddy, 2003: 40). If given the opportunity, women are potentially the best managers of energy enterprises (ibid). However, a study conducted by Winther (2008: 9) of rural households in Tanzania reveals that, even though the village has an electricity connection, women continue to cook with firewood on a three-stone hearth. Some of the reasons are that women do not own electrical appliances in the household due to the fear of losing them in the event of inheritance due to their husband's death or divorce. Other reasons include their fear of electric shock and the high cost of electricity use with stoves.

In conclusion, energy access relates to the potential ability to use energy. This potential ability registers according to physical, economic or social factors. Physical factors in the sense of a households' geographic proximity to a major electricity grid or the presence of a standalone off-grid system. The economic factors are related to the extent to which one can afford the financial cost of distribution, connection and daily consumption. Many sub-Saharan African governments face financial challenges of either establishing new electricity grids or extending existing ones. Micro-hydro power has increased in popularity as a more economic option for remote areas in which grids cannot reach.

Social factors are viewed according to the social context in which the energy is accessed and used within households. As governments and international organizations make efforts to provide energy poor communities with access to energy, it is also vital to consider the gender dynamics within this area. Women living in rural areas without access to electricity or other modern energy services play a major role in contributing biomass fuels to the

household mainly because biomass fuel is used for cooking. Moreover, it has been widely expressed that the use of biomass fuels in relation to the duties prescribed to women are harmful to their health and depriving them of personal, economic and social development. Therefore, the introduction of modern energy services such as electricity are highly welcomed as a form of development. Even though programmes such as rural electrification are not done with the main aim of reducing women's drudgery, their subsequent effects are freeing up women's time from collecting biomass fuels, reducing the labour and gaining access to information.

3. Methodology

This chapter presents a description of the study area and a description of the research methods used during fieldwork. Making use of the mixed methods approach, techniques from both qualitative and quantitative research methods are used. These include methods such as, free-listing and pile sorting, participant observation, interviewing, focus group discussions and a survey. The chapter also provides a reflection on my fieldwork experience with the use of the different data collection methods and the challenges faced.

3.1 Study Area

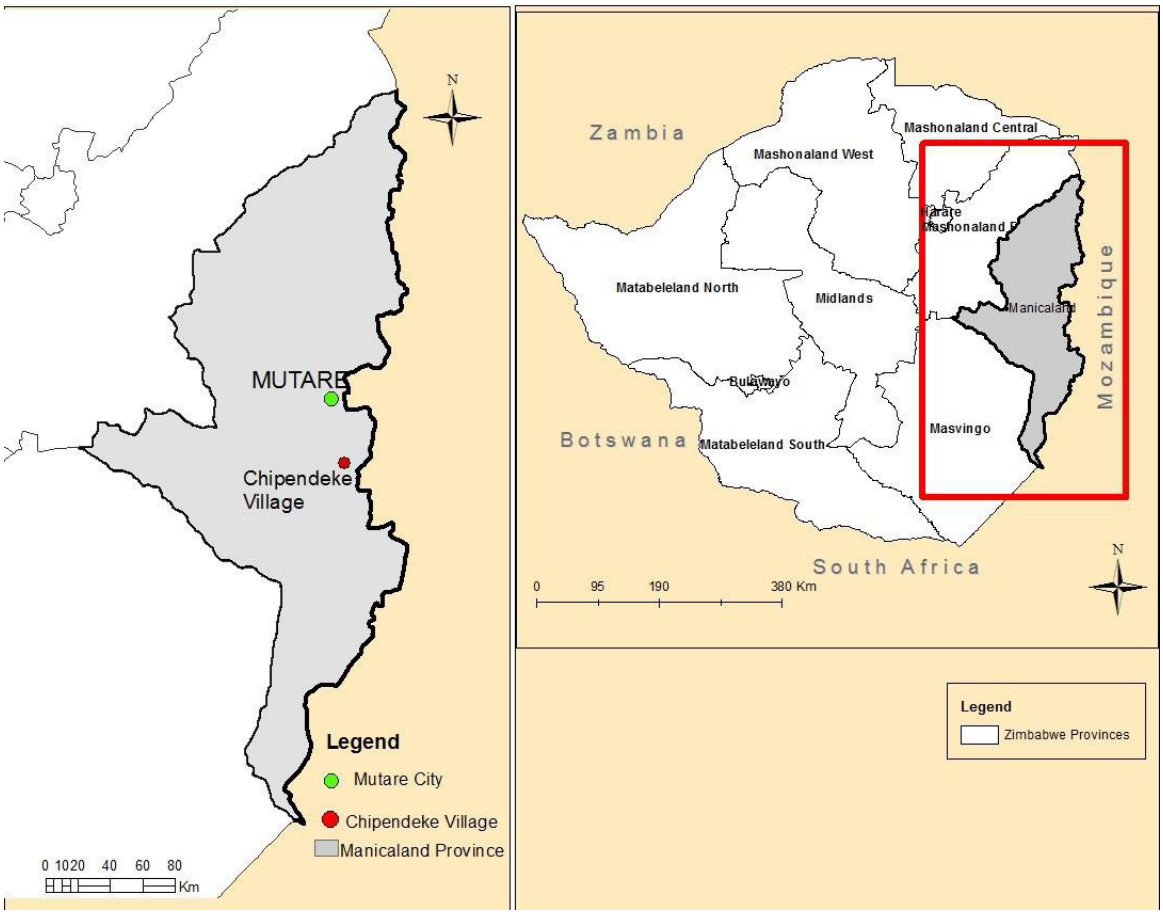
Chipendeke village is a remote rural village located 64km southeast of the city of Mutare in Zimbabwe, near the border of Mozambique (see Map 1). It is in Mpudzi Ward 22[2] of the Mutare Rural district council. The village is also located in Zimbabwe's Natural Farming Region 2, with an estimated annual rainfall of 700- 1050mm. Therefore, the region naturally possesses favourable conditions for farming which explains its status as a former colonial farm area. According to some of the respondents, they settled in Chipendeke soon after independence as part of the land resettlement program that started in 1980.

Currently, the main source of subsistence and income is from dry land farming and irrigation farming. The irrigation scheme which only caters for 47 hectares of land, is a gravity fed system that draws water from Chitora River, also known as Wengezi River, a perennial river system. The farmers produce various grains, vegetables and legumes such as Wheat, Maize, Chilli, Sugar Beans and Groundnuts for household consumption or commercial use. According to the Agriculture, Technical and Extension Services (AGRITEX) officer, the community also uses solar energy to dry Chilli after harvesting.

The journey to Chipendeke involves traveling 44 km by tarred road from Mutare along the Mutare Birchenough Bridge Road and another 20 km off-road along a winding dust road within the mountainous area. Depending on whether you use private or public transportation, the journey can last between two to four hours. Very few forms of public transport are available to ferry people to and from the village. Three vehicles that include a commuter mini-bus, a car and a lorry commute daily to and from Chipendeke and Mutare city. They depart from the village early in the morning around 6am only to return to the village late in the afternoon or evening. Thus, if one fails to board either one of these vehicles it is very difficult to obtain transportation to and from the village. The villagers do not own any vehicles hence they make use of the above-mentioned services, paying a fee board the vehicle. Furthermore, villagers commute to Mutare city to seek services that are

[2] Zimbabwe has 59 Districts that are divided into 1200 Wards.

not available in the village such as banking, grocery shopping and at times serious medical assistance.



Map 1 Location of Chipendeke Village. Country/ Regional boundaries/ features of Main map and Insert map: DIVA-GIS (Source: http://www.diva-gis.org/datadown). Date accessed 27 April 2015

Chipendeke village has a population of 4081 residents and an estimated 1000 households grouped into six sub villages. Similar to most rural areas in Zimbabwe, the homes in Chipendeke village are dispersed from each other, with each homestead consisting of two or more buildings. A separate building, commonly a round hut with a grass-thatched roof, is used as the kitchen especially for those that use biomass fuel for cooking. Households that do not have round huts as the kitchen use outdoor sheds constructed using brick and corrugated iron. There are various reasons to explain the presence of a separate hut for cooking. Apart from the problem of indoor air pollution, the respondents complained that the smoke from the fire can spread throughout the house and stain the walls and clothes.

Since establishing a micro-hydroelectricity scheme, the village has received substantial public attention. A signed guest book at the powerhouse shows that media personnel and academic organisations have visited the village to report on or study the scheme. News about the micro-hydroelectricity scheme has been reported in national newspapers such as

The Standard[3], Newsday[4], The Zimbabwean[5] and national television programs such as Green Studio.

The scheme generates 25kVa of electricity by harnessing the water flowing from Chitora River, the same river that supplies water to the village irrigation scheme. Considering that the village is remotely located in the eastern highlands of Zimbabwe, the project exemplifies the possibilities that are available for rural communities to use natural resources, such as the river and mountainous region to generate electricity. Thirty-nine households have an electricity connection in addition to the clinic, the primary school and the business centre. Each entity is responsible for paying for their household electricity consumption through a prepaid system.

The micro-hydroelectricity scheme at Chipendeke village has been in operation since 2011 and was officially opened in June 2012 by the Governor and Resident Minister for Manicaland Province. Although technical assistance came from Practical Action and funding from the European Union, the construction of the project is renowned for its community involvement. The total cost of the scheme is estimated at €68,000 with the community contributing 25% (€17,000) of the cost through sweat equity (Mutubuki-Makuyana, 2010: 40). The ACP-EU Energy Facility financed 75% of the project and Practical Action Southern Africa financed 25% (ibid).

The sweat equity model meant that during construction, villagers provided labour and other locally available materials as a form of investment hence gaining share of ownership of the micro-hydroelectricity scheme (ibid). This sweat equity model was encouraged in the hope of promoting sustainability and viability of the micro-hydro scheme through community participation. A case study done on behalf of the Regional Electricity Regulators' Association of Southern Africa views that of the ten small-scale mini-grids in Zimbabwe, Chipendeke is one of the communities that has demonstrated high levels of sustainability (Economic Consulting Associates and Practical Action, 2013: 39). This is possibly due to the high level of community participation and engagement that ensured buy in by the community (ibid).

There are three main reasons for choosing Chipendeke village as a study area. First, electricity is available since 2011 and this four-year period provides a favourable period for one to study their experience of using electricity. Second, the remote location of the village and its use of natural resources to generate electricity fit well with my interest in studying the innovative use of natural resources to provide opportunities for livelihood creation in

[3] http://www.thestandard.co.zw/2012/11/11/mini-hydro-power-station-changes-lives/ (accessed July 15, 2014).

[4]https://www.newsday.co.zw/2014/08/27/small-scale-power-generation-lights-chipendeke-himalaya/ (accessed August 17, 2015).

[5] http://www.thezimbabwean.co/2011/08/micro-hydro-power-lights-up/ (accessed August 17, 2015).

rural communities. Third, the reports of women's participation in the construction of the micro-hydroelectricity scheme sparked my interest in studying the relationship between energy and gender.

3.2 Entering the field

The ability to travel to the village, meet villagers and eventually collect data is a process characterized by many factors. Apart from the information I read in the media and the publications by Practical Action, I had never visited the village. Practical Action played a significant role during the implementation of the micro-hydroelectricity project hence I considered them as a good point of contact. Therefore, for more information about the project and the village I contacted Practical Action prior to starting on my fieldwork. After introducing myself and presenting them with a written letter from the university, they gave me an opportunity to conduct a short presentation that explained the purpose of my research.

As mentioned earlier, the village is located 64km away from the nearest urban area, Mutare, and has limited public transport to the area. On my initial visit to the village, Practical Action provided me with transport to and from the village. They also introduced me to members of the community who participated actively in the construction process of the micro-hydroelectricity scheme as well as introducing me to the AGRITEX officer responsible for irrigation farming, with whom I resided with for the duration of my study.

In terms of language, I did not experience any problems with communication as most members of the community speak a dialect of the Shona language called Manyika. I am a Shona speaking Zimbabwean from Harare and I lived in the Manicaland region for three years during my Bachelor studies. Therefore, I am familiar with the Shona language and Manyika dialect. Thus, I could carry out interviews and discussions with limited risks of poor communication between the informants and myself. When I introduced myself to the informants, I explained my status as a student who is conducting the study for academic purposes. The villagers were very welcoming toward me and considered me as a visitor who is interested in learning more about the village and its micro-hydroelectricity project.

3.3 Data Collection Methods

This section outlines the different data collection methods used during fieldwork. It also discusses the strengths and shortcomings of these methods in relation to the study.

3.3.1 Sampling

Non-probability sampling was used to select informants for the study. Six key informants were selected through snowball sampling. The selection is based according to whether they have any livelihood strategies using electricity to sustain their families, or the role they played during the construction of the micro-hydroelectricity scheme. Snowball sampling is a network sampling method generally known as a chain referral method used for studying "hard-to-find or hard-to-study populations" (Bernard, 2006: 192). Therefore, I used snowball sampling because the number of women involved in some form of income generation using electricity is still low and spread out across the village.

In addition to the six key informants, I selected twenty-three other respondents through purposive sampling to conduct a survey. The selection criteria are based on their age and length of residence in the village. During the interviews, I made use of a semi-structured questionnaire (see Appendix II). According to Bernard (2006: 189), "in purposive sampling, you decide the purpose you want informants (or communities) to serve, and you go out to find some". Hence, the selection criteria based on the respondent's length of residence sought to obtain female respondents who lived in the community prior to the installation of electricity. This gave room to include informants who have experienced life in the village before and after electricity. In the case of age, female respondents from the age of sixteen were considered because young women are not exempt from the use of household energy fuels during their chores such as collecting firewood and cooking.

I also interacted with other participants during fieldwork, with whom I conducted interviews and discussions. Therefore, the number of people who participated in the research are as follows:

- Six key female informants with household electricity.
- Twenty-three female informants with household electricity.
- Ten female informants without household electricity.
- Two male informants responsible for maintaining the powerhouse.
- Expert informants from Practical Action.
- Two expert informants from the Forestry Commission.
- One expert informant at Zimbabwe Rural Electrification Agency.

3.3.2 Participant Observation

Participant observation is one of the commonly used research strategies in anthropology. Bernard (2011: 257) describes participant observation as a strategic method like experiments, surveys or archival data that puts you where the action is and lets you collect any kind of data you want, narratives or numbers. The data collection process in the village was conducted within a period of four weeks. During this time, I mostly observed the way

of life in the village and the daily routines of my informants. I also participated in some of the activities that my informants engaged in during the day. Activities such as searching for firewood and their use of electricity in the home.

According to Bernard (2011), participant observation is a process of "immersing yourself in a culture and learning to detach yourself every day from that immersion so you can intellectualize what you have seen and heard, put it into perspective, and write about it convincingly" (ibid. 258). Therefore, participant observation gave me the opportunity to gain first-hand experience of the day-to-day lives of these women and an understanding of some of the nuances associated with their domestic work. For example, one informant explained that, one's inability to carry out activities such as cleaning their home, sweeping ash from the hearth and collecting firewood threatens their dignity amongst other women.

3.3.3 Interviews

Interviewing is also a valuable technique that I used during the study. An interview is a process in which the researcher asks the respondent a series of questions with the aim of obtaining certain information. According to Bernard (2000: 190), one can divide interviews into a continuum of four large chunks consisting of informal, unstructured, semi-structured and structured interviews. During fieldwork, I conducted unstructured narrative interviews using an interview guide with the six key informants (See Appendix I). Therefore, the interviews were based on a clear plan that I kept constantly in mind, but with minimum control over the respondent's responses (Bernard, 2000:191). The purpose was to gain descriptive information of their personal experiences before and after the introduction of electricity.

The strength of an unstructured interview is in its ability "get people to open up and let them express themselves in their own terms, and at their own pace" (ibid). Hence, the informants had the opportunity to share their experiences in a less rigid manner. I also used a questionnaire guide during interviews with experts from Practical Action, the Forestry Commission, and Zimbabwe Rural Electrification Agency (See Appendix III). Prior to each interview, I asked for the informants' permission to record our conversation with a digital recorder in which all the informants gave their consent. During the interviews, I also wrote down notes of important issues raised and questions that needed further clarification.

Lastly, I used a semi-structured questionnaire to interview the six key informants plus twenty-three other female informants who have an electricity connection in their homes. This was in the form of a survey (see Appendix II). The aim was to obtain quantitative data to compliment the qualitative data acquired through interviews, observation and focus group discussions. The semi-structured questionnaire collected overall statistics concerning elements such as the number of women engaged in livelihood enterprises and the number

of energy sources in the village. Informal interviews also occurred throughout the study, not only with the key informants but also with other villagers such as women without an electricity connection in their homes. Informal interviews give the respondents an opportunity to express their opinions in an informal setting.

3.3.4 Focus Group Discussions

On separate occasions, I conducted three focus group discussions toward the end of the study. Two of the groups included women with an electricity connection in their home and the other group included women without an electricity connection in their home. Focus group discussions provide an opportunity for members of a community to come together to discuss their different views on a certain topic. According to Bernard (2000: 207), "focus groups do not replace surveys, but rather complement them". Therefore, the rationale of conducting focus group discussions is to complement interviews and surveys with group discussions, which can give clarity to certain issues. To have a fruitful and manageable discussion a focus group should have at least six members and not more than twelve members (Bernard, 2000: 210). Hence, the three groups were composed of six to nine different participants. It is also important to have a moderator during the discussion to guide the discussion and manage the time.

According to Bernard (2000: 210), focus groups are more effective when used to collect data about content and process rather than collecting data about personal attributes or for estimating population parameter of personal attributes. Therefore, the discussions evolved around content and processes such as, their motives in participating in the construction of the micro- hydroelectricity scheme; their views on the lack of female caretakers working at the powerhouse and reports on women being happier than men about an electricity connection at the clinic (See Appendix I). These are unlike the survey questionnaire which asked questions that pertained to personal attributes such as how much they pay for electricity, or who pays for electricity, or the type of energy fuels used in their homes.

3.3.5 Free-listing and Pile-sorting

Free listing and pile sorting are cognitive techniques which I used at the initial stages of the research. Cognitive techniques provide a glimpse into the perceptions of the informants. The free-listing technique involves asking the informants to make a list of as many words or objects that they associate to a certain domain (Bernard, 2006: 301). According to De Munck (2009: 47), a "cultural domain refers to all things, at the same level of abstraction that members of a culture (or group) say belong together". These are emic rather than etic

categories because they are shared and constructed by the members of a culture and not by the social scientist or so-called expert (ibid).

The strength of free listing is therefore in its ability to provide emic representations of the community without being subject to researcher bias. The pile sorting technique usually comes after free-listing. By using the terms taken from the free-list, the researcher writes the terms on a paper or card with an arbitrary number on the back of the paper and then asks the respondent to make two or more piles of the cards. The correct implementation of the process has the potential to assist the researcher in formulating appropriate interview and discussion questions that informants can relate to.

I randomly selected ten informants from households with electricity and asked them to "List all the benefits that you associate with electricity". The cultural domain in this case is the benefits of electricity to these women. The aim of this question was to familiarize myself with how they value electricity given their inability to use electricity for cooking and ironing. I also asked the respondents to take their time listing and to exhaust all the thoughts they had on the topic. In terms of frequency, most informants listed words and phrases such as television, lighting during housework, no more candle and paraffin expense, cell phone charging and refrigerating goods for sale respectively (see Appendix IV).

When sorting these benefits into piles, it was more constrained as I asked them to make only two piles from the lists, one pile that shows how they as a woman specifically benefit from the electricity and another pile that they thought benefited the rest of their family members. The benefit of lighting when doing household chores and cell phone charging appeared more frequently in their pile of benefits specifically for women. However, one participant claimed that the electricity did not benefit her in any way especially in terms of her chores around the home.

3.4 Reflection on Fieldwork Experience

This section provides a reflection of my experience with the use of the different data collection methods and some of the challenges that I faced during fieldwork.

Although thirty-nine households have an electricity connection, I found that the electricity is not sufficient to accommodate the use of stoves and irons in each household. Therefore, villagers continue to use wood fuel for cooking and the responsibility is upon women to search and gather firewood. Given the initial outlook of my research that considered women's response to electricity as a new form of energy assuming that a transition from the use of wood fuel to electricity with regard to cooking had occurred I had to adjust my approach. Therefore, the first thing I did was to conduct free-listing and pile sorting exercises as explained in section 3.3.5. This also included adding a section within the questionnaires that studied women's use of wood fuel in the household.

When conducting participant observation some of the challenges I faced include not having the opportunity to write down everything that I have observed within the moment it occurred. When I had the opportunity, I wrote down notes during times of observation, for example when I went around observing the different features and functions of the micro-hydroelectricity scheme such as the weir and the powerhouse. However, at times I failed to write down notes because it was unconducive to take out my notebook and start jotting down notes. For instance, when my informants were collecting firewood and needed help in tying the wood together and placing on top of their head. Furthermore, although I also observed their use of firewood for cooking on the hearth, note taking during such times proved difficult due to the smoke produced from the fire. Thus, only when I had detached myself from such situations, mostly in the evenings, did I reflect and note down important aspects that would have occurred during the day.

The focus group discussions occurred successfully however, it was a challenge to get all the women who had agreed to participate to meet on time and as well as to stay longer as most women explained that they needed to return to work in their fields. The duration of the discussions varied between thirty to forty minutes. I observed that the groups of women with an electricity connection participated more actively and eagerly during the discussions. However, the focus group discussion that consisted of only women without any electricity was tense when the topic of household electricity came to the fore. The aim of conducting a focus group discussion with women without household electricity was to gain an understanding of their thoughts and feelings of the lack of electricity in their homes. Although these women expressed their joy of having electricity at the village clinic, primary school and business centre, they shared some of their concerns about the lack of household electricity as explained in section 4.2.3.

The use of different interviewing techniques proved helpful in producing qualitative and quantitative data. The unstructured interviews with key informants gave me the opportunity to have descriptive information about the experiences of the key informants. The survey which I conducted using a semi-structured questionnaire gave me the opportunity to interview other respondents and collect data on the amount of money that individual households spent on electricity; the genders of the persons paying for the electricity and the amount of money received from income generating activities that use electricity.

However, to conduct interviews with informants from the Forestry Commission as well as the Rural Electrification Agency I had to travel back to Harare the capital city of Zimbabwe. The officials in Mutare referred me to their offices in Harare to gain specific information such as the rate of deforestation in Zimbabwe and information about the national progress of the Rural Electrification Agency. This was because at the local level officials in Mutare did not have accurate information on the current national status. They were only able to provide

information of their local surrounding areas. Hence the need to visit their head offices in Harare.

Last, as explained earlier Chipendeke village has received much attention since the installation of the micro-hydroelectricity scheme. Therefore, in my opinion I felt that during the initial stages of the research, the respondents provided rehearsed information about the micro-hydroelectricity scheme. For example, information about their active contribution toward building the scheme and of how their village has access to electricity through the scheme. These did not fully express their personal opinions on the benefits of electricity and their inability to use other electric appliances such as stoves. However, I believe that my continued stay at the village remedied this as informants began to open up more about their experience with electricity as outlined in section 4.2. Furthermore, probing during interviews assisted me in gaining more information about their personal opinions and experiences. This involved occasionally nodding and silently listening to their responses as a sign of my attention, which in turn encouraged them to continue speaking.

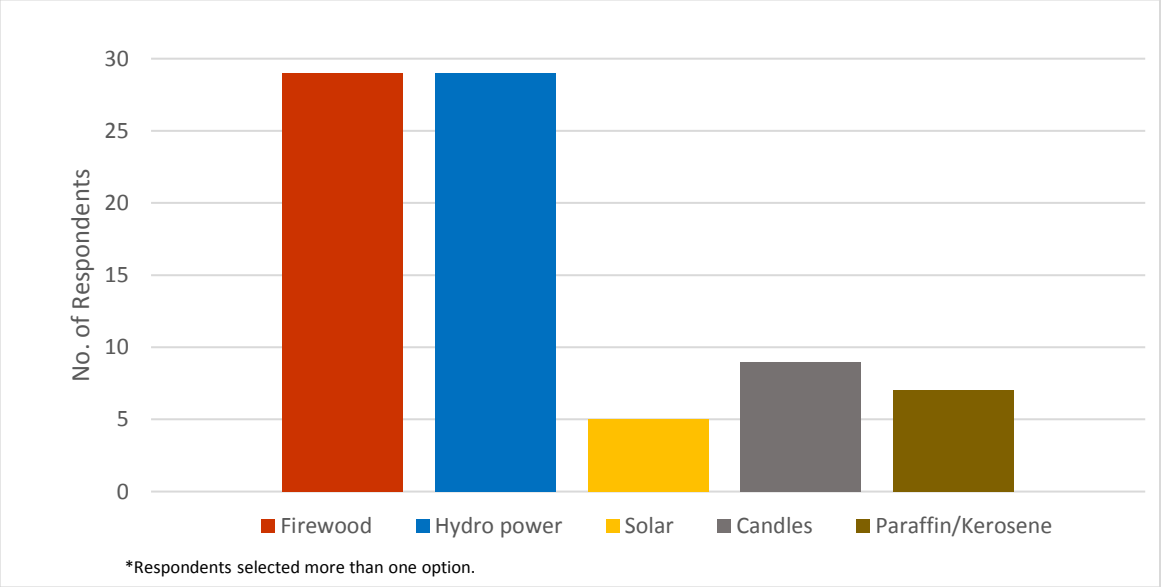
In summary, Chipendeke is a remote rural village that has gained popularity due to the introduction of a micro-hydroelectricity scheme. This has made it a practical point of reference to those interested in studying the relationship between energy and poverty. The above-mentioned techniques played a significant role in gathering information needed to answer the research questions for this study. These methods are largely qualitative, as I conducted participant observation, interviews, focus group discussions and free-listing and pile sorting. The use of quantitative methods to collect statistical data brought more perspective on the individuality of the respondents.

4. Energy Sources and Access

This chapter presents a description of the research findings based on the data collected. First, a description of the different energy sources and their use is given. Second, hydropower and wood fuel are described as the popular sources of energy in the village. Third, after outlining the sources of energy at Chipendeke village, the chapter explores how households gain access to electricity in relation to the financial and social factors.

4.1 Energy Sources in Chipendeke Village

This section describes the different energy sources in Chipendeke village. It also highlights how informants use each of these resources. When asked about the source of energy that they use in their homes, the respondents had the opportunity to select more than one answer for their responses. As illustrated in Graph.1, the options selected by the respondents included hydropower, wood fuel, solar, kerosene/paraffin and candles. All twenty-nine respondents indicated that wood fuel and hydropower are common sources of energy in their homes.

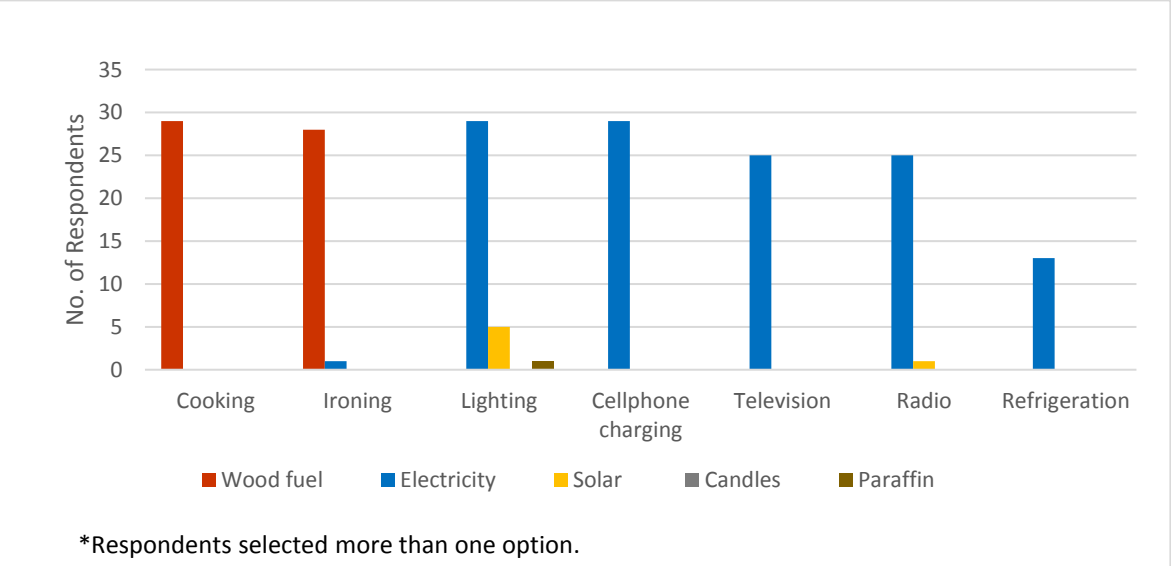


Graph 1 Household Energy Sources

Apart from hydropower and wood fuel, a few respondents selected other sources of energy. For example, respondents indicated the use of solar energy, another renewable energy source (see Graph 1). Five respondents mentioned that they possessed solar lamps that they occasionally use for lighting and listening to the radio especially when there is a disruption in electricity supply or in rooms that they did not install an electric bulb. Paraffin and candles are also among the least selected variables. Seven respondents indicated their use of paraffin and nine indicated their use of candles.

In comparison to other energy sources, respondents reported that electricity is a better option. Paraffin is unpopular as many respondents complained about the smell and smoke that stains clothes and walls. The use of candles is more expensive than electricity as they runout quickly. Similar to solar lamps, the respondents explained that they have reduced or even stopped the use of paraffin and candles for lighting purposes since having electricity in their homes.

It is also important to note that respondents use these sources of energy differently as illustrated in Graph 2. For instance, they use electricity from the micro-hydropower scheme for lighting purposes, charging cell phones, powering the television, radio and refrigerators. Whereas wood fuel is used for cooking and ironing. Only one informant mentioned during an interview that sometimes she uses an electric iron to iron her laundry. Although there was not sufficient time to investigate this issue further with other informants, her response gave me room to assume that many others maybe using these electric appliances secretly considering that electricity would often trip off during fieldwork. Respondents reported the use of solar lamps for lighting and listening to the radio, and paraffin for lighting purposes only when there is a disruption in electricity supply.



Graph 2 Household Energy Use

4.1.1 Hydropower

The following section provides a detailed description of how the micro-hydroelectricity scheme generates electricity from the river. There are many factors that are considered when constructing a micro-hydroelectricity scheme in areas such as Chipendeke. Factors such as the presence of flowing water and drop in height are essential for the extraction of hydropower. According to an expert informant from Practical Action, factors such as the

presence of head[6] and a perennial source of water flow determine whether a hydro site is suitable at a given area. The informant stated that:

> *"Hydro-power schemes require both water flow and drop in height (referred to as head) to produce power. It is a power conversion system, absorbing power in the form of head potential energy then kinetic energy to mechanical shaft power flow delivering power in the form of electricity" (Informant No.48, 24/9/2014).*

In this case, Chitora River is the source of electricity at Chipendeke. Several steps took place when identifying the site to construct the micro-hydro scheme. They include a capability and demand survey; consultation with the catchment's council and the stakeholders; selection of site; Hydrology analysis; Hydraulic study; Topography survey; Feasibility study; Hydraulic computations and data analysis and design of the individual components (Informant No.48, 24/9/2014).

The construction of significant structures was necessary for harnessing the water; however, no residents were displaced from their homes. Structures such as the weir, canal, penstock and forebay[7] tank constitute the various structures that make up a micro-hydroelectricity scheme. The weir (see Photograph 1), that collects flowing water at the initial stage of the process is located at an elevation of 1160m above sea level. This connects to a canal that diverts water away from the river to a forebay tank, through the penstock and down to the generator that is in the powerhouse. The powerhouse as shown in Photograph 2 is located at a considerable distance away from the nearest houses. Thus, the noise from the generator is less likely to disturb the villagers.

Photograph 1 Weir and Canal

[6]Head refers to the vertical distance that water falls, with small hydropower sites mostly categorized as low or high head. High head provides potential to use less water to produce a given amount of power, and smaller, less expensive equipment.

[7] A reservoir or canal from which water is taken to run equipment.

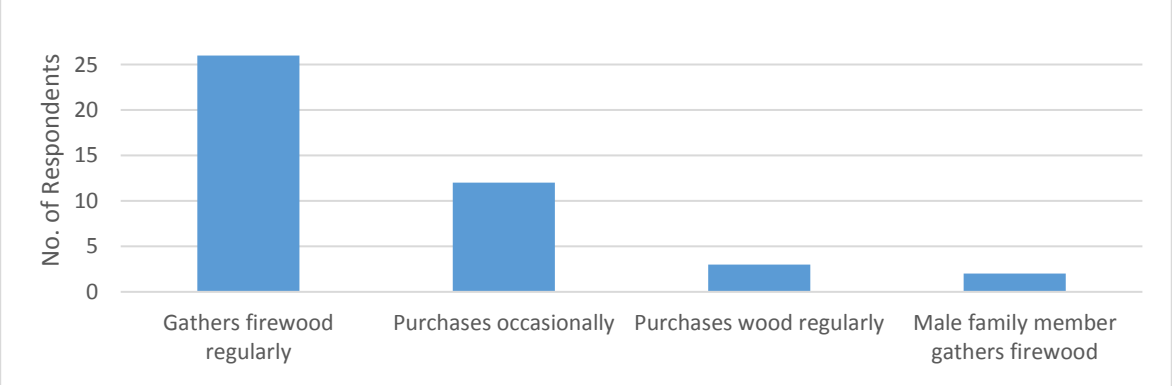
Photograph 2 Inside the powerhouse

It is also important to note that the river is the source of water for the micro-hydro scheme and the irrigation scheme. This exemplifies the potential of natural resources such as water bodies, as they can benefit a community in multiple ways. Although Chitora River is a perennial river system, the river flow is sometimes subject to the change in seasons. For instance, some of the villager's report that during the dry season, the velocity of the water flow is slower. This results in reduced electricity production to the extent that at times they must interrupt power supply in the form of load shedding.

Therefore, the newly introduced micro-hydro scheme in Chipendeke generates electricity from the water flowing from Chitora River. The presence of this perennial river and its location within a mountains region create favourable conditions for drop in height.

4.1.2 Biomass- Wood fuel

This section provides a description of biomass wood fuel as a source of energy in Chipendeke. The data in Graph 1 indicates that biomass fuel, as well as hydropower, is still a significant source of energy in Chipendeke. Consequent to the failure of the micro-hydroelectricity scheme to accommodate some electric appliances they agreed among themselves not to use high voltage appliances such as stoves and irons. Hence, both groups of households with electricity and those without use firewood for cooking and ironing.



Graph 3 Access to firewood

Twenty-six (89%) of the respondents reported that they collect firewood on a regular basis and only two (7%) respondents reported that a male member of the family gathered firewood (see Graph 3).

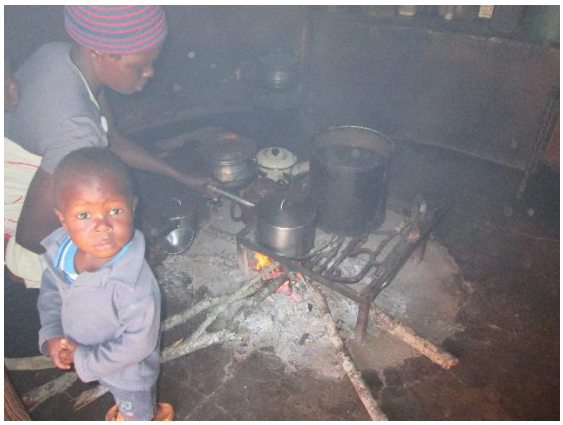
Apart from searching for firewood, there is another option of purchasing firewood from vendors. However, not many women do so. As illustrated in Graph 3, twelve respondents (41%) mentioned that along with gathering firewood from the bush, they occasionally purchase firewood from vendors. Whereas three (10%) respondents mentioned that, they purchase firewood regularly, more than they gather. The option of buying the firewood is also problematic, according to one informant:

> *"If you want to buy firewood and the seller notices that you are desperate and really need firewood, the price will be increased. If you buy in bundles, they will charge you a one dollar, but bundle will not last two days of cooking in the morning, afternoon and evening. And you realize that you are spending a lot of money. Fresh trees are prohibited from being cut down, if you are caught the environment officers have a say and the chief has a say, and you will spend a lot of money paying fines". (Informant No. 4, Focus group discussion 5/9/2014).*

The remote location of the village, away from urban areas and within a mountainous region makes the village a typical candidate for the exclusion from major national electricity grid connection. Therefore, during the construction of the scheme, they expected that they would be cooking with electricity. Some of the informants even indicated that they had purchased electric stoves expecting to use them once electricity was connected. One female informant describes how they felt about the introduction of electricity:

> *"When electricity was connected we were very happy and thought that we will not cook with firewood anymore. After a while, we noticed that when we cooked with our stoves the electricity would trip off and we were told that the electricity is not sufficient to power stoves. 'What do we do now?' We asked ourselves. 'Do we keep going to look for firewood?" (Informant No.5, Focus Group Discussion on 5/9/2014).*

Thus, the use of firewood for cooking is a longstanding practice in the village (see Photograph 3). The respondents reported that they gather firewood from the surrounding mountains. They mainly search for dry trees or already fallen trees as according to the law (See Photograph 4).



Photograph 3 A Woman using firewood for cooking and water heating

Photograph 4 A woman carrying tree branches

During one of the group discussions, an informant states that they enjoy searching for firewood, as it is their responsibility as women in the home. What makes the job difficult is that they must walk a long distance between the forests and their homes. She also explains how they have developed a system, that soon after cooking they extinguish the fire and then light it when it is time to use it again for heating. According to Informant No. 26:

> *"We like to fetch firewood, but the problem is that the firewood is now very far away and there are no dry trees, so we have to cut down fresh trees. And cutting down fresh trees is forbidden, if you are caught you are made to pay a fine. So as women we like searching for firewood as it is our responsibility but now it has become difficult for us to do. It is now difficult. We have now even developed a system that after cooking we put out the fire and then you light it up again when you want to heat up the food" (Informant No. 26, Focus group Discussion 5/9/2014).*

During the group discussions and interviews, women constantly expressed the challenge they faced with the environmental village monitors and chief who forbid people from cutting down trees. If a person is caught cutting down fresh trees they are liable to pay a fine such as money or a chicken. According to one officer at the Forestry Commission, environmental village officers and Chiefs are enforcing the Forest Act [Chapter 19:05] which seeks:

> *"[…] to provide for the setting aside of State forests and for the protection of private forests, trees and forest produce; to provide for the conservation of timber resources and the compulsory afforestation of private land; to regulate and control the burning of vegetation; and for other purposes connected with the foregoing." (Forest Act [Chapter 19:05]: 311).*

When asked about their opinion on the law that prohibits people from cutting trees for firewood and its enforcement process, most women confessed that this law is difficult to adhere to and that sometimes they have no option but to chop off some of the branches of fresh trees. This is because they are responsible for cooking and if they fail to find firewood for cooking it means that their family would not be able to eat. One informant explains that one does not have to cut down the whole tree but *"just parts of it here and there"* so that it dries up and then you can come back after a few days to cut it down (Informant No.5).
However, some female informants argued that although the law is difficult for them to adhere to they think that it is helpful for their wellbeing and the environment. For instance, two female respondents cite environmental and health benefits that come from restricting the cutting down of trees. One of the female informants gave her opinion on the matter by saying:

> *"This law in my opinion is tough on us but it protects us because if it was not forbidden I think the wind would harm us. There would be no trees at all to protect us because we would have cut them down. Therefore, this law is hard on us, but it preserves us. I as a woman I know that a place without trees faces many problems. If there is strong wind without anything to shield, it can destroy houses. Trees defend us where we live. I am thankful for this law. Yes, we go to fetch firewood far away and we face many challenges, but we persevere as women searching for dry wood. This law also helps us so that people do not just cut down trees without a plan. Trees preserve our lives. It's good for us to look for dry wood far away and if you decide to cut do not just cut everywhere" (Informant No.13, Focus group Discussion on 5/9/2014).*

Another female informant states that:

> *"This law is hard for us to keep but we will be killing ourselves because we will be harming our environment. When we cut down fresh trees and the water rains it will cause soil erosion which means we will have to live with gullies that form because there will be no more trees. It is also difficult for us to adhere to the law that instructs that to be able to cut down a tree you should plant another tree because we do not have the place to plant. In addition, we do not have anyone to teach us about how to do it although the law instructs that you are not allowed to cut down trees if you have no place to plant trees" (Informant No.26, Focus group Discussion 5/9/2014).*

Furthermore, another informant raises a different issue that pertains to the possibility of diminishing availability of wood in the area women are currently searching. She laments

that due to the large number of people who are traveling far away to look for firewood, the resources will deplete in that area. She expresses her concerns by saying:

> *"It's important for us to avoid cutting down trees, it is important for us to cook sadza with firewood because our generator does not have enough electricity. We are persevering going far away, but we are so many that even at this faraway place the wood will finish and we will have no more trees" (Informant No.12, Focus Group Discussion 5/9/2014).*

However, interviews with informants from the Forestry Commission reveal that the deforestation in Zimbabwe is mainly caused by the cutting down of trees for commercial purposes such as the sale of wood, curing tobacco and burning bricks rather than household consumption such as cooking. An officer at the Forestry Commission explained that:

> *"Apart from it being law, it is common place for communities to have set standards on how to utilize their natural resources, forests being part of them. As far as communal areas are concerned they have never been banned from using firewood. We know that traditionally in rural areas they use firewood, but we do not expect to find someone with a pile of firewood at their house, like big trees cut down for consumption at household level. The law comes in when people start exploiting forests for commercial purposes. That is when we come down hard on people because it is a resource for all of them to utilize. We understand that people in rural areas use firewood for energy and they have never been banned from using firewood. What they are banned from is cutting down trees. Yes. And if you go back to these communities they will tell you that traditionally they did not need to cut down trees. Dry trees fall on their own or even with some trees you can find some branches that are already dry, that is what they will pick and utilize for firewood. But the issue now is that people are cutting down even fresh trees drying them and then selling them for firewood. That commercial aspect is what we regulate as Forestry Commission because if you are going to be selling firewood it means you are a trader. That means you must be registered…Firewood is accepted as the energy source for rural communities but the way they go about it needs to be regulated because we expect it to be sustainable resource utilization. The worst part is that there are now urban communities going to exploit those rural communities to service the urban communities that are facing energy challenges. That is why there has been a lot of commercialisation of firewood…It is an offence to cut down trees without prior inspection of the area and understandable reasons. If we have apprehended someone with a large amount of firewood, it is because the firewood is above a cube. Above a cube of wood at their house. A cube and below we understand that it is for household use…it's the quantity that you have." (Informant No. 47, interview 23/9/2014).*

In addition to traveling long distances to find dry wood to collect and the challenges with enforcers of the Forestry Act, the informants reveal several other challenges associated with their physical wellbeing. These challenges include accidents such as breaking their

legs, extreme fatigue and some women reported instances of rape. For example, the following informant explains their challenges:

> *"You can make a mistake when you are fetching firewood by missing a step and breaking your leg or you fall and get hurt because you will be climbing up a mountain. Even when you come back home your neck hurts from carrying wood and walking long distances. By the time you get home you won't be able to do anymore work because of the pain from chopping and carrying wood" (Informant No.35, Interview 9/9/2014).*

The following narration given by Informant No. 5 describes her experience when she once slipped and broke her leg, it was in a cast for six months and another female relative had to come to help her with the household chores.

> *"I woke up early in the morning and did all my house work, sweeping and washing. After wards, since it was a school holiday I decided to go and look for firewood so that when schools opened it would not trouble me. I took my young daughter with me. And we set off at 5am, when we arrived up the mountain, we chopped some wood and gathered them together. We decided not to carry too much because we had walked a very long distance. After we tied them together we put them on our heads and we set off back home. We were walking back home but we had not even reached half of the way when I slipped. When I slipped, I kept holding on to the bundle of firewood on my head as I sat down and then I threw the bundle of firewood to the ground. My leg turned and faced backwards making a sound ka! And I said to my daughter… I am hurt…I cannot walk my leg is broken. I stood up and my leg was throbbing, I tried to walk but I could not, and I tried to crawl but I could not. I had my phone with me and I sent a Call Me Back message to my husband. And waited for him to call back. I asked my daughter if she remembered the way back home and she could not. And so, we had to wait for my husband to come looking for us" (Informant No. 5, Interview 4/9/2014).*

When asked about whom they go searching for firewood with, 24% of the women indicated that they went alone, while 38% indicated that they went with their children. The other 17% indicated that they went to search for firewood with a female friend or relative while only 7% stated that they go with a male relative. Furthermore, during the interviews and group discussions women listed what they considered as the duties and responsibilities of women in the household. Collecting firewood was one of the chores mentioned amongst activities such as cooking, cleaning the house, doing laundry and looking after the livestock such as chickens, turkeys and goats. I asked one of the informants to explain their opinion on why they considered collecting firewood as a woman's responsibility. She explains that:

> *"We say it's a woman's responsibility because it is, if it is about searching, because buying and searching are different. If it is about searching, it is better for the woman to go searching instead of the husband to climb up the mountain and come back down with a bundle of firewood on his head it is undignified. Unless it is about escorting each*

other but on the way back he may carry some logs and you will be carrying the bundle of wood on your head. Plus, you know the type of wood that burns well and that does not. A man does not know which one lights up easily or not. However, a woman knows which tree to chop because she knows which one is good for producing ash that she can use for ironing. That is the other advantage for a woman to go to search for firewood. And, when carrying the firewood on your head, I do not know why, but the way in which we were created, a woman is better suited to carry the wood than a man…if it is about buying it is my husband who buys. This difference is all about helping each other, maybe my husband does not have money and then I will search for firewood. When he has money, then I rest and he buys firewood. It's all about helping each other so that the work becomes easier." (Informant No. 27, Interview 9/9/2014).

Therefore, wood fuel is a resource commonly used in rural areas with no exception to Chipendeke village. Women in Chipendeke village reveal that they are the ones who mostly collect wood fuel. Occasionally, they may purchase firewood from vendors with the help of their husbands. The female informants also share some of the challenges they face with the use of wood fuel, including the local enforcement of the Forestry Act. The Forestry Act is a nationwide law that is in place to help preserve forests and trees. In Chipendeke, village environmental monitors and the chief enforce this law and informants explained that at times when they cannot find dry wood it is difficult for them to adhere to the law. Although they expressed their need for electricity for cooking and ironing, many of the women claimed they are proud of their community and the progress they have made in gaining access to electricity in their homes and in the clinic.

4.2 Electricity Access

This section describes electricity access in Chipendeke village by highlighting the financial and gender factors that relate to electricity access. It also outlines informants concerns about the financial sustainability of the micro-hydro scheme as well as the division it has created among villagers. At the time of fieldwork, the primary school, which is the only school in Chipendeke village, the clinic, the business centre that comprises of about three retail shops and thirty-nine households had an electricity connection.

4.2.1 Paying for Electricity Access

To access electricity, villagers with an electricity connection make payments thorough a prepaid voucher system. Households, the primary school and the local clinic, each pay 32 US cents/ kWh, 16 US cents/ kWh and 13 US cents/ kWh respectively. As explained by informant number 3, the amount paid by the primary school and clinic is lower than that of homes because they consider them as social services. The payment method, involves three steps,

"first, making a payment to the treasurer who will give the receipt to the security officer. Second, the security officer and the vendor will enter the desired electricity units to the account of the customer according to the amount paid through a computer system. At the end, the customer receives a printed voucher, similar to a receipt, with twenty digits which they will enter into their meter at home" (see Photograph 5), (Paraphrased, Informant no. 3, Interview 9/9/2014).

Photograph 5 Prepaid meter mounted on the wall

The cost of consuming electricity differs significantly depending on the needs of each household. As illustrated in Graph 4, the amount of money spent on electricity ranges from USD1[8] to USD30 per month. About 31% of these women indicated that they pay between USD6 to USD30 and 65% pay between USD1 TO USD5. I observed that women who use electricity to preserve produce for sale with a refrigerator or electric light for feeding chickens overnight stated that they paid more money for electricity in their homes. Whereas those that paid less than USD5 mainly use electricity for lighting purposes. Furthermore, the respondents claimed that the money spent on candles and paraffin per month was more than what they currently pay for electricity.

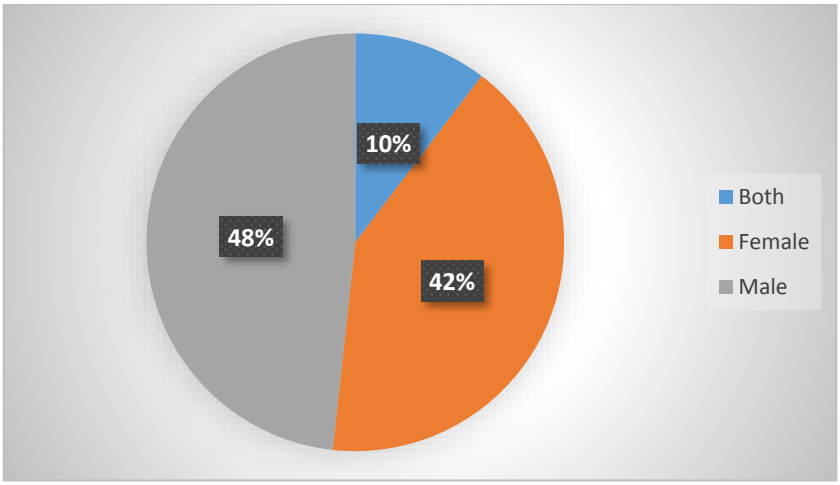
[8] Since 2009, Zimbabwe uses a multi- currency system which includes the use of the United States Dollar (USD), South African Rand (ZAR) and Botswana Pula.

Graph 4 Amount spent on electricity per month

The micro-hydro scheme is designed to supply two hundred households with electricity. In the first phase of their project plan, they plan to connect fifty households that are in the radius of the existing substations. Those that intend to connect their homes must pay a connection fee. The cost of connecting to the electricity supply therefore relies heavily on individual households. According to Informant No. 3, during the construction of the micro hydro scheme, some villagers shunned the project and did not contribute in building. These people must pay a connection fee of USD70 in contrast to USD30 for those that actively participated in the building process. The informant explains the agreement as follows:

> *"As for connection fees, the rule according to the terms and conditions for someone to be connected. We say one, for you to be connected, you should do all the wiring in your house. Two, you must pay a connection fee. Therefore, first and foremost, before anything is done, before you get electricity in your house you have to pay a connection fee. Many people pay this fee when they want to get connected. However, we now have a problem because when the program started some people got connected before we had established the payment rules. This means a lot of people connected electricity to their houses before paying that connection fee. At the end of the day we are now following up on these people telling them to pay connection fees, but some are paying but some are not paying. The strategy that we now use is that, if someone fails to pay connection fee we are going to disconnect them, we will just come and disconnect the pole until he pays then we reconnect them." (Informant no. 3, Interview 9/9/2014).*

There are also some gender distinctions in terms of electricity payments. When asked about who makes the electricity payments in the home, 48% indicated that their husband or a male member of the family paid for the electricity. While 42% of the women indicated that, they pay for electricity on their own and 10% of the women indicated that they share the responsibility to pay electricity with their husband (see Graph 5).



Graph 5 Electricity payments according to gender

4.2.2 Financial Sustainability of the Micro-Hydroelectricity Project

The community recognizes the scheme as a communal project. This is possibly because of their high participation during the construction, as well as the communal ownership system that is in place. This, however, has not prevented villagers from having questions concerning the overall financial sustainability of the project. Informant No.3 explains the situation as follows:

> *"According to the engineers, according to the design, the design limit of the generator is to connect 200 households with the ability to power machines, all the appliances such as irons, stoves, welding machines, grinding mill. That is what the engineers said about the design of the scheme after the installation of all the electro mechanical equipment and laying the network. However, what happened was that nothing we expected could use electricity. According to our strategic plan, we worked on assumption that if someone can use a stove, an iron, a welding machine and other things, they will be using a lot of electricity. To the extent that we expected that per month, a person would use 150kwh, with the assumption that if a person uses appliances that consume a lot of electricity we will be able to raise money but that was not the outcome because these appliances do not work. Which means there is need to upgrade the plant so that it reaches the level where the appliances can work because with those appliances that is the only way we can raise money. Right now, the electricity is for lighting purposes and powering refrigerators, so consumption of electricity is minimal… We had a strategic plan. Is not the lifespan of the project is 20 years? And we asked ourselves, 'in the 20 years what are we going to do?' Therefore, that strategic plan is broken into a 5-year development plan and phases. The first phase is to connect 50 households, so to date we have connected 39 households out of the 50; we are only left with 11. Automatically we can say we have met our target in terms of achievements but not in terms of income because as I said we expected that people would be paying more for electricity.*

However, it is not balancing. There is no revenue but the targets are growing, therefore we are revising our strategic plan because of course we made assumptions but if we continue with this trend we will not progress. At the end of the day, the money to sustain the operation and maintenance will become a problem because we do not have the revenue. If there is a major break down right now and if we check our coffers, we do not have any money to carry out those repairs. I can say this is the problem, but to overcome that there is still need for partnerships. Because as a community we cannot manage. (Informant no. 3, Interview 9/9/2014).

In addition, during the planning phase of the project the villagers were interviewed about their expectations of the scheme. In the following narration, another informant recalls this period as well as their view on the financial sustainability of the scheme:

"Our hope is that we get more electricity, so that we are able to really do the things our heart desire because before there was electricity they also came asking around like you are doing. Saying, 'we are bringing an electricity program, when it is here, where do want the electricity to go, where do want them to start from and end, and how will it help you?' And for sure we said everything and they said that everything will be done. 'You will not go to look for firewood anymore, we do not want people to cut down trees, and you will be using stoves, light, ironing everything'. However, when we started using stoves we noticed that the electricity trips off…if we have enough electricity to use stoves the project will move forward but if it continues like this, I do not see it progressing. Because if we look at the money that I will pay, maybe I will pay two dollars or three dollars, another person may not even have a fridge, maybe they have lights only and they will just pay one dollar. At the end of the month, there are about two or three people at the powerhouse who are looking after it and checking oil, in the end we are just paying these people. To the extent that if there is need to buy a pole to distribute the electricity further it is not possible because we are not paying a lot of money and the money is being used to pay the people looking after the powerhouse and it ends like that. So, the project does not move forward, if we count the number of years since it started there is nothing new that you can identify, it's just stagnant" (Informant No. 27, Interview 09/09/2014).

4.2.3 Electricity Access as a Divisive Element

I observed that the lack of electricity in some households has created a divide in terms of electricity access due to the uncertainty of whether the other households that are located outside the existing substation will get a connection soon. Although the whole village use wood fuel for cooking, during discussions with women who did not have electricity connection, the subject of household electricity connection provoked some tension in the

conversation, which I consider having come from the disillusionment of not having an electricity connection in their homes.

A sense of discontent when the subject of electricity came to the fore is illustrated when one woman explained the problem that they now face with their children who leave the house at night to go and watch television in the beer hall. The following is a narration given by one of the informants expressing some discontent:

> *"Our plea is that may the electricity reach all the households and that we get a bigger generator that produces enough electricity for cooking. Now if you observe we have another problem with some of our children, in the evening they will be in the shops and bars all because they want to watch television. And if you try to forbid them from going there, they will tell you that at school they are being made fun of by others because they do not know about a television. They say, "when others talk about what they see on television they laugh at me because I do not know anything about it, so I go there to watch so that when others boast about what they have seen I can also boast of what I have seen." Even if you tell them "in the evening nobody is going!" However, when you check for them when they are supposed to be sleeping they would have snuck away from their beds. It is painful that these children do not listen to you because of the television at the bar. If there was electricity in our homes we would look for televisions to watch at home so that the child's thoughts are on staying at home and obeying us…This is when they will start learning about prostitution and drinking in the bar" (Informant No. 16, Focus Group Discussion 5/9/2014).*

However, the opinion of the above informant, who has no household electricity, varies significantly from that of another informant who has electricity in her home. She believes that the introduction of electricity is a good thing for her children and says:

> *"I want to add by saying how electricity has been so good to us. The introduction of electricity, it is a good thing for us because we now have televisions like those in Harare; we are now saying Harare should come here, because we now have it here. Because our children here and the children in Harare, they are now on the same level, they are the same. Everything that they are watching in Harare our children here are also watching the same thing. Therefore, electricity is good for us, even soccer played outside the country we are even watching it here! Electricity has been a good thing for us. We used to have many problems before electricity. At one time, a room burnt down because my children had used a burning wooden stick as a lamp to search for clothes to wear when preparing to go out at night. They did not notice that some ambers fell onto the clothes and caught on fire. Their clothes and the beds burned up. This was all because we did not have electricity. Having access to electricity is good because now that we have electricity we can even sleep with the lights on. I am very thankful that electricity has done a good thing for us... As a mother this is a good thing because our children that we live with, in our homes, some of them are just born here and do not*

know or even travel as far as the tarred road, these children are afraid, they were afraid of electricity. Therefore, the introduction of electricity to our village helped open our children's minds; to know what electricity is and that it is not something to be afraid of because now they can just switch them on and off whenever they want… Even the children were saying, "we are also going to have electricity at our house!" Ah we saw that this was a good thing so when we worked it was not painful for us because we wanted electricity." (Informant No.13, Focus Group Discussion 5/9/2014).

Therefore, these different opinions highlight the differences in lifestyle and access to information technologies such as television created by the access to electricity.

In summary, this chapter highlighted the energy sources in Chipendeke village with specific focus on hydropower and wood fuel. Hydropower generates electricity for purposes such as lighting, refrigeration, cell phone charging, television and radio. Wood fuel, which is mostly collected by women from the surrounding mountainous areas, is used for cooking and ironing. The chapter also presents the financial and gender aspects associated with how villagers access electricity. Because there are other homes without electricity access, some respondents expressed their opinions on how the lack of electricity has affected their homes.

5. Women and Electricity

In this chapter, I group together the findings that relate more to the relationship between women and electricity. Particularly, I focus on how women use electricity in their homes, to improve their livelihood including fulfilling their health needs. I also explore women's participation in community development projects such as the micro-hydroelectricity project.

5.1 Electricity Access and Women's Social Roles

During the interview process, the respondents had to "list three important ways in which electricity has improved your life". Their responses, illustrated in Table.1, are according to the degree of importance. First, the introduction of electricity created opportunities for women to have lighting in their homes for an extended day to complete their work and other activities. Since farming is the community's main source of subsistence, women contribute to this economy by spending most of their time working in the field. Informant No. 13 explains that, it is her responsibility as a wife to work in the fields of her husband. I observed that she began her day at five in the morning to prepare and go to the fields and returned at sunset. Having access to electricity is an advantage for her because she can use the light from electricity to carry out other tasks that she was not able to do during the early morning and at night due to limited time. These activities include cleaning the house, hand sewing, peeling groundnuts and even winnowing grain.

Table 1 Ranking of how electricity improved women's life

Rank	How electricity has improved your life	No. of respondents	
1	Lighting for evening and early morning chores	19	65%
2	Watching Television	16	55%
3	Charging cell phone	9	47%
4	Livelihood strategies	7	24%

Second, another way in which electricity improved their lives includes watching television and third charging their cell phones. Electricity has made it possible for them to stay informed and connected with what is happening outside of the village. They have access to information that is broadcast through the television and their mobile phones are more likely to stay switched on for longer thus reducing the risk of missing important phone calls. In the past, they had to pay someone who had a solar lamp or battery to charge their cell phone.

As explained by the following informants, they can charge their phones at any time within the comfort of their homes and communication remains open:

> *"Before we had electricity, we could not listen to the radio or watch satellite television, things that need a lot of electricity which we did not have. The solar panels that we had could only play DVD's and not listen to Radio Zimbabwe to hear about what is happening in other places, other countries or to hear about what other women are doing when they meet. Even charging cell phones was difficult. Your phone could spend the whole week off, those that had solar panels and inverters would charge you 5 ZAR but you may not have that 5 ZAR but you need to use your phone." (Informant No. 35, Focus Group Discussion 11.9.2014).*

> *"…this meant that you would not receive some information, or miss out on what's happening because when people try to call your number, it doesn't go through because your phone has no battery power. It's only when you manage to charge it after a week that you find out there were things that needed to be done or that there was a workshop at work. Then you notice that you have fallen behind and for you to catch up with others it becomes difficult." (Informant No. 4, Focus Group Discussion 11/9/2014).*

> *"…electricity helped us because you can now charge your phone at any time when your battery runs out. Communication does not have to stop anymore it stays open. You know that these days talking is all about cell phones, so now everything moves well…" (Informant No. 27, Interview 9/9/2014).*

Therefore, the data shows that electricity access plays a significant role in providing the opportunity for women to engage in domestic work that they could not do in the past due to lack of lighting. The use of electricity to power televisions is also significant as it opens the door for accessing entertainment, information and knowledge. Furthermore, they have been relieved of the expense of paying to have their cell phones charged and are less likely to miss important phone calls.

5.2 Women's Livelihood Response to Electricity

When electricity was connected some women began various livelihood initiatives, while some of them, improved their existing enterprises. Thirty-four percent of women who have household electricity are engaged in some form of livelihood enterprise with the use of electricity. Table.2 illustrates the various activities that they undertake. A noteworthy aspect of this is that of the ten women, nine indicated that they have more than one strategy that they are engaged in. These range from using the light from electricity for hand sewing garments at night, which they eventually sell; to rearing chickens and refrigerating produce for sale or household consumption. This underscores the various opportunities that electricity provides for livelihood creation.

Table 2 Different uses of electricity for livelihoods

		Lighting for Hand sewing clothes at night for sale	Lighting for Rearing chickens for Sale/ HH consumption	Refrigerating for HH consumption	Refrigerating fish for sale	Refrigerating meat for sale (e.g. goat meat)	Refrigerating other products for sale (e.g. drinks; freezits)
Informant No.	12		X	X			X
	27	X		X		X	
	32		X	X	X		X
	34			X	X		X
	35			X	X		
	10		X				
	13			X	X	X	X
	42			X	X		X
	43			X			X
	44	X					

For example, informant number 12 rears chickens for sale, uses a refrigerator to preserve products such as meat for household consumption and drinks for sale. In addition to that, informant number 32 also uses a fridge to preserve fish for sale as shown in Photograph 6. One informant explains that before electricity they could not do such things as using a refrigerator to store meat for sale. She states that:

> *"[…] when we did not have electricity, we could not do certain projects but now that we have electricity you can even buy a goat, cut it into pieces, refrigerate and then sell it. You earn some money and you can also continue with the project." (Informant No. 27, Focus Group Discussion on 11/9/2014).*

Photograph 6 Refrigerated fish for sale

Most of the women who are involved in rearing chickens for sale view this as their own project in which they are responsible. This chicken rearing project involves buying day old Broiler chicks to raise specifically for commercial purposes. The chicks require extended hours of light to help them feed within the first weeks of their life. After four to six weeks, they would be ready for sale. One respondent shed more light on the way electricity has affected her chicken rearing project by saying:

> *"Before there was electricity we reared chickens for sale, but they could not feed at night and could not grow according to the specified time of four to six weeks, but it took them about eight weeks. However, ever since we had electricity, we can keep the light on at night for the chickens to feed… before we go to bed we put some chicken feed so that they can feed overnight and, in the morning, when we wake up we put some more. Before we had electricity, we used a paraffin lamp. But we were afraid and so when we switched it on, after a few hours we wake up to check that the chickens did not push it over and catch on fire" (Informant No.10, Interview on 4/9/2014).*

Furthermore, the informant revealed that the light from electricity also improved the sale of chickens as they can feed overnight as required during their first week of life thus increasing their value. Unfortunately, when asked whether she kept account of her transactions through any method of recording she admitted that she did not. However, she was able to explain the amount of income that she generates at a given time although she does not keep records of all her transactions. She stated that:

> *"I do not usually keep records, but I know that if I order 25 chicks or 50 chicks, maybe 5 are for household consumption and 45 are for selling. I calculate my profit on a rough piece of paper…if I have them in a month I sometimes make about USD250 to USD300 depending on how many chickens I have. Before I had electricity, I was not making that amount of money because the chickens did not grow as well as they do now, I ended up selling them at a lower price before they reached their time of maturation and their*

health was not as it is now that we have electricity." (Informant No.10, Interview 4/9/2014).

The informant explains that she spends the money from the sales in various ways. These include, buying fertilizer, paying school fees for the children, buying some food, buying seeds and buying more chicks to raise for sale.

Another respondent also claimed that the lighting from electricity helps her when sewing clothes at night. Although she does not use an electric sewing machine, the electricity helps her to increase her working hours, sewing and mending garments, overnight. Unlike informant number 10, she does not always receive monetary return for her work but rather exchanges with other goods. Informant number 27 explains that:

"[…] even though I do not use electricity for sewing with an electric sewing machine, I use the light from electricity which helps me to see when I am sewing. This has an advantage because during the day I may not get the time to sit down and sew but in the evening when I finish cooking and everything else, I can sit in front of my machine and start sewing from seven in the evening to eleven. During this time, I can sew many things without being disturbed. This is different from in the afternoons because in the afternoon, I can get visitors and I have to leave your work. Or sometimes I wake up as early as 2am and sew until day break." (Informant No. 27, Interview 9/9/2014).

Having noted the different activities, I felt it equally important to ask them to explain the importance of such activities in their homes. Taking into consideration that many of them spend most of their time on farming activities such as planting, weeding or harvesting. Their responses included reasons such as, providing for their family when their husband is unable to meet all the expenses and not frequently bothering their husband for money to buy things that she wants for herself such as tableware, decorations for her home or personal hygiene products such as sanitary wear. Informant number 30 gives the reason that:

"[…] it helps so that I can buy my own things because here in Chipendeke when men work they say everything here is mine. So as women if we have something that we are selling, we can buy what we want for our home" (Informant No. 30, Interview 9/9/2014).

Other informants state reasons such as:

"It has the advantage that, if your husband is earning about USD200, you do not have to wait and ask him for money to buy cups or to buy vegetables. There may be somethings that you really want but your husband does not have the money to buy it. But when you have your own money and if you feel like eating sadza with Kapenta today you just go and buy them and eat. That is the advantage. It is about helping each other. Plus, you can buy what you want at that time if you have the money." (Informant No. 27, Interview 9/9/2014).

"You will be helping each other with your husband and not just waiting for him to give you money. If he leaves the house and does not leave you some money for food you do not need to wait until he comes back. By the time he comes back you would have progressed. You buy your utensils with the money you get from your projects, you can even buy him something to wear and he will be happy and say, 'my wife bought this for me'. These projects are good because they uplift the family even arguments are reduced because everything will be in order, food is enough, money is enough. If your child is sent away from school because of not paying school fees and your husband does not yet have the money, you can use your money in the meantime" (Informant No. 4, Focus Group Discussion 11/9/2014).

On the other hand, respondents continually brought up their hope for a bigger generator. If the generator produced more electricity, they would be able to engage in many other activities such as baking, hairdressing or welding. According to Informant No.5, they "have a welding machine at home. It is idle because electricity is not sufficient. This is money that we could be earning for our project." Another respondent echoed similar complaints, revealing that they have a peanut butter making machine that they are unable to use because of low voltage electricity. They view this as a disadvantage and loss considering that they could be earning money with these machines. However, one informant expresses the need to continue working hard on their current projects and come up with alternative energy for cooking. She explains that:

"I want to add on by saying that, we as women we should not just sit, we should find something to start up. If we do some projects that give us money and our generator is still not producing enough electricity for cooking, we can buy two plate gas stoves with the money. These stoves will help us so that we do not need to go into the bush to look for firewood. When we have gas stoves, their sole purpose would be cooking because we already have light from electricity. This will help preserve our health since we no longer have to go up the mountain where we are likely to break our legs fetching firewood like what happened to that woman." (Informant No.12, Focus Group Discussion 5/9/2014).

Therefore, there are different livelihood strategies that women undertake in Chipendeke village with the use of electricity. These include chicken rearing for sale, the use of light from electricity for sewing and the use of electricity to store produce in a refrigerator for sale. The benefits of these initiatives are that they gain a form of financial independence and do not have to rely on one source of income that comes from either farming or their husbands.

5.3 Women's Participation in Community Development Projects

The focus on women's participation in community development came to light during informal discussions with the villagers. One of the informants stated that women participated actively

during the construction of the powerhouse. “About 65% of the contribution came from women, and they were actively involved in the work compared to men supposedly because they wanted the clinic to be electrified for their benefit” *(*Informant No.3). The women acknowledged that although they did not do the same work as their male counterparts such as the actual building, they worked alongside men by contributing their time and energy carrying rocks, pit sand and food, as one woman explained:

> *“When this project started, the community was told that they are the ones that are supposed to be working very hard towards this. When we heard about electricity we were so happy because this was a good thing. From our house, there was my sister-in-law, my husband, my son and me. We would all go to carry pit sand, collecting rocks and sometimes we would fall into the river, but we did not care! Because we were determined and expectant that electricity should be successful because it will help us in the future.” (Informant No.5, Focus Group discussion 5/9/2014).*

When asked about their motive to assist in the construction of the scheme, women gave various reasons. One informant stated that *“*electricity helps us with many things, it gives the village a higher status*”* (informant no. 13). This opinion suggests that electricity access influences the popularity and social status of the village. Other reasons include the expectation that their children would gain the opportunity to improve their education with light for studying at night. Since there is only one school in the village, they hope that electricity will provide opportunities for an increase in the number of schools. Furthermore, they expected that the clinic would have electricity to aid in the refrigeration of medicine. Informant number 5 continued by saying:

> *“The presence of electricity was also good for us because we knew that if our clinic gets electricity it will make the conditions better when giving birth and our medicine would be refrigerated at our clinic. Even at school, our children would get the opportunity to study in the evening. And we also thought it would be even good if secondary schools are built because of the presence of electricity” (Informant No.5, Focus Group discussion 5/9/2014).*

However, I observed that although the micro-hydroelectricity scheme is in operation, there are currently no women who are involved in the daily maintenance of the powerhouse, such as checking if everything is functioning well or attending to any fault. Two female respondents mentioned the presence of a woman in the committee of the powerhouse but with no clear knowledge of whether she is actively involved in the maintenance, the rest of the respondents claimed that there are no women active in this role. Only two male volunteers are involved in maintaining the powerhouse, they are furthermore the first point of contact regarding powerhouse issues and electricity in the community when visitors come. Informants explained that the role played by these men began during the planning

and construction of the scheme, which made them the first points of contact in terms of planning and implementation, such as receiving building materials.

Informants put forward various responses about the lack of female caretakers to maintain the powerhouse. These include; women were not called to attend when people received training on how to maintain the powerhouse; women do not have any background education on how electricity works, and it is not a safe job for women especially if they must attend to a fault at night. Other reasons are that, husbands are less likely to allow their wives to be involved in such an activity and women have no knowledge about how to go about fixing anything that is broken.

In addition, one informant explained that women already have a lot of work to attend to at home, so working at the powerhouse would be additional work that they did not have time to do. She says that:

> *"I think that for women it's because they have less knowledge about it, I do not know exactly what it is that will be functioning in the power house because for sure there are not many women working there. For me I think the problem would be time if it were about going there every day. If it is occasionally then it is okay because if it I need to be there all the time, then I do not have the time, but it is not bad to have the knowledge." (Informant No. 27, Interview 9/9/2014).*

In the group discussions women revealed that they would like to discuss with their male counterparts about the generator, to learn about how it works and how to maintain it. This includes gaining information on the costs that are associated so that when they work on their projects they are motivated to raise money for a bigger generator. The following informant expresses that:

> *"We would like to be empowered to discuss also with men about the generator. So that they do not just look after it on their own knowing how to fix a problem in our absence. When there is a fault, they should also call us as women to see what is wrong and how much money is needed to fix it. When they are fixing may they also include us in the process so that we learn about how to fix it and to know the expenses that are associated with repairing and maintaining. So that when we use our appliances… when we work on or projects we are motivated to raise money for a bigger generator" (Informant No.12, Focus Group Discussion 5/9/2014).*

Therefore, like their male counterparts, women contributed to the construction of the micro-hydroelectricity scheme. They give various reasons for their involvement in the process. However, in as much as they contributed to the construction they reveal that women do not have sufficient knowledge on how the scheme functions or how to maintain it. Hence, while some informant's reveal that they would like to learn about how the micro-hydroelectricity

scheme function, other women had concerns about their lack of time to commit to such a task.

5.4 Electricity Access and Women's Healthcare Needs.

An electricity connection at the clinic is beneficial for various reasons. First, the introduction of electricity improved maternal health care at Chipendeke Village clinic. The women of Chipendeke are very grateful that their clinic has an electricity connection (See Photograph 7). This includes both groups of women, namely those who have an electricity connection in their homes and those without. The informants reveal how electricity abated their fear of going into labour at night without sufficient light. They are also relieved from the expense of purchasing packets of candles that nurses asked them to bring when they went into labour at night because of the lack of sufficient lighting. This was a challenging period as one informant reports that:

> *"Sometimes they told us that you need to bring a packet of candles because you do not know how long you are going to be in labour. If you bring one candle and it runs out during labour, what will you do? When electricity came it helped women a lot. Even after you give birth you are not troubled if matches run out and you cannot light a candle to change the baby's nappy, you can just switch the light on and change your baby's nappy and breast feed, all this you are doing in the light. Therefore, we are very happy as women. You can even wake up and wash your baby's nappies in the middle of the night then you hang them out in the morning and start on other work you have to do for the day" (Informant No.4).*

Furthermore, one of the nurses at the clinic shared that due to the availability of electricity they also plan to construct an additional building to cater for mothers before and after delivery.

Photograph 7 Chipendeke Village Clinic

Photograph 8 Vaccines and Medication in refrigerator

Second, the availability of electricity to power a refrigerator for immunization vaccines provides the opportunity for children to receive immunizations on time (See Photograph 8). In the past, it was a difficult process because they used a gas refrigerator that was not reliable. The nurses need to keep the medication at the recommended temperature. Sometimes, they had to look for someone with a bicycle to rush to the nearest electrified clinic to collect and return the left-over immunization drugs. At times, they would fail to immunize their children on time because there would be no medicine available. One informant describes the challenges they faced by saying:

> *"[…] when the immunization medicine was left over we had to pay someone with a bicycle to return the medicine to Gutaraurara, the nearest clinic which had electricity to keep it refrigerated. This was a big risk before we had electricity. When electricity was connected another donor donated a refrigerator to put medication for our clinic" (Informant No.12, Focus Group Discussion 5/9/2014).*

Third, apart from the improved conditions while giving birth and the ability to store medication, women expressed that electricity helps them to cope with the challenges associated with caring for the sick at home. According to one informant, women have the responsibility to care for the sick in their homes. She explains that:

> *"As women we know that if someone falls sick at home, the mother is the one who is affected most and falling sick can happen at any time, even at night. If this happened at that time before electricity, it was difficult for us to go to the clinic. There were no lights, they had to use candles to look for medication to help you. Therefore, electricity makes many things easier for us. If someone in my home falls sick or maybe is bitten by a snake. It is easier now, I can carry them and go to the clinic at any time. It does not matter what time it is!" (Informant No.13, Focus Group Discussion 5/9/2014).*

Last, the informants also claimed that ever since electricity was connected, the nurses stay longer to live and work in the village. In the past nurses would move away from the village after a short time, the informants related this to the lack of electricity since working and living

without electricity was a challenge for the nurses. Although it requires more research to substantiate this correlation, many of the women agreed with this view. According to informant number 12:

> *"[...] since electricity came our nurses do not want to leave like what happened in the past. Now they live here and feel that they are in Mutare, they see Mutare at the clinic. All the things that they wanted to use in Mutare they bring them here. If we enter their houses they have everything they need. In the past they would have a small stove and a blanket to sleep on the floor which meant that they were not settled, and they can go on any day" (Informant No.12, Focus Group Discussion 5/9/2014).*

In summary, this chapter reveals that electricity provides women with light to extend their day and perform their domestic work before or after working in the field. Electricity has also given women the opportunity to supplement their household income by using it to power different livelihood strategies such as chicken rearing and refrigerating meat for sale. In terms of health, electricity access plays a significant role in providing lighting for the clinic. This is important for most women in the village because of the challenge they faced without sufficient lighting during childbirth. Electricity also provides the opportunity for their children to receive immunization vaccines at the specified time since they can now be stored at the clinic in a refrigerator powered by electricity.

6. Understanding Electricity Access in Chipendeke

This chapter presents a discussion of the previously outlined research findings. First, I discuss that amongst social and geographic issues, financial resources largely influence household electricity access in Chipendeke. Second, I discuss how electricity has influenced the socio- economic wellbeing of women and their healthcare needs. Last, I discuss women's role and contribution to community development projects.

6.1 Electricity Access

As shown in section 4.1, the community uses various sources of energy to meet their energy needs. Wood fuel and hydropower are popular sources of energy among the respondents. This means that there is the combined use of a traditional form of energy and modern form of energy. Households with an electricity connection have replaced the use of candles and paraffin with electricity for lighting purposes. However, in terms of cooking, the use of firewood still dominates because of insufficient electricity generation. Mehlwana (1997: 6) reveals that apart from economic factors, transitioning from traditional to modern energy is a process that involves many other aspects such as the gender of the purchaser, socialization and other non-economic factors. Electricity access is a significant feature in the village and I acknowledge that factors such as geographic location and gender biases influence access to electricity. I also argue that in the case of Chipendeke village financial resources significantly influence access to electricity.

Chipendeke village's situation is not unique to most rural villages in Zimbabwe. Distance, rugged terrain and inadequate infrastructure contribute to making rural areas inaccessible to a major electricity grid. However, electricity is accessible to the villagers in Chipendeke only through the presence of a stand-alone micro-hydroelectricity scheme. Borrowing from Brew-Hammond (2010: 2293), this is electricity access in the sense that households have a stand-alone electricity generator within their geographic proximity. This is also regardless of the number of houses with an electricity connection. Although thirty-nine households are connected, should the rest of the households wish to connect to electricity, their chances to do so have significantly improved due to the presence of the micro-hydroelectricity scheme. The irony of the geographic location of Chipendeke is that in as much as it prevented access to electricity through a major grid network, the mountainous region and the continuous availability of flowing water provide conducive conditions for micro-hydroelectricity generation. However, reports concerning the decrease in water flow due to seasonal weather changes need to be taken into consideration as this has the potential to reduce the supply of electricity.

On a socio-economic scale, the distinction between making electricity payments and collecting firewood indicates how gender difference plays a role in the choice of household

energy access and use. In the case of electricity access at the household level, graph 5 indicates that 48% of electricity payments are made by men, 42 % by women and 10 % by both. This suggests that men are more likely to pay for electricity in their homes. Similar to wood fuel, the villagers recognize electricity as a communal resource in which both women and men contributed labour to its establishment. However, electricity unlike firewood specifically requires financial means to access. This highlights that electricity is commercial energy whereas wood fuel is non-commercial energy since 89% of women indicated that they mainly gather wood fuel without any monetary costs.

It also indicates that women are more likely to pay for electricity than to purchase firewood. As one informant explained that searching for firewood is better if done by a woman whereas her husband helps by purchasing firewood occasionally. This is due to the availability of firewood in the surrounding areas and that women consider gathering firewood as part of their domestic chores hence shoulder that responsibility on their own. Therefore, one can infer that men are more likely to be the purchaser of household energy. The reason being that, men are more likely to have access to financial resources and the purchasing or decision-making power over them than women are (Munien and Ahmed, 2012: 116).

The current situation of the rate of household connectivity to electricity suggests the lack of sufficient financial resources amongst villagers. The bulk of the financial costs that are associated with the construction of the scheme came from international organisations such as the European Union and Practical Action. The villagers contributed in the form of labour and local materials. This supports the argument given by Kishore (2013: 45), that the initial investment required for micro-hydroelectricity schemes may not be affordable by remote, isolated communities without the help of heavy subsidies. Indeed, micro-hydroelectricity schemes are economic and environmentally friendlier than large-scale hydropower systems, but they still require significant amounts of money at the initial stage which most rural communities are unable to afford.

The informants also raise their concerns over the financial sustainability of the micro-hydroelectricity scheme, especially its lack of finances to repair a major breakdown if it occurs. Although micro-hydro schemes are popular for their longevity (Kishore, 2013: 44), this illustrates the extent to which villagers believe that financial resources are needed in maintaining the running of the micro-hydroelectricity scheme. This hints on the fragility of subsidised energy projects particularly in rural economies. It is fragile in the respect that, as the scheme was successfully installed through external financial assistance, the community has the responsibility of maintaining the scheme daily which they report to be financially challenging. The lack of financial resources stirs anxiety over their level of preparedness in dealing with a breakdown. Reflecting on the experience with solar home systems and liquid

petroleum gas (LPG), Bhattacharyya (2006: 662) views that the culture of subsidies can hinder sustainable development especially “if a technology or energy has to depend on subsidies and favourable incentives for its financial viability”.

Hence, there is a need to find other means of meeting costs for maintenance and breakdowns instead of solely relying on their monthly electricity payments or subsidies as sources of revenue. Fortunately, the principle of community ownership and responsibility is evident in the way in which villagers participated in the construction and refer to the scheme as their own. Therefore, in addition to financial resources the level of community acceptance and acknowledgement of responsibility toward the micro-hydroelectricity project goes a long way in contributing to overall sustainability of the scheme.

The process of connecting to electricity comes with connection fees and associated costs of wiring. There are also costs associated with the installation of substations and transmission lines that are required to connect the households that fall outside the existing substations. Furthermore, the village has an estimated 1000 households; this means that even when all 200 hundred households receive an electricity connection there will still be many households lacking the ability to connect to electricity. Bhattacharyya (2006: 660) argues that there are different factors that influence the decision-making process for the use of electricity as opposed to any other forms of traditional energy. Factors such as the “amount and regularity of money income, the alternative uses of money and the willingness to spend part of their income to consume commercial energies as opposed to allocating the money to other competing needs” (ibid).

Therefore, we find that the availability of electricity does not guarantee that all people will connect it to their homes especially if they cannot afford to pay for connectivity or prefer to spend their money on other needs. Villagers are also less likely to feel motivated to connect to electricity if they know that they will be receiving an insufficient supply. However, the fact that some homes do not have an electricity connection does not mean that they do not use electricity or have access to the services that electricity provides through their social networks. For instance, when one purchases goods such as meat stored in a refrigerator or clothing produced with the use of electricity they have access to electricity services. Moreover, the use of electricity at the primary school, the improved health services at the clinic and the children that seek to watch television illustrates the degree to which members of a community can all share and benefit from energy services.

6.2 The Socio-Economic Impact of Electricity on Women

The study revealed the role of women in creating a livelihood for their households in rural areas. According to Chambers and Conway (1991: 5), a livelihood in its simplest sense is a means of gaining a living. In view of the examples given by the respondents, electricity

access is an asset that enables them to contribute to their means of living through chicken rearing, storage of fresh produce and sewing for sale. More so, most of these women indicate that they utilize electricity for more than one activity hence widening the net of sustenance. These are complimentary livelihood activities for a rural agricultural based economy.

The introduction of electricity increased and improved the value of some of the products that women sell. The case of the informant whose sales from the chicken rearing project increased due to electricity highlights how access to energy in rural areas leads to better quality products and higher cash returns, this in turn leads to reduced vulnerability and increased food security (Clancy et al., 2002: 15). Furthermore, activities such as chicken rearing and sewing have the potential to grow and become sources of employment in the community when given the adequate support. According to Batliwala and Reddy (2003), poor urban and rural women demonstrate excellent managerial and entrepreneurial abilities in a number of contexts. Hence, energy access projects should not only consider women as beneficiaries of energy interventions but also as managers of enterprises and ultimately as energy entrepreneurs (ibid).

In agreement, Clancy et al., (2002: 19) argue that women are ideal candidates to become energy entrepreneurs, involved in supplying and even repairing modern energy appliances such as solar panels. Women in rural areas have the potential to become agents that distribute such equipment on a commercial basis. This is because women who live in rural areas know and understand local circumstances and needs, and thus may have a clearer view of the kind of energy services that rural people want (ibid).

The value of these activities is not only in their ability to add on to their husbands' existing income or farming income but also in creating financial independence. Women's financial independence is a significant driver of poverty alleviation and their own personal independence and empowerment. However, when women fail to record the transactions of their projects, it makes it difficult to track the progress of their initiatives to determine whether they are at a loss or gain. This possibly indicates the lack of information and knowledge as to methods of accounting for their transactions.

In addition to the livelihood strategies that they undertake, electricity has significantly affected the domestic work of women. In Chipendeke female informants reported that their daily responsibilities include working in the field, looking after livestock and cleaning the home. The informants explained that the lighting from electricity enables them to carry out some of their household chores in the early morning or at night. The interpretation of whether the increase in working hours is a positive or negative effect of electricity is relative and depends on an individual. Clancy et al., (2002: 19) argue that, "if as a result of improved

lighting, women themselves choose to work longer hours to increase their own income, this could be seen as an indicator of empowerment rather than as a loss of welfare".

In the case of communication technologies such as television, radios and cell phones, electricity plays a major role in not only keeping the informants entertained but also informed on current issues. According to Munien and Ahmed (2012: 119), the role of such social media can enhance women's access to information, increase-networking capability and provide platforms to raise relevant issues. Their access to information about markets outside the village has increased and, this is valuable for them as farmers when buying or selling farm inputs and outputs. Furthermore, the use of cell phones play a significant role in enabling communication during times of emergency as in the case of Informant number 5 who used her cell phone to call for help when she broke her leg whilst searching for firewood.

6.3 Electricity Access and Women's Health

Access to electricity improved conditions of childbirth and increased opportunities for immunizing their children. The significance of improved health services is that women are key contributors to the productive capacity of rural communities, hence their health and wellbeing affects the balance of such a system. The availability of electricity at the clinic also lessens the probability of women seeking alternative medical assistance outside the clinic from untrained health professionals. Furthermore, the respondents spoke about how electricity eases their responsibility when caring for the sick in the home. This reveals the role of women as domestic caregivers and the dynamic nature of their responsibilities in the home.

Unfortunately, the health of women and children is still at risk from gathering and using firewood for cooking due to insufficient electricity. The use of electricity for lighting, cell phone charging, refrigeration, television and listening to the radio are gender inclusive and available for use to all members of a household. On the other hand, an activity such as cooking which is more exclusive to women is devoid of electricity. In reference to energy demand, Bhattacharyya (2006: 660) reveals that, lighting and cooking are major end-uses, with cooking energy accounting for about 90% of the energy demand of poor people. This suggests that in the case of Chipendeke village, the micro-hydroelectricity scheme is yet to meet the biggest energy demand for poor people. The different experiences narrated by informants of supplying wood fuel to their homes uncovered their fears and the dangers that threaten their health and their lives. This resonates with preceding arguments against the use of biomass fuels.

On the other hand, the sufficient supply of electricity can affect the cohesive aspect of firewood collection. The informants revealed that they normally go to collect firewood with

other women. According to Mehlwana (1997: 12), “these groups strengthen the social bonds between women and become a foundation of more intimate relationships. Electricity and electric appliances on the other hand are not easily shared between households because of their high cost factor”. This suggests that electricity has the potential to affect bonds and networks that exist from gathering firewood thus creating distant individualistic relationships.

6.4 Women’s Participation in Community Development

The reports on women’s active level of participation during the construction of the micro-hydroelectricity scheme sheds more light on the existing role of women as contributors in the development of their community. However, the question of the lack of female caretakers at the powerhouse was of concern considering the reports about their involvement during the construction of the scheme. The reason such as their husbands are less likely to allow their wives to be involved in such an activity suggest the patriarchal character of the community and the extent to which they view such a job as male oriented types of job.

The reason that women lack knowledge on how the scheme works or is maintained is also an important signifier of how women lack access to education opportunities. According to Kishore (2013), the operation of a micro-hydro scheme is simple and training requirements are minimal. Yet one informant revealed that when training on how the powerhouse functions took place, women were not called to attend hence the lack of women who have knowledge on how the scheme functions. Batliwala and Reddy (2003: 36), reveal that when machines are developed to eliminate hardship, they are more likely to be appropriated by men, especially in a culture that considers machines the prerogative of men. Furthermore, men are considered as the most suitable beneficiaries of mechanical training. In addition, Munien and Ahmed (2012) state that

> *“socially assigned roles limit women’s educational opportunities and access to new knowledge, energy infrastructure and technologies, while increasing their health and time burdens in relation to their productive roles in the energy sector, making them one of the most vulnerable groups in society” (ibid. 114).*

These arguments relate to the situation in Chipendeke as women contributed their labour to the construction of the micro-hydroelectricity scheme but did not receive the same opportunity to learn about the functioning and maintenance of the scheme possibly due to gender biases.

7. Conclusion and Recommendations

In conclusion, Chipendeke village has access to electricity by converting water resources to electricity through a micro-hydroelectricity scheme. Since the completion of the project, the village has received much attention from the media and academic institutions. The popularity of the project signifies an important step that has occurred in making the public aware of the possibilities that are available in tackling the problem of energy poverty in the country. Although there are currently thirty-nine households that have connected to electricity, all the villagers enjoy the benefits of electricity through improved services at the clinic, primary school and business centre.

In as much as the village has become popular for the development of a micro-hydroelectricity scheme, the focus does not need to be on the scheme itself but rather on promoting and improving livelihood opportunities that the scheme makes possible. On an individual basis, women have different livelihood strategies such as chicken rearing, refrigerating produce for sale and sewing garments with the use of electricity. The promotion of female groups or clubs that can come together in relation to income generation projects with the use of electricity is one way in which they can utilize electricity access and grow their enterprises. Social groups are beneficial in that women can pull together their resources and networks to establish partnerships to sell their goods or farm produce.

Unfortunately, wood fuel remains a significant source of energy due to the schemes inability to accommodate other electric appliances such as cooking stoves. This is unfortunate considering that women continue to play the role of its supplier in terms of collection and use. As suggested by one of the informants alternative cooking energy and technologies are another option that women can consider in terms of addressing the use of wood fuel for cooking. However, the question of which technologies are best suitable for such rural communities remains, as previously introduced cooking technologies in other areas have been unpopular among women (Munien and Ahmed, 2012: 115). This suggests the need to extend research to study the social factors involved in the use and adaptation of alternative cooking energy and technologies.

Financial resources play a significant role in enabling electricity access in Chipendeke village. It is a financial issue when one considers that villagers are initially not able to finance the project on their own. The micro-hydroelectricity scheme was funded by non-governmental organisations and villagers contributed their labour and locally available materials. Thus, their contribution of labour and locally available materials is an approach that helps to bring the project into fruition. However, villagers report the lack of finances to maintain the micro-hydroelectricity scheme. Hence, the promotion of environmentally sustainable energy such as micro-hydroelectricity is a noble cause however, from the

perspective of poor rural communities the financial demands of implementing and maintaining such projects are beyond their reach.

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9. Appendices

Appendix I

My name is Tanyaradzwa Edith Whande a Master of Arts student in the program Culture and Environment in Africa at the University of Cologne Germany. I am conducting research for my master thesis, a requirement in fulfilling the program. My research topic is *Energy Sources, Access and Livelihood Strategies: A Case Study of Women's Response to Electricity Access in Chipendeke Village, Zimbabwe.* The aim of my research is to explore how electricity has affected the socio-economic wellbeing of women in Chipendeke Village as a new form of energy. I value your views and opinions and it would be very helpful for me if you openly expressed yourself. Whatever you share with me, I ensure anonymity by not writing your name in the report. Please may I also have your permission to record this interview?

a) Interview guide for key female informants.

1. May you describe your life experience before and after electricity access?
2. Describe your experience of collecting and using firewood for cooking?
3. What is your opinion of the use of electricity in comparison to other household fuels?
4. What motivated you to contribute to the construction of the micro-hydroelectricity scheme?
5. Why are women in the village happy about the electricity connection at the clinic?
6. Describe any activities you are engaged in with the use of electricity that provide food, money or any form of sustenance for your family?
7. Why is it important to you to carry out these activities?

b) Focus Group Discussion Guide

1. What do you consider as women's household work and how has electricity affected the work you do at home?
2. What motivated you to participate in the construction of the micro- hydro scheme?
3. Did you not think that construction was a man's job?
4. Why are there no female caretakers working at the powerhouse when anyone one does not need to have prior knowledge of it before training?
5. Why are women in the village happy about the electricity connection at the clinic?
6. What are your views on the law that forbids the cutting down of trees?

Appendix II

Semi- structured questionnaire.

My name is Tanyaradzwa Edith Whande a Master of Arts student in the program Culture and Environment in Africa at the University of Cologne Germany. I am conducting research for my master thesis, a requirement in fulfilling the program. My research topic is *Energy Sources, Access and Livelihood Strategies: A Case Study of Women's Response to Electricity Access in Chipendeke Village, Zimbabwe.* The aim of my research is to explore how electricity has affected the socio-economic wellbeing of women in Chipendeke Village as a new form of energy. I value your views and opinions and it would be very helpful for me if you openly expressed yourself. Whatever you share with me, I ensure anonymity by not writing your name in the report. Please may I also have your permission to record this interview?

Respondent number **Sex**

No. of years living in village **Age**

Year of electricity connection

Household energy sources in Chipendeke village

1. What energy fuels do you use in your household?

   Firewood [ ] Electricity [ ] Solar [ ] Paraffin [ ] Other……..…

2. What are the uses of the different energy sources?

		Firewood	Electricity	Solar	Paraffin	Other
1	Cooking					
2	Ironing					
3	Lighting					
3	Cell phone Charging					
4	Watching Television					
5	Listening to the radio					
6	Income generating enterprise e.g. selling fish, freezits, rearing chickens for sale.					
7	Other…….					

How did the access to electricity affect the productive needs/ social roles of women?

3. Do you have access to electricity?

   a. Yes [ ] No [ ]

   (If answers No, jump to question No.8)

b. If you have access to electricity, in what way has it improved your life? Please tick three main options:

		1	2	3	4
1	Cooking on stoves				
2	Electric Ironing				
3	Cell phone Charging				
4	Watching Television				
5	Listening to the radio				
5	Income generating enterprise e.g. freezing fish/freezits, lighting for rearing chickens for sale.				
6	Refrigeration for HH consumption				
7	Lighting for evening and early morning HH chores e.g. cooking, ironing, sweeping, washing dishes, hand sewing				
8	Lighting for rearing chickens for HH consumption				
9	Lighting for agricultural purpose e.g. peeling groundnuts, grading beans				
10	Lighting to help children with Homework				
11	Lighting for breast feeding, changing nappies				
12	Lighting when you are reading or studying				
13	Electrification of clinic				
14	Electrification of local shops (growth point)				
15	Other……..				

b. Please may you explain your answer:
……
……

4. How much do you pay to get access to electricity for a month?
   ……..
5. Who pays for electricity?
   Male [ ] Female [ ]
6. Does the electricity supply meet all your needs and daily requirements?
   Yes, I use electricity for ……
   No, I need more electricity for …….....

7. What is your opinion of electricity as a new form of energy as compared to traditional energy (candle, paraffin, firewood) you used in the past?

……

……

Women, Biomass and Cooking

8. a. What do you use for cooking:

   Firewood [ ] Electricity [ ] Paraffin [ ]

   Other……..

   b. If firewood, how does your household get access to firewood?

	Sometimes	All the time	Never
I gather firewood			
I purchase firewood			
Male relative gathers firewood			

9. a. How much time do you spend gathering wood fuel per day?

   1hr to 2hrs [ ] 2hrs to 3hrs [ ] 3hrs to 4hrs [ ]

   b. How many days a week do you gather firewood?

   Everyday [ ] Twice a week [ ] Thrice a week [ ]

   c. Who do you go gathering for fuel wood collection with?

   Alone [ ] With children [ ] With Female friend [ ] With male relative [ ]

10. How much do you spend purchasing firewood?

    ……..

11. Do you think it is a woman's responsibility to search for firewood?

    Yes [ ] No [ ] Both [ ]

    Please explain your answer?

    ……

    ……

12. Do you adhere to the law that prohibits the cutting down of trees?

    Yes, I only collect dry firewood [ ]

    No, I sometimes cut down fresh trees, for firewood [ ]

    Please explain why?

    .....

    .....

Gender roles

13. What is your opinion on the lack of female volunteers/ workers who maintain the powerhouse?

    ……

    ……...

14. Would you be interested in volunteering/ working in the maintenance of the powerhouse?

    Yes [ ] No [ ]

5. What livelihood enterprises are women engaged in in response to electricity access?

15. Are you engaged in any activities that use electricity to provide food, money etc for your family?

    Yes [ ] No [ ]

    a. If yes, please tick the applicable options:

Rearing chickens for sale	
Rearing chickens for HH consumption	
Refrigerating and selling Freezits/ cool drinks	
Refrigerating and selling fish	
Other	

    b. How much money do you obtain per month?

    ……

16. Do you intend to start any (other) enterprises with the use of electricity?

    Yes [ ] No [ ]

    If yes, please list them

    ……

17. May you please explain the importance of this enterprise to you?

    ……

-END-

Appendix III

Interview guides for expert informants.

My name is Tanyaradzwa Edith Whande a Master of Arts student in the program Culture and Environment in Africa at the University of Cologne Germany. I am conducting research for my master thesis, a requirement in fulfilling the program. My research topic is *Energy Sources, Access and Livelihood Strategies: A Case Study of Women's Response to Electricity Access in Chipendeke Village, Zimbabwe.* The aim of my research is to explore how electricity has affected the socio-economic wellbeing of women in Chipendeke Village as a new form of energy. I value your views and opinions and it would be very helpful for me if you openly expressed yourself. Whatever you share with me, I ensure anonymity by not writing your name in the report. Please may I also have your permission to record this interview?

a) Practical Action

1) What is micro- hydroelectricity generation and how does it differ from other methods of electricity generation?

2) What are the benefits of micro-hydroelectricity generation?

3) What environmental impacts are associated with micro-hydroelectricity generation?

4) What factors determine whether an area like Chipendeke village is suitable for a micro hydroelectricity scheme?

5) What factors determine where to construct the weir and how much water is needed to generate enough electricity?

b) Rural Electrification Agency (REA)

1) What progress has REA made in terms of rural electrification?

2) What challenges do you face in terms of implementing rural electrification?

3) What is your opinion of the relationship between women and electricity?

C) Forestry Commission

1) May you please elaborate more on the Forest Act that forbids the cutting down trees?

2) To whom does this act apply?

3) What are the main causes of deforestation in Zimbabwe?

4) Does the use of wood fuel for domestic use such as cooking contribute to deforestation?

5) What is your opinion on the role of women as suppliers and users of wood fuel in the rural areas?

Appendix IV

Free-listing: The benefits of electricity

Television	9
Lighting	7
No more candle and paraffin expense	6
Charging Cell phone at home	5
Refrigerate for sale	5
Lighting children's home work	4
Lighting when reading	4
Lighting warmth, feeding chickens at night	3
Cleaning house early morning/ at night before going to the field	2
Lighting when ironing with charcoal iron	2
Refrigerate food for HH consumption	2
Availability of cold drinks and meat storage at growth point	1
Cooking with electricity	1
Hair cutting business	1
Hair cutting children	1
Iron with electricity	1
Lighting for breast feeding and changing nappies	1
Lighting in living room not in smoky kitchen	1
Lighting for peeling groundnuts and other grains	1
Lighting for safety	1
Lighting when cooking with firewood	1
Lighting when hand sewing	1
Nurses retained at clinic	1
Other- Charging Torch	1
Other- Fan cooling	1
Radio	1
Teachers retained at primary school	1

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