

**UNIVERSITY OF EDUCATION, WINNEBA**

**COLLEGE OF TECHNOLOGY EDUCATION, KUMASI**

**CHALLENGES AND PROSPECTS ASSOCIATED WITH RURAL  
ELECTRIFICATION**

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## DECLARATION

### **Candidate's Declaration**

I hereby declare that this dissertation is the result of my own original work and that no part of it has been presented for another degree in this University or elsewhere.

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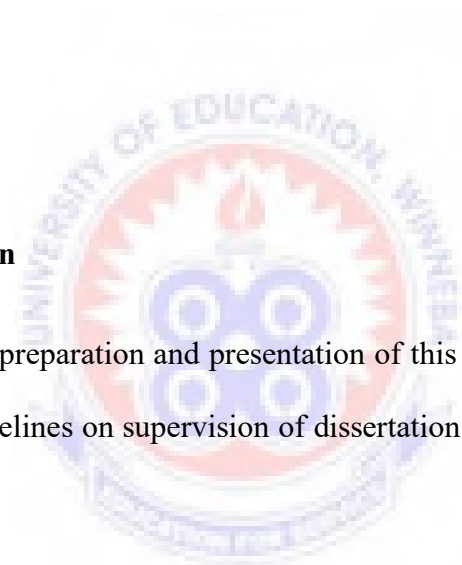
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### **Supervisor's Declaration**

I hereby declare that the preparation and presentation of this dissertation were supervised in accordance with the guidelines on supervision of dissertation laid down by the University of Education, Winneba

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## **DEDICATION**

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## ACRONYMS

ADB	Asian Development Bank
CFLs	Compact Fluorescent Lamps
EC	Energy Commission
ECG	Electricity Company of Ghana
ERR	Economic Rate of Return
GNESD	Global Network on Energy for Sustainable Development
GNP	Gross National Product
GridCo	Ghana Grid Company
IEA	International Energy Agency
IPPs	Independent power producers
LPG	Liquefied Petroleum Gas
MDGs	Millennium Development Goals
MMDAs	Metropolitan Municipal District Assemblies
NEDCO	Northern Electricity Company
NRECA	National Rural Electric Cooperative Association
OECD	Organisation for Economic Co-operation and Development
PEF	Private Enterprises Foundation
PURC	Public Utilities Regulatory Commission
SMEs	Small-to-Medium Scale Industries
SPSS	Statistical Products and Service Solutions
UNPD	United Nations Development Programme
VRA	Volta River Authority
WBGESS	World Bank Group Energy Sector Strategies

## ABSTRACT

Energy is essential and without it, societies can neither function socially nor commercially. Without sufficient and adequate energy resources, developing countries will not be able to foster the social and economic developments that are crucial for growth. Electricity is believed to have played a major role in development as well as poverty alleviation; expansion of access to electric energy to rural areas where poverty greatly resides has shown slow progress worldwide. In this regard, the study assessed the challenges and prospects associated with rural electrification in the Bawku West District of the Upper East Region of Ghana. Data for the study was obtained using structured questionnaires and interview schedule. In all, there were 123 respondents made up of 115 residents and eight management of the Bawku District Assembly and the Volta River Authority respectively. Quantitative data analysis was performed using the Statistical Products and Service Solutions (SPSS), version 18, while thematic analysis was performed on the interview data. The study concludes that rural electrification has had much positive effect on the residents of the Bawku West District. This is by decreased poverty, raising the standard of living, creating more jobs in the District thereby reducing unemployment as well as enhancing the academic achievement of children in school. Rural electrification significantly impacts on the creation of SMEs in the District. The major challenge of rural electrification in the District included the scattered nature of settlement which makes it difficult to extend electricity to other parts that are far as well as inadequate funds to extend electrification to other parts of the area. It is recommended that the government through the Ministry of Energy should create the needed incentives to attract investors for rural electrification. This can be achievement by creating a system of tariffs and subsidies that ensures sustainable cost recovery while minimizing price distortions.

## CHAPTER ONE

### INTRODUCTION

#### 1.1 Background of the study

Demand for reliable electricity services is significant. It represents a key driver behind economic development and raising basic standards of living (Cust, Singh & Neuhoff, 2007). The Global Network on Energy for Sustainable Development - GNESD(2007) accentuates that, lack of access to electricity remains the clearest indicator of poverty, and, indeed, of poverty in general. According to the World Bank Group Energy Sector Strategies - WBGESS(2010), achieving universal access to electricity is one of the most important goals set for the energy sector by governments in the developing world. Thus, the extension of electricity access to all parts of nations, continents, and the globe at large is a necessity for development.

Khatib (1993) argues that the lack of access to a reliable energy source is a major impediment to sustainable development in developing countries and to the harmonious progress of the global society. Khatib also believes that the idea that all nations on earth have a right and should have the means to pursue these benefits will become increasingly important in a world where opportunity is disproportionately divided between the industrialised countries of the northern hemisphere and the poorer nations farther south. If electricity is to truly promote human progress in developing countries, then the problem of rural electricity supply must be addressed. Although electrification commenced some one hundred years ago, as at 2001, about 40 percent of the world's population had neither had access to electricity, nor to sufficient other non-traditional energy forms (Zomers, 2001). Barnes and Foley (2004) further indicated that the pace of rural electrification over

much of the developing world is painfully slow. In many African and South Asian countries, it is even lower than rural population growth.

According to Lenssen (1993), some 2 billion people depend almost exclusively on biomass for their energy supplies globally. Most of the two billion people without access to electricity according to Haufstein (1996) live in thinly populated (rural) areas in developing countries and the extension of the grid to these areas is for economic reasons not feasible. Saghir (2005) and Sustainable Development Network (2007) argued that an estimated 1.6 billion people across the globe do not have access to electricity.

In the year 2008, the International Energy Agency (IEA) estimated that more than one-fifth of the world's population (1.5 billion people) lacked access to electricity. IEA (2008) further notes that 85 percent of the 1.5 billion people without access to electricity lives in rural areas, mainly in Sub-Saharan Africa and South Asia. Thus rural electrification which according to Mvondo (2010) is the process by which access to electricity is provided to households or villages located in isolated or remote areas of countries have had a very low growth rate in some parts of the world.

There are large variations in electrification rates across and within regions. Transition economies and countries belonging to the Organization for Economic Co-operation and Development (OECD) have virtually universal access. Saghir (2005) and Sustainable Development Network (2007) showed that 75 percent of Africans are without access to electricity. North Africa has an access rate of 99 percent, Latin America 93 percent, East Asia 90 percent, and the Middle East 89 percent. By contrast, South Asia has an electrification rate of 60 and Sub-Saharan Africa only 29 percent. The populations

without electricity in these two regions are 614 million and 587 million, respectively, accounting for 83 percent of the total world.

Historically, the use of electricity has been almost linearly associated with rising incomes and productivity (Guyol, 1969). Today, developing countries with higher per capital incomes typically consume more electricity per capita (Strout, 1977) and also devote more investment resources to rural electrification than do poorer countries. Dinkelman (2008) accentuated that electricity is pervasive in all industrialized countries and largely absent in developing ones. The provision of electricity in rural areas is widely believed to be a stimulus to increased agricultural productivity and output through irrigation and mechanization, to the growth of rural industries, and to raising the living standards of rural people. In most developing countries, rural electrification is considered important enough to subsidize extensively. The extent of rural electrification is nonetheless not great overall (World Bank, 1975).

Regarding the challenges associated with rural electrification in terms of connection, generally speaking, the electrification of rural areas is expensive. Capital cost is relatively high and revenues are frequently poor. Rural electrification is therefore often regarded as a utility's chafe. Designing sound off-grid electrification projects is far from an exact science. The combination of high cost of service; poor customers; and newer, less familiar technology options often makes it a more complex task than preparing a conventional energy project. Nevertheless, the evidence is clear: remote communities provided any type of decentralized electricity supply have marked improvements in welfare (Barnes, 2007).

Barnes and Foley (2004) also mentioned that rural electrification programs can undoubtedly face major obstacles. The low population densities in rural areas result in high

capital and operating costs for electricity companies. Consumers are often poor and their electricity consumption low. Politicians interfere with the orderly planning and running of programs, insisting on favored constituents being connected first and preventing the disconnection of people not paying their bills. Local communities and individual farmers may cause difficulties over rights of way for the construction and maintenance of electricity lines.

Electricity usage in the rural areas of Ghana is estimated to be higher in the coastal (27%) and forest (19 %) ecological zones, than in the savannah (4.3 %) areas of the country. With a customer base of approximately 1.4 million, it has been estimated that 45-47 percent of Ghanaians, including 15- 17 percent of the rural population, have access to grid electricity with a per capita electricity consumption of 358 kWh (Guide to Electric Power in Ghana, 2005).

The government of Ghana through the Ministry of Energy is responsible for policy formulation and aspects of its implementation. Uniquely for Ghana, regulatory oversight of the power sector is undertaken by two separate bodies, the Public Utilities Regulatory Commission (PURC) and the Energy Commission (EC), loosely referred to as the 'economic regulator' and the 'technical regulator'. Once again at industry level, all the features of a hybrid power market are evident. It is dominated by state owned entities; Volta River Authority (VRA), Ghana Grid Company (GridCo) and the Electricity Company of Ghana (ECG), while independent power producers (IPPs) have begun to enter on the margins of the industry. The VRA is a power generation company but also carries out some limited distribution through its Northern Electricity Department division; GridCo is



responsible for transmission and system operations whereas the ECG is the national distribution utility.

## **1.2 Problem statement**

Energy is essential and without it, societies can neither function socially nor commercially. Without sufficient and adequate energy resources, developing countries will not be able to foster the social and economic developments that are crucial for growth. Asian Development Bank -ADB (2009) emphasized that, the provision of essential social services, such as, electricity represents both the end and the means to economic development.

According to Meisen (2008), inadequate access to modern energy is both a determinant and a manifestation of poverty. Thus in agreement with Bensch, Kluve and Peters (2010), Meisen (2008) noted that access to basic, clean energy services is essential for sustainable development and poverty eradication. Although electrification is believed to have been playing a major role in the development as well as poverty alleviation, expansion of access to electric energy to rural areas where poverty greatly resides has shown slow progress worldwide. The unelectrified rural areas has been left out of development, as well as limited in the advanced way of doing things accurately and efficiently.

In the context of Ghana, although some efforts are being made to enhance rural electrification, the pace of rural electrification has been painfully slow (Maks Publication, 2012). There are still enormous communities without electricity. In the case of the study area; Bawku West District of the Upper West region, about 8.7 per cent of the district's population has access to the use of electric power supply (Maks Publication, 2012). This

means that a large chunk (91.3%) of the communities within the District lack access to electricity. Thus the bulk number of the residents in the district resorts to use wood as fuel, again millet and maize stalks are heavily relied upon after harvest. Some others depend on charcoal, kerosene and Liquefied Petroleum Gas (LPG). Against this background, there is therefore the need to empirically assess the prospects and challenges associated with rural electrification in the District. This will serve as a reference document for policy makers in the energy sector to intensify efforts in getting rural communities connected to national grids.

### **1.3 Purpose of the study**

The main objective of this study was to assess the challenges and prospects associated with rural electrification. Specifically, the study sought to assess:

1. The impact of rural electrification in alleviating poverty among residents of the Bawku District;
2. Rural electrification's contribution to the creation of Small-to-Medium Scale Industries (SMEs) in the District;
3. Challenges facing the electrification of the entire district; and
4. Make relevant recommendations to help boost up rural electrification in Ghana.

#### **1.4 Research questions**

Aligned with the study's objectives, the following research questions were formulated to guide the study:

1. What are the impacts of rural electrification in alleviating poverty among residents of the Bawku district?;
2. How does rural electrification contribute to the creation of Small-to-Medium Scale Industries (SMEs) in the District?;
3. What are the challenges facing the electrification of the entire district?; and
4. What relevant recommendations can be made to help boost up rural electrification in Ghana?

#### **1.5 Scope of the study**

This study was confined to the electricity supply to rural and remote areas. The effects of the developments and trends in large scale electricity supply systems and relevant organizations are not considered in detail. It is noted that the problems applicable to large scale systems differ from those of the electricity supply to rural and remote areas and are mainly of an administrative and technical nature. Additionally, this study did not give universal recommendations and does not intend to shape the future of rural electricity supply technology and management. It is emphasized that the situations and backgrounds differ from country to country and that, as an obvious consequence, the decision makers will have to adopt those solutions which are appropriate to their local circumstances.

Regarding geographical coverage, the study covered only the Bawku West District of the Upper East Region. This to some extent limits the generalization of the research

findings. Limiting the study to this District was due to proximity, limited resources and time. Additionally, the study only included communities which have been electrified.

### **1.6 Significance of the study**

Access to regular electric energy is noted in recent days to be one of the paths toward economic sustainability. Such access is a key element for the economic development of the rural environment and for the reduction of poverty. This study aims at contributing to an understanding of how rural electrification helps in improving the standards of living in rural areas as well as identify the challenges associated with rural electrification. Also, the study seeks to bring to light, how beneficial rural electrification can be to the betterment of national economies through a massive reduction in unemployment by the creation of small-medium scale enterprises.

Policy-makers and stakeholders with the help of this study would be able to critically diagnose the effects specific policies targeted at rural electrification would cause. On the academic facade, the study would add to the existing literature on rural electrification, as well as gives some directional indicators for future researchers in electrification. Thus the result from the study would complement existing literature and act as a vehicle to enhance rural electrification.

### **1.7 Organization of the study**

The study is structured into five chapters. Chapter one deals with the introduction which covers the background to the study, problem-statement, objectives of the study, research questions, scope of the study, and significance of the study. Chapter Two is the

review of related literature. Specifically, the chapter reviews literature on the challenges and prospects associated with rural electrification. Chapter Three presents the research methodology, which details how the study is designed including how the sample would be selected and how data would be collected and analyzed. Chapter Four presents and discusses the results in relation to the applicable theories and concepts discussed in the review of related literature. Chapter Five summarises the major findings from the study, and makes recommendations to stakeholders in rural electrification and development initiative, as well as directions for future research.



## **CHAPTER TWO**

### **LITERATURE REVIEW**

#### **2.1 Introduction**

This chapter is the review of related literature. It reviews both theoretical and empirical literature on the challenges and prospects associated with rural electrification. Specifically, the study reviews literature on the contribution of rural electrification in increasing the overall socio-economic development of nations, impacts of rural electrification on wealth creation by poverty alleviation in the rural areas; rural electrification's contribution to the creation of small-to-medium scale industries in rural areas and challenges associated with rural electrification.

#### **2.2 Overview of rural electrification**

Since the advent of technology, the ability for man to do work has been enhanced by the discovery of various forms of energy and the efficient management of these energy resources. Thus, all over the world, the GNP of a nation depends on the energy consumption per capita and the growth in the macro-economics of the locality. Primarily, the concept of rural electrification refers to the electricity supply to areas outside of cities. According to Zomers (2001), many researchers have given the concept of rural electrification highly divergent interpretations.

Munasinghe (1990) notes that rural electrification schemes are often defined in terms of local administrative units, mainly for convenience in implementation. Munasinghe (1988) also observes that most often, the term "rural electrification" refers to connections to a central grid. According to the international discussion and the understanding of agencies

such as the World Bank, the concept of rural electrification does not only refer to strictly rural areas but may also include small to medium-sized towns which are service centres for the surrounding rural areas within a given region (Vogel, 1993). Similar to the World Bank, Maillard (1985) state that an exact definition of rural electrification raises the issue of delimiting urban and rural areas. Maillard argued that a differentiation on the basis of statistical data carries with it the danger of inaccuracy because of the differences between countries, and because of the fact that data are often unreliable. It should also be noted that the classification of urban and rural areas based on statistical data, disregards specific features and opportunities of both areas. Maillard proposed that rural electrification comprises all activities aimed at enabling users situated outside major cities to have access to electricity.

Mason (1990) argues that in all, relevant sectors including electricity supply, “rural” suffers from the same definitional differences. Although surveys have revealed that most of the rural electrification projects in the past referred to communities of between 500 and 2000 people, both Mason (1990) and Foley (1990) state that the definitions of rural electrification vary considerably between countries. In one country ‘rural’ also includes provincial towns with a population up to 50,000 and in another it refers to small farming villages and surrounding areas.

In this study, a village is considered electrified if it is accessed by the grid, and has a transformer installed for low voltage distribution. Thus rural electrification in this study is the process of bringing electrical power to rural and remote areas.

### **2.3 Access to rural electrification**

The International Energy Agency (IEA) estimates that 1.5 billion people lacked access to electricity in 2008, more than one-fifth of the world's population. Some 85 percent of those without electricity live in rural areas, mainly in Sub-Saharan Africa and South Asia. For nearly half a century, while urban Americans enjoyed the pleasures of electricity, rural Americans continued to toil in darkness. Electrification had not proceeded at the same pace in rural as in urban districts primarily because the private electric industry believed bringing electricity to the countryside was not economically feasible (Alliance for Rural Electrification, 2012). Latin American countries have demonstrated strong commitment and invested a lot to reduce the number of people without access to electricity. This is clear when one looks at the absolute number (11 million people have gained access in the past 3 years), at the global electrification rate (92.7%) and at the high urban rate (98.7%). Moreover, in the last decade, 9 percent of all the continent's rural areas have gained access to electricity (Alliance for Rural Electrification, 2012).

Despite the efforts of the international community and the fact that energy has been for the past years, one of the main areas of the fight for economic development, the overall situation of Africa has gotten worse, mainly due to a population growth which has outpaced the slightly increasing electrification rates. In fact, still only 29 percent of the population has access to electricity today, the population without access jumping of 35 million from 2002 to 2008. This increase is mainly due to Sub-Saharan Africa since North Africa, with large rural electrification programs like in Morocco, has reached during the past decade a level close to full electrification in both rural (98.2%) and urban (99.6%) areas. In total, Sub-Saharan Africa accounts for 99.6 percent of the unelectrified population in Africa,



underlining the great disparities between both African regions (Alliance for Rural Electrification, 2012).

These facts according to the Alliance for Rural Electrification have led to two basic conclusions: first, the development goals are all linked with each other and access to modern energy is probably the most horizontal development issue of all. Secondly, these numbers show that without strong political commitments and the implementation of sustainable supporting frameworks, the electrification rate will never catch up with the population growth and the unelectrified population in the poorest regions of the world will keep increasing.

#### **2.4 Impacts of rural electrification on the socio-economic development of nations**

Achieving universal access to electricity is one of the most important goals set for the energy sector by governments in the developing world. Electricity alone is not sufficient to spur economic growth, but it is certainly necessary. Access to electricity is particularly crucial to human development, as certain basic activities such as lighting, refrigeration, running household appliances, and operating equipment cannot easily be carried out by other forms of energy. Sustainable provision of electricity can free large amounts of time and labour and promote better health and education. Electrification can help achieve economic and social objectives (World Bank, 2008).

Electrification is widely believed to contribute to the achievement of the Millennium Development Goals (MDGs), based on the assumption that sustainable access to modern energy services fosters economic and social development, and leads to improvements in the quality of life (Bensch, Kluve, & Peters 2010). The World Bank (1996) has documented the

economic and health benefits of switching from biomass fuels to electricity. According to another World Bank report (2001), efficient and clean energy supply is central to the reduction of poverty through many and varied linkages, as well as being important for economic growth. Barnes (2007) and World Bank (2008) cite several of these linkages, while noting that supporting evidence remains largely anecdotal.

Electricity use is expected to lead to more productive processes; thus the growth of businesses or farms using electricity will then increase demand for electricity, leading to a virtuous growth cycle profitable to both electricity providers and rural communities. Such economic growth is obviously an important achievement of any rural electrification programme. Some experts (Barnes, 2007), however, warn that the necessary conditions for such economic growth lie in the parallel or complementary development programmes for the newly electrified communities.

World Bank (2007) stated that the impacts of rural electrification on the socio-economic development of nations include:

1. Improved household income from paying lower prices for legal electricity than for electricity sold by illegal operators;
2. Health benefits from reduction in indoor pollution and the use of boiled water;
3. Improved household security as a result of fewer fires and light at night;
4. Reduced violence on women;
5. Increase in educational levels;
6. Boost in social status, from social exclusion to social inclusion; and
7. Security from street lighting.

## **2.5 Impacts of rural electrification on wealth creation through poverty alleviation in the rural areas**

The provision of electricity in rural areas is widely believed to be a stimulus to increased agricultural productivity and output through irrigation and mechanization, to the growth of rural industries, and to raising the living standards of rural people (Cecelski&Glatt 1982). In most developing countries, rural electrification is considered important enough to subsidize extensively. For over 30 years, the World Bank and other organizations have studied the social benefits of electricity access and have noted that these benefits are usually derived from the longer days that powered light bulbs offer to the household (Mvondo, 2010).

Beside the long day hours associated with electricity access, Mvondo (2010) further noted that, households mainly use electricity for powering light bulbs, fans, television sets, refrigerators, computers and phone. Thus households without access to electricity have shorter days, and also lack access to modern/stress free preservation service like refrigeration. In addition, Mvondo (2010) accentuated that access to information, communication and health care is facilitated by the powering of computers and phones. When electricity is used for powering home appliances, household chores tend to become less tedious; when it is used for lighting, the immediate benefit as opposed to candle light comes through the promotion of extended hours of study which in turn contributes to better educational achievements as well as leisure benefits (Barnes, 2007).

Women and children benefit directly from these improvements, but table or ceiling fans and television sets offer comfort during evening leisure time, increasing the general welfare of all members of the household (Mvondo 2010).Zomers (2001) argued that energy

is needed to achieve an acceptable quality of life for the global village as a whole. Comparism between households in villages without electricity and those in villages with electricity revealed that, villages with access to electricity have significantly better schooling outcomes (Khandker, Barnes & Samad 2009). However, the differences in economic outcomes are not consistent.

## **2.6 Impacts of rural electrification to the creation of Small-To-Medium Scale**

### **Industries in Rural Areas**

For economic development, income-generating activities are also needed to create employment opportunities through activities performed in households, in micro enterprise of different types and sizes, and in agriculture (National Renewable Energy Laboratory, 2000). Micro-enterprises are important in their role as contributors to the economy of the rural poor especially women, technological development of rural people and in their potential for employment creation (Maleko, 2005). Micro-enterprises like retail shops, salons, restaurants and bars, wood processing, welding, depend on electricity services for lighting, refrigeration, entertaining customers (playing Radio, Music systems and Television), cooking, baking, shaft power, grain grinding and oil processing (Sawe, 2004), contribute immensely to the economic empowerment of people living in rural areas.

There is evidence that access to electricity services in rural areas in the developing world has led to technological change in existing micro-enterprise. For example, in rural areas of Indonesia, some shoes workshops changed from the use of manually operated machinery to electrically operated machines with an associated enhancement of productivity (Smyth, 1994) small factory, making nuts, screws and bolts had been established after

electrification. In Kilimanjaro, six industrial projects had been started after electrification (Kjellstrom, 1992).

Also, Rana-deuba (2001) cited by Meadows, (2003), example from Nepal shows that increased access to electricity has resulted in or contributed to the establishment of small enterprises like bakeries, photo studios, grocery stores, and saw mills, in addition to agricultural activities such as poultry farming and goat keeping which are economic boosters. Estimates show that there are about 700,000 new entrants into the labour market every year of which about 500,000 are school leavers from all levels with few marketable skills (Maleko, 2005). According to Maleko (2005) most of these people end up in the MEs sector. In rural areas of Tanzania, micro-enterprises acts as a vehicle for creating income distribution for rural poor, they are resources of poverty reduction. As said by Maleko (2005), the rate of unemployment has been growing such that group of unemployed people looks for alternative means to sustain their lives e.g. establishment of Micro Enterprises (ME's) for income generating activities in their homeland, which is located in rural areas.

Also, Maleko (2005) stated that the growth rate of micro-enterprises were noticeably higher in areas with electricity services than in areas without electricity services, but the proportion was low compared to micro-enterprises growth rate and time of electricity introduction. According to the National Rural Electric Cooperative Association(NRECA, 2002), in agriculture, an estimated 1.1 million persons are directly involved in farmlands using rural electricity connected irrigation equipment. Currently, 63,220 industries using rural electricity employ 983,829 persons; and electrified industries, on average, generate 11 times more employment than the non-electrified industries. Rural and wholesale shops using rural electricity employ 848,630 persons in Bangladesh. Basing on the above , ME's has

proved important by creating employment for those who cannot find work in other formal sectors and also creates additional income to the households who are engaged in both agriculture and micro-enterprises. This suggests that the establishment of micro-enterprises can make the informal sector grow very fast (Maleko, 2005).

## 2.7 Challenges associated with rural electrification

Generally speaking, the electrification of rural areas is expensive. Capital cost is relatively high and revenues are frequently poor. Rural electrification is therefore often regarded as a utility's chafe. Designing sound off-grid electrification projects is far from an exact science. The combination of high cost of service; poor customers; and newer, less familiar technology options often makes it a more complex task than preparing a conventional energy project. Nevertheless, the evidence is clear, remote communities provided any type of decentralized electricity supply have marked improvements in welfare (Barnes, 2007).

Listed below are the challenges associated with rural electrification:

- **High costs of supplying rural and peri-urban households:** According to the World Bank Group Energy Sector Strategy (2010), most rural communities, as well as many peri-urban areas, are characterized by a low population density and a very high percentage of poor households. Demand for electricity is usually limited to residential and some agricultural consumers, and many households consume less than 30 kilowatt-hours (kWh) per month. The combination of these factors results in high costs of supply for each unit of electricity consumed.

Hourcade, Colombier and Menanteau (1990) indicated that both investment and operation costs of rural electricity supply differ from one country to another but they are always far higher than in urban areas. According to Hourcade et al.,(1990) these higher costs are due to the following factors:

1. Dispersed loads requiring long medium voltage lines or decentralized diesel power stations;
2. Line losses are often very high and the power system prone to service interruptions;
3. Expensive billing procedures and control of illegal connections; and
4. Low load factor due to dominant domestic consumption (in particular lighting), agricultural demand with seasonal periodicity and the absence of industrial demand.

Schramm (1991) argues that grid based electricity is by far the most costly form of energy supply in low-density rural areas, when compared to the other alternatives. Schramm notes that the real cost of electricity is very high and in most cases is underestimated because of the low load factors, the large distribution losses and the additional burden imposed during peak demand periods. The main criterion for the desirability of a rural electrification investment is apparently the economic rate of return (ERR) and that most of the other alleged beneficial effects must be either disregarded or viewed with great skepticism.

- **Lack of appropriate incentives:** The high costs of electricity supply in rural areas and the limited capacity of households to pay for the service make it difficult to attract investment in rural electrification. To do so, according to the World Bank

Group Energy Sector Strategy (2010) requires a system of tariffs and subsidies that ensures sustainable cost recovery while minimizing price distortions. However, such a revenue-generation scheme is absent in many countries. All too often, tariff subsidies are designed to favour the large majority of consumers, including the well-off, while failing to provide utilities with incentives to invest in rural electrification. Such ill-designed tariff schemes are found in particularly in Sub-Saharan Africa, where subsidies applied to residential consumers are highly regressive (Foster & Briceño-Garmendia, 2010).

Thus the funding of rural electrification schemes is a key issue. Some form of subsidy is therefore needed because the majority of rural dwellers have a very low income. In more industrialized countries, the ratio between rural and urban population allowed cross-subsidization within the utility.

- **Weak implementing capacity:** Adequate design and effective implementation of a rural electrification program requires technical and managerial skills that are not always available. Countries committed to extending electricity access need to go through an initial period of strategy development and capacity building. This process may entail new or amended legislation, institutional strengthening, planning, and establishing technical standards and regulatory procedures tailored to the nature of rural electrification.
- **Electricity generation shortage:** An obstacle to rural electrification in many countries with low access rates is insufficient generation capacity of the main



electricity system. Most countries in South Asia are experiencing permanent load shedding. More than 30 countries in Sub-Saharan Africa suffer from systematic generation shortages (Foster & Briceño-Garmendia, 2010). It is unrealistic to expect these countries to make more than modest gains in increasing electricity access by means of grid extension until the capacity constraint is eased. Off-grid electrification has the advantage of not being affected by this capacity constraint.

- **Population growth:** A further challenge in rural electrification is the growth of the rural population. While the migration of population from rural areas to cities is accelerating in the developing world, the impacts of this trend on requirements for rural connections are offset by rising demand due to population growth. In low-income countries, rural population will increase in number to 2040 (UNPD, 2007).
- The Government institutions are saddled with the sole responsibility of providing electricity to citizens;
- Insincerity on the part of government officials (i.e. over estimation and approval of substandard jobs);
- Attitude of the end user (e.g. vandalization, lack of protection for government facilities, etc);
- Rate of return on investment is almost zero
- Lack of technology to produce the sub-transmission material and equipment
- Location of towns and villages from the nearest National Grid/transmission lines at 11kV and 33kV respectively (DEREB, 2003).

Thus the challenges of providing electricity to rural households are manifold. Ever increasing demand–supply gap, crumbling electricity transmission and distribution infrastructure, high cost of delivered electricity are a few of these.

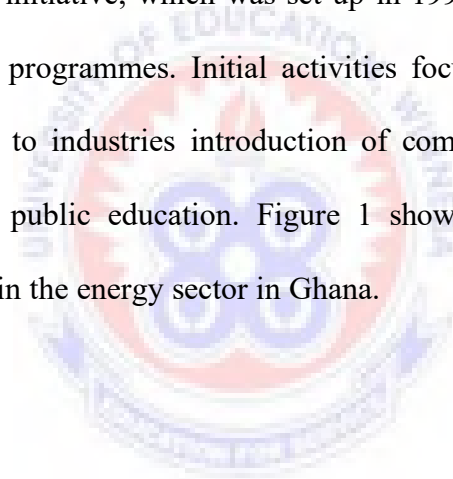
## **2.8 Stake holders and their roles in rural electrification in Ghana**

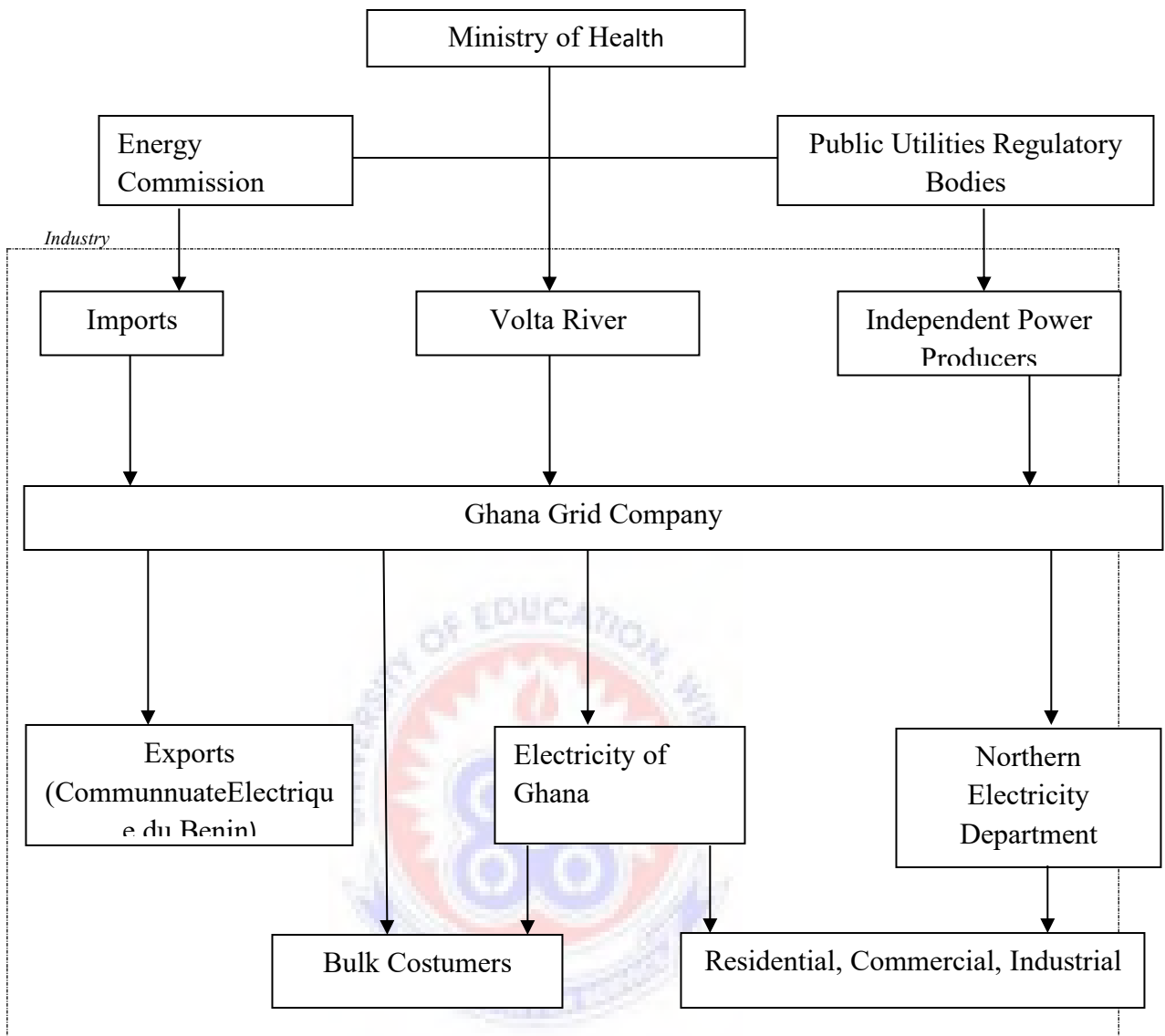
In Ghana, there are several key entities in the electric power industry; below are the list of all of such entities and a brief description of their tasks:

- The Ministry of Energy: Ultimate body responsible for development of electricity policy for Ghana.
- The Volta River Authority (VRA): State-owned entity that is responsible for generation and transmission of electricity in Ghana. VRA operates the largest generation facility in Ghana, the Akosombo hydroelectric plant.
- The Electricity Company of Ghana (ECG): State-owned entity that is responsible for distribution of electricity to consumers in southern Ghana, namely Ashanti, Central, Greater Accra, Eastern and Volta Regions of Ghana. ECG is the entity that consumers interact with when they receive and pay their bills or when they have service questions (billing, metering, line connection etc.)
- The Northern Electrification Department (NED): A subsidiary of VRA and responsible for power distribution in northern Ghana namely, Brong-Ahafo, Northern, Upper East and Upper West Regions.
- The Public Utilities Regulatory Commission (PURC): Independent agency that calculates and sets electricity tariffs educates customers about electricity services as

well as energy efficiency and conservation and ensures the effectiveness of investments.

- The Energy Commission: Independent agency that licenses private and public entities that will operate in the electricity sector. EC also collects and analyses energy data and contributes to the development of energy policy for Ghana.
- The Private Generators: Domestic or international entities that build power generation facilities in Ghana. They sell their electricity to VRA or ECG.
- The Energy Foundation: A Ministry of Energy – Private Enterprises Foundation (PEF) initiative, which was set up in 1997 to promote energy efficiency and conservation programmes. Initial activities focused primarily on provision of technical support to industries introduction of compact fluorescent lamps (CFLs) countrywide and public education. Figure 1 shows the logical flow of the key stakeholders within the energy sector in Ghana.





**Figure 1: Structure of the power sector in Ghana**

Source: Power Sector Reform and Regulation in Africa, 2010

## 2.9 Electricity generation in Ghana

In 2006, 8429 GWh of electricity were generated, which after a small amount of export left 8303 GWh for domestic supply. This is sufficient to provide 6519 GWh of electricity to end users, after high distribution losses of 1318 GWh (16%). The generation mix is two-fold: 67 percent comes from hydro power stations, mainly on Lake Volta, whilst the other 33 percent is generated by two oil fired power stations. This mix is, however, variable and strongly dependent on rainfall and the levels of stored water in Lake Volta.

In rural areas, grid access is less common, although some infrastructure is in place. However, whilst the transmission and distribution lines exist, connection of villages and buildings to this infrastructure is more complicated. Furthermore, even if it were connected, the reliability of the grid in such a remote location would be poor, both due to physical problems (trees falling across transmission lines) and electrical (voltage control and stability will be poor in remote locations).

With electricity demand set to grow by 8-10 percent per annum, extra generation capacity will be required in order to meet this. It is also recognised that distribution networks will have to be strengthened to provide a reliable electricity system and reach targets for rural electrification. The government has a target to provide 80-90 percent coverage by 2015. The Electricity Company of Ghana has wiring regulations which stipulate requirements for domestic wiring. Once in place, then they can be connected to the grid and get an electricity meter installed, for which ECG will charge US\$ 400. A further scheme exists to promote rural electrification for areas where no grid exists. If residents can provide the poles for the electricity pylons, then ECG will install the network extension.

## **CHAPTER THREE**

### **RESEARCH METHODOLOGY**

#### **3.1 Introduction**

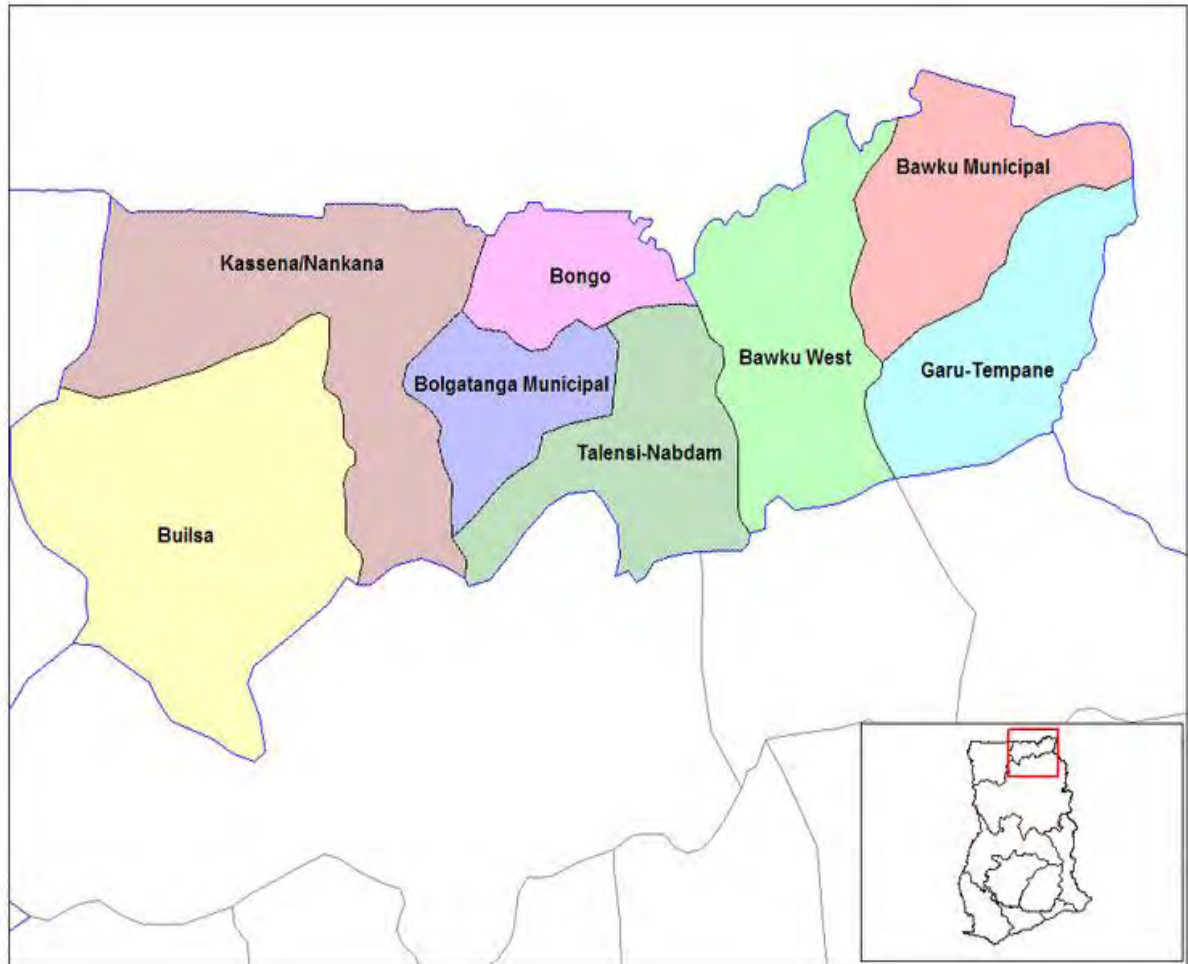
This chapter presents a discussion of the methods that was used to carry out the study. The discussion includes the study design, the study population indicating the unit of analysis, sources of data including both primary and secondary data sources, sampling procedure and techniques, instruments for data collection including structured questionnaires and interview guides. The chapter also addressed ethical issues regarding the administration of questionnaires and conducting interviews, as well as the methods for analyzing the data gathered from the field.

#### **3.2 Profile of the study area**

The area in which this study would be conducted is the Bawku West District of the Upper East region of Ghana. The Bawku West District is one of the eight districts in the Upper East Region of Ghana. The district was carved out of the old Bawku East District under the new local government system in 1988. The district capital of Bawku West is Zebilla. The District is bordered by Burkina Faso to the North, Bolgatanga District to the West and Bawku East District to the East. The District covers a land area of approximately 979 km<sup>2</sup>, which constitute about 12 percent of the total area of the region (Maks Publication, 1996).

According to the 2000 population and housing census, the district has 80,606 people of whom only 12 percent are literate. Kusaal is the dominant language in Zebilla. Goods and commodity trading occurs every three days in an open market in Zebilla. Figure 2 shows the

graphical distribution of the location of the Bawku West district on the Map of Upper East region.



**Figure 2: Location of Bawku West District**

Source: Ghana maps

Major communities in the District include:

Googo, Apodabogo, Binaba Central, Kamega, Azuwera

Galaka Gorogo Yarigu Kpalsako, Sakom Gore

Aneigo Tonde TiliNatinga, SapelligaNatinga, Gumbo  
Kubouko, Zokpaliga, Gumari.

Energy is needed for home consumption, work places and other areas to enhance livelihoods. About 8.7 per cent of the District's population has access to the use of electric power supply. In the District, the percentage of households using electricity, as the main source of lighting is 8.7 percent as compared with the national average of 43.7 per cent. The percentage of households using kerosene lamps as a major source of lighting is 88.7 percent as compared with the regional average of 84.6(Bawku West Medium Term Development Plan, 2008).

In light of the fact that availability of electricity is not meant only for household lighting, cooking and food preservation but also promotes industrial and other economic activities, the programme of rural electrification needs to be intensified in the District. There are great potentials for generating and using solar energy, considering the high annual average temperature of 32<sup>o</sup>c, the low canopy structures of most trees sparsely located in communities, thus allowing direct sun-rays on the ground levels among other factors. To this end, usage of solar energy is becoming common in the District even among the rural settlements.

Gas and electricity are not very affordable and accessible to most households. With the exception of few households mostly in the urban areas, that can afford electricity, solar panels and/or Liquefied Petroleum Gas as their energy sources, most (rural) households resort to wood lots usage processed as firewood and/or charcoal to their source of energy. Nevertheless, almost all households in the urban and rural areas use wood fuel for their domestic and/or commercial activities.



Establishment of Urban/Town/Area councils is clearly stipulated in the Legislative Instrument (L.I 1855) that creates MMDAs. The District has five Town/Area Councils to enhance its local governance functions.

### **3.3 Research type/design**

Many research designs are available. However, the choice of a particular research design should be informed by the research questions and objectives (Polit & Hungler, 1995). This study employed the cross-sectional descriptive survey with a questionnaire and interview guide for data collection to provide answers to the research questions. A descriptive survey is a non-experimental design which measures the characteristics of a sample at one point in time. Descriptive surveys tend to be cross-sectional.

The choice of the cross-sectional descriptive survey design in this study was informed by the views of Cohen and Manion (1995) who have indicated that the survey approach was useful in studying attitudes ( in this cases, the attitudes of residents in terms of rural electrification was explored ). The use of this type of design was to help generalise specific observations and information as well as develop specific perditions from general principles regarding the prospects and challenges associated with the implementation of rural electrification. Additionally, the descriptive survey was considered the most appropriate for this study on the basis of its advantages of economy of design, the rapid turnaround in data collection and the ability to identify attributes of the population from a sample derived from that population. Also, because it involves system organization and presentation of data in order to arrive at valid and accurate conclusions. This helped to minimize errors in the research work.

### **3.4 Target population**

The population which this study targeted was residents of the Bawku West District whose households have been connected to the national grids and using electricity for operating their businesses. Additionally, to explore the challenges associated with rural electrification, management of the energy sector in the District as well as staff of the District Assembly were included.

### **3.5 Sources of data**

Both primary and secondary sources of data were gathered for this study. Primary data was obtained directly from the study's unit of analysis. In this case, respondents provided their responses regarding the challenges and prospects associated with rural electrification through the data collection instruments (questionnaires and interviews). On the other hand, the secondary data involved a desk research of relevant materials, documents and reports on rural electrification. Specifically, secondary data for the study was obtained through library research including books, journals, reports, and other relevant document the researcher considers important to the study.

### **3.6 Sampling techniques and procedure**

Both probability and non-probability sampling techniques were used in sampling the units of analysis for this study. Specifically, the multi-stage sampling technique of probability sampling was employed in the sampling of residents, while the purposive sampling technique was used to sample management of the energy sector (VRA) at the District level as well as the Officials of the District Assembly.

In applying the multi-stage sampling, the geographical demarcation of the District in terms of Town and Area Councils was used. As indicated earlier, the Bawku West District has five Towns and Area Councils. In this case, each of the Area/Town Council represented a cluster. This is because, apart from the variations in the numerical strength of the Town and Area Councils, their characteristics in terms of demographics are similar. That is to say, the economic activities within the Area/Town Councils are homogenous in terms of characteristics but are heterogeneous across the communities.

Communities within each Town or Area Council were purposively selected. This was because; only communities that have been electrified within the Town/Area Councils were selected. It is important to mention here that in sampling the communities, Councils that have more communities were largely represented. In this case, Councils with the smallest number of communities had the smallest representation. Further sampling involved the random sampling of households and micro-businesses within the selected communities. For the purpose of this study, only households that have been electrified were randomly selected, while the last stage of sampling involved the sampling of residents within the selected households.

### **3.7 Population and sample size**

The populations for the study consist of 178 subjects. It comprises 4 officials of Bawku West District Assembly, 4 V R A Management staff at Bawku West District and 33 respondents from the five area/town council constituting 165 subjects as residents and business owners. The sample for the study comprises 150 subjects. It included all 8 management staff from Bawku West Assembly and V R A, and 115 residents and business

owners randomly selected from the resident's population of 165. Thus 69.6% of the residents selected for the study - in line with the suggestion of Nwana (1992) that if a population of the study is few hundreds, a 40% or more sample size suffices

### **3.8 Instrument for data collection**

Data collection is an important aspect of any type of research study. Inaccurate data collection can significantly impact on the results of a study and ultimately lead to misleading results and conclusions (Tannor, 2010). This section discusses the data collection methods and tools used for the study with sound and justifiable reasons for the choice. A further brief description of the instrument, thus the relevant items on the instrument is also included in this section.

Although a number of instruments for data collection could have been used, a structured questionnaire and interview guide was deemed the most appropriate for the study. Questionnaires were used because they were easy to administer, friendly to complete and fast to score and therefore took relatively very little time of the researcher as well as the respondents. Additionally, questionnaires are valuable methods of collecting a wide range of information from a large number of individuals or respondents. In this case, the population size of residents with electricity in the District was large enough to obtain statistically useful information.

The questionnaire was administered through a face to face interview. This was appropriate as most of the study population is illiterate and could not read to adequately respond to the items on the questionnaire. Thus although the face to face interviews are time

consuming and carry additional personnel costs, it helped provide an opportunity for clarifying the questions when there was the need.

The key to getting the right data depends on the questions that are asked (Sanders, 1997). The questionnaire for this study contained opened and closed-ended questions with the majority of the questions being closed-ended to make data analysis easy. Regarding the close ended questions, respondents were provided with a set of options (multiple choices) to a question and were to choose among them, while with the opened-ended; respondents provided answers in their own words through writing. The open ended questions allowed the respondents to express an opinion without being influenced by the researcher (Foddy, 1993). Thus the opened ended questions paved way for respondents to include more information, including feelings, attitudes and understanding of the prospects and challenges associated with rural electrification.

To ensure that the questionnaire is designed in relation to the objectives of the study, the questionnaire was structured into four parts where each part focused on one of the objectives. However, the first section focussed on some background characteristics of the respondents including age, gender, marital status, educational background, and respondents' occupation. The second section focussed on the impact of rural electrification in alleviating poverty. In assessing the impact, a four-point scale was used against the traditional five-point scale due to the tendency for individuals to select responses in the centre of the scale if an odd number response scale was used (Anderson, 1985; Casley & Kumar, 1988; Downie, 1967). The responses for the four-point scale are, strongly agree (4), agree (3), disagree (2), and strongly disagree (1). In all, seven items were used to assess the impact of rural electrification in alleviating poverty among the rural folks.

The third section of the questionnaire examined rural electrification's contribution to the creation of Small-to-Medium Scale Industries (SMEs) in the District, while the last section elicits views from respondents regarding measures that can be implemented to ensure that the prospects associated with rural electrification can be tapped. The interview guide was also designed in relation to the objectives of the study.

### **3.9 Pre-testing of survey instruments**

Ultimately, designing the perfect survey questionnaire, interview guides and protocols is impossible (Tannor, 2011). However, effective surveys can still be created. To determine the effectiveness of a survey instrument, it is necessary for it to be pre-tested before actually using it. The questionnaire and interview guide were pre-tested. This was done in Googo, one of the sub-communities electrified in the District.

The pre-testing helped to determine the strength and weaknesses of the survey instruments regarding their reliability and validity before proceeding to the actual field work. Also was to reveal any unanticipated problems with question wording, format, instructions to skip questions, and to make sure that respondents understand the questions and provide useful answers to develop and so refine the questions. A few revisions were made to the instruments before finally using them for the main survey.

### **3.10 Ethical principles**

Specifically, the significant ethical issues that were considered in this research process included informed consent, anonymity and confidentiality. To secure the consent of the selected participants, the researcher relayed all important details of the study, including

its aims and purpose, while confidentiality of the participants was ensured by not disclosing their names or personal information in the research. Only relevant details that helped in answering the research questions were included. .

### **3.11 Data analysis**

Before the data analysis, all questionnaires and interviews were adequately checked for completeness. Thus, data cleaning and processing were done to identify errors in data recording prior to the data analysis. The quantitative data gathered was coded and entered into a spreadsheet and analyzed using the Statistical Products and Service Solutions, version 18. Quantitative analysis involved generating descriptive statistics. The descriptive statistics included frequency tallies and their corresponding percentage scores. Cross tabulations were further used to examine the relationship between some key variables relevant to the study. Charts such as bar charts and pie-charts were further used to depict the trend.

## **CHAPTER FOUR**

### **RESULTS AND DISCUSSION**

#### **4.1 Introduction**

The results of the data analyzed and the discussion of the findings are presented in this chapter. The discussion involves the possible implications of the findings. In discussing the findings, attempts were made to relate the findings of the study to the pertinent concepts and theories discussed in the review of related literature in Chapter Two.

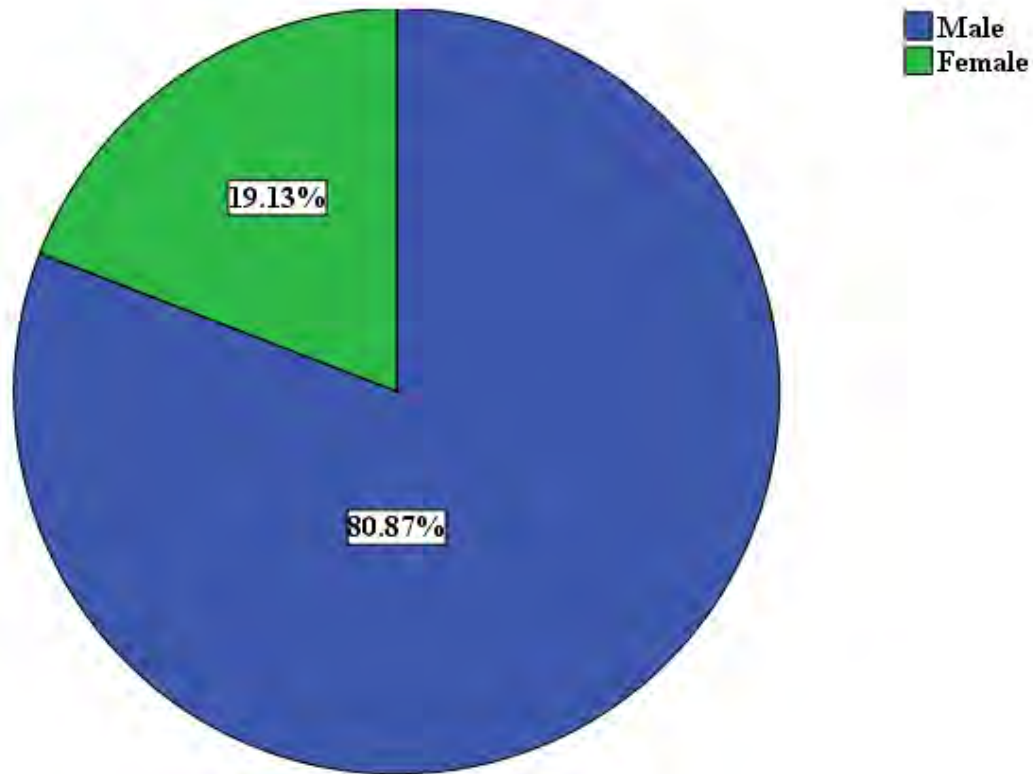
The results of this study are presented in four sections where each section focused on one of the objectives of the study. However, the first section presents the demographic characteristics of the respondents. The second section presents findings and discussions on the impact of rural electrification in alleviating poverty among the residents while the third section presents the findings and discussions on rural electrification's contribution to the creation of small to medium scale industries (SMES) in the District. The fourth section presents findings and discussions on the challenges facing the electrification of the entire district.

#### **4.2 Demographic characteristics of the respondents**

This section presents the analysis and discussions of respondents' demographic characteristics. In all, there were 123 respondents of which 115 were residents, four management of Bawku West District Assembly and four management of VRA in Bawku West District participated in the study. In examining the demographic characteristics of the respondents, the following five variables were analyzed for the residents: Age, gender, marital status, educational background and the occupation of the respondents.



Figure 3 illustrates the graphical distribution of the gender of the respondents.



**Figure 3: Gender of respondents**

Source: Field work, 2012

The results in Figure 2 shows that majority (80.87%) of the respondents were males. Thus the proportion of males who responded to the study was higher (61.74%) than the proportion of female who also responded to the study. This suggests that the males significantly outnumbered the female who responded to the study.

In analysing the demographics of the respondents, the study further examined the ages of the respondents. Descriptive analysis presented an average age of 28.51 years with

minimum and maximum ages of 18 years and 59 years, respectively. A standard deviation of 7.533 was obtained indicating that the ages of the respondents were unclustered around their mean age. Table 1 further shows detailed result on the ages of the respondents based on the minimum and maximum ages obtained.

**Table 1: Age of respondents**

Age (Years)	Frequency	Percentage
18-25	55	47.8
26-33	40	35.1
34-41	14	12.3
42-49	8	7.0
50 and above	1	0.9
Total	115	100.0

Source: Field work, 2013

The most prevalent ages obtained among the respondents were 18-25 years (47.8%) and 26-33 years (35.1%), respectively. Further analysis show that majority (79.8%) of the respondents were between 18 to 33 years, indicating that the respondents were young and had much of youthful traits. The implications for this study therefore is that the youthful nature of the respondents make them energetic and active, thereby making them economically active and productive. Hence rural electrification could create employment as well as livelihood opportunities for the people of the Bawku.

Additionally, the marital status of the respondents were analysed and discussed. The results are shown in Table 2.

**Table 2: Marital status of respondents**

Marital status	Frequency	Percentage
Never married	51	44.3
Married	60	52.2
Divorced	2	1.7
Widowed	2	1.7
Total	115	100.0

Source: Field work, 2013

More than half(52.2%) of the respondents were married, although the proportion which had never been married was equally higher (44.3%). These results are consistent with the ages of the respondents. In other words, the respondents who had never been married were between 18 to 33 years, while it is also common to find the married folks in this age group.

The study further examined the educational qualification of the respondents with the results depicted in Table 3.

**Table 3: Educational background of the respondents**

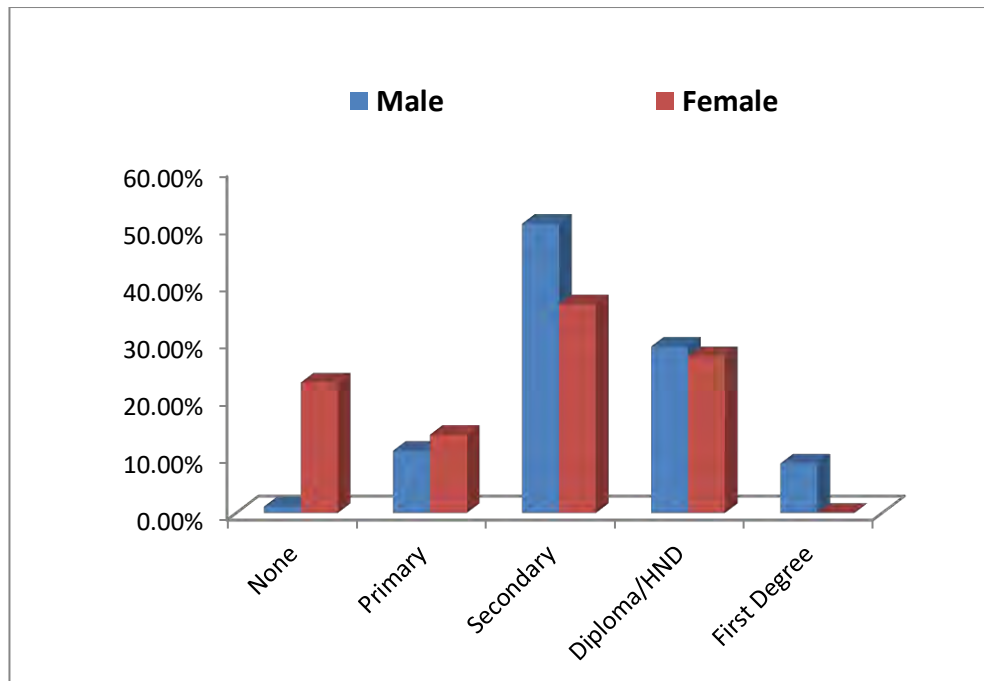
Education	Frequency	Percent
None	6	5.2
Primary	13	11.3
Secondary	55	47.8
Diploma/HND	33	28.7
First degree	8	7.0
Total	115	100.0

Source: Field work 2013

The most prevalent educational background among the respondents was Secondary (47.8%) followed by Diploma/HND (28.7%). Only 7.0 percent of the respondents had university degree whilst there was no respondent with a second degree. However, about 35.7 percent of the respondents had tertiary education (at least Diploma) while over 60 percent (64.3%) of the respondents did not have a tertiary educational background. Generally, majority of the respondents did not have higher educational backgrounds. This suggests that the respondents were likely to be engaged in the informal sector of employment considering the fact that higher education is a critical determinant of formal employment or occupation.

The educational background of the respondents was further explored across gender. While only one of the males had no formal education, about 22.7 percent of the females did not have formal education. Additionally, while 37.6 percent of the males had tertiary

educational background, less than thirty percent (27.3%) of the females had tertiary educational background. Generally, over seventy percent (72.7%) of the females had maximum of secondary education as against 62.3 percent of the males. Figure 4 illustrates the educational background of the respondents across gender.

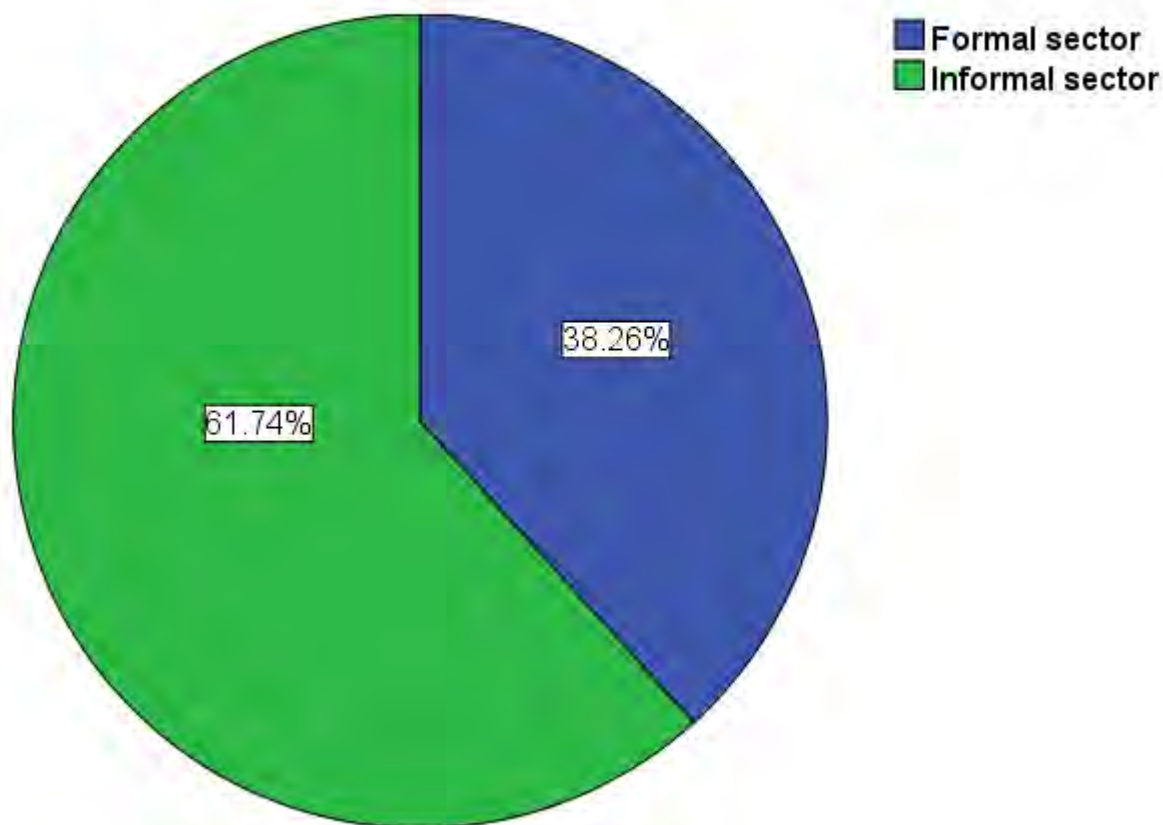


**Figure 4: Educational background of the respondents across gender**

Source: Field work, 2013

It is noted in Figure 4 that none of the females had first degree. Generally, it can be concluded that although the respondents did not have much higher educational backgrounds, the males were more educated than the females. This further suggests that the males were most likely to be engaged in the formal sector of employment as compared to the females.

In this regard, the study further examined the occupation of the respondents. Their occupation was categorized into formal and informal sector and the results are presented in Figure 5.



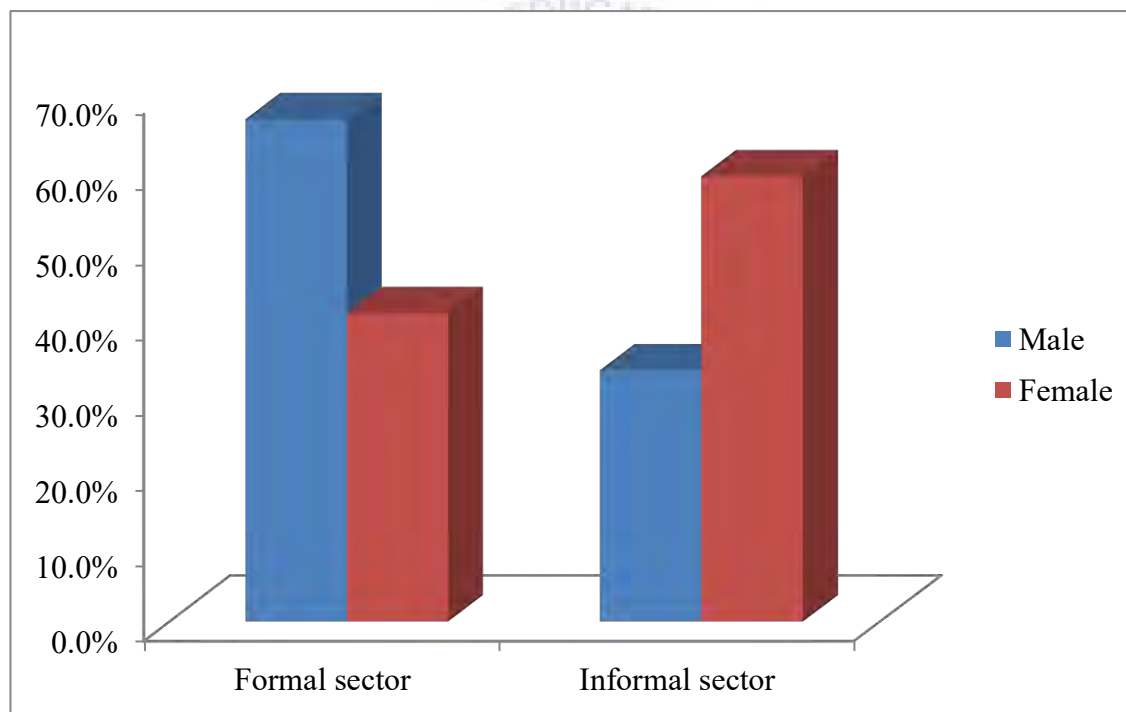
**Figure 5: Occupation of respondents**

Source: Field work, 2013

Figure 5 reveals that a little over 60 percent (61.74%) of the respondents were employed in the informal sector (Trade and service sector). Thus, an assessment of the results in Figure 4 suggests that majority of the respondents were employed in the informal sector. Having the majority of the respondents being in the informal sector was expected

since the trade and service industry is major driver of the informal industry as noted by the Ministry of Trade and Industry (2010). This as noted from the earlier findings could be attributed to the lower educational background of the respondents.

Further analysis in relation to the occupation of the respondents and their gender shows that majority of the males (66.7%) worked in the formal sector while majority of the females worked in the informal sector (59.1%). In other words, the proportion of the females who worked in the informal sector was about 25.8 percent higher than the proportion that worked in the formal sector. Figure 6 shows the graphical view of the findings.



**Figure 6: Gender of respondents across occupation**

Source: Field work, 2013

It is noted in Figure 6 that there were more males in the formal sector as compared to the females. This could be explained by the fact that majority of the males had higher

educational background than the females which is a key pre-requisite for working in the formal sector.

#### **4.3 Impact of rural electrification in alleviating poverty among residents of the Bawku district**

According to Cust, Singh and Neuhoff (2007), rural electrification represents a key driver behind economic development and raising basic standards of living. In this regard, this section of the chapter examined the impact of rural electrification in alleviating poverty among residents of the Bawku District. Specifically, the study investigated whether or not rural electrification has helped decrease poverty in the District. Table 4 shows the results.

**Table 4: Rural electrification has reduced poverty**

Response	Frequency	Percentage
Strongly disagree	11	9.6
Disagree	5	4.3
Agree	39	33.9
Strongly agree	60	52.2
Total	115	100.0

Source: Field work, 2013

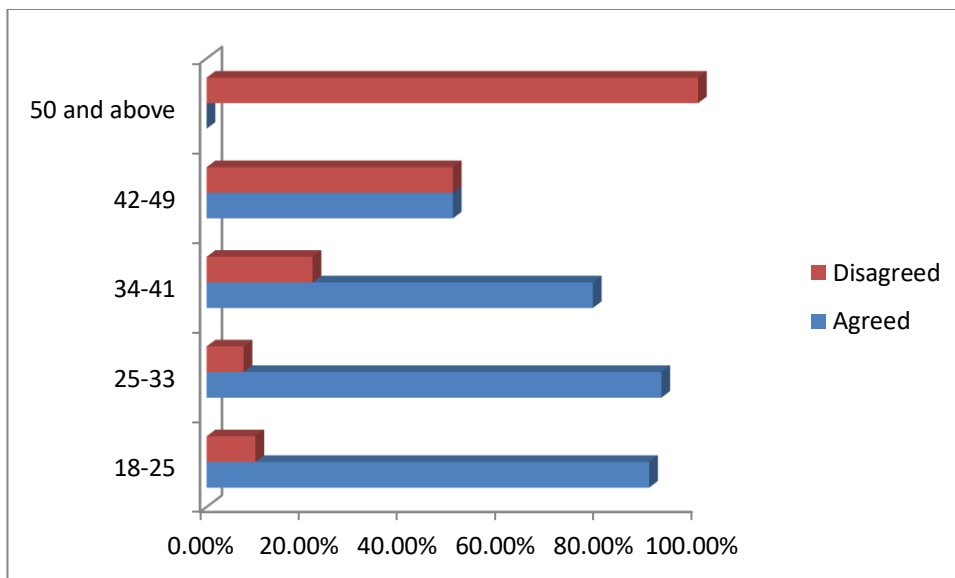
The analysis in Table 4 shows that a significant proportion (86.1%) of the respondents agreed that access to electricity has helped to decrease poverty in the area. This result is also consistent with the management of VRA and the District Assembly in Bawku.



It was noted from the interviews that rural electrification is the panacea to poverty alleviation since the proliferation of SMEs powered by electricity have created jobs for many residents to earn some monetary income to alleviate poverty.

According to World Bank (2001), efficient and clean energy supply is central to the reduction of poverty through many and varied linkages. This means that electricity supply to residents of the Bawku District plays a pivotal role in reducing poverty in the area. This could also explain why World Bank Group Energy Sector Strategies -WBGESS(2010) was of the view that achieving universal access to electricity is one of the most important goals set for the energy sector by governments in the developing world.

The study further explored whether or not the views of the respondents on access to electricity decreasing poverty differed across the demographics of the respondents. In relation to age, none of the respondent aged 50 years and above was of the view that access to electricity had decreased poverty in the area. However, there were mixed reactions among the respondents aged 42-49 years. Half (50.0%) agreed that access to electricity had decreased poverty while the other half (50.0%) disagreed. On the other hand, more than seventy percent of the respondents aged 34-42 years (78.5%), and ninety percent of those aged 26-33 years (92.5%) and 18-25 years (90.2%), respectively agreed that access to electricity had decreased poverty in the area. Figure 7 shows the graphical view of the results.



**Figure 7: Percentage distribution of whether access to electricity has reduced poverty in Bawku or not across respondents’ age**

Source: Field work, 2013

Further analysis shows that the views of the respondents in this regard was dependent on their age and that the youth considered access to electricity as a key determinant to poverty reduction as perceived by the elderly. This could be explained by the fact that the youth are energetic hence could use electricity in a number of income generating activities (IGA) to enhance their economic status, thereby reducing poverty.

There was however no difference in the views of the respondents on access to electricity reducing poverty across their gender as well as the sector in which they were employed. For example, while 87.1 percent of the males agreed that access to electricity has helped reduced poverty, 81.8 percent of the females also agreed. Additionally, while 81.8 percent of those employed in the formal sector also agreed in this regard, 88.7 percent of

those in the informal sector also indicated that access to electricity has helped reduced poverty in the area.

As part of examining the impact of rural electrification on poverty alleviation, the study further investigated whether or not rural electrification has helped lift the standard of living of the people of Bawku of which the results are depicted in Table 5.

**Table 5: Access to electricity has helped lift the standard of living of the people**

Response	Frequency	Percentage
Strongly disagree	8	7.0
Disagree	3	2.6
Agree	46	40.0
Strongly agree	58	50.4
Total	115	100.0

Source: Field work, 2013

A little over ninety percent (90.4%) of the respondents consented that rural electrification has helped lift the standard of living of the people. Thus the proportion of the respondents who agreed in this regard was about eighty one percent higher than the respondents who disagreed. This result was also supported by the key informants who participated in the study. According to the District Chief Executive Officer of Bawku:

*Rural electrification has improved the economic and leaving standards of the people with more settlements springing up in the District, thereby making the District economically viable*

This results concord with the argument of Bensch, Kluve and Peters (2010) who pointed out that rural electrification leads to improvements in the quality of life. This gives an indication that when there is electricity in a rural environment, the standard of living of the inhabitants would definitely improve.

The study therefore deduced that access to electricity has indeed raised the standard of living of the people. Poverty is a critical determinant of standard of living. Hence access to electricity rising the standard of living of the people could be explained by the fact that majority of the respondents were of the view that access to electricity had reduced poverty. Further analysis shows that through the access to electricity, the standard of living of both the married and unmarried had risen. Over ninety percent (92.1%) of those who had never been married was of the view that access to electricity had lifted the standard of living in the area as against 88.2 percent of those married.

The study further examined the specific ways through which access to electricity has enhanced the standard of living. The following means were noted:

- i. Women do not travel long distance to grind their food stuff such as maize
- ii. Reduce the cost of fuel
- iii. Expenditure on lighting is reduced

In relation to lightening, one of the respondents stated:

*Electricity has made most tailors spend the night sewing thus improving their standard of living*

Khatib (1993) argues that the lack of access to a reliable energy source is a major impediment to sustainable development in developing countries and to the harmonious progress of the global society. In this regard, the study investigated whether or not electricity has become a primary factor for development. Table 6 shows that results.

**Table 6: Access to electricity is indeed a primary factor for development**

Response	Frequency	Percentage
Strongly disagree	5	4.3
Disagree	2	1.7
Agree	35	30.4
Strongly agree	73	63.5
Total	115	100.0

Source: Field work, 2013

It is noted in Table 6 that over ninety percent (93.9%) of the respondents agreed that access to electricity is indeed a primary factor for development. According to the World Bank (2008), access to electricity is particularly crucial to human development which is consistent with the results of the study. The World Bank further stated that certain basic activities such as lighting, refrigeration, running household appliances, and operating

equipment cannot easily be carried out by other forms of energy. This means that with access to electricity, the respondents could have access to lightening; using electrical operating machines for their businesses among others, and this is indeed the primary factor for development.

As part of exploring the impact of rural electrification on poverty alleviation, the study also examined if access to electricity has reduced expenditure on fuel. The results are shown in Table 7.

**Table 7: Access to electricity has reduced expenditure on fuel**

Response	Frequency	Percentage
Strongly disagree	14	12.2
Disagree	8	7.0
Agree	28	24.3
Strongly agree	65	56.5
Total	115	100.0

Source: Field work 2013

Majority (80.8%) of the respondents admitted that the access to electricity has reduced their expenditure on fuel. For example, the key informants who participated in the interviews noted that sheabutter processors would now use electricity to manufacture their sheabutter. With electricity, they can use machines for the processing which would make it faster for them while spending less on fuel. This has brought about the migration from the

use of charcoal and firewood in businesses such as sheabutter to using electricity fuelling machines for the processing.

Access to employment through business creation is a critical determinant to poverty alleviation. In this regard, the study further investigated whether or not access to electricity has created many businesses thereby creating employment.

**Table 8: Access to electricity has resulted in the creation of many businesses thereby creating employment for households**

Response	Frequency	Percentage
Strongly disagree	7	6.1
Disagree	5	4.3
Agree	34	29.6
Strongly agree	69	60.0
Total	115	100.0

Source: Field work 2013

Majority (89.6%) of the respondents admitted that access to electricity has resulted in the creation of many businesses thereby creating employment for households. This suggests that many businesses especially those in the informal sector have sprung up in the Bawku area upon the accessibility of electricity. The creation of businesses through the accessibility of electricity has reduced the unemployment in the area.

The result on the creation of businesses was supported by the interview data gathered from management of VRA and the District Assembly. The area manager of VRA in Bolgatanga stated:

*Rural electrification has enhanced the creation of SMEs in Bawku: Through the use of electricity, the people have been able to set up small and medium scale enterprises which have dramatically improved their living standard. SMEs have sprung up rapidly in the area and almost everybody has something to do to improve their livelihood.*

The Area Engineer of VRA in responding to the relationship between rural electrification and the alleviation of poverty among the residents of Bawku West stated:

*Rural electrification becomes the driving force of large and small scale industries such as the processing of she abutter which provides employment to reduce or alleviate poverty among the residents.*

According to Barnes (2007), when electricity is used for powering home appliances, the immediate benefit as opposed to candle light comes through the promotion of extended hours of study which in turn contributes to better educational achievements as well as leisure benefits. In this regard, the study examined whether or not access to electricity has improved children's educational performance.



**Table 9: Access to electricity has improved children’s educational performance**

Response	Frequency	Percentage
Strongly disagree	3	2.6
Disagree	4	3.5
Agree	21	18.3
Strongly agree	87	75.7
Total	115	100.0

Source: Field work, 2013

Majority of the respondents (93.8%) admitted that access to electricity has improved their children’s educational performance. This result is also consistent with Khandker, Barnes and Samad (2009) comparative studies finding that villages with access to electricity have significantly better schooling outcomes.

The study also noted that the rural electrification impact on alleviating poverty in the following areas based on the views of management of VRA and the Bawku District Assembly:

- Improvement in communication: Electricity in the area has brought with it the use of mobile phones and more importantly the use of the internet.

According to the District Engineer of the Assembly:

*They are now able to connect to people from far and near and to transact business*

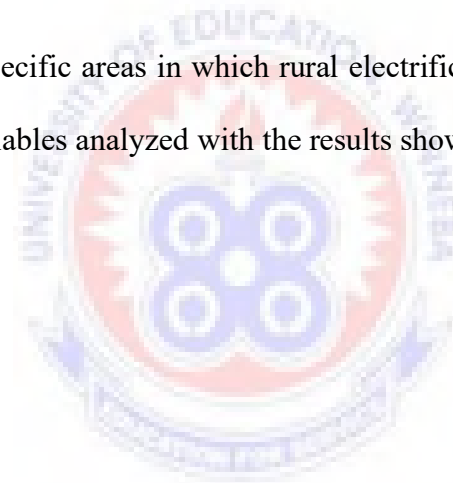
*through the mobile phone and the internet. It has exposed them to what goes on around them as well as from far places*

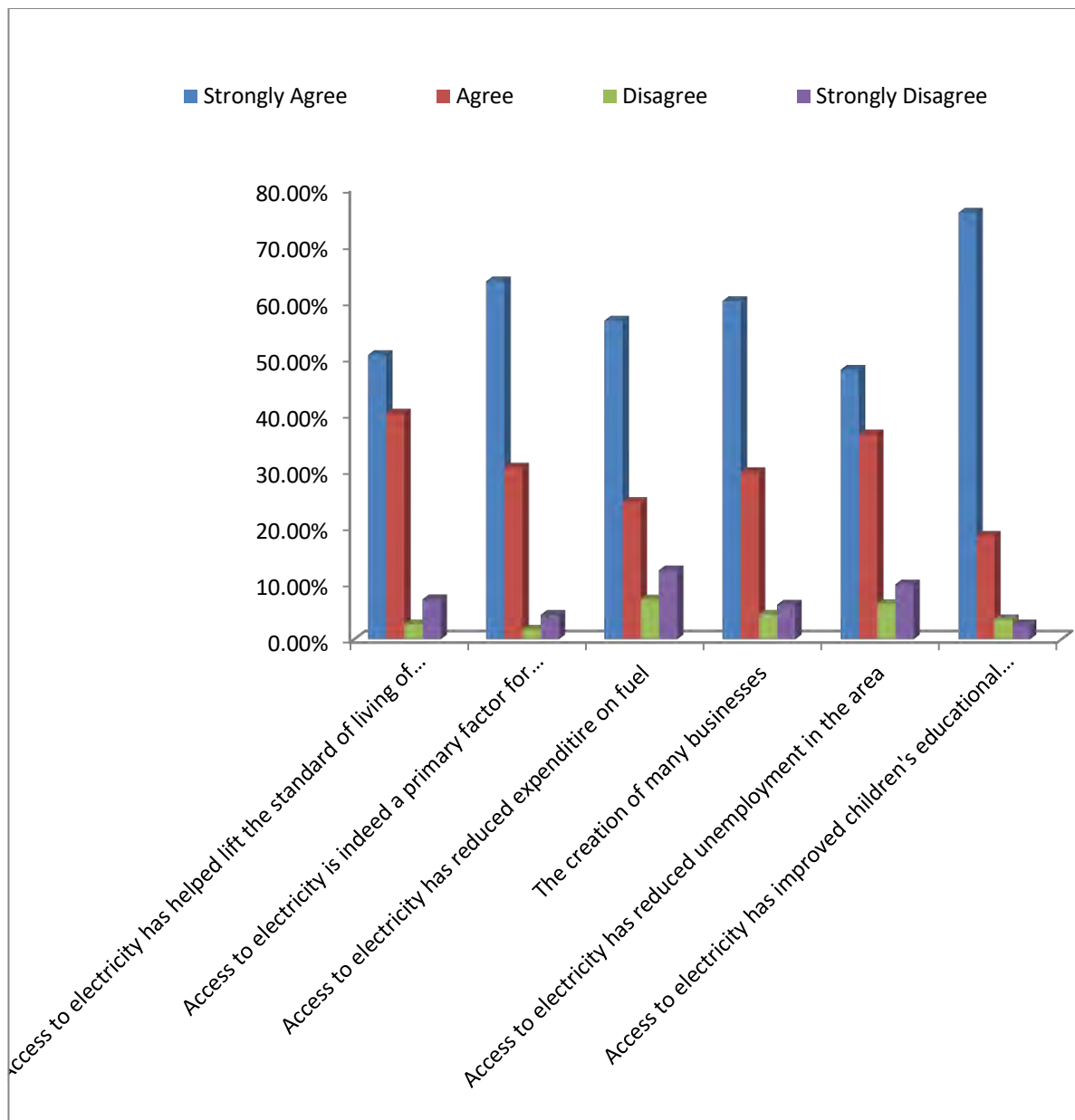
- Improvement in security: Electricity has helped curb the activities of robbers who take advantage of the non-availability of electricity especially at night to rob residents.

The District Chief Executive Officer stated:

*Additionally, more security personnel have accepted postings to the area because of the availability of electricity and are fighting crime in the area.*

To further explore the specific areas in which rural electrification reduce poverty, the study aggregated the seven variables analyzed with the results shown in Figure 8.





**Figure 8: Impact of rural electrification on poverty reduction**

Source: Survey data, 2013

It is noted that the major ways through which access to electricity has reduced poverty is the improvement in children’s educational achievement followed by the creation of many businesses thereby creating employment for households.

#### **4.4 Rural electrification's contribution to the creation of small to medium scale industries (SMEs) in the district**

According to Kjellstrom, (1992), there is evidence that access to electricity services in rural areas in the developing world has led to technological change in existing micro-enterprise. In this regard, this section examined how electricity has contributed to the growth of businesses as well as electricity being a major contributor to job creation in the area.

In this regard, the study investigated the type of business the respondents were operating in of which the following major businesses dominated among the respondents engaged in any business:

- i. Barbering/saloon
- ii. Beer bar operation
- iii. Corn milling
- iv. Electrical repairs
- v. Photocopying and printing
- vi. Driveling
- vii. Bicycle repairs
- viii. Trading

Micro-enterprises like retail shops, salons, restaurants and bars, wood processing, welding, depend on electricity services for lighting, refrigeration, entertaining customers (playing Radio, Music systems and Television), cooking, baking, shaft power, grain grinding and oil processing (Sawe, 2004).It is noted that in exception of trading, the

businesses of the respondents used electricity hence the study can conclude as noted earlier that electricity has created many small scale businesses in the District.

As part of analyzing the contribution of rural electrification to the creation of SMEs in the District, the study analyzed and discussed the extent to which electricity has contributed to the growth of businesses of respondents. The results are presented in Table 10.

**Table 10: Electricity contribution to growth of business**

Response	Frequency	Percentage
Very significant	83	72.2
Significant	42	36.5
Insignificant	1	0.9
Total	115	100.0

Source: Field work 2013

More than seventy percent (72.0%) of the respondents rated the contribution of electricity to the growth of their businesses as very significant while only 1.2 percent rated the contribution as insignificant. Thus a significant proportion of the respondent was of the view that rural electrification has significantly contributed to the creation of SMEs.

The Area Finance Manager of VRA stated:

*Power availability opens up the area to other businesses and people outside those communities, causing trading activities to triumph which significantly impacts on the creation of SMEs*

This suggests that the growth rate of micro-enterprises could be noticeably higher in areas with electricity services than in areas without electricity services as noted by Maleko (2005).

In this regard, the study explored in what specific way rural electrification has affected the operations of respondents' businesses. The following major findings were noted:

- i. Creating comfortable working environment through the control of the temperature which makes the business environment comfortable for customers
- ii. Increase in efficiency and speed hence generating much revenue
- iii. Increase in production as a result of the change in manual way of manufacturing creative arts items such as shoes

This is consistent with Smyth (1994) assertion that in rural areas of Indonesia, some shoes workshops changed from the use of manually operated machinery to electrical machines with an associated enhancement of productivity

- iv. Enhances convenience in undertaking business
- v. Makes communication with customers efficient through the mobile phone and internet

This implies that access to electricity services in rural areas has led to technological change in existing micro-enterprises as noted by Kjellstrom, (1992)

- vi. Makes security of the business center through night lighting
- vii. Reduce expenditure on other sources of power such as generator and batteries
- viii. Help to work over long hours in the night

However, the study also noted that rural electrification affects the micro-businesses in the following ways:

- i. Higher electricity bills making turnover from business low
- ii. Damages to business equipment when there is power surge
- iii. Loss of customers when there is power outages

Generally, an assessment of the positive and negative impacts of rural electrification on the creation of SMEs shows that the positive impact of rural electrification on the growth of SMEs far outweighs that of the negative impact.

Additionally, the respondents were asked whether or not electricity has been a major contributor to job creation in the area of which the results are shown in table 11.

**Table 11: Electricity has been as a major contributor to job creation**

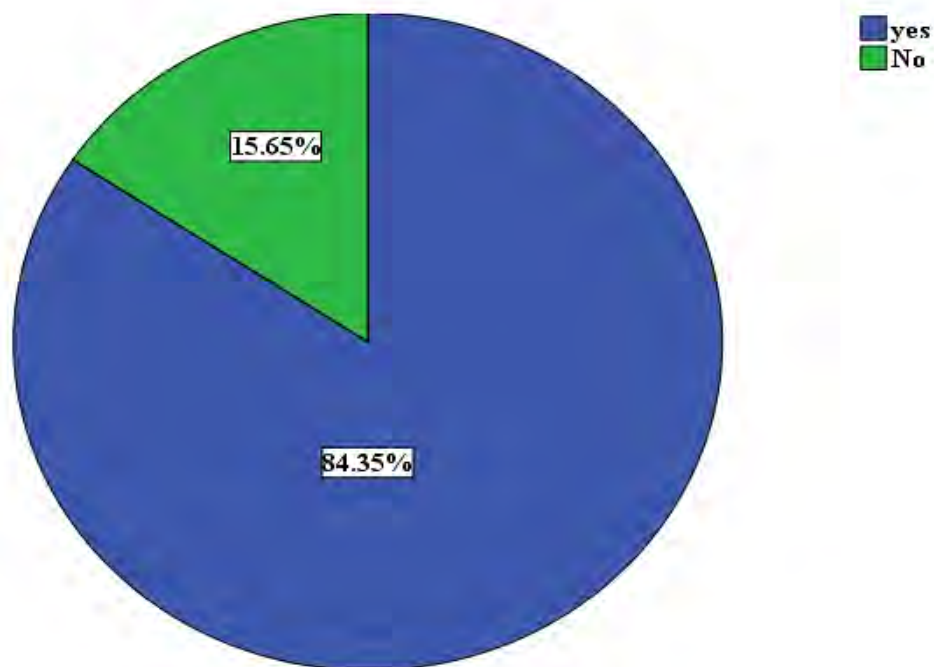
Response	Frequency	Percentage
Strongly agree 57	49.6	
Agree 45	39.1	
Not sure	10	8.7
Disagree	3	2.7
Total	115	100.0

Source: Field work 2013

Majority (88.5%) of the respondents admitted that electricity has been a major contributor to job creation in the area. According to Maleko (2005), rural and wholesale shops using rural electricity employ 848,630 persons in Bangladesh. Based on this, rural electrification has proved important by creating employment for those who cannot find work in other formal sectors and also creates additional income to the households who are engaged in both agriculture and micro-enterprises. This suggests that the establishment of micro-enterprises can make the informal sector grow very fast. The result implies that electricity has immensely contributed to the creation of job in the area thereby reducing unemployment.

Furthermore, the respondents were asked whether or not they had knowledge of any small scale enterprise whose creation was as a result of access to electricity in the area. The result area presented in Figure 9:





**Figure 9: Knowledge on creation of SMEs as a result of access to electricity**

Source: Field work, 2013

Figure 9 reveals that majority (84.35%) of the respondents knew of many businesses that have sprung up as a result of the access to electricity in the area. The Human Resource manager of VRA who responded to the study via the interview stated:

*Most of the SMEs in the District have been created as a result of the access to electricity and that there is a direct correlation between rural electrification and the creation of SMEs for the sustainable livelihood of the rural people especially the women*

#### 4.5 Challenges confronting rural electrification in the District

Generally, the electrification of rural areas is expensive. Capital cost is relatively high and revenues are frequently poor (Barnes 2007). This informed this section of the chapter to focused on the challenges confronting rural electrification in the District

Management of the Bawku West Assembly and VRA outlined the following challenges:

- i. Inadequate funds to extend electrification to other parts of the District;
- ii. Scattered nature of settlement makes it difficult to extend electricity to other parts that are far.

The scattered nature of the communities implies that there exist dispersed loads which requires long medium voltage lines or decentralized diesel power stations

- iii. Few resources are allocated to few communities in the area.
- iv. Reluctance of residents to pay electricity bills in the area.

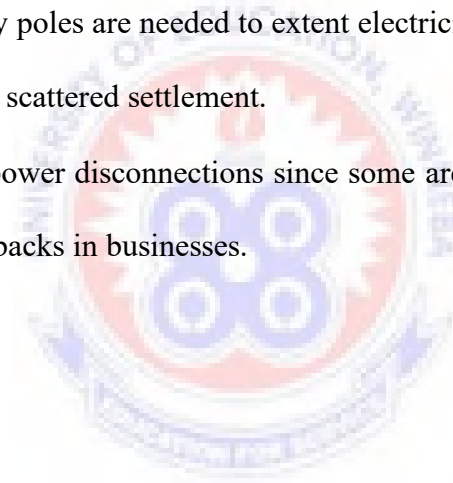
This could be attributed to the low income of the rural folks and the expensive billing procedures. Hourcade et al (1990) indicated that both investment and operation costs of rural electricity supply are always far higher than in urban areas because of expensive billing procedures and control of illegal connections

- v. Bush fire creation that burns electricity pole.

This could explain why Hourcade et al (1990) noted that line losses are often very high while the power system is prone to service interruptions in rural electrification

In relation to how these challenges affect the successful electrification of the District, management of VRA outlined the following:

- Allocation of resources for rural electrification becomes unbalanced as a lot of resources are used in very few communities to the disadvantage of other communities
- Prolong delays or non-expansion of electricity to communities
- Development in the area is unbalanced since some residents still do not have electricity.
- A lot of electricity poles are needed to extent electricity to those whose houses are so far because of the scattered settlement.
- There are many power disconnections since some are reluctant to pay their bills and this has led to setbacks in businesses.



## CHAPTER FIVE

### SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

#### 5.1 Introduction

This chapter presents a summary of the findings from the study as well as the conclusions, recommendations, and directions for future research. Thus, the chapter focuses on the implications of the findings from the study for policy making and future research. The recommendations are made based on the key findings and major conclusions arising from the study.

#### 5.2 Summary

The study analysed the challenges and prospects associated with rural electrification in the Bawku West District of the Upper East Region of Ghana with specific focus on the impacts of rural electrification in alleviating poverty among residents of the Bawku West District, whether or not rural electrification contributes to the creation of Small-to-Medium Scale Industries (SMEs) in the District as well as the challenges facing the electrification of the entire District.

In all, 123 respondents participated in the study. This was made up of 115 residents of Bawku and, four management of Bawku West District Assembly and four management staff of VRA in the Upper East area. Both questionnaires and interview schedules were used in the collection of data. Data analysis was performed using the Statistic Product and Service Solutions (SPSS), version 18 and Microsoft Excel.

The first objective of the study focused on the impact of rural electrification in alleviating poverty among the residents of the Bawku West District. The following major findings emerged:

- i. Rural electrification had a significant impact in alleviating poverty among the residents of the Bawku West District.
- ii. Rural electrification impacted on poverty reduction in the District by raising the standard of living of the people, reducing expenditure on fuel, creation of many businesses, reducing unemployment in the area and enhancing children's educational performance
- iii. The major ways through which access to electricity has reduced poverty is the improvement in children's educational achievement followed by the creation of many businesses thereby creating employment for households.

Rural electrification's contribution to the creation of small to medium scale industries (SMEs) in the District was the focus of the second objective with the following major findings:

- i. Rural electrification had significantly impacted on the creation of small to medium scale industries (SMEs) in the District
- ii. Generally, rural electrification impacted both positively and negatively on the growth of SMEs in the District. However, the positive impacts far outweigh that of the negative impacts.

- iii. Majority of the respondents were of the view that rural electrification has been a major contributor to job creation among the SMEs in the District
- iv. Specifically, rural electrification has positively affect the operations of respondents' businesses through the increased in efficiency and speed hence generating much revenue, increase in production, makes communication with customers efficient through the mobile phone and internet and reduce expenditure on other sources of power such as generator and batteries
- v. The study noted that rural electrification negatively affects the SMEs in the following ways: higher electricity bills making turnover from business low, damages to business equipment when there is power surge and loss of customers when there is power outages

In the third objective, the challenges confronting rural electrification in the District were examined with the following key findings emerging:

- i. The challenges of providing electricity to rural households in the District were manifold
- ii. Inadequate funds to extend electrification to other parts of the District
- iii. Scattered nature of settlement makes it difficult to extend electricity to other parts that are far
- iv. Reluctance of residence to pay electricity bills in the area
- v. Bush fire creation that burns electricity pole.

### **5.3 Conclusions**

The study concludes that rural electrification has had much positive effect on the residents of the Bawku West District. This is by decreased poverty, raising the standard of living, creating more jobs in the District thereby reducing unemployment as well as enhancing the academic achievement of children in school.

In relation to the creation of SMEs through rural electrification, the study concludes that rural electrification significantly impacts on the creation of SMEs. Also, rural electrification increase the growth of SMEs by increasing their production level, efficiency and speed, the generation of much revenue and creating the enabling business environment in a more secured transaction platform.

The study also concluded that in spite of the many benefits that electricity has brought to residents, there are still challenges that are confronting the connection of electricity to communities without electricity. The major challenge is the scattered nature of settlement which makes it difficult to extend electricity to other parts that are far as well as inadequate funds to extend electrification to other parts of the District.

### **5.4 Recommendations**

Based on the major findings from the study, the following recommendations are made for policy making:

- **Creating appropriate incentives for investors**

The government through the Ministry of Energy should create the needed incentives to attract investors for rural electrification. This can be achieved by creating a system of tariffs and subsidies that ensures sustainable cost recovery while minimizing price distortions

- **Rural electrification funding schemes**

Sufficient funds should be made available by government through the Ministry of Energy to help extend electricity to other parts of the District that have not yet been connected to the national grid. This can be achieved by the government and all other major stakeholders in the energy sector creating appropriate incentives for investors. The District Assembly can also raise funds for the extension of electricity through its internally generated funds (IGF).

- **Avoiding indiscriminate setting out of building structured**

The scattered nature of settlement makes it difficult to extend electricity to other parts that are far. In this regard, this study recommends that the Town and Country Planning Department of the District Assembly should regulate and supervise the manner in which building permits are issued to the residents.

- **Institutional Support**

The business objectives of electrical utility companies generally do not encourage them to invest in rural schemes with low levels of demand. In any case, they are rarely well placed to work effectively with rural communities in a supportive manner. In this regard, this study suggested that there is a need for institutional support of the electricity companies such as NEDCO, ECG at the national and local level, but most particularly at an intermediary level in extending electricity to the rural folks

- **Scope for cost reduction**

There can be considerable scope for reducing costs and improving the financial performance of electrification schemes. The initial cost of household connections can be reduced by a



number of means, such as simple wiring looms with connection boards. The cost of meter reading and billing can be reduced by means of simplified fixed (maximum demand) monthly tariffs. Tariffs should be such as to provide a reasonable return on investment

- **Education of residents**

Residents should be given education on the importance of electricity and how to use electricity effectively and efficiently in the home as well as for business. The education should cover issues such as illegal connections, low consuming electrical gadgets among others. The education should be carried out by government in conjunction with ECG as well as the District Assembly and the NEDCO.

Additionally, residents in the area should be educated on the need to pay their electricity bills since revenue accrued from electricity can be used to extend electricity to other parts that do not have electricity after operational costs have been taken care of. In enhancing high payment of electricity bills, post-paid meters should be changed to prepaid meters in order to reduce the non-settlement of electricity bills among the residents.

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**APPENDICES**

**APPENDIX A**

**CHALLENGES AND PROSPECTS ASSOCIATED WITH RURAL  
ELECTRIFICATION**

**INTERVIEW GUIDE**

**FOR**

**MANAGEMENT OF VRA IN BAWKU WEST DISTRICT: ZEBILLA DISTRICT**

**Introduction**

This study is designed for academic purpose. The study seeks to assess the challenges and prospects associated with rural electrification with specific focus on the impact of rural electrification in alleviating poverty among rural folks, the contribution of rural electrification to the creation of small-to-medium scale industries in the district, and the impact of rural electrification on the reduction of rural-urban migration through job creation in rural areas.

You are however assured that information provided to complete this questionnaire would be treated with the strictest confidentiality.

**Part A: Background characteristics**

1. Position in VRA.....
2. How long have you been working with VRA in Bawku?.....

**Part B: Impact of rural electrification in alleviating poverty**

3. In your view, what impact is rural electrification having on the residents of Bawku West in alleviating poverty?

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

4. What is the relationship between rural electrification and the alleviation of poverty among the residents of Bawku West?

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

**Part C: Impact of rural electrification on micro-business**

5. How would you relate the creation of SMEs in the district to rural electrification?

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



**Part D: Challenges confronting rural electrification in Bawku West**

6. What are the available sources of funding of rural communities in your district and what are the key stakeholders involved?

.....

.....

.....

7. Kindly outline any significant challenge (s) confronting the electrification of communities in the district?

.....

.....

.....

8. How do these challenges affect the successful electrification of the District?

.....

.....

**Part E: Recommendations**

9. In your view, what measures can be implemented to ensure that the prospects associated with rural electrification can be tapped?

.....

.....

**APPENDIX B**  
**CHALLENGES AND PROSPECTS ASSOCIATED WITH RURAL**  
**ELECTRIFICATION**  
**QUESTIONNAIRE**  
**FOR**  
**RESIDENTS OF BAWKU WEST: ZEBILLA DISTRICT**

**Dear respondent**

This study is designed for academic purpose. The study seeks to assess the challenges and prospects associated with rural electrification with specific focus on the impact of rural electrification in alleviating poverty among rural folks, the contribution of rural electrification to the creation of small-to-medium scale industries in the district, and the impact of rural electrification on the reduction of rural-urban migration through job creation in rural areas.

You are however assured that information provided to complete this questionnaire would be treated with the strictest confidentiality.

**Thank you in advance for participating in the study**

**Section A: Socio-demography data**

1. What is your Age?.....
2. What is your Gender?
  - a. Male
  - b. Female

3. Marital status

- a. Never married
- b. Married
- c. Divorced
- d. Widowed

4. What is your Highest Educational Qualification?

- a. None
- b. Primary
- c. Secondary
- d. Diploma/HND
- e. First Degree
- f. Second Degree
- g. Specify if others.....

5. What is your occupation?.....

**Part B: Impact of rural electrification in alleviating poverty among residents of the Bawku district.**

6. Below are a number of statements on the impact of rural electrification in alleviating poverty among the residents of the Bawku West District. Kindly indicate your where 1= Strongly Disagree and 4 = Strongly Agree

Statements	1	2	3	4
Access to electricity has helped decrease poverty in this area?				
Access to electricity has helped lift the standard of living of the				

people in this area?				
Access to electricity is indeed a primary factor for development?				
Access to electricity has reduced our expenditure on fuel				
Access to electricity has resulted in the creation of many business thereby creating employment for households				
Access to electricity has reduced unemployment in this area				
Access to electricity has improve our children's educational performance				

**Part C: Rural electrification's contribution to the creation of Small-to-Medium Scale Industries (SMEs) in the district**

7. Kindly indicate the type of business you are operating with electricity (**Only business owners**)

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8. To what extent has electricity contributed to the growth of your business? (**Only business owners**)

- a. Very significant
- b. Significant
- c. Insignificant

9. Electricity has been a major contributor to job creation in this area?

- a. Strongly agree
- b. Agree
- c. Not sure
- d. Disagree
- e. Strongly disagree

10. Do you know of any small/medium scale enterprise whose creation is as a result of access to electricity in this area?

- a. Yes
- b. No

11. Kindly indicate in what way(s) does electricity affect the operations of your business

- a. Positively.....  
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.....
- b. Negatively.....  
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**Part D: Recommendations and suggestions**

12. In your view, what measures can be implemented to ensure that the prospects associated with rural electrification can be tapped?

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