UNIVERSITY FOR DEVELOPMENT STUDIES

RURAL ELECTRIFICATION AND THE SHEA INDUSTRY IN THE BONGO DISTRICT OF GHANA

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BY

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DECLARATION

Student

I, the undersigned, hereby declare that the work contained in this dissertation is my own original work and that I have not previously in part or entirety presented it at any university or elsewhere for another degree.

Candidate Signature……..... Date……

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Supervisor

I hereby affirm that the preparation and presentation of the thesis was supervised in harmony with the guidelines on supervision of thesis laid down by the University for Development Studies

Principal Supervisor's Signature……. Date……

Prof. Agnes AtiaApusigah

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DEDICATION

To my beautiful wife, Mrs. Monica AbazeesiBasumah, who gave me all the encouragement and support I needed. Monica persevered on her own raising our kids, coupled with her own studies and working unremittingly to keep our family in good shape.

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ABSTRACT

This study ties access to rural electrification (RE) services with productivity and rural industrialization in Ghana. The benefit of grid-electricity is pivotal to rural economic growth. The increasing recognition of RE as a source of sustainable energy for agro-processing and MSE activities translates into productive use beyond lighting. This variance is embedded in the fact that RE access is woefully inadequate for productive activities among MSEs and agro-processing industries in rural areas. A vital case has been that if the MSEs have access to grid-electricity on regular bases in production centres, productivity will be enhanced and rural industrial growth expanded. Therefore, facilitating the provision of RE (i.e., grid-electricity) infrastructure is one sure way of modernizing processing activities in the Shea-industry in Ghana. Lately, the sheatree/butter industry has appeared as a hopeful economic product and has achieved international recognition as the second most important oil crop/industry in Africa after the palm nut tree. The shea nut is consumed as household food, used for industrial purposes and an important foreign exchange earning export. Thus, the potential of the industry has informed the study,which sought to assess the impact of rural electrification on the Shea processing industry in Bongo District of Ghana.

The case study approach was adopted using purposive, snowball and random sampling procedures in selecting respondents from six communities; Bongo Soe, Apatanga, Beo, Adaboya, Namoo and Dua in Bongo districts based on their similarities, accessibility of the Shea tree and consideration of RE access for Shea productive ventures. Respondents from the six selected communities included twenty (20) women beneficiaries of RE as well as ten (10) women non-beneficiaries of RE from each community, making a total of One Hundred and Eighty (180) interviewed. Data were analysed using descriptive statistics.

The main findings of the study are that RE contributed significantly in boosting production levels, improved marketability and promoted the mechanization and efficiency of the Shea industry in spite of some challenges in the study area. The critical challenge that restrained Shea-processors regular access to electricity in the Shea industry were the insufficiency of power supply, unaffordable power rates, high cost of maintenance as well as cost of appliances/machines. Important commendations from the study is that the Government and Electricity service providers to support women processors by providing regular and reliable power supply and other services such that they can improve their productivity and expand markets.

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ABBREVIATIONS

AEGCC	Advisory Group on *Energy* and Climate Change
CEPA	Centre for Policy Analysis
DA	District Assembly
DCD	District Coordinating Director
DCE	District Chief Executive
ECG	Electricity Company of Ghana
FAO	Food and Agriculture Organisation
GDP	Gross Domestic Product
GH₵	New Ghana Cedi
GNP	Gross National Product
GOG	Government of Ghana
GRIDCo	Ghana Grid Company
GSS	Ghana Statistical Service
IEA	International Energy Agency
IEG	International Evaluation Group
ILO	International LabourOrganisation
ISSER	Institute of Statistical, Social and Economic Research
M&E	Monitoring and Evaluation
MDG	Millennium Development Goals
MoFA	Ministry of Food and Agriculture
MSE	Micro and Small Enterprises
NBSSI	National Board for Small-Scale Industries

NDPC	National Development Planning Commission
NED	Northern Electricity Department
NES	National Electrification Scheme
NGO	Non-governmental Organisation
NREL	National Renewable Energy Laboratory
OECD	Organisation of Economic Cooperation and Development
SD	Skills Development
SNV	Stichting Nederlandse Vrijwilliger
SSA	Sub Sahara Africa
SSI	Small Scale Industries
UNDESA	United Nations Department of Economic and Social Affairs
UNDP	United Nations Development Programme
UNIDO	United Nations Industrial Development Organisation
VRA	Volta River Authority

GLOSSARY

By Day: Sale of labour for instant cash

Pito: local name for the local beer brewed in Ghana

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Electricity services provision to rural communities is believed to transform their quality of life and living conditions by helping to stimulate economic growth and inure social benefits that are expected to lead, ultimately, to enhanced social equity, rural employment and conducive environment for the achievement of the MDGs (Modi, 2005; UNDESA, 2007). The phenomenon of expanding access to electricity for rural people has been found to contribute to alleviating energy poverty and improving rural people's quality of living, but what is not obvious is how effectively and to what extent Rural Electrification translates into sustainable development. For instance, the expansion of productive sectors such as agriculture, agro-processing, micro-enterprises and/small-scale industries, are expected to generate rural employment and increase incomes and thus impact on socio-economic conditions by reducing poverty, improving public services and the health of women and children, and appreciably improving gender relations through reduced manual labour/workloads of rural populace (Kapadia, 2003).

Historically, electrification has supplied industry with cheaper and cleaner power and thus brought many benefits to society. It thus plays a pivotal role in socio-economic development and especially of rural population; socially, environmentally and economically. Until now, the poor in society could not relatively afford electricity and consequently benefited little from the said advantages electricity contributed to society and development. Yet, the fact that today billions of people lack access to the most basic energy services, as adduced by Saghir Jamal (2005), is worrisome. Saghir explains that about 1.6 billion people in the world lack access to electricity; and 2.4

billion people rely on traditional biomass fuel for cooking and heating. According to the International Energy Agency's (IEA) World Energy Outlook (2013), more than 1.2 million people worldwide did not have access to electricity in 2011. Almost all of them live in developing countries (i.e., 1,257,000 out of 1,258,000), with Sub-Saharan Africa being the most region affected by the lack of electrification.

Developing countries in this light are still struggling to maintain existing supply, and to make electricity more broadly obtainable particularly in rural and remote areas. These economies face problems such as institutional flaws, lack of capital, uneconomic tariffs, and unacceptable technical and managerial performance, thus leaving African governments unable to put in place relevant structural reforms geared towards electrical infrastructure for intensive industrialization.

Traditionally, like other developing countries, Ghana's rural sector lacks adequate access to electricity services for rural household and productive ventures which can potentially contribute to the growth of Ghana's industrial sector. It is for this reason that the service sector over the years has seen a tremendous rise above all other sectors. The rise has been dominated by small-scale trading often clouded by "buying and selling" as traders engage principally in imported merchandise and small agricultural produce. Ghana's economy therefore continues to face important growth constraints and risks which have to do with infrastructure gaps, low agricultural productivity, a challenging investment climate as well as the need to sustain macroeconomic stability by improving public sector efficiency and maintaining prudent fiscal management (GoG, 2006). These are thorny factors to the much desired structural transformation in the agricultural and industrial sectors. However, power to

drive the economy remains key among them. Thus this study seeks to establish the linkage between rural electrification and the Shea industry in the Bongo District.

1.2 Problem Statement

Electricity is the backbone of socio-economic development of any country and is associated with the provision of numerous services to people from diverse backgrounds which directly enhances their quality of life. There is little doubt that access to and utilization of electricity is beneficial to people's daily endeavours, not only in the current electricity-dependent world but also in developing rural areas. While electricity may not bring development on its own it is a highly desired commodity and a prerequisite to rural development in long term perspective. In the first industrial countries massive electrification was initiated in the 1880s, to be completed only decades after the World War II; a huge effort backed by powerful institutions (Ahlborg, 2011). The challenge in this trajectory had been to spread the same technologies in emerging economies with often very different institutional, cultural and financial conditions. One such region is Africa and in Ghana particularly where the electrification level is diminutive, especially in rural areas (Ahlborg, 2011). It is generally accepted that electrification improves the quality of life of the people at the household level, opens up rural enterprises and thus stimulates the entire economy at a broader stratum. In spite of its relevance to Ghanaian industrial economy, electricity services have remained the single most dominant factor that continue to retard the ardent growth of a rather vibrant small scale industrialization process which is potentiated to cause a dramatic turn in the staggering economy of Ghana. The inadequacy in connectivity and access to grid-electricity service makes electricity unreliable, with less likelihood of utilizing contemporary electrical appliances, such as gas cookers, welding kits, fridges and machinery which may pave the way for small

and rural industries. There is also no suitable lighting to sustain long business hours and augment businesses such as bars, fashion and retail shops, which often have the potential to reduce the number of customers. Ghana rural economy's unyielding effort to grow is a result of continuous lack of adequate access and use of electric energy for productive purposes for rural home based/small to medium scale business enterprises.

Despite the provision of electricity to populations living in rural areas, many rural areas especially in the Upper East Region have not yet achieved the universal electricity coverage set by the National Electricity Service (NES) of Ghana and even in areas where the rural electrification program have been rolled out fully, a huge section of the population still have access as well as affordability issues, which adversely affects a large percent of small scale industries (micro-enterprises) in rural Upper East. According to Saghir Jamal (2005), about 1.6 billion people in the world lack access to electricity; and 2.4 billion people rely on traditional biomass fuel for cooking and heating. Also (IEA) World Energy Outlook (2013), reports that many of the world's population rely on the traditional use of biomass for cooking, which causes harmful indoor air pollution. These people are mainly in either developing Asia or sub-Saharan Africa, and in rural areas.

Thus the absence of electricity access leads to increased use of solid fuel which is usually combusted in inefficient cook stoves, producing a variety of health-damaging gases and particles (Smith, 2001), such as black carbon (BC), organic carbon (OC), methane, and carbon monoxide. Approximately 2.8 billion people, more than ever before in human history, use solid fuels, including wood, coal, charcoal, and agricultural residues, for cooking/heating which are usually burned incompetently, resulting in considerable emissions of air pollutants that affect humanity and health prospects (Bonjour, 2013). This is also supported by the 2010 Global Burden of

Disease/Comparative Risk Assessment Project which estimated that exposure to household air pollution from cooking with solid fuels caused 3.5 million premature deaths in 2010 (Lim, 2012).

There is thus far-reaching evidence (Lim, 2012) that in-door air pollution is strongly linked to the lack of adequate access and use of electric energy by rural people and entrepreneurs leading to the use of kerosene for lighting, cooking and for micro-processing activities which impacts negatively on human health, especially among children. It is not thus surprising that this kind of emission accounts for about seven percent (7%) of annual global black carbon emissions.

The Government of Ghana together with some multilateral agencies/donors have played a vital role in the provision of electricity to rural areas in a bid to stimulate human, social and economic development in the country but the effort has still not yielded the desired goal, leaving a huge rural electrification access deficit in engendering rural enterprises growth, especially the Shea industry and this is seen as a disincentive to creating sustainable and productive economic activities. Inadequate access and the lack of productive use of RE is thus doubtful in creating opportunities and stimulate the growth of small-scale industries in rural areas. As anticipated per World Bank (2008) estimates; well designed, carefully targeted and effectively implemented rural electrification programs will have the potential of opening up opportunities for low income rural people especially women to increase their incomes and thereby accelerate rural development.

In the light of intensified Rural electrification programmes embarked upon by governments in SSAs and in particular Ghana, to ensure the boost of the rural economy, enormous gaps still exist which hinder the achievement of these said goals and in view of the huge capital resources invested in the Ghana Rural Electrification

programme to expand SSIs/rural industrial economic activities among rural entrepreneurs especially women; it will therefore be appropriate to find out if the efforts of these programmes have yielded any significant result.

1.3 Research Questions

The study was guided by the following research questions.

1.3.1 Main Research Question

How has ongoing rural electrification impacted on the Shea industry using the Bongo District of the Upper East Region of Ghana as a case?

1.3.2 Research Sub-questions

1. How has the expansion of rural electrification impacted on the production activities of the Shea-industry?
2. How has rural electrification services affected the marketability, mechanization and efficiency of the Shea industry?
3. What are the main constraints affecting the Shea industry?
4. How might rural electrification be rechanneled to better serve the Shea industry?

1.4 Research Objectives

1.4.1 Main Research Objective

Assess the impact of rural electrification on the Shea processing industry in Bongo District of the Upper East Region.

1.4.2 Specific Objectives

The specific objectives were to;

1. Examine how the expansion of rural electrification impacted on the production activities of the Shea-industry in Bongo District of the Upper East Region

2. Determine how rural electrification has an effect on the marketability, mechanization and efficiency of the Shea industry in Bongo District of the Upper East Region.

3. Examine the constraints of the Shea-nut industry in accessing and utilizing the ongoing rural electrification promotion initiative and make recommendations for improvement

1.5 Hypothesis

Null Hypothesis: Rural electrification has no positive impact on the Shea industry in Bongo District of the Upper East Region.

Alternative Hypothesis: Rural electrification has a positive impact on the Shea industry in Bongo District of the Upper East Region.

1.6 Significance of the Study

The overall purpose for the research is to illuminate and assess the impact of Rural Electrification (RE) on small scale industrialization with particular focus on the Shea industry and the benefits accruing from being connected to the national grid. The research is focused, for analytical and possible policy direction, in the Upper East Region which has potential economic benefits to rural communities in terms of growth and sustained development in the Region.

The results of this study may contribute to the development efforts of practitioners, especially Municipal and District Assemblies, NGOs, energy service providers and

financial institutions who are involved in the design and implementation of micro-level poverty reduction and local development interventions.

For the sustained growth of the Shea-industry, there is the need for all District Assemblies and Municipalities in the Upper East Region, especially in the Bongo District, to assess and find out the prospects of the Shea-industry and also determine how best the sector can be developed to support livelihoods of women. Findings from this study could provide input for the preparation of support initiatives for women in district development plans and programmes. These commendations can be used by policy makers in their strategic planning and implementation of development policies towards the Shea-industry. This would also prompt other investigators and researchers who may want to conduct further research into the Shea industry and similar issues in future.

It is on this score that the study has focused on the inadequacies and limitations of grid-electricity services in the Shea processing enterprise, as well as fills identified data gaps. It also can pave the way for more studies into the Shea industry in order for a holistic development of the sector as a viable indigenous enterprise to supplement the income of households and entire rural communities.

1.7 Limitations of the study

In spite of the methodological credentials associated with a case study, the research findings of such a study could not be universalized. Moreover, the researcher was faced with financial and time constraints in undertaking such an important study. Due to financial and logistical constraints, visit to all Thirty-six communities within the Bongo Districts was highly impossible. Thus the study was conducted in selected six communities in the Bongo District of the Upper East Region and not the entire Bongo

district of the Upper East region and country at large; therefore, the study has been limited in scope.

1.8 Organisation of Study

The thesis is organized in five chapters under the broad headings as Introduction; Literature Review; Methodology; Results and Discussion and; Conclusion and Recommendation. Chapter 1 gives a background of the thesis, the problem statement, justification of the study and sets out the main and specific objectives to allow readers get a better understanding of the topic. In Chapter 2, a review of the existing relevant literature on the theme of the study is presented based on available documents on potential roles of RE and its impact on the Shea-industry. It is on the basis of these apparent RE benefits that the field research design was founded and empirical evidence collected. Chapter 3 outlines the methodology employed to accomplish the objectives of the study. In Chapter 4, the results and discussion of the study are presented. Finally, the conclusions of the findings and recommendations on the study are made in Chapter 5.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

Electrification of rural areas in developing countries is multifaceted; hence, its operation requires dedication and objective forecast in order to realize impacts on rural industrial development and energy needs in general. Recent studies show that more than 1.6 billion people in the world are without electricity; majority live the in rural areas of the developing world, where efforts to provide access remains rather slow (Barnes, 2012).

Although rural electrification (RE) forms an imperative of the economic infrastructure of an economy, most developing countries do not make this a priority. In various parts of the world, RE has been triumphant in stimulating industrialization and economic progress. Electricity is therefore a major input that fuels socio-economic development in view of the fact that its provision is crucial for improving industrial productivity as well as fostering social activities (United Nations, 2005).

In this chapter, however, a review of relevant literature to this study is done. The study focuses on the theoretical and conceptual issues within the energy (including Rural Electrification) and industrial development discourse with reference to the core issues of the studies. The literature on rural electrification encompasses issues on electricity access and affordability; problems and challenges; the institutional dimensions; socio-economic and environmental impacts on Small-Scale Industrialization, and women empowerment. This chapter also highlights some of the important issues discussed in various international papers, journals and books that the author finds pertinent to this study to reduce the gaps.

2.1 Conceptual and Theoretical Issues

2.1.1 Rural electrification

Basically, the concept of rural electrification refers to the electricity supply to areas outside of cities. Scholars argue 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 is also noted that the classification of urban and rural areas based on statistical data, disregards specific features and opportunities of both areas. One of the consequences of these differences in appreciation is that a comparison between rural electrification projects in different countries is extremely difficult if not impossible. Towns and villages with populations of over 250 were not considered rural with isolated loads of over 100kVA maximum demand. After some time, this definition led to the peculiar situation where the areas surrounding villages were electrified while the villages, with over 250 inhabitants, had no electricity or had to rely on inadequate local generation. A redefinition of the concept of 'rural' was needed. Thus, in the context of this study "rural electrification" encompasses the activities designed to provide people with access to electricity in those areas which show specific features, which do not only include low loads and the need for particular approaches as recommended by Mason, but also area specific opportunities. The method of bringing electricity to these areas can be very different including isolated generators serving a single or several consumers, supply from a regional or national grid, and solar home systems. It is also observed that the methods can vary, depending on local circumstances and the degree of saturation of the electricity supply.

2.1.2 Electricity Access and Rural Industry Development

Access to modern forms of energy in general and electricity in particular to rural economies, especially those of developing countries, has gained substantial interest. Rural electrification is well recognized as one of the important pre-requisites in uplifting the living standards of geographically and economically disadvantaged communities in developing countries. Energy is essential; 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. An improvement in the living conditions as well as satisfying the basic needs of rural people as the case of women in the Bongo District can be an instrument of change and an increased socio-economic independence. This could be especially so for those engaged in the Shea industry, when propelled by the promotion of small-scale industrial activities. Research has revealed that in many developing countries, industrial employment can often be found in small-scale firms and industries in rural areas.

In the above perspective, it is affirmed that adequate provision of rural electrification services, infrastructure and technology has a decisive influence on the growth of small scale industries. This can only be realized if modern forms of energy, particularly electricity, are available. The scenario of Ireland is a clear example where a developed rural industrial sector had led to manufacturing of more refined products as a result of the institution and injection of electricity service into the rural economy.

Rural development programmes usually aim at an improvement in infrastructure, particularly to inspire indigenous industrialization, agricultural production, agro-processing and social services such as health care and education. But rural development policies have the tendency not to include electrification. Thus, in spite of

the availability of electrical energy, there are very few development projects that include a clear view of how and where as well as to what extent electricity could be utilized within the activities of rural development. For instance in the agro-industry in the Bongo District over the years has missed electricity supply, the apparent reason been lack of desired industrial development especially in small scale manufacturing sector. As a rural and poor District endowed with Shea, cereal crops and rocks, electricity could have been a sure way to small scale industrialization. However, the lack, poor or low access to electricity has left these potential industries to continue to wallow in deprivation. The inadequate infrastructure to aid the growth of productive ventures by entrepreneurs continues to compound their situation.

Although adequate energy provision is not the only relevant factor in rural development, it is one of the prerequisites for improved agricultural and rural industrial productivity. Thus, Barnes (2012) established that in households with electricity, people have enhanced chances of undertaking activities that require higher levels of lighting as opposed to households with no electricity. Modern energy, particularly in the form of electricity, in combination with other essential conditions can help raise industrial output by promoting innovation and improving quality of industrial products. Electricity, in particular, has also a vital role to play in improving living standards through satisfying the basic needs of rural households such as lighting. Improved energy supplies can also enhance the success of programmes related to water supply, health care, education, marketing of industry products and so forth.

2.1.3 Energy and Development

The relationship between “energy” the ability to transform a system (Smil, 2008a) and “development” as a process of material improvement or an improvements in well-

being, living standards and opportunities (Edelman & Haugerud, 2007) have been the subject of scholarly debate for decades. According to Carbonnier (2011), some scholars hold the view that the link between energy and development dates back to some 5000 years ago. Some of these scholars (who belong to the development school of thought) try to establish the link between energy and economic development and human wellbeing by analysing the relationship between the exploitation of the various sources of energy and the economic development (particularly the stages of development). Their analyses led them to believe that human history could be divided into periods based on the kind of energy used (Wilk, 2002).

Netting (1993) notes that the discoveries and inventions that tapped larger sources of energy were the prime engines of change providing not only more material goods but a higher standard of living. It is this line of thinking that humankind has employed two strategies in their quest to develop. First, we harnessed powerful forces of nature, brought them under their control, and made them to work for them. Second, we harnessed energy using new technologies and also by improving the efficiency of old ones (Wilk, 2002).

Some scholars of the development school of thought believe that the use of technology for exploitation and utilisation of energy for development account for the differences and diversities in societies across the globe (Carbonnier, 2011). Such scholars have tried to establish the link between energy and stages of a country's development by analysing the relationship between the exploitation of the various sources of energy and the development that is associated with it. Toman and Jemelkova (2003), have tried to advance the concept of energy and development arguing that energy development is an increased availability of energy in quantity and quality and is central to the theory of economic development.

In another vein, (Toman & Jemelkova, 2003) in a conceptualisation of energy and development, contend that increased availability of energy is a key stimulus of economic development at every stage of the development ladder. They pointed out that at the lowest level of economic development, energy sources tend to come from biological sources (wood, dung, sunlight for drying). Economic activities carried out by humans also tend to be humanly powered. Energy at this level remains abundant and cheap in terms of cost. At the intermediate stage of economic development, the sources of energy tend to come from processed bio-fuels (charcoal), biogas, animal power and some commercial energy. Energy production begins to undergo stages of development aided by technology which helps to deliver energy in the form, desired by industry. At the more advanced stage of economic industrialisation and development commercial fossil energy (gas, coal, oil, nuclear) and ultimately electricity become the predominant source of energy.

Thus, from development theoretical strand energy in the form of electricity is crucial to human society and any inadequacy of it, reveals a challenge that has to be addressed for the progress of any community and her populace. It has been argued further that, all things being equal, societal change is impossible if there is little or no access to electricity (Omorogbe, 2011).

According to Carbonnier (2011), the industrial revolution occurring in the 19th century unquestionably preserved the link between energy and development. Grinevald (2007) in his description of “thermo-revolution” stated that the developmentalists argue from socio-epistemological and anthropological position that the industrial revolution would not have occurred without the twin pillars of energy and technology (Carbonnier, 2011). This further explains why after the Second World War, the development of complex technologies combined with oil, gas and electricity

has further deepened transformation of societies and brought the entire human race into one global village.

2.1.4 Power Sector Reforms and Rural Electrification Causality (PSR)

Proponents of PSR such as the World Bank argue that reform would bring about improvements in the power sector by availing more resources to RE (Wamukonya, 2001). Liberalisation in the electricity industry would likely introduce new private players in the market with potential for competition, increased investment and introduction of new management and technical skills and further stimulate innovations particularly in the approach to rural electrification and the application of cost-effective technologies.

With regard to regulation, proponents of PSR argue that independent regulation of the power sector facilitates transparency, public participation and fair rules for all stakeholders (Wamukonya, 2001). Reforms further provide an opportunity for policy makers to change institutional arrangements that have failed to facilitate increased access to electricity in rural areas in the last two decades. For instance, utilities as agents for RE have limited capacity to integrate RE with end-use demand enhancing components such as micro-business development and social entrepreneurship in rural settings.

On the other hand, liberalisation and unbundling could also fragment the market, leading to loss of economies of scale and scope required for system expansion to rural (Wamukonya and Davis (2001). In addition, liberalisation could increase bureaucracies and transaction costs for rural electrification projects. Commercialisation, privatisation and independent regulation could lead to increased tariffs. Commercialised and/or privatised utilities are also not interested in supply of

electricity to non-profitable rural areas, which rather aggravate the sufferings of the rural entrepreneur who would want to venture into small scale enterprises such as in the Shea industry.

2.1.5 Electricity supply and energy services

The important function played by the SSI sector of an economy will largely be possible if industries have access to energy for their operations (AusAID, 2001:2). Thus, the continuous supply of human needs by SSIs chiefly depends on sustainable and affordable energy supplies for industrial operations. In the view of Oviemuno (2006:1), one of the pre-requisites for the development of the SSIs, is affordable and abundant supply of energy, particularly, electricity for driving industrial' machinery. This underscores the fact that industries are the main users of any country's supply of energy. Oviemuno claims that it is due to the significant function energy plays in the development of industries that entrepreneurs always stress on the provision of affordable and reliable electricity for production. Thus, the availability and reliability of energy (electricity) for industries in a country determines the level of development of the country in question. This is evident in the high quantity of energy consumed by the developed countries relative to that of the developing world as developed countries are developed mainly because they consume higher amount of energy (AusAID, 2001:2). In contributing to the significance of energy (electricity) to the development of the manufacturing/SSI sector, the NDPC (2007) points out that the first Government of Ghana sought to build the Akosombo Dam to supply electricity to drive her import substitution industrialisation policy. Additionally, the Centre for Policy Analysis CEPA (2007) and the MoFEP (2008) reveal that due to the power rationing exercise in Ghana, the SSI sector's contribution to GDP limped from 9.5 per cent in 2006 to 7.4 per cent in 2008. Unreliable electricity supply in Ghana is

consequently ranked first among 13 problems identified to affect the SSI sector (NDPC, 2007). Thus, the supply of energy for socio-economic development is indispensable. Oteng-Adjei (2008: 103-115) sums up the link between energy and the development of SSIs by remarking that "most economic activity would be impossible without energy, even the small-scale village and household enterprises in developing countries that are the main source of income for the poor in those countries." Since electricity is said to be the major tool for national development, Ghana made stringent efforts to provide adequate and affordable electricity for the development of industries and to ensure that industries have access to reliable and affordable electricity in Ghana (NDPC 2008). In terms of supply, electricity in Ghana has thus gone through a period of evolution since the colonial era to present day Ghana. According to the Institute of Statistical, Social and Economic Research (2005:16), electricity provision in Ghana has progressed through three stages identified as: "the before Akosombo", "the hydro-years" and "the thermal complementation."

However, with new approaches to electricity supply, perception of the electricity system itself has changed. The initial picture of the electricity sector focused mainly on the supply side, by describing the conversion of primary energy resources into electricity, and its subsequent transport and distribution to the user. In contemporary understanding, however, the user does not need electricity itself, but the services that can be derived from its use. Most electricity services thus require specific appliances which, in most cases, could be electrical, and can be bunched into the following five groups: lighting; heating (cooking, space/water heating, process heat); cooling (of space, food or medicine); mechanical power (for transport and stationary machines); information and communication technologies (ICT). It is thus difficult to define the quality of electricity services (e.g. a 'sufficiently' illuminated or heated space, or

'sufficiently' cooked food) in an objective manner, as this perceived quality strongly depends on the expectations of the user as well as the way the service is used. Nonetheless, electricity and electrical appliances are usually considered to be comfortable, clean, comparably cheap, and universally usable. They deliver also services that cannot be provided by other means, especially ICT-services. Electrical appliances therefore compete with, and can substitute for, fuel-based appliances. But the reason to switch from fuel-based to electrical appliances includes other aspects beyond perceived service quality and the convenience and safety of their use. In particular, their investment and operation costs, and the availability and reliability of both the appliances and the electricity supply, not forgetting measuring the services via inputs rather than outputs which can significantly mask the enormous efficiency gains which have historically characterized technological change in energy end-use applications (from candles to white diode lighting, or from horses to electric vehicles), and which generally go unnoticed in long-term estimates of economic productivity and welfare growth.

2.1.6 Impact of Electricity on Income Generating Activities

It is an undisputed fact that electrification augments peoples' incomes and livelihoods in a number of ways. By stimulating employment and income generating activities, beneficiaries build or expand their agro-processing activities and achieve better revenues to continue being in business. Extra electric lighting and small-scale processing activities are made possible by the use of improved technology/innovation facilitated by electronic gadgets/machines, likely to reduce women's labour and as well, create other opportunities to set up more small-scale industries or firms. In common, one of the underlying dilemmas of rural enterprises in developing countries

is that electric machinery potentially replaces labour that is comparatively cheap and potentially beneficial for users of motive power.

There is also confirmation that access to electricity services in rural areas in the developing world has led to technological change in the income generating activities of existing SSIs. For example, in Philippines, many ME's activities transformed their technical and economic efficiency by going over to modern technology powered by electricity. The key question therefore is: "Do electricity services play an important role in stimulating SSIs development in rural areas?" There is not a lot of empirical evidence to support the argument but Rana-deuba, (2001) cited by Meadows, (2003), cite an example from Nepal which shows that increased access to electricity has resulted in and contributed to the establishment of SSIs like bakeries, photo studios, grocery stores, and saw mills, in addition to agricultural activities such as poultry farming and goat keeping.

One study that really makes a clear distinction is by Prasad and Dieden (2007). They stated that growth in income generating activities principally resulted from businesses already connected to electricity. In their study of household data over a period, they examined the impact of electrification on the development of micro, small and medium sized industries and those in self-employment among households to estimate that between 40% and 53 % of the increase in small-scale industries' activity was attributable to the extension of the electricity grid. They intimated that small-scale industries growth was higher among those already connected and that, in the more remote rural areas the up-take did appear to be stronger. Kirubi, C., Jacobson, A., Kammen, D., & Mills, A. (2008) in his work in Kenya, reaffirm that electricity enables the use of electric power tools and equipment which results in increased productivity of industries studied, such as retail shops, grain mills, petrol garages,

welding and carpentry businesses. In addition, SSIs activities such as beauty parlours, photocopying, ice making and battery charging in Indonesia came into existence after electrification. In rural Peru, a similar experience of the growth of new retailing SSIs was observed and there was a definite positive correlation between use of electricity and the surfacing of new commercial establishments (Rogerson, 2007). In Brazil and Mexico, the spread of electrification into rural areas stimulated the expansion of rural SSIs activities through subcontracting, particularly of clothing and textiles production operations. Evidence of the impact of electricity from Elandskraal, Northern province in South Africa also points out that electricity has a potential input for upgrading the condition of the ME's economy (Rogerson, 2007). However, in all these studies, firm conclusions have not been drawn to be able to access the impact that rural electrification has had on income generating activities. There are equally some studies that provide a more negative view of the link between the growth of small-scale industries (SSIs) and grid-electricity. Wamukonya and Davis (2001) study in Namibia for instance reported that electrification did not have a significant impact on the growth of income-generating activities in rural areas. They found that the share of households with home-based income generating activities was highest among households without electricity. In their study home-based activities included basket weaving, cake making and welding. Few home-based enterprises used electricity except for lighting. All the businesses that used electricity started before electrification. The source of electricity, whether from grid or solar powered energy, did not influence the overall findings. Further, in a more narrowly focused study on the effects of lanterns for lighting, Adkins (2010) examined the relation between electric lighting and income generation in Malawi. They looked at the innovative use of lanterns that use light-emitting diodes (LEDs) powered by batteries and charged by

grid or small solar panels. These have emerged as a relatively cost effective alternative to kerosene and other fuel-based lighting technologies since they provided a brighter light for longer duration. They found little evidence of a clear connection with income generating activities. Lanterns were paid for in cash and not instalment plans. The introduction of LED lanterns dramatically changed lighting patterns for buying households, decreased their reliance on traditional lighting sources and reduced their fuel outlays. Similar conclusions made by Agoramoorthy and Hsu (2009) from their study in India were clear that lanterns in comparison with other energy sources may still be unaffordable and possibly out of reach of the very poor. Though studies of some households indicated, lanterns did provide opportunities to expand business opportunities by allowing more time to work at night when compared to fuel-based lighting sources. The extent of this is often difficult to measure simply in terms of numbers.

Nevertheless, there are more studies that show rural electrification can contribute to the development of income generating activities. But even in the majority of these studies it is difficult to determine that electrification alone accounted for the positive result. Mapako and Prasad (2008) in their study of Zimbabwe adopted a different approach to examining basic indicators by focusing on end user perspectives. Rural electrification took place mainly as a result of extensions to the grid. Their investigations as revealed in a number of small-scale industries in Matebeleland, concluded electrification increased the number and scope of small industries and increased employment. It also confirmed that their survey did not yield complains about higher tariffs by respondents, but were more concerned with the reliability of supply. Hiremath (2009) also established the viability of small scale renewable energy technologies in India with which implementation allows for increases in activities

such as sewing and handicrafts for local communities and producers as well as agricultural work and/ or activities extended to night times.

Other studies in this light, have sought to broaden the argument of the benefits of rural electrification beyond income generation. Fan and Chan-Kang (2002) in China, concluded that the quality of education, health, and gender equality have effects on poverty reduction. The World Bank's study (ESMAP 2003); in the Philippines found that access to electricity was correlated with educational achievement. Better illumination from solar electricity contributed to improved conditions for study. Access to electricity for television viewing also improves information and helps spread knowledge on health and family planning. Gustavsson (2007) illustrated also in Zambia the educational benefits resulting from rural electrification. The study did not measure accurately school children's marks as enhanced or improved, but more time according to the study, was spent reading and studying and the same benefits accrued to the Health sector. Clearly, the benefits for income generation through strengthening education are more likely to be revealed in the longer term. Kanagawa and Nakata (2008), using multiple regression analysis show that literacy rates above six (6) years are explained by household electrification.

Finally, Howells, Alfstad, Victor, Goldstein and Remme (2005) examined the effects on the quality of life in rural Africa as a result of energy use. They argue that the benefit of electrification in reducing local pollution (cleaner energy) and allowing for special high value added services, helps explain why most countries in Africa and Asia have engaged in electrification programmes for poor areas and support a subsidy for an initial volume of electricity for poorer consumers.

2.1.7 Rural Electrification on the Performance of Small Scale Enterprises

The SMEs worldwide are recognized as a key contributor to economic growth. There are few factors found to be critical for accelerating SMEs in any country. Rural electrification is one of those key factors. Rural electrification is well recognized as one of the important pre-requisites in uplifting living standards of the geographically and economically disadvantaged communities in developing countries (Chaurey, 2004; Bhattacharyya, 2005). It also assists the business conduction of diversified types of businesses.

Microenterprises can be distinguished according to the nature of activities and type of energy services they use for production or performing their services. Micro-enterprises such as brick burning, local beer brewing, ceramic firing, salt drying, fish drying and smoking, and charcoal production depend on biomass fuels as a source of process heat. Other 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, 2003).

In Tanzania, the electricity consumers identified in four districts located in rural areas (Same, Sumbawanga, Njombe, and Babati) can be classified as light commercial and light industrial. However, most light commercial industries do not really depend on electricity for their operation. The light industries like welding workshops and garages use electricity for running electric motors and for lighting. The average electricity consumption for these small industries is higher, ranging from 394 to 924 per month while for the residential and light commercial consumers; the range is between 100 and 200 per month (Kjellstrom, 2002). Based upon the observations made in four rural villages by Kjellstrom and co-workers, they concluded that productive uses of

electricity have resulted in a modest expansion of small-scale industries. In Sumbawanga, a small factory, making nuts, screws and bolts had been established after electrification. In Kilimanjaro, six industrial projects had been started after electrification (Kjellstrom, 2002).

There is evidence that access to electricity services in rural areas in the developing world has led to technological change in existing microenterprises. For example, 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 (Smyth, 2004 and Rogerson, 2007). In Philippines, many Microenterprises activities transformed their technical and economic efficiency by going over to modern technology powered by electricity. Micro enterprise activities such as beauty parlours, photocopying, ice making and battery charging in Indonesia came into existence after electrification. In rural Peru, a similar experience of the growth of new retailing microenterprises was observed and there was a definite positive correlation between use of electricity and the emergence of new commercial establishments (Rogerson, 2007).In Brazil and Mexico, the spread of electrification into rural areas stimulate an expansion of rural ME‟s activities through subcontracting, particularly of clothing and textiles production operations.

2.1.8 RE Services and Gender

In this section I discuss the relationship between gender and energy as pertains to the study. Gender, as a concept, refers to the socially, culturally, and politically constructed ideas and practices of what it is to be female or male. It contrasts with the concept of sex which uses biological attributes to categorise someone as male or female (Reeves and Baden, 2000; Clancy, 2011). Feminists and development practitioners argue that energy needs for men and women are different and therefore

policies must address these different needs. They contend for example that the energy required by men and women in the home and in the business environment is not the same and therefore policy must aim at taken care of energy needs by both genders (Karlsson, 2007). UN-Energy (2005) notes that access to energy services is particularly important for women, given that energy services and technologies are not gender neutral. The lack of modern fuels and electricity reinforces gender inequalities. Gender issues are therefore to be integrated in energy planning and implementation processes and infrastructure development programmes just as in for example health programmes. In other words gender sensitivity in energy needs to be considered. The feminist school of thought argues that energy is important for women's health, work and education and for reducing the time women spend on household tasks especially in societies where fuel provision is the duty of women and therefore policies must reflect these issues to ensure equity. Gender equity recognises that women and men have different needs and interests, and that to achieve equality in life outcomes, a redistribution of power and resources is required (Reeves and Baden, 2000; Clancy, 2011).

2.1.9 The Impact on Access and Affordability

The concept of affordability is based on the premise that the ability to use any modern fuel is dependent on the energy-users' ability to afford not only the energy-using appliances but also their ability to pay for the fuel on a regular basis. For example having a gas cylinder (the appliance) is one thing and being able to buy gas on a regular basis is another thing. In another related example having your house wired is one thing and being able to pay your electricity on regular basis another. In poor households for example this can be an issue hence many of them tend to rely on cheap technology and cheap fuels to meet their energy needs (Bhattacharyya, 2011:509).

Thus affordability can also create disruptions to supply. Affordability also limits companies' ability to expand their networks of infrastructure into areas where electricity and gas is most needed especially in the rural areas where population is scattered and ability to pay is relatively lower. Thus energy poverty is not only a problem of electricity or LPG not being available but also a problem of having the ability to afford it when it is available. Households that do not have the means to buy LPG will most probably rely on biomass as the alternative.

Electrification which is understood as the physical set up of electricity generation and distribution infrastructure, is thus generally considered a prerequisite for industrial development and therefore a prominent element of most national energy policies. In 2009, about 1.4 billion people worldwide had no access to electricity, of which 85 per cent were living in rural areas (IEA 2010: 240). Even though access to electricity and energy in general is not part of the Millennium Development Goals (MDGs), it is considered an important cross-cutting issue (Modi 2005). Its relevance for sustainable development has recently been highlighted by the UN General Secretary, by setting the ambitious target of universal energy access, including access to electricity, by 2030). According to World Development Indicators (World Bank, 2007) access to electricity is lowest in low income countries and, as a percentage of population, is lower than access to other infrastructure services such as telecommunications, water and sanitation. While access to electricity is undoubtedly the major problem facing electricity reform programmes in developing countries, much progress at an individual country level has been achieved. In recent years, for example, electrification levels have more than doubled in South Africa from 34 to 70 % between 1994 and 2001 and from 20 to 42 % in Zimbabwe between 1980 and 2001 (Davidson and Mwakasonda, 2004). In these countries off-grid electricity

programmes were used to reach the poor, particularly for lighting. Questions have been raised concerning whether or not this use of electricity is the highest priority for the poorest communities (Davidson and Sokona, 2002). It has been argued that designing energy reform programmes for the poor ought to address their cooking and water heating needs over lighting. A study by Louw, Conradie, Howells and Dekenah, (2008) further concedes that it would reduce the heavy dependence on traditional fuels such as wood, dung, candles and kerosene that are predominantly used by the poor, although here the value to lighting cannot be under estimated, in terms of providing opportunities for the poor to have an additional illuminated time to engage in simple income earning activities.

However, it has not always been the case that the poor have switched to more sophisticated forms of energy when these have become available (Howells & Dekenah, 2010). In practice, most small-scale processing centres (e.g. Shea-Industry) continue to use a combination of fuels at any one time, some of which may be advanced and others more traditional. In any event, these centres' fuel choices are likely to be related to the size and diversity of their incomes, and other factors such as education and distance and availability of natural resources which come into play (Heltberg, 2004).

The cost and availability of electric gadgets/appliances, such as cooking stoves, has often been a prohibiting factor in the take-up of electricity. If appliance costs were to be subsidized then indications are that the demand for electricity connection and use would be enhanced amongst the poor. However, whether or not the cost for this is borne through cross-subsidisation by higher income and/or higher consumption of small-scale processing industries, it has to be carefully considered as price sensitivity among higher income groups could lead them to switch to other fuels, with a

consequent fall in the demand for electricity. So a distinction can be made regarding the type of policy that ought to be used to improve connection where electricity has arrived, and towards expanding electricity to areas where it does not presently exist. Thus, affordability in the context of electrification and use of electricity means whether SSIs can afford to actually use electricity once they are connected to the grid. The price of electricity with which consumers are actually faced is assessed in relation to SSIs incomes, purchasing power (opportunity costs of other goods), and relative price of electricity compared with other commodities. In countries with high proportions of the poor, analysis should distinguish income groups within the poor (Prasad & Visagie, 2005).

For the SSI sector, the affordability of electricity is assessed in relation to production costs and costs of other energy forms. From the perspective of halving energy poverty (McKinsey, 2004), actual electricity use by rural SSIs is a priority (Spalding-Fecher, Winkler, & Mwakasonda, 2005). In terms of affordability, it may also mean looking more critically at discriminatory tariffs to capture the poor that go beyond the cross subsidisation of commercial and non-commercial users, largely been attributed to the comparatively high cost of connection. Laos is also cited as an example, where 30 % of the population cannot afford the $100 connection charge. They also reiterate that even though off-grid schemes can be delivered to a community at lower cost than an electric grid can be extended to an area, it is sometimes still the case that the price of off-grid electricity is higher than to those rural enterprises that are buying electricity from a grid elsewhere. It is understandable, however, as was researched in Ghana by Barfour, (2013) that cost continues to be a barrier to accessing off-grid electricity for poorer rural people and their small scale businesses.

Prasad (2008), in his studies compares the impact of energy reform in Botswana, Ghana, Senegal and Honduras. He gives two examples of successful energy reform to increase access and affordability. In Senegal home business units got subsidies for butane gas for cooking. The scheme also subsidised small stoves and gas cylinders. This led to a reduction in the use of charcoal and wood and helped with deforestation. The exit of the subsidy did depress growth in demand. 85 % of Senegalese households and small scale enterprises across all income ranges tend to use gas for cooking compared to 23 % of the lowest income group in Botswana.

Typically, subsidies for rural electrification tariffs are based on estimates of household/home businesses spending for lighting and light electricity use. This was the case in Argentina (Covarrubias & Reiche, 2000). In the absence of Willingness-to-Pay analysis, small-scale enterprises expenditure on kerosene, bottled gas and dry batteries was used as an indicator of the upper limit of electricity tariffs and affordability. Obviously, there are advantages which they may not recognize such as convenience of use and less pollution. The problems thus remain in relation to the information poor communities have over the benefits of electricity and in convincing them that these will eventually contribute to improving welfare. Rural enterprises may continue to be reluctant to adopt newer processes when they recognise meeting regular monthly payments will be difficult, since their income flows vary in time and are often seasonal.

2.1.10 Impact of an improved Access to Electricity-based Services

An increased access to electricity-based services is expected to have positive impacts on regional socio-economic development. Main impact categories described in the literature are: the reduction of indoor air pollution due to decreased fuel combustion for lighting and cooking, the possible increase of productivity in agricultural

processing and other manufacturing, and improved social services such as schools and health centres (Modi, 2005; Ramani & Heijndermans 2003). However, realising such impacts largely depends on the degree of access that can be achieved for small scale industries, as well as on numerous other factors, which empower and drive specific user groups. Access to electricity-based services might also have negative results. If a substantial share of home-businesses or small scale enterprises income is spent on the electricity bill without any income-generating effects, then the amount of money available for basic needs might be reduced. Furthermore, recent debates have served to highlight the subjective and relative character of poverty. If only a few home businesses/enterprises in rural areas gain access to electricity, the disadvantage felt in the poorest enterprise might even increase.

2.1.11 Electricity, Economic Growth and Poverty Reduction

The need for increased investments in rural infrastructure and other key public service that are necessary for achieving growth and reducing poverty in rural areas has been underscored by various stakeholders. Singh and Ali (2001) have restated that government expenditure on rural telecommunication, electricity and roads can has a substantial impact on rural poverty reduction.

Rural electrification has gained prominence in recent years with the heightened interest in infrastructure in relation to the core part it can play in improving welfare and reducing poverty (Fishbein, 2003; World Bank, 2008). In the last two decades, poverty reduction has been a major policy focus in the development circles. As a result, the international development agencies have officially recognized poverty as a core issue and this is evidenced by putting poverty reduction as a global development goal. This is a sure recognition that infrastructure has a close relationship to the level of development of a particular country. Ondari (2010) asserts that no country in the

developing world has ever achieved the 10% annual growth required to reduce poverty without modern energy (in this case electricity). The highest poverty levels in rural areas of Kenya highlight the importance of investing in basic infrastructure such as electricity, as part of the national development agenda (Otieno and Awange, 2006). Electricity as consumption and an intermediate good has been linked to income growth and therefore a causal relationship exists between income and infrastructure (Cook, 2012).

Rural electrification promises a brighter future for many rural communities and in the long term, the benefits of providing electricity to poor households can be high. Research study outcomes have given evidence indicating the positive relationship between electricity consumption and gross domestic production. This correlation has been reflected by the relationship existing between the electrification rate in a country and the percent of households who are living above the poverty line of two dollars per day (Kirubi, 2006; Tuntivate, 2011). Whereas demand for energy in urban areas is high due to large commercial enterprises, the energy demands of commercial sector, small industry and communities in the rural areas follow similar evolutions to those of households as economic activity increases. Electricity is an important condition for the development of the Shea-Industries and that under the right circumstances it can result in considerable economic growth.

2.1.12 RE and Development

Rural industrialization is well situated with desired commercial activities when well designed and planned electrification programmes are implemented, which in turn creates conducive environment for rural entrepreneurs and especially women to curve meaningful livelihood ventures to nurture and raise the standards of living of rural households and stimulate the growth of the rural economy. Therefore, lighting up

rural areas is a pleasant change among the rural population, and electricity for TV, radio and charging of mobile telephones is highly appreciated for facilitation of access to news and communication, better health services, water services and improved security resulting from installation of streetlights. In addition, electricity has been pointed out as important for reduction of fuel wood consumption, thereby preventing deforestation (Sida, 2002). For economic development, also income-generating activities are needed to create employment opportunities through activities performed in households, in small scale enterprises (NREL 2000), in industries of different types and sizes, and in agriculture. According to Guliberg (2004), access to twenty-four (24) hours of electricity services is generally seen as important for the establishment and growth of businesses. Even a limited level of electricity service has been pointed out to be able to have positive effects on operating hours, working conditions, mechanisation, product preservation, communication and education (NREL, 2000).

There are different opinions about the gender aspects of rural electrification (Cecelski, 2000). Some are of the opinions espoused are that rural electrification is an energy sub-sector that does not have any different impact on women versus men. Other energy professionals feel strongly that energy projects have the potential to provide special positive benefits for women. More efficient stoves, drinking water pumping and agro-processing can reduce women's workloads, improve their health, and provide income-earnings, with which benefits often depend on electrification. Better lighting can extend the day for both productive and reproductive work and strengthen education and health services. Irrigated agriculture can provide better income-generation and employment opportunities, removal of indoor air pollution and exclusion of the need to spend time and efforts on gathering of cooking fuel by

switching from cooking with wood fuel to electric cooking (OECD, 2007), which is another acclaimed benefit of electrification that is vital for women.

2.1.13 Productive use of Electric Energy

The conceptual understanding and knowledge base linking energy and productive uses have expanded over the past decade. Traditional understanding emphasizes direct income generation as the primary goal of the productive use of electric energy (Barnes, 2007; Rogerson, 2007; FAO, 2000; IDS, 2001). It could be a huge cement factory or a tiny juice stand with an electric blender. However, in order to respond to international development goals, which go beyond income and to also keep pace with an updated understanding of what development, some researchers have expanded the traditional thinking to encompass the tremendous impact that energy services have on education, health and gender equality (Cabraal, 2006).

Kapadia (2003) defines productive use of energy to involve the utilization of energy both electric and non-electric in the forms of heat or mechanical energy for activities that enhance income and welfare. The activities are typically in the sectors of agriculture, rural enterprise, health and education. Examples of such activities are pumping water for agriculture, agro-processing, lighting, information and communications and vaccine refrigeration. For a broader exploration of the impact of electrification and economic development, including micro-enterprises, agriculture and education at Bongo, this study adopts the expanded view of productive energy use, which signifies income generating and other welfare related activities that are directly and positively affected by the use of electricity, which also stimulates growth of SSIs. It is a general consent that SSIs have an important role in contributing to economic development and reduction in poverty rates, where growth is viewed in relation to employment, with small scale industries/enterprises, constituting a major

source of job creation/employment with significant domestic and export earnings. Since SSIs have great potential for job creation, their growth gradient can be based on the employment opportunities that such SSIs generate. Thus, rural electrification access can improve the quality of life, rural industrial productivity and profitability of SSIs (Chaurey, 2004). Uptake in electricity in this case, has the potential of creating new opportunities; an equal and competitive ground for SSIs owners to enhance and expand their businesses and income generating activities.

Additionally, growth of SSIs especially the Shea-Industry is based on the degree of forward and backward linkages to such enterprises. On this score, the uptake of electricity can urge the growth of SSIs in terms of competitiveness as well as accelerating the shifts towards more sophisticated and value added industrial structure through technology development and product upgrading, quality and improvement (Sawe, 2003). This further explains how SSIs can augment their market competitiveness through electricity access as well as further expand new leeway and opportunities for growth.

2.1.14 Electricity Access and Women Empowerment

There is a growing recognition that women in developing countries lack control over resources and the self-confidence and opportunity to participate in decision-making processes. Parikh (1995) has noted that some analysts and academic scholars argue that energy (Electricity) is there for all to use. Therefore, if it is there for all to enjoy then what difference does it make to different users? It is also a truism among feminists and development practitioners that energy needs for men and women are different and policies must address these different needs. They contend for example that the energy required by men and women in the home and in the business

environment is not the same and therefore policy must aim at taking care of energy needs by both genders (Karlsson, 2007).

UN-Energy (2005) notes that access to energy services is particularly important for women, given that energy services and technologies are not gender neutral. The lack of modern fuels and electricity reinforces gender inequalities. It has also become widely accepted that women have an increasingly important role to play in social and economic development. With access to and availability of electricity, women productivity in the industry will increase and lead to control and better access to economic resources.

According to Martinez and Glenzer (2005), CARE defines an 'empowered woman' as a woman who enjoys bodily integrity (is free from coercion over her physical being), has positive images of her own worth and dignity, has equitable control and influence over strategic household and public resources, and lives in an enabling environment in which women can and do engage in collective effort. Alsop and Heinsohn (2005) also define empowerment as a person's capacity to make effective choices and to transform choices into desired actions and outcomes. In this regard, given the urge and power, women can transform electricity access and use into productive purposes. Empowerment increases the capacity of individuals to be more entrepreneurial and self-reliant.

Deshmukh-Ranadive (2003) has reported that women's empowerment does not necessarily take place when incomes are generated, when livelihoods are improved or when groups are created. This is because within families and households, hierarchies and structures do not alter. He added that public interventions such as electrification, which result in new social activity and new avenues for income generation, can

actually heighten tensions within households. It is at such times that supplementary interventions are required. The intervention shows that in order to change the socio-cultural space of women in the home, other members of the household need to be involved in the empowerment processes (Deshmukh-Ranadive, 2003).

2.1.15 Adoption of Rural Electrification on the Performance of Small Scale Enterprises

The development of micro-enterprises in rural areas is linked with the increase in access and use of grid electricity services, leading to changes in micro-enterprises, and changes in livelihood characteristics of entrepreneurs, employees and community members in areas where these enterprises located.

Bose (2013) conducted a study aiming at evaluating the impact of electricity availability on the operation and performance of SMEs in the rural areas of Bangladesh. The results were based on a study from a survey carried out in two electrified villages in Paikgacha, Khulna. The study detected favorable changes on the production costs, profit margin, development and modernization of business, women empowerment, quality of life, and human development due to the electrification.

Muhoro (2010) conducted a study seeking to identify the factors that affect rural electrification in rural western Uganda. The study used both quantitative and qualitative methods, including informal surveys, intra-business energy allocation studies and historical analysis, to analyze off-grid electricity access among micro-enterprises. Data was obtained from 56 micro-enterprises located in 11 village-towns within 3 districts in Uganda. Findings showed that Micro-enterprises in rural Uganda created income for the poor; they acted as resources for poverty reduction. Further findings indicated that without subsidies, credit-based sales and better financing

options, it is unlikely that access to electricity will increase beyond the levels established in the existing cash market.

Peters (2013) investigated the impact of electricity on the performance of micro-enterprises by comparing the performance of firms in grid-covered and non-covered villages in Northern Benin. The study used firm-level data while the empirical analysis employed Propensity Score Matching techniques. Findings revealed that beneficial impacts are found from firm creation after electrification, firms that existed before showed an inferior performance compared to their matched counterparts from a non-electrified region. However, the performance gap was insignificant.

Maleko (2005) carried out a study in Tanzania and sought to find out the effect of adoption of electricity on the performance of microenterprises. Result revealed 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. Fifteen micro enterprises owners (15) out of forty-three (43) interviewed said they had added at least one permanent employee since its establishment because there are enough activities and long working hours, which needed assistance from these permanent staff. In addition, the establishments of new branches/expansion of micro-enterprises within and outside the studied areas were observed. For instance, in Foo village, Hai district small Kiosk was selling salt and kerosene but the business grew into many branches within the village and now there are grain-milling machines, sunflower oil extraction machines and wood workshop, all these used electricity services for production.

Decline and closure of micro-enterprises was observed in the study area at a very low rate. These declines of business were caused by high competition and market

saturation. Introduction of electricity services created more MEs of the same nature without having a good plan for the markets of their products. This ended up with market saturation. The market saturation caused low turnover, low saving from electricity services and high running costs (Maleko, 2005).

There is evidence that access to electricity services in rural areas in the developing world has lead to technological change in existing ME‟s. For example, 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 (Smyth, 2004). In Philippines, many ME‟s activities transformed their technical and economic efficiency by going over to modern technology powered by electricity.

In Brazil and Mexico, the spread of electrification into rural areas stimulated an expansion of rural ME‟s activities through subcontracting, particularly of clothing and textiles production operations. Evidence of the impact of electricity from Elandskraal, Northern Province in South Africa pointed out that electricity was a potential input for upgrading the condition of the ME‟s economy, this experience also provided strong support for the argument that the provision of electricity is an important precondition for the emergence and growth of diversified, dynamic small micro-enterprises (Rogerson, 2007). A study undertaken in Namibia about impact of rural electrification on social–economic development showed that electricity services did not seem to have had a significant impact on growth of income generating activities (Wamukonya , 2001). The findings from the same study showed that the share of households with home-based income generating activities was highest among un electrified households. Furthermore, few home-based enterprises use electricity for income generating activities, and when they did, mainly made use of electricity only for lighting. None of the businesses using electricity started after rural electrification

and hence electricity service could not have been the driving factor behind the establishment of the new micro-enterprise (Wamukonya, 2001).

Foley (2009) concluded that availability of modern energy services, particularly electricity, has had only a modest impact on creation of small industries. In addition, an increase in economic activities and higher living standards due to arrival of electricity was observed. Hence, it can be concluded that electricity service is among the factors needed in influencing the decisions of local entrepreneurs to invest in a variety of productive enterprise. However, due to lack of reliable information about impact of electricity services on MEs development, many local entrepreneurs have little use of electricity services for production.

Abdullaha (2009) investigated the major issue impeding rural electrification programs in rural Kenya (high connection payments). The study used estimates obtained from a stated preference study, namely a contingent valuation method completed in 2007, to examine the willingness to pay to connect to grid-electricity and photovoltaic services. The key findings suggested that the government needs to reform the energy subsidies, increase market ownership and performance of private suppliers, establish financial schemes and create markets that vary according to social-economic and demographic groups.

Ahlborg (2011) conducted a study seeking to establish the specific drivers and barriers for rural electrification and off-grid solutions in Tanzania and Mozambique. The study was done across a stakeholder spectrum. It was part of a larger research effort, undertaken in collaboration between Swedish and African researchers from natural, engineering and social sciences, aiming at an interdisciplinary assessment of the potential for an enhanced utilization of available renewable sources in off-grid solutions. By qualitative methodology, data was collected in semi-structured

stakeholder interviews carried out with ten national level energy sector actors. Findings revealed that there existed country-specific institutional, financial and poverty-related drivers and barriers to grid and off-grid electrification.

Chaieb (2011) conducted a study seeking to identify whether community perceptions affects rural electrification in parts of Tunisia. The study was conducted using participatory rural appraisals (community interviews and investigations) to discover the perceived benefits of introduced access to electricity in Tunisian communities. Linkages were discovered between rural electrification and the areas of education, basic health, family planning, and women's reproductive health. Many families had purchased (and now consistently watch) televisions, which prompted intellectual expansion, expose women to political happenings, and introduce families to messages concerning personal hygiene and health. Findings revealed that communities" perception increased economic opportunities for women, who were choosing to sew or open hair-salons at home rather than travel to urban areas in search of work.

Barfour, (2013) conducted a study seeking to establish the barriers to rural electrification in Ghana. The results showed that there existed various challenges which include: level of the rural people; high cost of grid extension to thinly populated and remote areas; lackluster acceptability of off-grid systems; ownership, management and operations of renewable systems especially mini grid; inadequate funding from government budget; low level of electrification levy and lack of private capital lack of commitment of the utilities.

Hisaya (2011) explored intra-state disparity in access to electricity and examined the determinants of electrification at the village level in Bihar, one of the underdeveloped states in India. Data was collected through field survey of 80 villages in 5 districts conducted in 2008–09. The econometric analyses demonstrated that location is the

most important determinant of a village's electricity connection. Results showed that 48 villages (60%) were electrified. Further finding revealed that rapid progress of rural electrification under the recent government program and the tendency to connect the villages that are easily accessible, the collective bargaining power of the village, which used to significantly affect the process of electrification, had lost influence. This adversely affected remote villages. The researcher recommended that the government needs to consider other options for sustainable electricity supply, such as decentralized distribution of electricity rather than the conventional connection through the national/local grids so as to extend electricity supplies to remote and geographically disadvantaged villages. Nanka (2010) conducted an analytical study of the socio-economic factors which have a significant impact on rural electrification development in sub-Saharan Africa. The study employed cross-sectional data for 24 of the 47 countries in the sub-Saharan region. Findings revealed that there exist several factors which include the Human Development Index, wealth distribution, institutional development and urban population size of a country to have a significant impact on rural electrification development. A detailed policy survey of four countries from the sample; two countries categorized as over-performing (Nigeria and Madagascar) and two as under-performing (Tanzania and Chad), highlighted that collaboration with international partners, integration of national policies and strategies and the use of renewable energy sources enhanced the development of rural electrification in sub-Saharan Africa.

2.1.16 Critique of Energy and Development

Critiques of the energy and development concepts have questioned the role of energy in national development. For example scholars like Andre Gunder Frank argue that categorisation of countries into developed and underdeveloped fail to capture the

complex historical, economic, political, social and cultural regimes and systems under which such nations have been governed in the past or are governed at present. Frank (1996) points out that "we cannot formulate adequate development theory and policy for the majority of the world's population who suffer from underdevelopment without first learning how their past economic and social history gave rise to their present underdevelopment". Thus we cannot exclude for example the political decision making process from the discourse of energy and development, neither can we ignore the global economic, political and social environment within which countries have to operate. For example global energy market is highly dominated by the rich consuming nations like U.S, Japan, Canada, and the E.U. Due to the size of their economies, its dependence on oil and gas and the need to ensure energy and economy security, the global energy market is influenced greatly by the actions and behaviour of the big energy consumers sometimes to the detriment of the poor countries.

In other words the governance of the global energy architecture is dominated and controlled by actors of the global north whose immediate priority is to satisfy their constituencies and hence their national security. Thus the unequal global distribution of income, wealth, economic, technological and political power; neoliberal economic policies of the World Bank, IMF and the WTO has a greater role in determining energy accessibility and affordability especially in developing economies. These issues at the global level translate into energy insecurity and energy poverty at national and also the household levels

2.2 Small-Scale Industrialization

2.2.1 Small Scale Industries (SSIs)/Enterprise (SSEs)

The concept of SSIs relates generally to small industrialised activities including agro-processing, handicrafts, construction and repair services. SSIs are given different

explanations and definitions at both the international and local contexts. In the context of international studies, the term 'SSI' refers to private enterprises, both in the manufacturing and industry and the service and trade sectors, with fewer than 250 employees (Anyagari, 2005).

In Ghana, two major definitions may be used to describe SSIs: one based on capital requirements and the other on employee size. The National Board for Small Scale Industries (NBSSI, 2004) defines small-scale industry as one whose capital requirements for plant and equipment do not exceed the cedi equivalent of US$100,000. Firms employing 30 or more persons are normally included in the enforcement of employment and minimum wage legislations in Ghana and are thus regarded as formal. On the other hand, those employing less than 30 persons are described, generally, as informal since they are not normally registered.

The European Union (EU) uses the term 'Small and Medium Enterprise' (SME) to describe small industries/enterprises. For the purpose of differentiating SSIs from the other small-scale non-farm economic activities, the emphasis is placed on the manufacturing aspect. Manufacturing here is understood as producing or making physical items. This means that pure service activities such as government services, retail trade, banking recreation and insurance services are not included. However, repair services are included in the manufacturing enterprises because they have something to do with formally manufactured goods.

SSI is therefore used here to refer to those small self-help industries/enterprises that are carried out in the home, community centres and/or some other convenient places. SSIs are thus developed mainly out of the need for an additional source of income, because of the need to use one's spare time gainfully and because of the relative ease of acquiring the necessary raw materials to set up such industries. In a much broader

term SSIs which is also referred to as "micro-enterprise" refers to a very small business that produces goods or services for cash income. SSIs can be identified on the basis of a number of characteristics. SSIs can also be describes as usually operating in the informal sector of the economy, require little in the way of initial start-up capital, and have few employees, usually defined as less than ten, home-based, and as a result the employees are usually family or household members working on a casual basis (sometimes without cash wages).

In northern Ghana and in the Bongo District of the Upper East, SSIs such as Pito-brewing, smock weaving, basketry, soap making, Shea butter processing and groundnut oil processing, among others, are prevalent. Indeed, in the Bongo District of the Upper East Region of Ghana, mention cannot be made of the contribution of small scale industries without pointing to the Shea industry as it appears to be a major source of income that sustains rural farm families.

2.2.2 The contribution of micro and small-scale enterprises to development objectives

All over the world, irrespective of the development level of countries, SSIs are an integral part of a nation's development. Fry (2004) notes that there are four special ways that small scale industries/enterprises affect society in every spheres of development.

In many developing countries, the SSI sector has played a major role in economic development, especially after the Second World War. SSIs train workers in-house and on-the-job, teaching employees' valuable skills and offering a breeding ground for entrepreneurial and managerial talents for both men and women. They also provide a pool of skilled and semi-skilled workers. Indeed, many large enterprises start small, and managers as well as employees improve on their skills as these enterprises grow.

Small enterprises enable risk-taking and motivate individuals to find avenues for their talents to new types of business activities and innovations. Some small businesses contribute to the improvement of forward and backward linkages as ancillaries to large-scale enterprises. In fact, a strong and productive industrial structure can only be achieved where micro, small, medium and large enterprises not only co-exist but also function in a symbiotic relationship. SSIs tend to develop in almost all the regions of Ghana and, thus, contribute to reducing the concentration of industries in urban areas, thereby promoting balanced economic growth between the administrative regions and between the rural and urban areas. SSIs can, therefore, contribute immensely to income distribution by alleviating poverty and reducing income disparities among social groups and ensuring the closer integration of women and people in rural and deprived areas with the national economy.

Evans (2008) notes that the development experience of East Asian countries, such as South Korea, Japan, Taiwan, Hong Kong and Malaysia, shows that they developed their economies on the back of their SSIs. He asserts that the big companies that rule the world economy today, such as Microsoft, Volkswagen, General Motors, McDonalds, Hewlett-Packard and Google, all began as SSIs. He indicates further that, in the United Kingdom, small businesses are recognized as the backbone of the British economy, accounting for more than half of UK's turnover. According to the NBSSI (2004), SSEs have a significant role to play in developing the rural areas of Ghana. The Board has identified five important roles played by the enterprises in economic development of Ghana. These roles are seen in the areas of employment generation, use of local resources base, role in micro-credit, improvement in infrastructure services and export market potential.

2.2.3 Problems facing SSI/Es

SSIs, particularly those in developing countries where the service infrastructure and business environment have not been developed and typically face operational problems which make it difficult to start-up, expand or develop to reach their full potential. Such problems could be generalised as follows: Lack of access to electricity services; Lack of Market access; poor access to skill development for workers; Lack of access to better technology and equipment; Lack of access to information vital to business operations and management; and Lack of business management skills to tap and sustain utilization of available electricity.

The traditional approach to SSIs assistance or promotion reflects a "donor dependent" relationship between governments and external donors on the one hand, and SSIs, on the other, with services provided directly by public institutions on a subsidized basis. It is based on the old assumption that the demand for financial and non-financial services by SSIs is low because of their inability to pay, that such services including electricity cannot be provided profitably, and that SSIs care more about cost than quality and access.

2.3 History and Distribution of the Shea tree

According to CRIG (2002), the Shea is a golden tree; what cocoa does, Shea can also do but cocoa cannot do what Shea does, yet little attention has been given to the Shea. The Shea tree usually grows to an average height of about 15m with profuse branches and a thick waxy and deeply fissured bark that makes it fire resistant. The fruits are round and green in colour and maintain the same colour when ripe, except that most ripped fruits are soft to touch (CRIG, 2002).

The Shea tree, *Butryospermum paradoxum*, is now called *Vitellaria paradoxa*. The oldest Shea specimen for scientific examination was collected by Mungo Park on May 26, 1797, resulting in the eventual scientific name vitellaria paradoxa (CRIG, 2002).

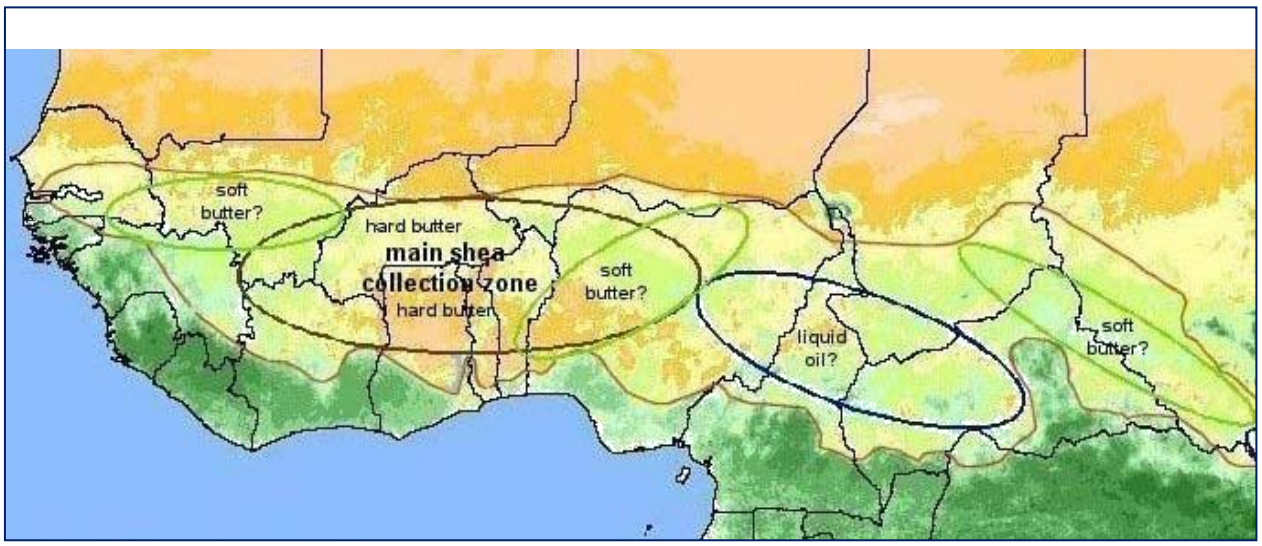
Many local names exist for Vitellaria, which is an indication of its wide range of incidence of early 5000 km from Senegal (West) to Uganda (East) across the African continent.

The Shea tree grows naturally in the wild in the dry savannah belt of West Africa from Senegal in the west to Sudan in the east, and onto the foot hills of the Ethiopian highlands. It occurs in 19 countries across the African continent. These include: Benin, Ghana, Chad, Burkina Faso, Cameroon, Central African Republic, Ethiopia, Guinea Bissau, Cote d'Ivoire, Mali, Niger, Nigeria, Senegal, Sierra Leone, Togo, Uganda, Zaire and Guinea. In Ghana, it occurs extensively in the Guinea Savannah and less abundantly in the Sudan Savanna.

Yidana (2004) estimates the population of Shea trees growing naturally in Ghana to be about 9.4 million with apparent yield of 100,000 tons of dried Shea-nut per year. Shea tree population covers the whole of Northern Ghana, an area estimated to be over 77,670km2, and about two thirds of the total land area of the country (Yidana, 2004). There is sparse Shea tree cover found in Brong-Ahafo, Ashanti, Eastern and Volta regions in the south of the country.

The 19 countries in which Shea is found (predominantly Sub-Saharan) across the continent of Africa are Benin, Ghana, Chad, Burkina Faso, Cameroon, Central African Republic, Ethiopia, Guinea Bissau, Cote d'Iviore, Mali, Niger, Nigeria, Senegal, Sierra Leone, Sudan, Togo, Uganda, Zaire (now Democratic Republic of Congo) and Guinea (CRIG, Bole, 2002).

Map 2.1: Shea producing countries in Africa



Source: WATH Technical Report No. 2. Peter Lovett

Legend

- Sahara Desert
- Savanna Grassland (where Shea Occurs)
- Forest Zone

Map2.1 above provides a picture of the several cross-cutting Shea producing countries in Africa ranging from Senegal across to Sudan and Ethiopia. The map identifies the West Africa Sub-Region where the bulk of Shea trees occur and where Shea products are processed. The high Shea production countries from figure 2.2 above are Ghana, Burkina Faso, Benin, Cote d'Ivoire, Nigeria, Mali and Togo. Northern Ghana is singled out as being one of the main sources of high quality Shea products.

2.3.1 Benefits of the Shea Industry

The rural population of Ghana has limited opportunities for employment besides engaging in subsistence agricultural activities and other peripheral commercial activities of buying and selling. This situation is worse for the rural farming communities of the Bongo District of the Upper East Region of Ghana where the

already erratic rainfall is limited to the months of July – September. Indeed, the peak of the rainfall and farming season in Northern Ghana is June-August; a very brief period often associated with specific crop failure each year. This puts the people of the area in a perennially insecure situation, warranting very hazardous coping and endurance mechanisms some of which are the alternative to charcoal burning (Shea tree), bush burning that accompany hunting, and cutting down mostly Shea-trees for fuel wood (Researcher survey, 2015).

Developing the Shea industry is as crucial as it is a strategy to contributing to the issues of livelihood options that Shea picking is usually pursued as a matter of "life and death". Indeed, some other economic activities in the rural economy come to a standstill at the peak of Shea nut picking in the Bongo District. There is usually a "big hunt" for Shea fruits in many rural communities mainly by children and women for direct consumption and for sale. Men, who traditionally do not pick Shea nuts, harvest Shea fruits for lunch whilst on their farms. In recent times, however, Shea products have become indispensable in international trade. For example, the butter of Shea is a substitute for cocoa butter in Europe and there is increasing demand for Shea butter and nuts in Europe. There has been a documentation of best practices for the export of Shea butter products to the United States, Europe and other Western markets.

2.3.2Shea Extraction Industries

The Shea-Industry like other agro-processing industries in the Bongo District have various processing methods employed to arrive at the final product (Shea-butter) for the Ghanaian market and also internationally. Like other Agro-processing industries, Shea industrial activities comprise two major categories; primary and secondary operations. Primary (Traditional) processing operations involve activities such as picking, shelling, cleaning, grading, and packaging. These activities are mainly

carried out to transform the commodity into a slightly different form prior to storage, marketing or further processing which is often done manually using labour. Secondary (Mechanized) processing operations entail increasing the nutritional or market value of the commodity with its physical form and appearance often totally changed from the original. Some examples of secondary processing are milling, grinding or pressing oil out of nuts, in the form of manufacturing and value addition.

Depending on the type of product, equipment needed for primary processing is completely different from that used in secondary processing where major adjustments and modifications need to be done to suit production requirements. In traditional processing, fresh fruits are collected and processed within 2 to 3 days to avoid germination. This step involved the processing of fresh fruits to obtain the dry kernel (Shea nut) and is as follows: de-pulping, par-boiling, sun-drying and cracking of the nuts. Shea butter is extracted from the dry Shea-nut primarily by individuals on a small scale using a traditional method that varies slightly in detail and generally consists of the following steps: crushing of the nuts, roasting the pieces in a hot pan, milling the pieces, kneading the milled mass in water to extract the crude fat and boiling the crude extract to obtain purified Shea-butter.

With the mechanized process, machines have now been employed to speed up the major steps involved and to make the process less arduous. The crusher, miller and the kneader with a boiling drum attached are some of the manufacturing machines that have been modernized to cure this laborious task undertaken by processors. Others include cookers, coolers and refrigerators and other storage facilities for packaging and standardization of products. The machines have a capacity of extracting butter from 3000kg of Shea-nut per day. However, only about 30% of the fat content of nuts is extracted. This is the same value as in traditional extraction

methods, though extraction is faster by this method, it is of considerable advantage. The hydraulic press developed such as the Bridge press can extract up to 90% of the fat contained in the nuts. Thus the use of hydraulic press and other electrical gadgets has increased the efficiency and quantity of Shea-butter from the available Shea nut.

2.3.3 Utilization of Shea-butter

The seed kernel (often incorrectly called 'nut') contains a vegetable fat known as Shea-butter.

High quality Shea-butter is consumed throughout West Africa as cooking fat. Refined fat has been marketed as margarine and baking fat. It is used for pastries and confectionery because it makes the dough flexible. Many cosmetic products, especially moisturizers, lotions and lipsticks, have Shea-butter as a base because its high unsaponifiable matter content imparts excellent moisturizing characteristics. Shea-butter has been used as a moisturizer to treat dry cracked skin, as massage oil for colds and sore muscles, and host of minor skin problems. It is also used by midwives on new-born babies to moisturize their skin and also as a protection against diaper rash (Lovett & Haq, 2000). It is used to relieve inflammation of the nostrils. Low-quality Shea-butter, often mixed with other oils, is a base material for soap. It is especially suitable for making candles because of its high melting point. Shea-butter is a suitable base for tropical medicine. Its application relieves rheumatic and joint pains and heals wounds, swellings, dermatitis, bruises and other skin problems. The oil is placed in ritual shrines and used for anointing. Shea-butter is given externally and internally to horses to treat sores and galls and the black sticky residue, left after oil extraction, is used to fill cracks in walls and as a waterproofing material.

Internationally, Shea butter has become important product because of its therapeutic properties for the skin. It can act as a mild ultra-violet barrier, protecting skin from the sun. It has regenerative and anti-wrinkle properties and it is used in bath, beauty and body-care products such as soap, creams and lotion. It also has a wide application for the pharmaceutical industry, such as suppositories. The growth rate of use of Shea butter in just the US market has been estimated at over 25 per cent per annum and continues to grow (Lovett & Haq, 2000).

The biggest growing market in Shea butter use is in the formulation of base creams both in the pharmaceutical and cosmetic industry. Addaquay (2004) reports that crude Shea-butter, processed in the region, is sold as food oil and also as skin cream.

2.3.4 Marketing in the Shea-Industry

The Shea industry comprises the picking of Shea fruits and nuts; the processing of nuts into butter and the sale of both nuts and butter domestically and for export. Shea picking and processing on small-scale for household use as well as for sale is dominated by women and children. However, the sale of Shea nuts has become big business, requiring huge financial investment, and hence gradually slipping into the domain of men with the financial wherewithal. The transportation and haulage of both Shea nuts and butter from Northern Ghana to the south, and for export to Europe and North America, has been a major avenue for creating job opportunities for haulage trucks as well as those who load the goods onto the trucks.

The Shea industry is defined by its value chain which is rooted from picking to processing of nuts for sale directly or into butter. Studies on the value chains have enabled appreciation of the pricing, extraction and the stakeholders (women, children, traditional authorities, buyers, sellers, NGOs, international commercial agents) in the industry who ensure production and consumption of Shea products. According to

Yidana (2004), the major Shea-nut exporting companies immediately after the privatization period were: Kassarjian Industries which is the leading private Shea-nut company, Olam Ghana Limited, A.A. Dimbala Farms Limited and Farmers Services Company Limited. The demand of Shea nut is linked with demands of exporters and the yields of the Shea tree population in that year (Yidana, 2004).

Total purchased quantities of Shea nut by the Ghana Cocoa Board in 1990 and 1991 were 3,959 and 5,040 tonnes respectively. Total exports were 2,856 and 3,200 tonnes for 1990 and 1991 respectively. The highest tonnage purchased for any single year since 1975 was 40,267 tonnes for the 1985/86 Shea nut season (Yidana, 2004). Prices of nuts in the world market are generally considered as low, varying from UD$150-400 per tonne. However, with increasing awareness of the potential industrial uses of Shea-butter and the efforts to stabilise the production and supply of the nuts, world market prices of Shea-nut could stabilise in the near future.

Table 2.1 Estimates of Shea kernel production and marketing in tones for six leading producers of Shea in selected West African countries

Country	Est. Total Potential Production (Tones)	Est. Actual Collection	% share of Actual Shea kernel production in WA	Est. Consumption	Total Exports	Exports as Shea kernels	Export as Shea Butter
Nigeria	250,000	100,000	18.69	80,000	20,000	20,000	0
Mali	250,000	150,000	28.03	97,000	53,000	50,000	3,000
Ghana	200,000	130,000	24.29	70,000	60,000	45,000	15,000
Cote d'Ivoire	150,000	40,000	7.47	15,000	25,000	15,000	10,000
Burkina Faso	150,000	75,000	14.01	35,000	40,000	37,000	3,000
Benin	80,000	40,000	7.47	14,900	35,100	35,000	100
Total	1, 130,000	535,000	100	321,900	263,100	217,000	46,100

Source: *Reorganized data from WATH Technical Report No. 2, Nov. 2004*

From the Table 2.1 above, Nigeria, Mali, Ghana, Cote d'Ivoire, Burkina Faso and Benin have been identified since 2004 by studies of the West Africa Trade Hub (WATH) to be the lead producers of Shea products in West Africa. In terms of estimated total actual Shea nut collected in the six (6) leading Shea producing countries in West Africa (WA), Ghana has a 24.29% share only second to Mali with 28.03 percent. However, Ghana has a superior comparative advantage compared with the six other countries with Shea butter exports as direct industrial inputs. This means that the value added to Shea kernel or nuts could secure Ghana greater revenue in the form of export duty and direct income to Shea dealers if the rest of the estimated uncollected 70,000 tonnes are collected, processed and exported. Research has also shown that the Shea tree has great untapped capacity for producing copious amounts of sap that can constitute an important source of raw materials for the gum and rubber industries (CRIG, 2002).

One of the prime reasons for connecting the Shea industry to the development of Northern Ghana is its potential role in spatial reorganization. The three northern regions of Ghana form the poorest regions of Ghana, where socio-economic progress is behind that of other regions of the country. The potential contributions of the Shea as illuminated above could be a good source of fostering regional balance in Ghanaian development. According to Songsore (2003), regional development is a process by which the productive capacities of all regions are mobilized by linking them in both a structural and an organizational sense to the mainstream of the national economy. Therefore, investing resources in the Shea industry and promotion RE would be demonstrate a shared approach to achieving sustainable development. While RE promotes industrialization for socio-economic growth, the trees also provide vegetative cover to the semi-arid lands of Northern Ghana. At the same time, the Shea

industry contributes securing the livelihoods of the poor rural people, particularly women. Therefore, developing the Shea-industry is a sure was to tackling an important development need of Northern Ghana.

2.3.5 Role of the Shea Industry in National Development

Role of the Shea Industry in National Development One of the principal reasons for linking the Shea industry to the development of Northern Ghana is to justify the view that development is spatial reorganization. According to Songsore (2003) Regional Development is "seen as a process by which the productive capacities of all regions are mobilized by linking them in both a structural and an organizational sense to the mainstream of the national economy". Investing resources in the Shea industry would be a two-pronged approach to achieving sustainable development in the sense of providing tree cover to the semi-arid land of Northern Ghana, and at the same time securing livelihoods for poor rural people, particularly women. Developing the Shea industry is seen largely, as part of the solution to the regional imbalances between Northern and Southern Ghana. Space plays a significant role in national socio-economic development and that is why worldwide, regional planning is used as a tool for spatial organization to promote national development. However the way regional development has been pursued in Ghana since independence takes no much departure from the colonial legacy of a centre-periphery approach where the coastal and forest "resource regions" have been developed to comprehensively exploit the resources available at the expense of the" bare" regions of Northern Ghana, resulting in the existing yawning disparities between the South and North of Ghana. The concentration of development in the south and middle belts of Ghana follow a rather logical sequence of the complex relationships which exist between decision making or human actions or inactions and the consequent benefits which are meant to be derived

by individuals, the firm, society and government. This human tendency in the use of space of Ghana has obscured the need to explore and develop the true potential of every part of it in a holistic and all-encompassing manner. Meanwhile when deprivation is prolonged throughout the lifespan of individuals or groups, it can result in intergenerational transfer of poverty which in turn creates and perpetuates social exclusion. This is typical of the situations of chronic poverty in most parts of the three regions of the North of Ghana which have the highest incidence of poverty (UNDP, 2007). The result is that existing generations are unable to provide better opportunities for the next generation. Ghana is worth over 250,000 tonnes of Shea nut worth 200 pounds per ton and the industry currently employs over 3000 people in the picking, processing and sale of Shea nuts and butter within three regions of the North alone (Shea workshop, 2008). Since Shea trees already cover a land area of over 77, 670 square kilometres beyond the three regions of the North, a conscious effort of Shea plantations would ensure better tree cover to safe the fast depleting strands of trees in Northern Ghana. Research by the America Shea Butter Institute has shown that Shea butter has an exceptionally high healing fraction. It contains important nutrients, vitamins and other valuable phyto-nutrients required for healing. The healing fraction can be as high as 17 percent, and the larger the healing fraction, the better the chances are for a good quality Shea butter. Other oils have a healing fraction of 1percent or less. The unique healing properties of the Shea tree have earned it the name, “karate” in Francophone countries, which means the “tree of life”.

CHAPTER THREE

PROFILE OF THE STUDY AREA AND RESEARCH METHODOLOGY

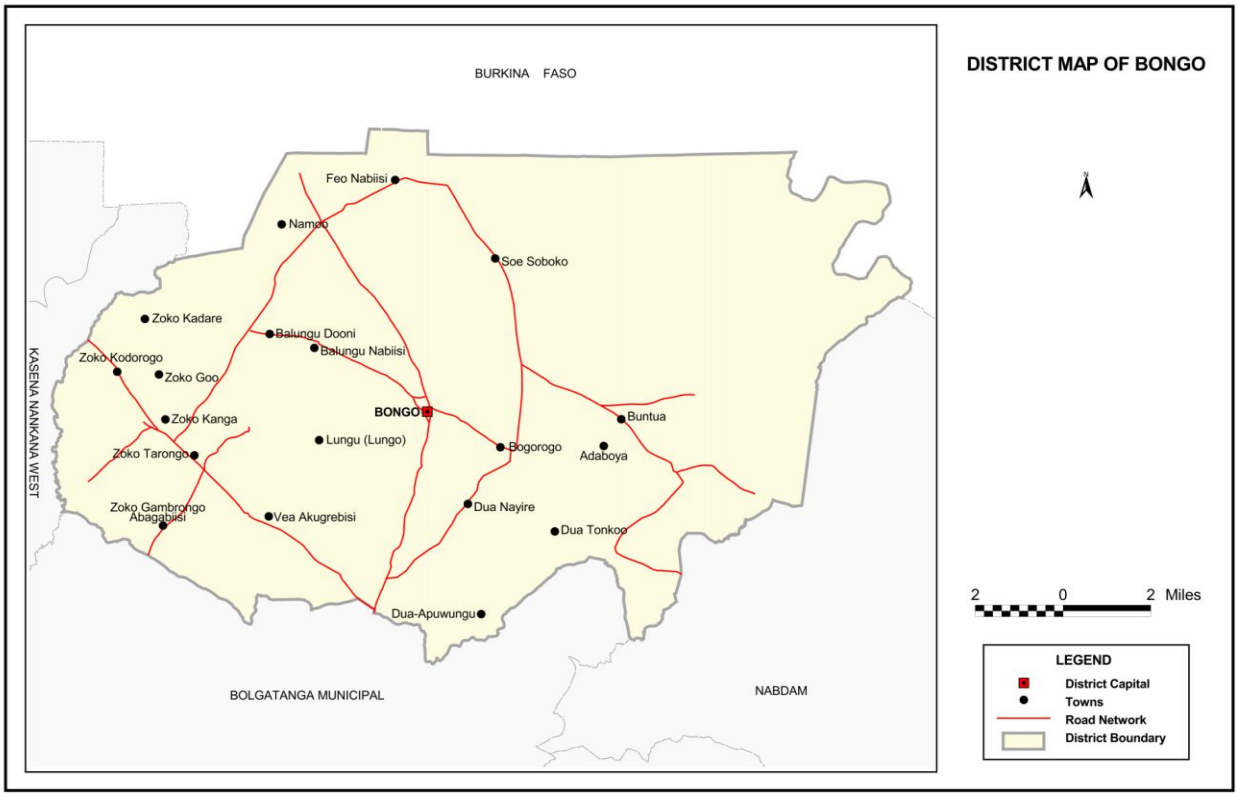
3.0 Introduction

It is important to clearly state that the study would employ a mixed design comprising qualitative and quantitative approaches in data collection and analysis. This chapter outlines the research approach adopted for the study, how the sample frame and sample sizes were determined, tools used for data gathering, the unit of enquiry and analyses as well as data requirements and sources. This section finally describes how field data was made suitable for presentation and analysis and the tools used for data presentation and analysis

3.1 Study Area

The Bongo District is one of the thirteen (13) administrative districts in the Upper East Region of Ghana. The Bongo District was created out of the then Bolgatanga District (now Bolgatanga Municipal) in 1988 following the implementation of Ghana's comprehensive decentralisation programme that year. Located between longitude 0.45^0 W and latitude 10.50^0 N, the district covers a total land area of 459.5 square kilometres. The Bongo District shares boundaries with Burkina Faso to the North and East, Kassena-Nankana West and East Districts to the West and the Bolgatanga Municipal to the South (BONDA, 2010).

Map 3.1 Bongo District showing study communities



Source: Adopted from Ghana Statistical Service, GIS (2010)

3.1.1 Climate and Vegetation

Like many areas in the Upper East region, Bongo District has a tropical climate. The Northern East position of the District makes Bongo enjoy both a dry and raining season. The latter which generally runs from May through October and records the maximum rainfall between August to September (annual rainfall of 800 to 1,100 mm). The other season which is longer, spans from November to February, is earmarked by winds which are either hot and dry or cold and dry with dust. The short and poor rainfall pattern in the District negatively affects agricultural activities. Not only are crop yields said to be declining, some fields are not usually cultivated largely because of the erratic nature of rains at the beginning of the cropping season. During the long dry season, the District often comes under the influence of the dry, dusty harmattan

winds. Water bodies in the district also dry up during this long dry season, thus reducing their capacity to support vegetable production and livestock watering. This practice is contributing negatively to the depletion of forest belts and the siltation of river basins in the districts, particularly the Red Volta and White Volta Basins. The physical environment in the Bongo District has also been subjected to constant destruction by human activities such as intensive farming, overgrazing, and constant felling of trees and shrubs which is not matched by an equal measure of tree planting efforts (Bongo District Assembly, 2010).

The plant cover which is made up of short deciduous leaves which are scattered and drought resistant includes the following species: *dawadawa*, baobab, acacia and Shea trees which all contribute to communities' incomes. There is a forest reserve and the Red Volta which offers an excellent environment for the development of certain wild animals such as baboons, monkeys, rats, mice, hares, buffaloes, antelopes' and guinea fowls (Bongo District Assembly, 2010).

3.1.2 Demographic Characteristics

Results of the official National Population Census conducted in 2010 put the population of the Bongo District at 84,545 people with a growth rate of 2.8% provided by the 2010 Population and Housing Census Report (GSS, 2012). Population growth in the Bongo District is related to its high natural growth (compared to other parts of the regions) mainly since migration from neighbouring Districts is very scarce. Using the 2006 figures, the population density is about 200 people per sq km and this is very high when compared to the whole Upper East region which records 104 people per sq. In terms of age groups, 44.8% of the population is between; 0 to 14 and only 7% are beyond65. The proportion of the adults is about

40% of the total population of the District. The women are slightly more than the men. (Bongo District Assembly, 2010)

Table 3.1: Age Distribution of the Bongo District

Age Group	Absolute Population	Percentage (%)
0-14	44,841	44.8
15-44	33,229	33.4
45-64	14,913	14.9
65 and above	6,906	6.9
Total	**99,889**	**100**

Source: Bongo District Assembly, 2010

The population distribution presented in Table 3.1 shows that the Bongo District has a youthful population. As shown in Table 3.1, about 44.8% of the population in the district is below 15 years. The large youthful age group suggests a high birth rate in the district. Although the youthful nature of the population presents prospects for labour, it equally presents problems to the Assembly in view of the limited economic opportunities in the district. For instance, not only is agricultural land in the district limited, its fertility is also on the decline. At the same time, off-farm economic activities in the district are limited and less developed. The age distribution as shown in Table 1 also presents a picture of high dependency ratio in the district. As can be seen from Table 1, more than half of the population falls within the dependency age group (i.e. below 15 years and above 64 years) (Bongo District Assembly, 2010).

3.1.3 Settlement

The settlement pattern in the District is largely rural, with Bongo Township, the district capital as the major settlement. Other relatively bigger settlements in the

Districts are Namoo, Soe, Zorko, and Beo. The average household size in the district ranges between 5-10 persons. The Gurunsi and Boosi (of the Frafra) ethnic group are the main linguistic groups of the District. People in the District live in various types of dwellings, including compound houses, detached and semi-detached houses. According to the 2010 Population and Housing Census Report, about 58.9% of the people in the Bongo District live in compound houses (GSS, 2012). Aside the government quarters in Bongo town and Gowrie, only a very limited number of modern private flats and apartments can be found in the district. (Bongo District Assembly, 2010).

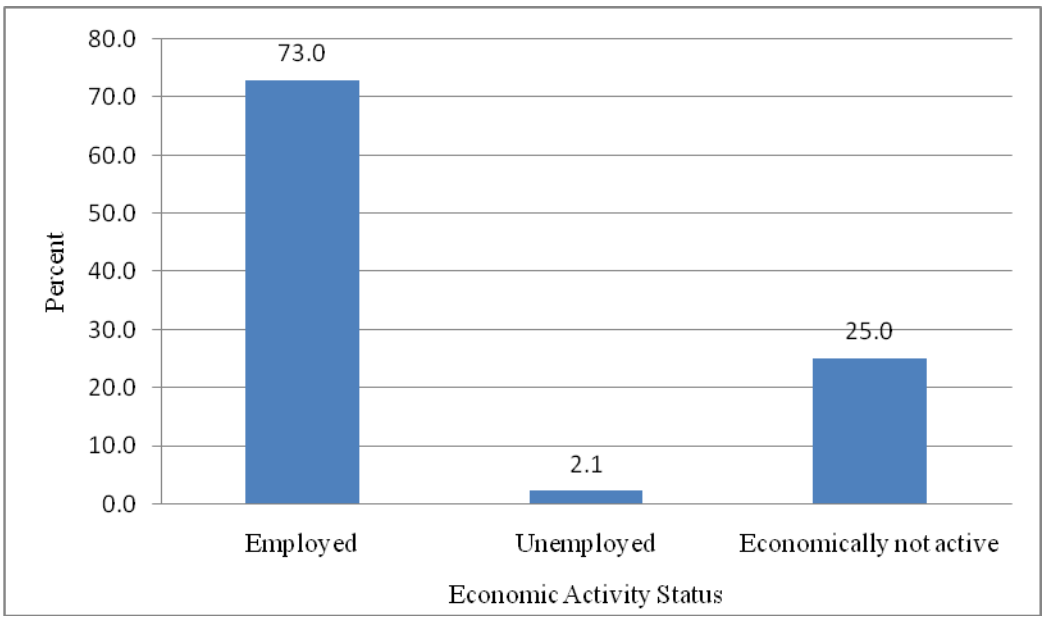
3.1.4 Electrification in Bongo District

A total of twenty-four (24) communities in the Bongo District of the Upper East Region of Ghana have been hooked onto the national electricity grid under the rural electrification project. Ten (10) communities benefited under Phase I while an additional 14 have been rolled onto the Phase II. Some of the beneficiary communities under Phase I included Atiabisi, Atanseka, BalunguApugbia, Kadare, Goo and Awaa while those under Phase II comprised Ayopia, Adaboya, Feo, Soe-Tamoliga, Amanga and Gurugo. (Bongo District Assembly, 2010).

3.1.5 Industry and Economic activities

There is no major industry in Bongo but many small scale manufacturing enterprises exist in areas with high population density. These enterprises work on child weaning food or produce baskets, dawadawa, and so forth. There are also artisans such as mechanics, metal workers and even hair dressers and dressmakers. These small industries make great use of local raw materials.

Figure 3.1: Economic Activity Status of the population 15 years and older



Source: Field Data, (2016)

There are three major industrial activities at the District level represented in Table 3.2: agriculture, including forestry and fishing (72.2%), manufacturing (14.2%) and wholesale and retail; repair of motor vehicles and these include: motorcycles (4.6%). The three combined contribute as much as 91.0 percent of industrial activities in the district. Agriculture is the primary activity in the district for both males and females. But females (18.4%) are into more manufacturing activities than males (8.9%). Manufacturing activities in the District include brewing, Shea butter extraction, groundnut processing, weaving and, smock making.

3.1.6 Shea-butter Processing

Shea butter processing is one area that has engaged the services of most women in the district. It employs close to 75% of women which includes the pickers and the processors. It is one area that has served as a major source of income for most women

and their families. It also has the potential of breaking through the international market and local markets.

3.2 Research Methodology

It is important to clearly state that the study employed a mixed design comprising qualitative and quantitative approaches in data collection and analysis. Qualitative approaches look at the settings and people historically and deal with how people think and act in their everyday live.

Some of the techniques used to get these qualitative data for the study included field observation, focus group discussion, semi structure or unstructured interviews. These methods assume that social interactions form an integrated set of relationships that can best be understood through an inductive procedure.

3.3 Research Design

A research design is a master plan specifying approaches and strategies for collecting and analysing required information (Zikmund, 2000) cited in Mahemba, 2003). This was employed in order to determine the cause or consequences of differences that exist between or among women groups, processing Shea butter and who are connected to RE and those who are not connected to RE.

The group difference variable in a causal-comparative study is either a variable that cannot be manipulated or one that can be manipulated, but for one reason or another has not been. The basic causal-comparative design involves selecting two or more groups that differ in a particular variable of interest and comparing them on another variable. The groups differed in one of two ways: one group either possesses a characteristic that the other does not, or the groups differ on known characteristics. The two groups in this study were the beneficiary and non-beneficiary women groups.

The main difference investigated between the two groups was those groups connected to and use RE for processing of Shea-butter while the other was those who did not have access and thus unable to use RE for processing of Shea butter.

3.4 Data Sources and Instruments for Data Collection

Semi-structured questionnaires were largely administered for primary data, eliciting both qualitative and quantitative data with regards to adoption and use of RE as well as the cultural practices in relation to the Shea industry, and how RE access economically impacts on the expansion of the Shea industry in the study districts. A guide was developed from the semi-structured questionnaire and administered at Focus Group Discussions. The purpose of the Focus Group Discussions (FGDs) was to obtain more specific information from Shea processing groups in the six sampled communities in the Bongo district. Given this backdrop, information needed was specialized with respect to the identification of the various key players and actors in the Shea-industry such as Pickers, marketers of nuts and butter (traders in the industry), processors/producers (women), Tindana/Chiefs, Opinion Leaders, NGOs, Government/State agencies such as MOFA as well as RE service Providers (ECG/VRA), among many contacted on the impact of RE on small scale industrialization specifically on the Shea industry in the Bongo District of the Upper East region.

3.4.1 Secondary Sources

In order to get information which is already worked up on by others, this source enabled the researcher to get some information written in text books, and internet through documentation so as to make the study at hand to have coherence and consistency. Policies and regulations, population and demographic data will be

obtained to enrich the study. Secondary documentary source takes the use of results of previous investigation of a given problem being investigated. As a result, earlier work done which serve as useful information on the subject matter would be reviewed.

In this case the investigator relied mainly on what had been documented related to a given problem. The use of such recorded information was subject to all the specifications and observations made earlier in relation to the exploration to existing literature under the definition of the problem being investigated. In effect, the researcher consults literature from past and present study of relevance to includes; official reports, census data, archival material, statistical data and many related writings. Also, information was sought from NGOs, publications, journals, newspaper, magazines, the electronic media and books were reviewed as part of my literature review.

3.4.2 Photography

Photography/portraits were used since pictures often reveal a lot of practical meaning to interpretation and documentation of the research outcomes.

3.4.3 Population of the Study

The population of the study includes a group or category of individuals selected for the research refers to the population of the study. For purposes of this study, the target population was Small-scale Shea-butter processing women groups who were beneficiaries and non-beneficiaries of rural electrification, Volta River Authority staff and operators, the District Assembly staff (Local authority), Traditional Heads, Shea industry traders (buyers/sellers), including Shea-nut pickers as well as identified micro-enterprises operating/existing in selected communities in Bongo District of the Upper East Region.

3.5 Sampling Design and Sample Size Determination

The research sought to generate evidence that could be used in initiatives that seek to protect the livelihoods and promote the survival strategies of the people of Bongo District engaged in SSIs. It again sought to find out how RE access on SSIs, especially the Shea industry would improve productivity in the Shea-industry in the Bongo district and the country as a whole. It is often however impossible to do strict probability sampling in the field, other alternatives is appropriate under different circumstances.

The case study approach was adopted which offered an empirical enquiry that allowed the researcher investigate and understand the dynamics of the Shea industry. The study assumed a non-probability sampling design and purposively sampled specific geographical areas, groups, individuals and institutions involved directly or indirectly with the Shea and its products within each chosen case study area. The study assumed these sampling techniques to select communities, groups, individuals and institutions involved directly or indirectly with the Shea-industry and its products within each chosen community of study. It was for this reason that the research process targeted some research institutions, Civil Society groups, CBOs and NGOs in the Shea-industry, traders (sellers and buyers of Shea products), Shea pickers, traditional authority and other individuals in the six selected communities.

The District Coordinating Director and Planning officer was interviewed at the District Assembly level and obtained both planning and policy dimensions of the Shea industry with regards to access to RE. Six communities in the Bongo District were selected for study based on their similarities, accessibility of the Shea tree and consideration of RE access for Shea productive ventures. The communities most famous for Shea production activities were the ones selected ahead of the others listed

by the Bongo District Assembly. Individuals, particularly traditional leaders were targeted for interview based on their role, knowledge and history of the Shea-industry. Shea processing groups were purposively selected for interview. Respondents from the six selected communities included twenty (20) women beneficiaries of RE as well as ten (10) women non-beneficiaries of RE in each community, making a total of One Hundred and Eighty (180) Women Shea butter processors interviewed. In addition to interviews, the FGDs were used on separate women groups of ten (10) to acquire more information about the consistency of their formation and productive activities over the years and how RE access has impacted or otherwise, activities in the Shea-industry.

Table 3.3: Communities and Participants sampled for Study

No.	Name of Communities	Sample Size	
		with RE	without RE
1	Bongo Soe	20	10
2	Apatanga	20	10
3	Beo	20	10
4	Adaboya	20	10
5	Dua	20	10
6	Namoo	20	10
TOTAL		**120**	**60**

Source: ***(Field Survey, 2015)***

3.6 Data Collection Procedure

Research Assistants were trained over a two-day period on the questionnaires with respect to the objectives of the research, and to coach them on the skill of questionnaire administration. Each respondent was tasked to give an interview according to the time scheduled on the time table. The interview guide and the check list for the women were interpreted into the local languages (Guruni) to enable respondents give appropriate answers. The questioning of respondents was done strictly on a face-to-face interaction basis. The entire interview guide was read individually to ensure that the questions received the attention of respondents and appropriately responded to. For those respondents who were established to be literate and could read and make meaning from the text, there were provisions for self-administered questionnaire as a method of data collection which allowed respondents to respond appropriate at their most convenience.

3.7 Method of Data Analysis

Both descriptive and inferential analyses were used to achieve the objectives of study. The descriptive analysis was performed using averages and mean difference tests, frequency tables, percentages, graphs, pie chart, T-test, Chi-square test, percentages to compare socio-economic characteristics of beneficiaries of RE and non-beneficiaries of RE, to obtain significance differences.

3.7.1 Kendall's Coefficient of Concordance *(W)*

Research Question 4: Kendal Coefficient of Concordance was used to analyse constraints confronting productivity of women engaged in the Shea-industry in the study area. Thus, in identifying and ranking the constraints affecting the Shea industry in the Bongo District, Kendall's coefficient of concordance was used to obtain the degree of agreement in the ranking.

The Kendall's Coefficient of Concordance (W) is calculated as:

$$W = \frac{12\left[\sum T^2 - \frac{(\sum T)^2}{n}\right]}{nm^2(n^2-1)} \quad \text{.....(1)}$$

Where, W = Kendall's Coefficient of Concordance, T = sum of ranks for constraints being ranked, m = total number of respondents (processors), and n = total number of constraints being ranked. The Coefficient of Concordance (W) was tested for significance in terms of the F – distribution.

The F-ratio is given by; $F = \left[(m-1)W/(1-W)\right]$ .....(2)

Numerator degree of freedom, $(n-1)-(2/m)$

Denominator degree of freedom $(m-1)(n-1)-(2/m)$

If the test statistic W is 1, then all the survey respondents have been unanimous, and each respondent has assigned the same order to the list of concerns. If W is 0, then there is no overall trend of agreement among the respondents, and their responses may be regarded as essentially random. Intermediate values of W indicate a greater or lesser degree of unanimity among the various responses (Legendre, 2005).

3.7.1.1 Hypotheses

Null hypothesis (H_O): there is no agreement between the rankings of the constraints in the study area.

Alternative hypothesis (***H_A***): there is agreement between the rankings of the constraints by the Shea nut processors in the study area.

3.7.1.2 Decision rule

Wc is calculated Kendall's coefficient of concordance. The decision rule is that if F-calculated is greater than the F-critical value, the null hypothesis (Ho) would be rejected otherwise, it would not be rejected.

Therefore, the null hypothesis in this case is rejected if the calculated F-value exceeds the tabulated F-value, indicating that processors of Shea-butter agreed with each other on the ranking of the constraints. Thus:

The estimated Kendall's coefficient of concordance values were 0.69, 0.61 and 0.44 respectively and significant at 1% which indicated that there were about 69%, 61% and 44% (in that order) agreement among the rankings by the sampled processors. Hence, the null hypothesis which stated that there was no agreement between the rankings of the constraints in the study area in terms of Production, Storage and Marketing have been rejected in favour of the alternative thus; there was agreement among Shea-butter processors on the rankings of constraints in the study area.

CHAPTER FOUR

DATA PRESENTATION AND ANALYSIS

4.0 Introduction

This Chapter presents the results and discussions of the empirical data collected in the study areas regarding the impact of grid electricity services on the Shea processing industry in the Bongo District of the Upper East Region (UER) of Ghana. The goal of the study was to assess the impact of rural electrification on the growth of the Shea-industry in the study area. This chapter consequently provides analyses of the effects of Rural Electrification (RE) up-take on rural industrialization (Shea-industry) in the study area. In order to examine the issues properly, this Chapter presents the results in two main parts, Shea-enterprises with uptake of RE services and the situation of those who do not have RE services in Bongo District. In addition, there is an analysis of the socio-demographic data of participants. Overall, it provides the framework against which the analyses have been carried out.

4.1 Socio-Demographic Characteristics of Participants

4.1.1 Age Characteristics of Respondents

All 180 respondents interviewed were women. Twenty-three (23) of the respondents fell within the ages of 15-24, seventy-one (71) of them fell within the age range of 25-34, sixty-seven (67) within 35-44, nineteen (19) fell within the range of 45-54, six (6) of them fell within 55-59 and the remaining three (3) were women who fell above 60 plus range. It could be deduced that majority of the women fell within the active labour force that is from ages 15-44 representing about 89.4% of the total population as in Table 4.1.

Table 4.1: Age Distribution of Respondents

Age cohort	Frequency	%
15-19	2	1.1
20-24	21	11.7
25-29	33	18.3
30-34	38	21.1
35-39	36	20.0
40-44	31	17.2
45-49	11	6.1
50+	8	4.4
Total	**180**	**100**

Source: Fieldwork (March, 2016)

4.1.2 Sex distribution of Respondents

The study took into consideration two kinds of operators in the Shea-industry; participants with RE and those who do not have RE. Both categories of respondents showed female dominance in their response to the questionnaires. Table 4.2 thus represents the sex distribution of respondents.

Respondents were female dominated with all one hundred and eighty (180) respondents representing 100% being women Shea pickers, butter processors as well as traders in the Shea industry in the Bongo District. The rationale was to establish knowledge on impact of RE on Shea processing industry in the Bongo District; and to give a spice to the study by obtaining varied views from various Actors involved in the Shea value chain.

4.1.3 Marital status of Respondents

Table 4.2 shows the marital status of respondents who participated in the survey. Out of the total number of one hundred and eighty respondents, (91) respondents were married, representing 51%. The number of respondents who were singles was 20 representing 11 %. Respondents who were divorced numbered (29) representing 16percent and those who were widowed also numbered 40 representing 22 %.

The upshot of the above analysis does not illustrate that marital status has had an influence to the adoption and use of RE for the processing of Shea-butter in the case study area.

Table 4.2: Marital status of respondents

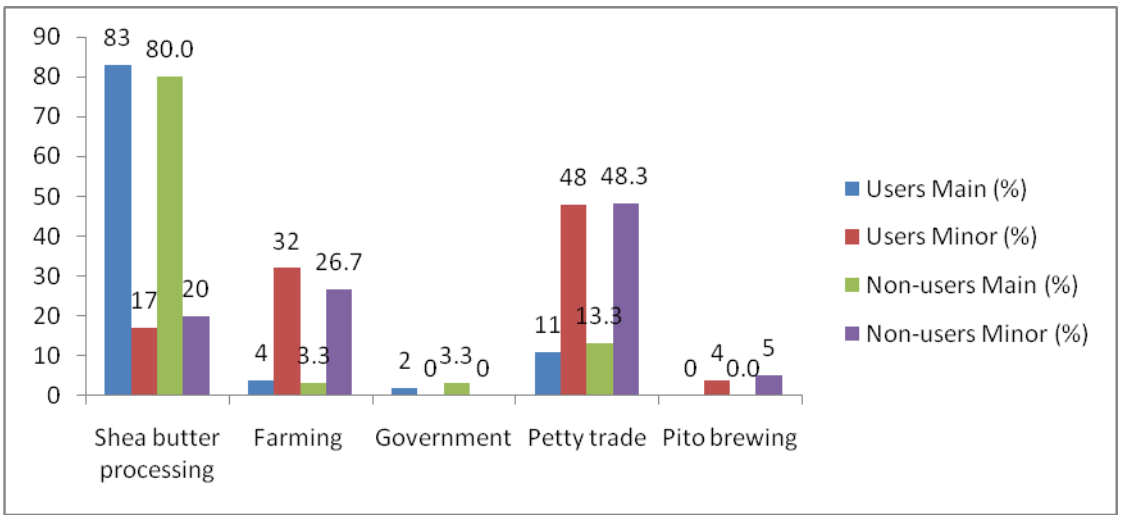
Marital status	**Users**		**Non-users**	
	Frequency	**%**	**Frequency**	**%**
Married	63	53	35	58
Single	13	11	6	10
Divorce	19	16	9	15
Widow/widower	25	21	10	17
Total	**120**	100	**60**	100

Source: Fieldwork, (March, 2016)

4.1.4 Occupations of Respondents

Figure 4.1 presents survey results from six study communities in the case study District, which revealed some clear differences in the occupations of Respondents with RE (users of grid-power) and those who do not have RE (Non-users of grid-power).

Figure4.1: Shows the occupations of respondents in the case study area



Source: Field Data (2016)

With respect to participants with RE at selected communities in the Bongo District, approximately 100 participants (83 percent) were engaged in Shea-butter processing as their main occupation while 20 participants (17 percent) do Shea-butter processing as a minor activity. Also, 5 participants (4 percent) engaged in subsistence farming business, while government employees (teachers or retired teachers) were 2 respondents (2 percent) and 13 respondents (11 percent) were involved in petty trade.

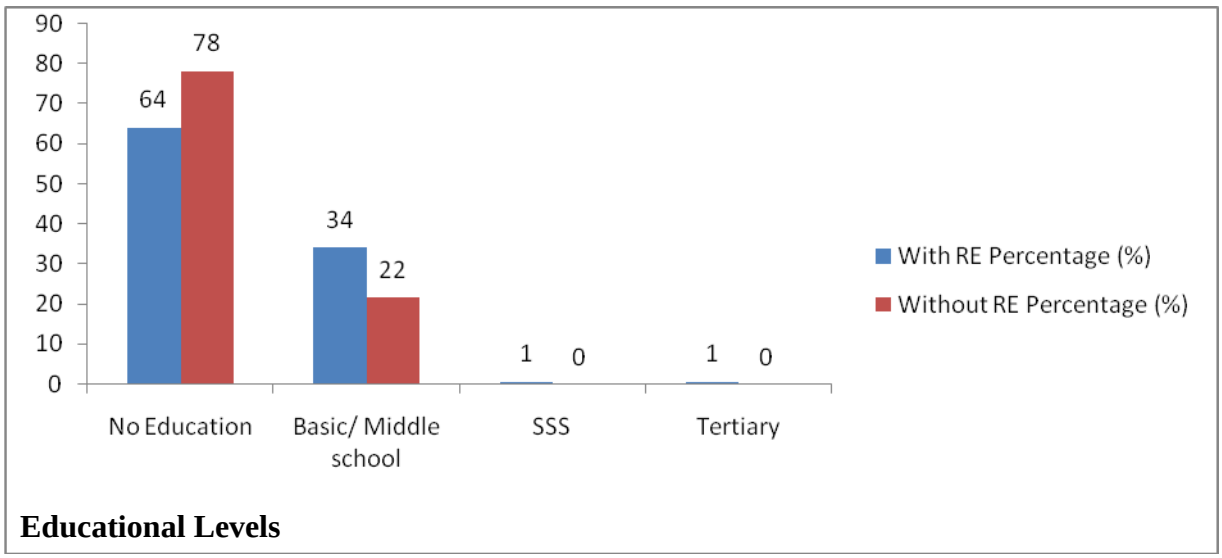
The study also revealed that respondents without RE were engaged in diverse forms of livelihoods activities trade as their main occupation including; Shea-butter processing which recorded 48 participants (80 percent) of respondents in that industry, 2 participants (3 percent) farming businesses; 2 participants (3 percent) government employees and about 8 participants (13 percent) engaged in petty trading. It further revealed that about 12 participants (20 percent) engage in Shea-butter processing as a minor activity; while 16 participants (27 percent) in subsistence farming, 29 participants (48 percent) petty trade and 3 participants (5 percent) in 'Pito' brewing respectively as minor activities. Figure 4.1 gives a clearer picture of

the occupational attributes of respondents. There were no significant differences on occupational stance, suggesting an influence of RE on the choice of occupation type in the study area.

4.1.5 Education of Respondents

Evidence from the questionnaire survey confirmed an almost similar outcome with respect to the two categories of respondents in terms of the educational levels of participants in Shea-processing communities in the study area. This is illustrated in Figure 4.2.

Figure 4.2: Educational status of respondents in the case study district.



Source: Field Data (2016)

Figure 4.2 clearly shows a higher percentage of 64 (77 respondents) with RE of having no education at all, while 78 % (47 participants) who do not have RE had never been to school. Both categories realized 34 % (41 participants) and 22 % (13 participants) respectively had either attained basic/middle school educational levels.

With other levels of education such as Senior High School and Tertiary, both categories had 1 percent respectively in all six select communities of study area. This implies that the illiteracy rate is high among women engaged in Shea butter

production within the Bongo District. This has a trickle-down effect on the Shea-butter industry as women will be unable to keep simple records to determine the profit and loss of their activities. This is evident on the ground as most women interviewed were unable to give accurate records of their daily activities. It is therefore essential to initiate non formal educational programs to help the women keep simple records and as well respond to accounting demands of their monetary and enterprise performance.

4.1.6 Activities of Respondents in the Shea-industry

Results from the study revealed five (5) main activities through which respondents in the various communities connected to the Shea-industry in the Bongo District. Such activities included Shea-butter processing, trading in butter or nuts, soap making, Shea-nut picking and pomade making.

Table 4.3 Shea-industry activities in Bongo District.

	With RE		Without RE	
Shea Activities	**Freq**	**%**	**Freq**	**%**
Shea butter	112	93.3	60	100
Trading in butter/nut	96	80	60	100
Soap making	20	16.7	-	-
Shea-nut picking	55	45.8	27	45
Pomade making	20	16.7	-	-

Source: Fieldwork (March, 2016)

Table 4.3 demonstrates the various activities respondents undertake in the Shea-industry. Among the respondents with RE, 112 were engaged in Shea-butter processing representing about 93%. About 96 respondents traded in butter and nuts representing 80%, while 20 respondents engaged in soap making representing about

17%. Shea-nut picking had a total record of 55 respondents representing 46% and pomade making had a record of 20 respondents also representing 17%.

From the investigation, it can be said that most of the respondents interviewed were engaged in more than one activity.

Also, 60 respondents were engaged in activities such as Shea-butter processing and trading in butter/nuts, representing 100% each, demonstrating that the two activities had dominance over the others. Also, 27 respondents comprising 45% were in Shea-nut picking while there were no respondents in soap and pomade making.

4.1.7 Operations of Respondents in the Shea-industry

Table 4.4 is an illustration of the operations of respondents, in the six select communities in the Bongo District. Women formed the core of interview participants who operated their Shea business activities individually or in groups.

Table 4.4: Operations of respondents in the case study area

	With RE		**Without RE**	
Operations	**Freq**	**%**	**Freq**	**%**
Individual	8	7	14	23
Group	112	93	46	77
Total	**120**	**100**	**60**	**100**

Source: Field Survey (March, 2016)

The findings captured in Table 4.4 show that 8 respondents with RE operates individually, representing 7% and 112 respondents operating in groups, representing 93% , while 14 participants who do not have RE operated individually characterizing 23%, with 46 operating in groups, also representing 77%.

Results from Table 4.4 further demonstrates that 93% respondents with RE in the study sample are likely to operate in groups than the 77 % who do not have RE.

4.2 Rural Electrification and Production Activities in Bongo district

Interviews supported by observations and documents reviews, revealed the different ways in which grid-power has been economically constructed, particularly through its use after RE installation. Although the discussion of the various uses of RE is taking place under the aforementioned sub-sectors in the Shea-industry, issues under some of the sectors are not mutually restricted. Hence, a number of ways in which the technology is used might be discussed under more than one segment, depending on the circumstance.

4.2.1 Main uses of Rural Electrification in the study Areas

Two main industrial uses of RE was identified from the survey data: RE for production of Shea-butter and lighting for related Shea-industrial activities. Results from the field indicates that majority of respondents with RE acknowledged the use of grid-power for varied activities in the Shea-industry. Table 4.6 shows the information clearly.

Table 4.5: Main uses of Grid-power in beneficiary communities in Bongo District

Main uses	Frequency	(%)
Kneading	12	10
Milling/grinding Shea-nut	120	100
Packaging	15	12.5
Roasting/Cooking	13	10.8
Lighting	20	16.7

Source: Fieldwork (March, 2016)

Table 4.5 shows various uses of RE for productive activities in the Shea-industry. The major use of RE within the Study area was grinding Shea-nuts for butter production obtaining 100% of the 120 respondents with RE. It should be noted that in conducting the fieldwork, the 120 respondents with RE were asked to indicate all the uses of grid-power in their production centres. Table 4.6, thus explains why the uses of RE totals more than 100%, because some respondents indicated more than one use. Comparatively, RE for milling Shea-nuts dominated among all the other uses. 12 respondents representing about 13% used RE for packaging of Shea-butter products (Shea-nuts and Butter, Pomade and Soap). 13 respondents representing 11% used RE for Roasting of Shea-nuts and finally, 12 respondents representing 10% indicated the use of RE for kneading process of Shea-butter production.

4.2.2 RE and lighting of Shea-processing Centres

Table 4.5 shows that about 17 percent (20 respondents) with RE indicated lighting service as one of the ways RE had been used after its installation for the Shea-industrial sector. The connection between lighting service and access to RE has been enormous in the Shea-industry. As many as 103 participants (86%) said access to RE improved lighting system in processing centres and thus increased processing hours during the night leading to production of higher quantities of butter and other Shea products; 90 participants (75%) indicated that RE led to a decrease in industrial accidents especially from kerosene lamps; and 67 participants (56%) celebrated RE as having enhanced their communication knowledge through ICT (mobile telephonic access).

Access and productive use of RE at processing centres has facilitated knowledge sharing and capacity building amongst illiterate adults women who have improved

upon their mode of communication with customers to market their Shea-products; whereas the opposite effect was felt in rural communities that do not have RE.

4.2.3 Rural Electrification and Production levels

Research data from the six sampled communities (Table 3.3), indicated that appropriate technology adopted by 103 Shea processors (86%) as a result of RE access in their processing community resulted in improvement from manual processing to mechanized production using electronic machines and appliances, which subsequently increased output from 1000kg before the year 2010 to 45000kg in 2015 (Table 4.6), culminating in higher and improved revenues in the study area. Participants said adoption and use of grid electricity resulted in growth and expansion of Shea-enterprises in terms of increased production levels due to the use of new technology/machines for Shea-butter production and other Shea-industrial activities in the study District. Shea butter processors in the six study communities sampled in Table 3.3 acknowledged that due to changed production machinery over the last five years, production levels have been improved tremendously which boosted Shea butter production levels of women Shea-processors from 3000kg in 2011 to about 45000kg in 2015 in the case study community. Women entrepreneurs claim that, the quantity obtained from 9 kg of dried kernels is about 3 kg of butter, thus conversion from kernel weight to butter weight is done with 1/3. Thus the quantity obtained depends on factors such as uniformity and temperature of roasting and on the fineness of grinding which have been achieved using mechanized/automated machines which are powered by grid (RE). Data gathered from Shea butter processors, pointed up that the best, the roasting and the finer the grinding, the more butter that can be obtained. The electric press machine is yet another extraction method which facilitates processing of Shea butter with the fineness of grinding using grid power.

Women groups also stated that their Shea butter extraction groups/centres are able to process 200 - 250 kg of nuts a day using RE, which can result in extraction of between 80- 100 kg /day of butter. Due to connection and use of RE, the groups capacity has been increased tremendously. Shea butter processors (women) are able to use electricity to power automated milling machine, kneaders and roasting machines to process about 85 kg in less than 4 hours. Women groups recalled that they had an average of 200kg/day of kernel processed, with a record of about 45000kg/yr in 2015 as compared to 3000kg/yr and below in the year 2009 when they had no electricity and with no equipment and machines to aid production. This is illustrated in Table 4.6. groups of processing women sampled for the study recount in Shea production centres that demand for Shea butter determines the quantities produced, therefore when demand of their customers increases for the Shea-butter, processing centres with access to RE are capable of increasing production levels even further. Participants said they had only one known established buyer (OJO Collectives) the rest were minor ones and that if they had more customers demanding for their Shea butter products, they had the facility to produce to meet the quantity demand. However, production is based on the quantities demanded from their customers.

A discussant from Bongo-soe community remarked:

"In using grid-power we are able to process more butter to meet demand and thus reap the benefits of RE, which other women entrepreneurs obtain from the national grid in most urban areas of the country."(Women Shea processors FGD, Bongo-soe; March, 2016)

On the other hand, 60 women interviewed who do not have access to RE disclosed that they have not changed production technology in their production centres which has led to marginal and insignificant increase in production levels over the last five

years. Field data exposed by discussants, explains that the manual or traditional method of extracting butter involves so many processes and stages which need to be done on the same day with limited time. The drudgery and laborious processes according to participants leads to extraction of a maximum of 6-12kg/day of kernels processed. The traditional methods of production according to the women was not yielding higher output levels with a seemingly constant figures of 1000kg before the year 2010 and with a marginal increase of 2000kg in 2015 (Table 4.6).

It is thus clear from Table 4.6 that RE access and use among operators in the Shea industry have a huge influence and an incentive for higher production levels leading higher output over the years, while those processors who do not have RE wan in stagnation as noted with insignificant margins of change.

Table 4.6 Quantity (Output levels in kg) of Shea-Kennel processed per year

Year	**With RE**	**Without RE**
	Output (kg)	Output (kg)
2010	3000	1000
2011	7500	1500
2012	15000	1500
2013	20000	2000
2014	28000	2000
2015	45000	2000

Source: Fieldwork (March, 2016)

4.2.3.1 Rural Electrification and Employment of women

Table 4.7 suggest that RE services in the Shea-butter processing industry has enhanced employment opportunities for women and thus provided the needed

incomes that had aided them to meet their basic needs and, in effect has helped to enhance their livelihoods and the lives of their families. Participants reiterated that when women earn an income, they are more likely than men to spend it on food, education and health care for their children and families. Table 4.7 shows that women's access to RE led to employment and higher incomes. Participants believes that the situation of RE access in their communities has boosted women's self-esteem and bargaining power within the household/community, giving them more mobility and exposure to new ideas and knowledge. Before RE, 82 representing 68% said they earned incomes lower than GH¢51 but after RE was installed in their communities a good number (about 85%) of the women positively acknowledged that their incomes have been improved from an amount between GH¢101 to GH¢500 and above.

Table 4.7: Incomes of Women processors in the Bongo District

GH	Before RE Freq	After RE Freq	Before RE %	After RE %
51-100	82	18	68	15
101-200	26	64	22	53
201-300	8	24	7	20
301-400	4	6	3	5
401-500	0	5	0	4
5001& above	0	3	0	3
Total	120	120	100	100

Source: Field Data (March 2016)

Field data also showed a 92% improvement in employment rate from 50-400 processors for respondents who had access to and use RE services for their Shea production processes in the Bongo District. According to Discussants of FGD organised for the six communities sampled, they have observed that situation before access to RE (i.e. five to six years ago) was quite different. This is because production of butter in the study area was virtually on individual Shea-processing base which

employed less than 50 women. Respondents also affirmed that access to RE, helped to upmarket Shea-industrial activities leading to the present improved employment situation of women.

A Discussant from Dua community puts in plain words;

''Grid-power has facilitated work in the Shea-industry as drudgery and laborious activities hitherto have been curtailed. Many community women now engage in various activities in the Shea-enterprise where they make some income to support their families.''(Women Processors FGD, Dua Community; March, 2016)

4.2.3.2 Rural Electrification and Empowerment of women

The study further revealed that electricity services have had major impact on women's empowerment looking at the enormous upscale of productivity and improved production levels of the Shea-industry in the study area. Empowerment is a person's capacity to make effective choices and to transform choices into desired actions and outcomes. It has also become widely accepted that women have an increasingly important role to play in social and economic development and with electricity access and availability; increases women social influence, productivity and as well led to control and better access to economic resources within the study area.

During FGD conducted in the case study area, women entrepreneurs observed that they have not only transformed electricity access and use into industrious purposes but their self-esteem, image and dignity. Access and adoption of RE systems has thus enabled women processors in the Bongo District to wield self-confidence and capacity to participate in family as well as community decision-making processes. For instance, in terms of decision making between women and men, it was observed that both men and women made decisions through consensus on a majority of decisions such as planning and prioritizing daily activities. This observation was made by

Participants; with 94 respondents (79%) revealing RE services to have brought about greater participation of women in community decision making at both house-hold and community levels which improved position of women as partners in development. According to Martinez, E. and Glenzer, K, (2005), CARE defines an 'empowered woman' as a woman who enjoys bodily integrity (is free from coercion over her physical being), has positive images of her own worth and dignity, has equitable control and influence over strategic household and public resources, and lives in an enabling environment in which women can and do engage in collective effort. According to these respondents, women are also seen some level of improved income from their Shea-businesses (Table 4.8); as a result they are able to take care of their children's (girls) education as well as health and nutritional needs of their families. Views from Participants indicate that their contribution to the family and community development has accorded them high esteem and recognition in community decisions affecting their wellbeing. This is further confirmed by studies conducted on Enhancing Opportunity for Women in Development (ENOWID), an intervention in Ghana exposed increased independent decision-making in domestic affairs and children's education by women participants as compared to non-participants who took more joint decisions with their spouses.

Therefore, it can be concluded that there is a link between access to RE services and women's socio-economic development as users of RE have had such opportunities to increase their incomes through improved productive technology and efficiency in the Shea-industry. The feminist school of thought also supports the argument that energy (Electricity) is important for empowering women in terms of health, work and education and for reducing the time women spend on household tasks especially in societies where fuel provision is the duty of women (Parikh, 1995).

4.2.4 Rural Electrification and Marketability of Shea-industry

The study revealed that an increased access to electricity-based services has had a positive impact on the growth and marketability of Shea-products within the Shea-industry in the study area. Electricity is therefore accepted among participants with RE as an important condition for the development of the Shea-industrial market and under right circumstances, the result will be a considerable expansion in demand for Shea-products.

Butter produced and sold in the study area is either white or yellow in colour. Processed butter is well stored in well-conditioned environment and packaged for the market. RE access has led to mechanized production in the processing centres and according to participants it makes the output have low moisture content (hard butter) which is considered good quality butter and hence high demand by traders and consumers.

This was further affirmed by some identified key informants/stakeholders contacted in the Shea industry in the study District; opinion leaders, Assembly representatives of the study communities, women leaders (‘Magazia’ and Queen mother) as well as some actors (consumers and traders) in the Shea-industry. Key Informants specified that white Shea-butter is pure Shea butter, which is mostly used for cooking. The yellow butter is favoured and more attractive for the making of cosmetic products. Although, Lovett (2004) dictates that there is no difference in texture between the different coloured butters when taken into labs for testing. Participants agreed that access and use of grid-powered machines in processing centres in the Bongo District for extraction of butter is more sanctioned, smooth and with no contamination mixed into the butter, such as granular/stones, sand or dust and created the needed market condition for the Shea-industry and its products. During a focus group discussion,

participants opined that the national and export industry is more demanding on the quality of Shea butter, but current traditional methods of processing Shea-nut into Shea butter especially by women group processors who are not connected and use RE, results in quality that is too inconsistent for international markets. The illustration on Table 4.8 details RE to have a positive influence on the marketability of the Shea-industry as it impacts on the source of demand for Shea-products within study area.

Table 4.8: The sources of customers for Shea-products in Bongo district

	With RE		**Without RE**	
Source of customers	**Frequency**	**%**	**Frequency**	**%**
Local	88	73	60	100
National	20	17	-	-
Foreign/International	12	10	-	-
Total	**120**	**100**	**60**	**100**

Source: Fieldwork (March, 2016)

A question posed as to whether respondents had new customers during field investigations, also showed divergent views. About 51 respondents (43%) with RE, disagreed explaining that demand came from the same persons they have previously traded with while 69 respondents (58%) agreed that they had potential customers from various location including local, national and international as a result of the constant exposure of the Shea-industry on the media (Radio).

Meanwhile 41 respondents who do not have RE, about 68%, disagreed that new demand source was available in their Shea-business, while 19 respondents (32%) agreed that there has been new buyers aside those who often demand Shea-butter from them, as in Table 4.9.

Table 4.9: New customers for Shea-product in Bongo District

New customers	With RE		Without RE	
	Frequency	**Percent**	**Frequency**	**Percent**
Disagreed	51	42	41	68
Agreed	69	58	19	32
Total	**120**	**100**	60	100

Source: Fieldwork (March, 2016)

4.2.4.1 Rural Electrification and Income Levels

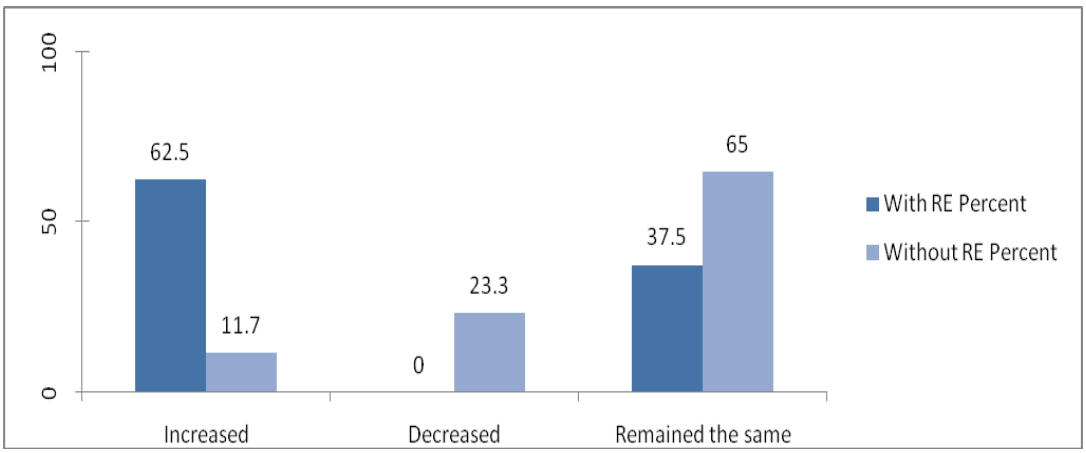
The general consensus among 75 participants (63%) with RE in the study area indicated that levels of their incomes had been improved leading to positive expansion of their Shea-enterprises. According to participants of a Female focus group discussion, the Shea industry is a potential and vibrant economic opportunity for women in the sub-region due to high demand for Shea produce. Access and use of RE amongst processors (groups/centres) over the past five years has seen a marked improvement in income generation of women in the Shea industry, which is a result of higher patronage and exposure of the Shea industry due to access and use of RE which transformed income levels through cash revenue increases which leading to expansion of Shea-industrial activities. Field Data (Table 4.7) shows that income generation opportunities increased faster over the past five years, in parallel with the period of RE expansion. One study that really supports the claim is by Prasad and Dieden (2007), which stated that growth in income generating activities principally resulted from businesses already connected to electricity. SNV-Ghana in 2006, also reported Shea butter prices to have increased from USD 1.4 to USD 2.2, increasing women's incomes by 50% among processing centres connected to and use grid-

power. There was no account pointing to decreasing incomes, but when participants who did not have access to RE were asked whether they encountered any decrease in their incomes, 45 respondents (33%), said their incomes remained the same.

With the other category respondents who has access and use RE for production, they acknowledged that increased incomes among processors in Shea production sector, has led to women's ability to meet cost of regular maintenance of electric gadgets, used machines for processing and as well sustain RE services in processing centres.

Whereas non-users of grid-power, 7 respondents (12%) agreed that their income levels increased, it was so negligible based on the use of traditional energy sources for processing Shea-butter, 14 respondents (23%) in this category pointed out that income levels rather declined due to the continuous and long hours of searching for wood fuel and other traditional sources of energy to process their butter, while 39 of the respondents (65%), said their incomes have remained the same over the last five years of production activities in the Shea-industry. Figure 4.3 illumines clearly the income situation amongst respondents in the case study area.

Figure 4.3: Income status of respondents in Bongo District



Source: Field Data (2016)

Accounts from Participants (Figure 4.3), showed that levels of women income, number of years of processing groups and centres connection to electricity services

was highly associated with Shea-business expansion due to improve incomes resulting from access and use of RE. This consistent conclusion with highlights from Table 4.7 implies that processing groups/centres with access to and use of RE services may have benefited tremendously from improved incomes over the last five (5) years after installation and use of RE among groups and Shea butter processing centres.

4.2.4.2 Rural Electrification and Communication

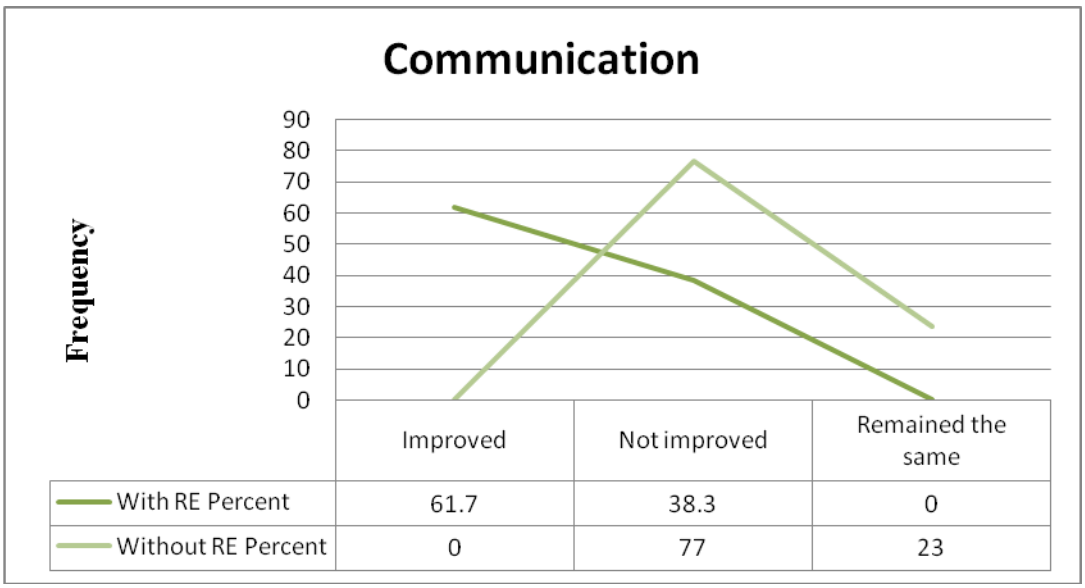
The introduction of RE in the study area according to the findings, indicated that electricity power has created the possibility of conversion into a wide range of energy services with productive and enterprise situations. The effect of RE on communication is thus clearly illustrated in the figure where 74 respondents (62%) with access to RE accepted that RE has improved communication between processors and buyers beyond their community leading to improved patronage of Shea butter and other Shea products in the Bongo District. They reported access to RE as having enabled women to charge mobile phones and connect to the world's market through the internet where they draw a lot of information about existing markets for Shea-butter and other produce from Shea. This is evidenced in Table 4.9 where national and foreign/international customer base has facilitated the scaling up of production levels of processors and as well improved quality, over the last five years leading to high demand for the Shea butter/products. According to the respondents the installation and adoption of RE for production activities in the Shea industry has opened up the study district through information sharing. 46 respondents (38%) in this category, held the view that communication has not been improved.

With the non-users of RE in the case study area, 46 respondents (77%) on the contrary did not acknowledge any improvement in communication as a result of installation of RE since their processing centres are not connected to grid electricity, while 14

women representing 23% of respondents from the category, said that communication had remained the same.

The data therefore supports access to grid-power services on communication as a direct effect resulting from huge jobs creation through provision of right avenue to reach a large customer base for women entrepreneurs in the Shea-industry (supply and demand sides), with also an indirect effect resulting from the increased economic activity that access to grid-power services facilitates in terms of communication.

Figure 4.4: Demonstrates respondents' level of communication in the case study area.



Source: Field Data (2016)

4.2.5.a: RE and Mechanization of Shea-industry

The access and use of RE has led to the adoption of new and appropriate mechanical technology by Shea-butter producers (women) in the Shea-industry. This has led to the expansion of the industry from the use of manual equipment for processing to mechanized production by means of machines, powered by electricity. Observations from the field data also revealed that output levels were very low as showed in Table 4.6. Women processors disclosed that before RE, output level was in the range of

1000kg, but after installation and use of RE for productive purposes, productivity in their processing centres improved for the last five year with a 2015 total figure of 45000kg butter processed in the six sampled communities that employed electric powered machines for production, indicating about a 93% increase in output levels from 3000kg in 2010 when RE was newly installed in the study communities to 45000kg output levels in production centres in 2015 (i.e. five years after installation of RE). Thus Table 4.6 reveals that RE installation and use, influenced Shea Butter Production and its output levels among women processors. In the past, women Shea butter processors covered by this survey used to employ mainly family and group labour for their processing energy requirement. But with the advent of RE access, Women Beneficiaries (with RE) now use machines to undertake activities such as roasting, milling and kneading of the Shea nuts as well as packaging Shea-butter. This is not the case with respondents who do not have access to RE in the study area, they work as individuals in their various homes as has been the practice.

In assessing man energy used by women processors, labour units were determined by the number of hour's man energy was engaged in producing a given quantity of Shea butter. It was clear from the survey that labour in man-hours was higher in processing centres who did not have access to RE compared with those centres with access to RE in the six sampled communities. This was largely because of the kind of processing methods and machines used. Women processors in the six sampled communities, who did not have RE, used drudgery methods throughout processing cycle. Whereas most of the processes, such as milling and roasting, were mechanised in production centres in the six sampled communities, connected to and use RE, significantly dipped man energy and time spent in processing butter at those processing centres. It was disclosed by women processors in the survey that the use of machinery, such as an

electric crusher and milling machine, saved considerable time and energy in processing centres which were connected to RE compared, while in production centres that were not connect to RE in these same sampled communities, mortar and pestle were used for the crushing of nuts into grits.

In all the production centres in six sampled communities that were not having access to RE in their production centres, the equipment used was a wooden carved mortar from a tree trunk and a pestle for physical pounding to crush the kernel which also had considerable burden on women's health. A grinding stone chipped out of solid rock served as a platform for grinding the roasted grits into paste. This stage was observed to be highly demanding, with regard to physical strength, on the processors and was time consuming. Table 4.10 illustrates the man-hours used in the various processes in Shea-butter processing.

Table 4.10: Time on Task per Person in processing Shea-butter

Processing Activity	**With RE (1kg of nuts)**	**Without RE (1kg of nuts)**
Crushing/Breaking	00:35	02:50
Roasting	01:10	02:05
Kneading/Beating	01:08	02:30
Boiling/Cooking of emulsion	01:00	02:10
Pounding and Milling/Grinding grits into paste		
Labour using grinding stone (manual) for 1kg of nuts	-	03:34
Labour using milling machine for 1kg of nuts	00:31	-

Source: Field Observation (March, 2016)

Field data gathered from Shea butter processors (women) make known, machines such as the mill (grinding mill/machines), the Kneaders, Roasters, Crushers and other packaging machines (Heat Sealer) are employed for the production and packaging of finished products in the Shea-industry in the Bongo District. Before installation of RE in the Bongo District, operators and other women groups in the Shea-industry employed traditional methods of processing Shea kernel into butter which was drudgery and arduous with several independent stages which had to be followed in order to complete a single processing cycle. These stages involved the use of equipments such as grinding stone (chipped from a rock), mortar (moulded from tree trunk), and hand kneading/beating using big iron basins and also roasting of nuts using big iron cooking pots.

The study revealed that out of the 180 women (users and non-users of RE) interviewed, 120 changed production machinery since 2012 (four years now) and this resulted in an increase in production level for users of RE. On the other hand, about 60 out of the total women interviewed still use traditional source of labour (man energy) for productive functions and consequently did not up-scale their production levels over the last four years. Refer to Table 4.6

Consequently, varied use of some machines in production centres recorded a total number of 120 respondents (100%) with RE who said they used the milling machine to grind/mill Shea-nut for butter processing, 16 respondents making about 13% said they used the Kneader mixing and extraction of butter processes. Apparently, 13 women (11%) indicated the use of Crusher for de-hushing/de-shelling of nuts for processing while 15 respondents representing 13% said they used the Roaster which gives an even distribution of heat leading to quality nuts processed. Addaquaye J.,

(2004) mentioned the Kneader and dryer as being part of the mechanized processes and tools for butter.

Field investigation also revealed that respondents who do not have RE did not use any of the machines as illustrated on Table 4.10. Surveyed data recognised that these women processors used other conventional equipments and methods to process nuts into butter following traditionally required processes. It is clear from table 4.10 that, the installation and use of RE in beneficiary communities as in other parts of the developing world, has not displaced other conventionally established methods of energy use and for that matter, the kinds of energy, equipment and machines employed for micro-processing activities thus increased time on task per person in processing Shea-butter.

Plates 1, 2, 3 and 4, denote the use of manual equipment and implements used to process Shea butter, before connection to grid-power (RE). It shows Shea-nuts being grind on a grinding stone (plate 1) which is part of the manual processing equipment now replaced by grid-powered milling machine after up-take of RE, as in plate 8. The clean cook stove has also come to replace the traditional method of cooking/heating Shea-nut using biomass as in plates 2, 4and 5 respectively, and it is environmentally friendly in terms of gas emission. The Clean cook is a mechanized designed equipment/machine that protects the butter processor from exposure to excessive heat. Moreover, the quantity that can be roasted or cooked at a time is bigger and heat is equally distributed; and the use of the kneader is used for processed nut to be well mixed with water mechanically, using grid power to enable the processor extract butter oil from the residue/remains of nuts as in plate 6. The heat sealer equipment which uses grid-power, on the other hand is aimed at meeting the requisite of buyers for well packaged, clean and quality Shea butter. With this equipment, Butter is well

packaged in sealed rubber polythene and paper boxes for onward transportation to required destinations as seen in plate 7. Finally, the electric motor in plate 9, which is hooked onto the switch board in plate 10, serves a conduit for performance of most of the electric appliances and machinery that are being used in the Shea-industry in the case study area.

BEFORE CONNECTION TO GRID-POWER (RE)

Plate 1: Manual Shea-nut grinding stone

Source: *Adopted –SNV report*

Plate 2: Mechanized Roaster

Source: *Fieldwork, April 2016*

Plate 3: Crushed nuts dried (using mortar)

Plate 4: Roasting of nuts using dung

AFTER CONNECTION TO GRID-POWER (RE)

Plate 5: Clean cook stove

Plate 6: Butter Oil Kneader

Source: *Fieldwork, April 2016*

Plate 7: Sealing of butter in packages

Plate 8: Grid-powered grinding mill

Plate 9: The electric motor

Plate 10: Electric control panel

Source: *Fieldwork, April 2016*

The analyses of the plates make obvious that Shea-industry operators who do not have RE, which also form part of the nucleus economic structure of the rural population (especially the deprived), their activities have not been enhanced by RE.

4.2.5. b. Rural Electrification and Efficiency of the Shea-industry

The general understanding among respondents (with RE) is that grid-power in the Shea productive venture was positive. This assessment was concurred by participants who use grid-power in their production centres, recognising that RE has improved machines use among women processors largely and increasing the efficiency of production in the study area, especially processed butter for the consuming public. About 115 Shea-butter processors (96%) who had access to RE used electric grinding mills, as opposed to diesel-driven mills, which they regard as very efficient in the production process. Survey data further unveiled that electric machinery and equipment provided faster services, cheaper costs, more efficient output, and more instantaneous and cleaner applications as compared to diesel driven mills and manual processes. Electrically-driven machines cost up to a third less, are noise pollution free, face low maintenance requirements, and enable continuous processing services all year round. Processors prefer to use electricity for milling and production processes as it is more efficient than manual process, and cheaper than diesel machines both in capital and running costs. It was reported that processors prefer travelling long distances to processing centres connected to and use RE for milling services. The major reasons respondents recounted were substantially lower milling costs and more reliable services and most of all totally eradicating traditional and drudgery processes/methods of processing Shea-butter. Table 4.11 clearly shows that RE services and improved use of mechanized machines has generally led to improved production efficiency Shea-butter processors in the study area.

Table 4.11: RE and Improved Shea-production efficiency in Bongo district

Electricity on Mechanization	Frequency	Percent
Improved use of machines	120	97.0
Improved quality of Shea products	120	89.0
Improved efficiency of production	120	92.0

Source: Fieldwork (March, 2016)

Table 4.11 further elucidates an aggregated response from participants based on their views on production efficiency of the Shea industry in the Bongo District. Whilst 116 respondents (97%) indicated that production activities have seen an improved use of machine, 4 respondents (3%) denigrated any significant use of machines in production centres. The study further revealed that whereas 107 respondents (89%) disclosed that there has been a considerable improvement in the quality of Shea products in the Bongo District, about 11% (13 respondents) think otherwise of improved Shea product quality. Table 4.11 also points up improved efficiency in production centres at sampled communities with a 92% (110 respondents) confirming there has been improve efficiency due to the introduction and adoption of new technology as a result of installation and use of RE in these communities, about 8% (10 respondents) did not agree that there was efficiency in the production centres.

From the findings, whereas current supply and installation of RE in the Bongo District is geared towards the enhancement of the production processes and methods of cottage industries (Shea-industry), it has not been the case for all women engaged in the Shea-processing industry in the case study community, thus efficient levels of production have not improved over the last five years. Below are some views that

were expressed by two key Shea-butter processors who do not use RE (all women), were interviewed in the Bongo-soe and Beo communities.

"Processing of Shea-nut into butter is waning because it takes a lot of time to collect wood-fuel. Right now we have to travel very far before enough wood-fuel is collected. As a result, some women have stopped processing Shea-butter and in its place, have started trading in rather the Shea-nuts"{Shea-butter processor I (Key Informant Interview; Bongo-soe, March, 2016)}.

"If there is some other forms of energy that can be used to process our Shea-nut into butter apart from the use of wood-fuel we will appreciate. At present, our production levels has declined because we use a lot of time in search for wood-fuel" (Shea-butter processor II (Key Informant Interview; Beo community, March, 2016)

4.3 RE Constraints of Shea-industry

Results from the survey data revealed in processing centres hooked to, and use Grid-power in the study area, that these centres have access to electricity by virtue of their connection to the national electricity grid. Apart from Shea-processing and lighting, access to electricity enables them to use appliances such as television, fridges, blenders, electric cookers, which greatly enhanced the quality of production and marketability of Shea-products in the study community. Although the physical infrastructures are established, the sufficiency, adequacy, quality of supply, affordability, cost of appliances/equipment and maintenance were raised as factors that restrain processors access to electricity.

4.3.1 Electricity-related Constraints in Production

Results from the field analysis from per wise ranking conducted in the six sampled communities among 120 respondents in the study District, respondents identified

some constraints among which was the importunate power outage, confronting Shea-butter processing centres. Shea-butter processors described the situation as negatively affecting their processing businesses as respondents from all the six sampled communities rooted the frequency and unreliable power supply of power in production centres affect continuous productive activities. This was supported in the literature review where at the national level Braimah (2012), identified irregular supply of electricity as a major problem of industries in Ghana, pointing to the fact that industries in Ghana ranked irregular and interrupted power supply as the biggest among thirteen other problems.

Respondents also identified a problem which came up regularly from the six sampled communities with regards to energy consumption which was affordability and was ranked second, in the Bongo District after up-take of electricity due to high monthly bills. The processors of Shea-butter concluded that the running expenses were high compared to turn over (profitability). Respondents observed that due to lower profits and income generated from Shea-businesses, the purchasing power of the women was low. Respondents also explained that affordability includes being able to buy power and being able to pay for repairs/replace warn-out equipment and also pay for the electricity consumed in the industry, which was practically absent in their production centres. The demand side of the concept of energy security as revealed I in literature review supports the argument that consumers should be able to afford the energy they consume otherwise it could ensure doom for energy providers and subsequently users. As a result of affordability; that is being able to pay for energy consumed is a greater guarantee for continuous supply of energy (Bhattacharyya, 2011). Aside that, secondary document reviewed also revealed a complicated tariff structure. There were high initial connection and installation fees identified. The initial connection fee and

monthly bill increases inhibits most processors to use grid-power for productive activities

The barrier ranked third among respondents was distance covered to access power sales points. Shea-butter processors encounter difficulties in terms of distance travelled to the district and regional capitals to purchase power. This leads to bigger queues and long hours of waiting just to buy power for processing butter, this often led to the inability to meet timelines of production.

Finally, the least identified constraint in this category was the cost of maintenance, which they still attributed their low incomes and affordability as accounting for their inability to purchase high cost equipment and machinery to augment production in processing centres.

Among all the constraints mentioned by participants in the survey, frequent power outages is the most pressing constraint with a mean rank of 1.15, followed, in order of importance was Affordability of Grid-power, Distance covered to access sales points for power credit and Cost of maintenance (Table 4.12).

Table 4.12: Electricity-related Constraints confronting production

Production	**Mean Rank**	**Rank**
Frequent power-outages	1.15	1
Affordability of Grid-power	2.17	2
Distance covered to access sales points for power credit	3.09	3
Cost of maintenance	3.58	4
Kendall's W	**0.69**	
Chi-Square	**248.331**	
Asymptotic Significance (P-value)	**0.000*** **	
Sample	**120**	

Source: Field data (March, 2016) ******* represent 1% level of significance

The estimated Kendall's coefficient of concordance value was 0.69, suggesting that there was 69 per cent agreement in the ranking of the constraints by processors (Table 4.12).

Thus the null hypothesis is rejected in favour of the alternate hypothesis. This is also evidently shown by the P-value of 0.000, indicating significance at 1 per cent. This means there is significant agreement among the rankings of the constraints faced by Shea-butter processors.

4.3.2 Electricity-related Constraints in Storage

The study revealed the various challenges faced by the sampled Shea-butter processors in the study area as shown in Table 4.13.

Table 4.13: Electricity-related Constraints confronting storage

Storage	Mean Rank	Rank
Frequent Power outage	1.19	1
High cost of storage materials	2.32	2
Inadequate skills to use storage machines	2.96	3
Maintenance of storage facility	3.53	4
Kendall's W	**0.609**	
Chi-Square	**219.078**	
Asymptotic Significance	**0.000*** **	
Sample	**120**	

Source: Field data (March, 2016) *** represent 1% level of significance

The constraints were ranked with 1 as the topmost and 4 as the least setback based on the outcome (mean scores) of the analysis of the data on processors constraints using the Kendall's coefficient of concordance (W). Thus, the constraint with the least mean score is ranked the most pressing problem with the highest mean score being the least urgent. The Kendall's W was 0.609 and significant at 1% indicating that there was about 61% agreement among the rankings by the sampled processors. This implies that about 61% of the respondents considered frequent power outages as their topmost challenge, followed by High cost of storage materials, inadequate skills to use storage machines in that order as shown in Table 4.13. Respondents' ranked maintenance of storage facility as the least of their concerns or constraints (ranked 4). Since storage infrastructure/building are rarely available in the study area.

4.3.3 Electricity-related Constraints in Marketing

Table 4.14 presents the rankings of the constraints that influence the efficient functioning of the Shea-industry in terms of marketing of Shea-products. Kendall's

test of Concordance was used to test agreement among rankings of the constraints by respondents.

Respondents ranked four (4) constraints in a descending order, which is from the most pressing constraint to the least pressing constraint. The mean rank of each constraint is then used to determine the relative position in the list (Table 4.14).

Table 4.14: Electricity-related Constraints confronting marketing

MARKETING	MEAN RANK	POSITION
Lack of appropriate Packaging materials	1.49	1
Reduced butter quality	2.26	2
Delay in meeting production and customer orders	2.74	3
Transportation	3.51	4
Kendall's W	**0.435**	
Chi-Square	**156.685**	
Asymptotic Significance	**0.000*** **	
Sample	**120**	

Source: Field data (March, 2016) ******* represent 1% level of significance

The coefficient of concordance is 0.435 with 3 degrees of freedom. This coefficient is significant at 1 percent. This implies a44 percent agreement among Shea producers, concerning the constraints that influence the marketing function of Shea-product. The Asymptotic Significance was 1%, which represents the fact that, there was a 100% agreement among the various rankings that 44% of the coefficient of concordance is correct. Hence, the null hypothesis which states that there is no agreement between the rankings of the constraints in the study area in terms of marketing is rejected in favour of the alternative thus; there is agreement among Shea-butter processors on the rankings of the constraints in the study area in terms of marketing as in Table 4.14.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.0 Introduction

The Shea-industry contributes to rural economies by way of generating employment and incomes for many women. As an increasing growing cash crop, Shea is also establishing itself as a foreign exchange earner, thus contributes to the national economy. However, in its unprocessed state, its fortunes have been limited. Hence, the push to improve the production value chain in order to enhance its benefit. Access to electricity has been found to be an important breakthrough for powering the machines that process Shea into its many by-products. It is in this view that this study has been focused on the impact of access to grid power to the Shea industry in the Bongo District of Ghana. This concluding chapter gives a summary of the whole research by highlighting the conclusions, recommendations and suggestions.

5.1 Summary

This part includes summary of main findings. The main purpose of this thesis is to build understanding on the impact of ongoing rural electrification on the Shea industry in the Bongo District of the Upper East Region. To be able to investigate the issues, five (5) research questions served as guide.

Question one was on the impact of the expansion of rural electrification (RE) on the production activities of the Shea-industry in Bongo District. The results from that assessment showed that the increased access to grid electricity services led to changes such as growth and expansion of the Shea-industry due to introduction of newer technologies. Interviews supported by observations and documents reviews revealed the different ways in which grid-power had been economically constructed, particularly the use of electric equipment and appliances, which has boosted

productivity and revenues in the Shea industry.Participants said adoption and use of grid electricity resulted in growth and expansion of Shea-enterprises in terms of increased production levels due to the use of new technology/machines for Shea-butter production and other Shea-industrial activities in the study district. Surveyed data also showed that access and adoption of RE in production centres empowered women to use requisite technology by way of electric appliances and machines to optimise production levels. Up-take of RE from the year 2010 up to date has increased tremendously the Shea-processing businesses of women across the study area. This was revealed by women when they stated that their Shea butter extraction groups/centres were able to process about 200 - 250 kg of nuts (2-3bags of Shea-kennel) a day using RE, which results in extraction of between 80- 100 kg /day of butter. They acknowledged that due to connection and use of RE, their capacity has been increased immensely as they now process about 85 kg (1bag) of kennel in less than 4 hours. Women recalled that they had an average of 200kg/day of kernel processed, with a record of about 45000kg/yr in 2015 as compared to 3000kg/yr and below in the year 2009. This was found to be very advantageous, because electricity services and supply were available, reliable and affordable (cost of electricity) to most of the women producers/processors. Due to RE benefits, other micro-enterprises such as diesel Shea/grain mills switched to electricity-powered motor engines while other diesel engines such as Shea-kennel/grain mills closed down due to higher running and maintenance costs.

In addition, there were changes observed in the women Shea-processing industry. The women revealed that access to RE improved the lighting system in processing centres and thus increased processing hours during the night, which also led to increased quantity levels of their groups and production centres. It had enhanced human asset;

communication knowledge (use of mobile phone), skills and experience leading to Shea value addition, thus expanding production activities of the industry within the context of innovative processing technology with the output being quality Shea-products processed.

The second research question looked at how rural electrification affected the marketability of Shea products. The study revealed that access to grid-power has had a positive impact on the marketability of Shea products resulting in more sales, thereby boosting business revenues. There has being an increased knowledge and information sharing among operators and stakeholders across Shea industrial market segments (local, national and international), as a result of the use innovative communication appliances such as mobile/cell phones, radio sets as well as internet services, powered by grid electricity. Other factors mentioned as a result of the uptake of RE was, the introduction of grid-powered automated packaging equipment/ machines, good storage facilities and media coverage of processing activities of production groups and centres within the Bongo District. These have improved contacts between entrepreneurs and buyers/customers, within and beyond the study area, leading to exposure and higher patronage of Shea-butter and other Shea products enhancing growth and expansion of the Shea enterprise.

Research question three was on how rural electricity services affected the mechanization and efficiency of the Shea industry. The research revealed that access and use of RE had led to the adoption of new and appropriate mechanized technology by the Shea processors. For instance, electric mills could instantly offer faster, more efficient, cheaper and cleaner milling services at low maintenance costs compared to diesel mills. This according to participants had facilitated the growth of the Shea-industry from the use of manual equipment for processing to mechanized production

resulting in increased output and increased productivity/efficiency of women Shea-processors in the study area. Participants of the study thus recognised that the RE up-take had led to improved machines usage in the Shea-processing industry, which have largely increased efficient production systems among the women processors in the study area.

Research question four was about the main constraints affecting the Shea industry in Bongo District. Some of the challenges reported were the insufficiency and low quality of power supply, unaffordable power rates, and high cost of appliances/machines as being factors that restrained Shea-processors regular access to electricity for productive purposes. Other factors reported to have inhibited rapid growth and expansion of the Shea-industry were attributed to high cost of storage material/equipment, inadequate skills to use storage equipment/machines and the maintenance of these equipment and finally, lack of appropriate packaging materials, reduced butter quality, delays in meeting orders from customers and ineffective transport and communication systems.

5.2 Conclusion

From the foregone, it can be concluded that the availability of grid electricity services has supported the expansion of the Shea industry in the Bongo District. The installation and adoption of RE in the Bongo District has led to increased use of electric gadgets and appliances which has enhanced efficiency and productivity in the Shea industry, culminating in a 93% increase in processed Shea butter (output levels) from a figure of 3000kg in 2010 to 45000kgs in 2015. The 90% elevation in the incomes of women engaged in Shea butter processing from less than Gh¢50 before RE to Gh¢500 and above after RE access and adoption is an indication of improved information and communication, a consequent of triggered market demand for Shea

products in the study District. Access to RE and adoption has therefore contributed significantly in the Bongo District by boosting production activities, improved marketability and promoted the mechanization and efficiency of the Shea industry in spite of some challenges. This also shows that there is a direct link between the arrival of rural electrification programmes and changes in participants' productivity leading to growth and expansion of the Shea-industry in the Bongo District. There is thus a possibility for the rapid emergence and development of the Shea-industry in the Bongo District if RE services are sufficiently available, reliable and affordable to processors in the Shea-industry. RE is a crucial resource essential for maintaining growth and expansion of the Shea-industry. It is evident from the study that RE is indispensable in terms of job creation, women's empowerment, knowledge and information sharing and effective transport and communication systems. Thus, the Shea industry in the Bongo District, as it is in many rural areas in Ghana and elsewhere around the world, would have little meaning without RE infrastructure being established and adopted for productive use. The study thus points out that connection and use of electric energy have led to an enhanced productivity, efficiency, growth and expansion of Shea industry. Therefore improving rural micro-enterprises such as the Shea-processing industry's access to electric-energy and maintaining regular supply is vital not only to achieving the socio-economic progress but also to sustaining rural livelihoods especially those of rural women who tend to be burdened with securing energy for agro-processing purposes.

From the findings, it is also said that with time, it is possible that rural communities would be able to take advantage of the opportunities provided by the introduction of grid-power services by expanding their Shea-based businesses as they use electricity more productively. An attention was drawn from observation from both sides;

processors who have access and use RE on the one hand and those who did not have access to RE; that in order to promote and enhance productivity in the Shea-industry, there was the need to expand access to RE further in Shea-processing centres and among women processing groups in the study district and other rural communities in the Upper East Region of Ghana. Moreover, majority of the participants who did not have access to RE expressed the interest to be connected to the grid, but claimed that existing tariff structure was complicated with initial connection and installation fees as well as high monthly bills inhibiting them from accessing electricity services for improve productivity.

5.3 Recommendations

From the investigations and especially, challenges identified, a number of recommendations are being made.

1. Government (Ministry of Energy/power) and the electricity service providers (ECG/NED/VRA), support women already accessing electricity by providing regular and reliable power supply and other services such that they can improve their productivity and expand their markets
2. The District Assembly through NBSSI and the private sector (Rural Banks/Micro-finance Institutes) should increase support services by focusing on skill training and micro-credit provision to assist women entrepreneurs to get the needed skills and capital as well as subsidies with credit based sales, for agro-processors to be encouraged to purchase equipment and machines in order to expand their Shea-processing enterprises in the study district.
3. There is also the need for the District Assembly to create the needed investor enabling environment through Ghana Cocoa Board, Ghana Investment Promotion Centre (GIPC) and Ghana Trade Hub as avenues for promoting

Shea industrial activities in the entire district. This will smooth the progress for investor confidence in the industry, the exposure and the encouragement for more value additions to Shea butter and other products, with the use of grid-powered equipment/machines. This in the long run could augment income, improve productivity of women and enhance foreign exchange that boosts the domestic economy.

4. Improve income-generation by use of electric-powered and appropriate technology such that there is efficiency and product quality to avoid production deficits that are famous amongst women entrepreneurs in rural areas.
5. Support women in the agro-processing and or the shea industry with other alternative sources of energy such as solar energy, for processing and production activities inorder to revamp the Shea industry in the Bongo District and beyond.

5.4 Suggestions for Further Study

This study had a few discussible issues, which may be taken into account when conducting similar studies in the future. A comparative study should be done between various districts in the Upper East Region to expand the geographical scope in order to compare and contrast the findings as far as expansion of RE to rural areas and its up-take is concerned in impacting on productivity of the agro-industry in the Upper East Region. Other studies should focus on other viable joint sources of energy such as solar energy and bio gas energy that could promote the value addition for enhanced productivity of the agro-processing industry in Upper East Region.

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APPENDIXES

APPENDIX:RESEARCH 1QUESTIONNAIRE

APPENDIX A

Interview schedule with Shea processors in the Shea-industry connected to Grid Electricity

Section A: Demographic survey of Shea Processors in the Shea-industry.

Please answer all the questions provided as honestly as possible, to the best of your knowledge.

1. Respondent's ID …….

2. Name of Respondent community……

3. Respondent's Age…….

4. Respondent sex ……

5. What is your current marital status? .....

6. Occupation:

   1. Main……..

   2. Minor…….

7. What is your higher level of education …….

8. How long have you been in the shea industry?

9. How did you get involved in the shea industry and how?

10. What activities do you engage in within the shea industry?

11. Do you operate in a group or as an individual?

Section B: Impact of electricity on expansion of Production Activities

1. Is there Grid power in your community? ……
2. If yes, is the Grid power used in the shea industry? Explain
3. What are the dominant uses of electricity in the Shea Industry? .....
4. How many employees do you have before and after the electrification program?
    1. Before ……..
    2. After ……
5. In your view, would you say installation of Grid-power has increased employment of women in your community? Explain ……
6. Has the expansion of Grid-power program led to empowerment of women? Explain……
7. What would you say are some changes made in Shea processing activities as a result of installation of electricity?
8. Has the extension of rural electrification to Bongo District, affected production levels in the Shea-industry? Explain

Section C: Access and affordability of electricity affect patronage of Shea products

9. What would you say about your income levels after installation of Grid power? Explain.....
10. Has there been any improvement in communication between buyers and processors of Shea Products in the community/district? Explain.....
11. In your view, how has installation of Grid-power in the Bongo District affected the marketability of Shea products?
12. Where in your opinion do you get most of your demand from customers? Explain.....

Section D: Effects of Electricity on Mechanization and efficiency of Shea-industry

13. Do you use machines in processing shea-nut into butter?
14. What is the effect of rural electricity services on mechanization in the Shea-industry? Explain.....
15. Do you think the installation of Grid-power has improved the use of machines and equipment for processing Shea-nut into Butter? Explain.....
16. In your opinion is the quality of processed Shea products improved as a result the use of machines? Explain.....
17. Can you say these machines have improved the efficiency of the production process?

    Explain.....
    .....

Section E: Electricity-related Constraints affecting the Shea industry and way forward

18. Do you think entrepreneurs in the Shea industry have electricity access and affordability problems in your community? .....
19. If yes explain the following:

    i. Electricity-related Constraints in production.....

    ii. Electricity-related constraints in marketing.....
20. What would you consider to be constraints the Shea-industry face in the Bongo District?
21. What recommendations would you suggest to enhance the Shea industry's performance in your community/district?

Thank you very much for completing this survey.

APPENDIX B:

Interview schedule with Shea processors in the Shea-industry without Grid Electricity.

Section A: Demographic survey of Shea Processors

Please answer all the questions provided as honestly as possible, to the best of your knowledge.

1. Respondent's ID …….
2. Name of Respondent community……
3. Respondent's Age…….
4. Respondent sex ……
5. What is your current marital status? .....
6. Occupation:
   1. Main……..
   2. Minor…….
7. What is your highest level of education ……
8. How long have you been in the shea industry?
9. How did you get involved in the shea industry and how?
10. What activities do you engage in within the shea industry?
11. Do you operate in a group or as an individual?

Section B: Impact of electricity on expansion of Production Activities

1. Is your Shea-processing enterprise connected to Grid power? ……
2. What kind of energy do you use in Shea-nut processing?
3. What are the major inputs used in processing Shea-nuts into butter manually?
4. What type of labour do you use?

5. How many employees do you have in your Shea processing enterprise?
6. In your view, would you say your Shea processing enterprise has increased employment of women in your community? Explain ……
7. Do you think your Shea processing enterprise has lead to the empowerment of women? Explain……
8. Has traditional processing methods expanded production levels in the community? Explain……
9. Do you consider businesses that are connected to grid electricity to have certain advantages over your Shea-nut processing venture? Explain…….

Section C: Access and affordability of electricity affect patronage of Shea products

10. What would you say about your income levels, using traditional methods in the Shea processing industry? Explain.....
11. In your opinion has there been any improvement in your income levels per annum, from processing Shea-nuts manually?
12. Has there been any improvement in communication between buyers and processors of Shea Products in the community/district? Explain.....
13. Do you think installation of Grid-power in the Bongo District has affected the marketability of Shea products?
14. Where in your opinion do you get most of your demand from customers? Explain.....

Section D: Effects of Electricity Mechanization and efficiency of the Shea-industry

15. Do you use machines in your enterprise to process shea-nut into butter?

16. Is there any effect of rural electricity services on the mechanization and efficiency of the Shea industry in your community/Bongo District? Explain.....
17. Do you think the installation of Grid-power can improve the use of machines and equipment for processing Shea-nut into Butter? Explain.....
18. In your opinion is the quality of processed Shea products improved as a result the use of machines? Explain.....
19. Can you say these machines have improved the efficiency of the production process?

    Explain.....
    .....

Section E: Electricity-related Constraints affecting the Shea industry and way forward

20. **Do you think entrepreneurs in the Shea industry have electricity access and affordability problems in your community? .....**
21. If yes explain the following:

i. Electricity-related Constraints in production.....

ii. Electricity-relatedConstraints in marketing.....

22. What would you consider to be constraints the Shea-industry face in the Bongo District?
23. What recommendations would you suggest to enhance the Shea industry's performance in your community/district?

Thank you very much for completing this survey.

APPENDIX C:

Interview schedule with key informants (Local authority, Opinion leaders and Heads of Institutions/Organizations) involved in the Shea-industry.

SECTION A: Demographic survey of Respondents

1. Respondent's ID ……
2. Name of Respondent's community……
3. What is your age? ……..
4. What is your sex?
5. What is your current marital status?
6. What is your occupation? .....
7. What is your highest level of education ……
8. How long have you been in the shea industry?
9. How did you get involved in the shea industry?
10. What activities do you engage in within the shea industry?
11. Do processors operate in groups or individually?

Section B: Impact of electricity on expansion of Production Activities

1. Is the Shea-industry in Bongo community connected to Grid power? ……
2. Do entrepreneurs in the Shea industry use electricity for production? Explain.....
3. What are the dominant uses of electricity in the Shea Industry? .....

4. In your estimation, do you think many people in your community have been employed in the Shea industry as a result of the electrification program? Explain……..

5. In your view, would you say installation of Grid-power has increased employment of women in your community? Explain ……

6. Will you say the expansion of Grid-power program has lead to empowerment of women in your community? Explain…….

7. What would you say are some changes made in Shea-processing activities as a result of installation of electricity?

8. Has the extension of rural electrification to Bongo District, affected production levels in the Shea-industry? Explain

Section C: Access and affordability of electricity affect patronage of Shea products

9. What would you say about the income levels of women engaged in the Shea-industry after installation of Grid power? Explain.....

10. Has there been an improvement in communication link between customers and processors in the Shea-industry? Explain.....

11. In your view, how has installation of Grid-power in the Bongo District affected the marketing of Shea products? .....

12. Where in your opinion do women in the Shea-industry get most of their demand for Shea products from customers? Explain.....

Section D: Effects of Electricity on Mechanization and efficiency of Shea-industry

13. Do you think processors use machines in processing shea-nut into butter?

14. What is the effect of rural electricity services on mechanization in the Shea industry? Explain.....
15. Do you think the installation of Grid-power has improved the use of machines and equipment for processing Shea-nut into Butter? Explain.....
16. In your opinion is the quality of processed Shea products improved as a result the use of machines? Explain.....
17. Can you say these machines have improved the efficiency of the production process? Explain.....

Section E: Electricity-related Constraints affecting the Shea industry and way forward

18. Do you think entrepreneurs in the Shea industry have electricity access and affordability problems in your community? .....
19. If yes explain the following:

i. Electricity-related Constraints in production.....

ii. Electricity-relatedConstraints in marketing.....

20. What would you consider to be constraints the Shea-industry face in the Bongo District?
21. What recommendations would you suggest to enhance the Shea industry's performance in your community/district?

Thank you very much for completing this survey.

APPENDIX D:

Interview Guide, Check list and Focus Group Discussion (FGD) with Shea Processor groups, key informants, (Local authority, Opinion leaders and Heads of Institutions/Organizations).

1. Have installation of Grid-power increased employment and the empowerment of women in the Bongo community?
2. Do you think the extension of Grid-power services to the Shea-industry in Bongo has enhanced production levels?
3. In your view have income levels of processors been enhanced as a result of the installation of Grid-power?
4. What has been the market linkage situation between customers and processors in the Shea-industry?
5. Where do processors get most customers for their products?
6. Has installation of Grid-power improved the use of machines and equipment for processing Shea-nut into Butter?
7. Are you able to confirm that machines have improved the efficiency of the production process?
8. What would you consider to be constraints the Shea-industry face in the Bongo District?
9. What recommendations would you suggest to enhance the Shea industry's performance in your community/district?
10. How can the performance of the Shea-industry be enhanced in Bongo community/district?

Thank you very much for completing this survey.

APPENDIX E: CONSENT FORM

UNIVERSITY FOR DEVELOPMENT STUDIES

(GRADUATE SCHOOL)

Tel.: 03720-22369
Fax: 03720-22080
Website: www.uds.edu.gh
E-mail: graduateschool@uds.edu.gh

P. O. BOX 1350
Tamale, Ghana

Our Ref.: UDS/MDS/0237/12

Your Ref.: .....

OFFICE OF THE DEAN

Date: February 09, 2017

TO WHOM IT MAY CONCERN

Dear Sir/Madam

LETTER OF INTRODUCTION: ROBERT NINTANG BASUMAH
UDS/MDS/0237/12

Mr. Robert Nintang Basumah is a registered student of the University for Development Studies, Tamale. He was admitted in the 2012/2013 academic year to pursue a 4 year programme leading to the award of Master of Philosophy (M.Phil) degree in Development Studies.

We write to confirm that **Mr. Robert Nintang Basumah** is writing a thesis titled "**Rural Electrification and Small Scale Industrialization: A Study on the Shea Industry in the Bongo District of Ghana.**" as a requirement for the award of the degree.

We would be very grateful if he is accorded the necessary courtesies that he may deserve in the data collection process, please.

Yours faithfully,

Thomas A. Azuure
Senior Assistant Registrar
For: Dean

Cc:

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