# "IMPACT OF ELECTRICITY SERVICES ON MICROENTERPRISE IN RURAL AREAS IN TANZANIA"

**BY**

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**LIST OF ABBREVIATIONS**

| | |
|---|---|
| BoT | Bank of Tanzania |
| CBO | Community based organization |
| DFID | Department for International Development |
| EASE | Enabling Access to Sustainable Energy |
| ETC | Educational Training Consultancy |
| GDP | Gross domestic Product |
| HDI | Human Development Index |
| ILO | International Lab our Organization |
| kWh | Kilowatt-hour |
| LPG | Liquefied Petroleum gas |
| ME | Micro – Enterprise |
| MEM | Ministry of Energy and Minerals |
| PRA | Participatory Rural appraisal |
| REA | Rural Energy Agency |
| REF | Rural Energy Fund |
| UNDP | United Nations Development Programme |
| URT | United Republic of Tanzania |
| US$[1] | US Dollar |
| TZS | Tanzania Shilingi (Local currency of Tanzania) |

[1] US$ 1= TZS (Tanzania shilling) 1150 as of August 2005. (BoT exchange rate).

## GLOSSARY[2]

**Modern energy services:**

These are energy services provided through modern energy carriers or modern appliances. They are used often for services using electricity, whether from the grid or from decentralized generation at any scale, but also including clean cooking fuels such as LPG or biogas or motive power

**Modern energy:**
Modern energy refers to a variety of energy carriers[3] including LPG, kerosene, petroleum and electricity, either grid or off-grid electricity (generated by burning fossil fuels or by using alternative, renewable sources such as solar, biomass, hydro or wind).

**NGO:**
This is an acronym for Non-Governmental Organization. Generally, this refers to not-profit organizations or charities.

**HDI:**
An acronym for Human Development Index; a composite index measuring average achievement in three basic dimensions of human development-a long and healthy life, knowledge and a decent standard of living. The HDI is produced of UNDP and presented in annual Human Development Reports.

**Electricity Services:**
An electricity service is the function provided through use of electricity. Usually in combination with an appliance, examples of electricity services are cooking, lighting, processing, and communication.

**Rural Area:**
The term "rural area" refers to a physical locate outside of areas that are administratively managed by urban authorities. In this context, a rural area is relatively far deprived in terms of modern energy infrastructure. In other words, it is poorly served with modern energy infrastructure: grid electricity or a petroleum product distribution chain. A rural locality could be a township, a market centre, an area of dispersed settlements, or even a peri-urban area. Therefore, rural energy service encompasses energy services for agriculture, non-agriculture, domestic, productive and consumer activities. Rural areas are sparsely settled places away from the influence of large cities and towns. Such areas are distinct from more intensively settled.

**Household:**
A household is a social group, which resides in the same compound, share the same meals, and make joint or coordinated decisions over resource allocation and income pooling.

[2] Source EASE Programme in Tanzania
[3] The form in which energy is delivered to the end-user (fossil and biomass fuels, batteries, electricity); the energy carrier will need further conversion to useful energy (light, sound, heat, mechanical energy).

**Livelihood:**
Broadly, a livelihood comprises the capabilities, assets (stores, resources, claims and access) and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stress and shocks, maintain or enhance its capabilities and assets, and provide sustainable livelihood opportunities for the next generation; and contributes net benefits to other livelihoods at the local and global levels and in the long and short term.
In a narrow economic sense, the word livelihood is used for (the way someone earns) the money people need to pay for food, a place to live, and clothing. To avoid confusion we will only use the broader definition.

**Micro-Enterprises (MEs):**
This term is used to mean very small business that produces goods or services for cash income. There is no universally accepted definition of MEs, different countries use various measures of size depending on their level of development. The commonly used yardsticks are total number of employees, total investment and sales turnover. In the context of Tanzania, micro-enterprises are those engaging up to four people, in most cases family members or employing capital amounting up to Tshs. Five million.

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## EXECUTIVE SUMMARY

The development of micro-enterprises in rural areas in Tanzania 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.

Micro-enterprises are important in their role as contributors to the economy of the rural poor especially women, technological development of rural people and in their potential for employment creation. Estimates show that there are about 700,000 new entrants into the labour market every year about 500,000 of whom are school leavers from all levels with few marketable skills. Most of these people end up in the MEs sector. In rural areas of Tanzania, micro-enterprises acts as a vehicle for creating income distribution for rural poor, they are resources of poverty reduction.

The main problem that was addressed in this work was lack of understanding of the linkages between uses of grid electricity services and micro enterprise establishment, expansion, growth, decline and closure in rural areas in Tanzania.

The main aim of this research was to explore linkages between increased access to grid electricity services and micro-enterprise development in rural areas in Tanzania. This project investigated changes in both micro-enterprises and livelihood of people involved in enterprises after uptake of grid electricity services for operation. Livelihood context was used to contribute to understanding of the changes happening in micro-enterprises both within and between each other after up taking of grid electricity services.

To achieve the aim of this research, the general research question sought to identify the effect(s) of grid electricity services in facilitating and supporting the establishment, growth, expansion, decline, and closure of micro-enterprises in rural areas. In order to provide the answers to the general research question, the research addresses the following specific research questions.

- After taking up electricity in rural areas in Tanzania, what changes of establishment, growth, expansion, decline and closure can be felt and which changes in livelihood have taken place in micro-enterprises?
- Who experiences these changes, and why?
- What are the main barriers experienced by micro-enterprises in rural areas in Tanzania in accessing and taking up grid electricity services?

The research findings serve as tools to stimulate the understanding of linkages between grid electricity services and micro-enterprise development, allowing stakeholders to take actions and support rural electrification programmes, and increasing awareness for entrepreneurs about impact of electricity services on income generating activities and finally to reduce poverty in rural areas in Tanzania.

This research was a single case study, involving more than one unit of observation. Units of observation were selected from three villages in rural areas in Kilimanjaro; fifteen (15) enterprises were selected from each village Foo and Mahango, and thirteen (13) enterprises were selected from Lyasongoro village. These three villages are among the villages used by EASE programmes in Tanzania as a study area. Foo and Mahango villages used by EASE for research on productive uses of electricity and biomass heat energy. Lyasongoro village used

for EASE for pilot projects on promotion of improved firewood stoves, charcoal baking ovens and charcoal production kilns for productive uses.

This case study uses Triangulation method to explore the impact of grid electricity services on micro-enterprises. Both secondary and primary quantitative and qualitative data were used for explanation. Quantitative data were collected and used to back up qualitative explanation.

The first research question was answered by assessing the changes that happened in micro-enterprises such as increase establishment, growth, expansion, decline, and closure. Also, changes in livelihood characteristics of the people involved in micro-enterprises were assessed using physical, financial, human and social assets after up taking the electricity services. The micro-enterprises such as grain milling, furniture manufacturers/carpentry, welding shops, tailoring shops and salons were established after introduction of electricity services.

Also, it was observed 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.

Furthermore, the establishments of new branches/expansion of micro-enterprises within and outside the studied areas were observed. In Foo village, Hai district small Kiosk was selling salt and kerosene but the business grew and branches within the village and now there grain-milling machines, sunflower oil extraction machines and wood workshop, all these used electricity services for production.
Another example observed in Lyasongoro village where two entrepreneurs said they initially owned grain milling has expanded their business; one had opened a retail shop and a bar within the same village. The second entrepreneur opened retail shop within the same village and computer centre including internet and fax services in the nearby village; all these were possible because there was availability of electricity services.
In the same village, one tailoring machine expanded now had three machines and a hairdressing salon with three driers. In the same areas, yet there was one welding workshop but at the time of data gathering, the owner had two salon cars. In Mahango village, a respondent said he started with a small retail shop now owned one “pick up” car, welding workshop and battery charging machine.

Decline and closure of micro-enterprises were 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 creates more MEs of the same nature without having a good plan for the markets of their products. This ends up with market saturation. The market saturation caused low turnover, low saving from electricity services and high running costs. This situation was observed in all three villages

The livelihood characteristics of entrepreneurs and employees had changed as a result of taking up electricity services for production or operating the enterprises for example there were accumulation of physical assets such as modern houses, radio cassette, cattle, and saloon cars among the interviewed enterprisers. Financial assets had changed as well, there was increase in income earning which facilitated change in living standards like being able to pay good medical charges, school fees and good meal. In addition, human assets had increased; as observed, people gained business knowledge after dealing with customers for a long time;

Young people gained knowledge and experience after they had participated in training like carpenters, welders and tailors.
With respect to the second research question, the beneficiaries of the changes, which happened in micro-enterprises, were assessed within micro-enterprises and between different micro-enterprises. This was done by using livelihood characteristics of enterprise owners, employees, and of communities in which enterprises were located. Some indicators related to those changes were used, such as technology used for production or offering the services, production process, quality and quantity of products, changes in knowledge and skills, changes in living standards, and change in external relationship.

The beneficiaries of the changes brought in micro-enterprises after up take of grid electricity services are people within enterprises and community members in which these enterprises are located. The electric motor machines for milling, hair driers and hair cutting machines were observed to be more used and located at a short walking distance in the research areas as a result of having electricity services, this save time and human energy for other productive activities.
Other benefits were business knowledge, experience and skills gained after being involved in business activities. For example in Mahango and Lyasongoro grain milling operators were said to gain experience and skills to run machines using electricity, as well as doing maintenance or repairs.

Electrified MEs realised income increase from energy saving and a higher turn over. The savings obtained enabled entrepreneurs to make extensions of electricity services to their homes; this extension benefited the low-income households to charge their mobile phone and be able to get news through watching TV and playing radio cassette. Male entrepreneurs were observed to be benefiting more than female since they preferred choosing larger profit making business and women were involved in survival business such as local beer brewing and hair dressing salon rather than business aiming in development.

The problems and barriers experienced by MEs in accessing and using grid electricity services for production in rural areas in Tanzania were examined by the third research question. The field findings of this research confirm that in rural areas of Tanzania there were problems and barriers experienced by micro-enterprises in accessing and using electricity services in rural areas. Some of these barriers are due to lack of connection materials like fuses, cables, poles and transformers from electric supply utility; complicated and expensive tariff structure for rural people; illegal connection and vandalism of cables and theft of cooling transformer oil, which result low voltage and fluctuation of power this discourage new customers to apply for connection.

Some productive uses that have been identified as positively affected with access to electricity services in rural areas include lighting in shops, lighting, providing power in rural workshops, such as carpentry, and welding shops.

In conclusion, it was revealed that there is evidence that rural micro-enterprises are enhanced by the availability of electrification programmes. The latter stimulate establishment, growth, expansion, decline and closure. Some micro-enterprises such as grain milling, hairdressing, and hair cutting salons and welding are in need of electricity service provision. Therefore, blackout of electricity or power rationing for these types of enterprises causes low production or stop services provided resulted into low income and slow down a strategies for poverty reduction.

# CHAPTER 1. INTRODUCTION

## 1.1 Back ground Information

This study is concerned with the role of electricity services on micro-enterprises success and/or failures particularly in rural areas in Tanzania. There are several reasons for studying the linkages between impacts of electricity services and micro-enterprises in rural areas. Firstly, through economic restructuring programmes in Tanzania, the government is following the worldwide trend to privatize state-owned enterprises and rely on private ownership and liberal market mechanisms to achieve socio-economic goals. This system affects the pattern of employment; such that many people are retrenched and others forced to have early retirement. The rate of unemployment has been growing such that group of unemployed people looks for alternative means to sustain their lives e.g. establishment of micro enterprises (ME's) for income generating activities in their homeland, which is located in rural areas.

Tibandebage et al., (2003) in the intergraded labour force survey 2000/01 in Tanzania, revealed that households with informal sector[4] activities constituted 27%, which is about 1.4 million households of the total households in rural areas in Tanzania. This is comparatively than 21% of total rural households in 1990/91, suggesting a substantial increase.

Apart from the group mentioned above, a larger part of population in Tanzania (about 80%) lives in rural areas and most of them depend mainly not only on agriculture but also on ME's activities for their income generation. The data in the 2000/01, Integrated Labour Force Survey, show that the informal sector accounted for the second largest proportion of employed persons16% of the total labour force of 17,827,578 million people, more people in urban areas about 35% compared to rural areas 11%, with agricultural activities having the largest share (about 81%). (Tibandebage, et al., 2003)

Basing on above data, ME's has proved important by creating employment for those who can not find work in other formal sectors and also creates additional income to the households who are engaged in both agriculture and micro-enterprises. This suggests that the establishment of micro-enterprises can make the informal sector grow very fast. However, what factors, which exactly influence the success and failure or make some ME to remain at a stationary level, are not well known. In some areas there is a general belief that more women tend to employed in informal sector rather than formal sector.

King and McGrath (1999) pointed out that people in rural areas are pushed to operate MEs by a lack of viable alternatives. Examples to this include landless households or people living in unfavourable agro-climate conditions. Others include people forced to do so in response to favourable opportunities e.g. a response to dynamic local markets that open up profitable possibilities; or the presence of other activities in the household that generates funds, enabling the operator to invest in the MEs.

Electricity service is one of the factors, which may have both a direct and indirect impact on small micro-enterprises development. Relatively, very little detailed research has been undertaken on the specific benefits or disadvantages of electricity services for micro-enterprises in rural areas in Tanzania. It appears that often only a few and not so detailed

[4] The working definition of the informal sector for Tanzania (EASE Project) "In contrast with the formal sector, the informal sector encompasses economic activities that are not recorded by the state, i.e. activities to which the state has no means of access."

studies and reports have been documented, (for example Kjellstrom, B. et al., and (1992). Rural Electrification in Tanzania).

Generally, empirical evidence on the impact of electricity services on micro enterprise success or failure is lacking. This lack of information/research about the role-played by electricity services in the performance of micro-enterprises in rural areas may be reflected in the lack of attention paid by responsible institutions, policy makers and other stakeholders about rural electrification programmes.

The Tanzania government appointed external consultants/advisors to assist in the restructuring and privatization of the national electricity Supply Company (TANESCO) for improving efficiency performance of the company, to develop the electricity trading arrangements and regulatory environment in the electricity sector, to develop the approach to improving access to electrification (rural electrification) and to meet universal obligations.

All these measures demonstrate the government interest to increase the number of energy consumers who had the ability and willingness to pay for electricity services. The strategies to achieve this are through promotion of the use of electricity services for income generation activities.

A few issues emerge regarding rural Tanzanian:
If rural poor people have access to electricity services, are they willing to have a connection and use it for productive activities? What affect does electricity services have on their livelihood strategies such as living standard? How does electricity service influence income generation activities for the poor people? These are some of issues this research has looked at in order to obtain insight of relationship between electricity services and ME's development in rural areas in Tanzania.

### 1.2 Structure of the Research Report

This is an academic research project, which is part of the final step in the Masters of Environmental Business Administration, Environment and Energy management (MBA), at the CSTM and Technology and Sustainable Development Group (TSD), University of Twente. The opening phase of this research includes a review of relevant literatures and documents and discussion with energy experts. The main fieldwork exercises and report writing took place during a period of July to October 2005. The contents for each chapter in the report are summarized below and List of experts interviewed is attached as Appendix 1.

### Chapter One

This first part includes a literature review; it also provides an introductory part of the research by giving background information of the research, structure of research report, followed by importance of micro-enterprises, nature of micro-enterprises, energy sector (electricity sub-sector and rural electrification) in Tanzania. Also, the chapter includes growth and decline of micro-enterprises, impacts of electricity services on micro-enterprises and finally the conclusion based on concepts in the literature.

**Chapter two**

This part outlines the statement of the problem and justification for the research, significance of the study, research objectives, research framework, research questions, and expected out put.

**Chapter three**

The chapter outlines the research areas, research design, research strategies and research materials that have been used to answer the research questions raised in chapter two. Type of micro-enterprises studied, data gathering tools, data analysis techniques and compilation methods and work plan of the research.

**Chapter four**

This chapter presents the results and makes a discussion of the findings obtained from the study areas (three villages in rural areas in Kilimanjaro region).

**Chapter five**

This is a chapter dedicated to summary of the whole work, summary of major findings and conclusions reached.

### 1.3 Importance of Micro-enterprises in Tanzania

According to the Government of Tanzania (URT, 2003)[5], it is estimated that about a third of the GDP originates from the MEs/informal sector. Based on the Informal Sector Survey of 1991, MEs operating in informal sector alone consist of more than 1.7 million businesses, engaging about 3 million persons. This is about 20% of the Tanzanian labour force. However, the data on informal sector are estimation and unreliable, it is reflected that informal sector plays a crucial role in the employment opportunities and economy development in Tanzania.

In the early 1980s, Tanzania like most of the fewer developing African countries, was faced with economic crises that forced her to adopted economic reforms. Through this economic restructuring programme, most state owned enterprises/industries were privatized and downsized. Their capacity to provide employment was reduced and, as a result, people lost jobs and their real purchasing power declined (Nelson, 2003). Those retrenched Tanzanians were absorbed in MEs sector.

Due to the shrinkage of the formal wage employment and erosion in real wages, Tanzania has envisaged the informal sector as one of the priority development policies towards income earning and poverty alleviation. Moreover, some conducive environment such as a national policy to recognise an informal sector has been provided to the sector in recent years. More important, the government had initiated deployment measures to enable retrenchees engage in self-employment in the informal sector (Luvanga, 1997). As a result, micro-enterprises have grown rapidly. Estimates of the numbers of micro enterprises with up to 5 employees and small enterprises with between 6 and 50 employees range widely, from 1 to 2.5 million countrywide[6].

[5] The United Republic of Tanzania – Small and Medium Enterprise Development policy: Ministry of Industry and Trade Dar es Salaam, April 2003.
[6]Germany Development Services (The DED in Tanzania).http://www.ded-tanzania.de/ accessed on May 2005:

At present unemployment in Tanzania is a significant problem that needs to be addressed. According to URT (2003), estimates show that there were about 700,000 new entrants into the labour force every year. About 500,000 of these were school leavers at all levels with few marketable skills. Only 400,000 of them were employed by public sector leaving about 660,000 unemployed, most of them ending up in opening small businesses. Therefore, micro-enterprises were apparently the best option to address the problem of joblessness.

According to the integrated Labour Force Survey (2001/2002), the total labour force (aged 15 years and above) had increased from 11.2 million in 1990/91 to 17.8 million in 2001. This implies that 650,000 new people had been entering the labour market every year, (URT, 2005).

Micro-enterprises tend to be more effective in the utilization of local resources using simple and affordable technology. They also play a fundamental role in utilizing and adding value to local resources. In Tanzania most micro-enterprises use local resources and affordable technology to undertake their activities, these activities include:

- Making craftwork e.g. carpentry, pottery, clothes-making/tailoring
- Small-scale agricultural activities such as dairy processing, bee keeping, poultry farming and goat keeping
- Food preparation and processing such as bakeries, local beer brewing, honey processing, grain milling and fish smoking.
- Small-scale mining and processing activities such as tinsmiths and blacksmiths.

In addition, MEs technologies are easier to acquire, transfer and adopt such that there are better positioned to satisfy limited demands brought about by small and localised markets due to their lower overheads and fixed costs (URT, 2003). A lesson from Japan indicates that the Japanese economy has been influenced by enterprises taking on the role of suppliers of innovative components and sub assemblies to large companies (Gunasekaran, et al., 2000) cited in Mahemba, 2003). In the United States of America (USA), small enterprises have been a driver of a free market economy through legislation (Mahemba, 2003).

Furthermore, in rural areas in Tanzania, micro-enterprises are found to be important suppliers of materials and services to small and medium scale enterprises whilst at the same time providing access for poor producer and traders to local urban and national markets. This was observed in the study areas for this research though there is no documentation to support the observation.

The above reasons and example lead one to a conclusion that micro-enterprises are important for the creation of employment for those who cannot find work in other sectors and create additional income to the households who are engaged in agriculture.

### 1.4. Nature of Micro-enterprises in Tanzania

The MEs in Tanzania are characterized by very low productivity and lack of capital accumulation; most are self-employed and located at home due to lack of designated work premises and not linked to modern sector (larger enterprise) because of people's ignorance of regulations. This means that they do not go through business formalities (which the state imposes) such as registration, keeping accounts and even paying taxes. Another reason is use of traditional and inefficient technologies in production.

There are micro-enterprises which are seasonal in the sense that its lifetime depends on situation in other sectors such as agriculture. When there is a good harvesting period many enterprises of this nature are established and buy grains from farmers for processing example for local beer making.

Some existing documentation support the argument by saying that micro-enterprises are neither registered nor licensed[7]. They are home-based activities and have been established for the reasons of survival rather than with a longer-term plan for growth.

The life time of enterprises is apparently driven by the purchasing power/economic stability of community members since these enterprises depend more on local markets, and many customers are doing farming activities. These enterprises get high income during harvesting season when most people have much grain for selling and processing. Low purchasing capacity of the community members means that the earning for enterprises is also low. This implies that whenever there is very low purchasing power of the community there is usually no lifetime for enterprises located in that particular community.

Apart from low purchasing power and lack of marketing opportunities, it is widely felt that there are serious constraints that limit growth in numbers and in terms of the contribution to Gross Domestic Product (GDP) or economic development in general. The most important inhibiting factors for micro-enterprises sector growth is a low capital, low product quality due to inadequate and outdated technology and low level of savings[8].

Estimations of the percentage of the labour force engaged in micro enterprises in rural areas are increasing. The data from integrated labour force survey done in 2000/01 show that households with informal sector activities constitutes 27% of the total house holds in rural areas as compared to 21% of households in 1990/91, (Tibandebage, et al., 2003). The informal sector is said to dominate the economy, accounting for 70% of employment and 30% of GDP (Nelson, 2003). However, there is a lack of monitoring of micro-enterprises establishment and development in Tanzania, resulting in out-of-date statistics and understanding their contribution to national GDP. Data are not available to show a distribution of informal enterprises by size and occupational categories (Sawe, 1998). Nonetheless, the findings obtained from the study areas revealed that a total of 43 enterprises studied were established between 1994 and 2005 and had 44 permanent employees and 33 employees working under temporary basis.

### 1.5 Energy Sector in Tanzania and sectoral development

The Energy Sector is one of the key sectors for development and the proper functioning of all sectors of the economy. The vision of the energy sector is to effectively contribute to the

[7] Germany Development Services (The DED in Tanzania). http://www.ded-tanzania.de/) accessed on May 2005
[8] Germany Development Services (The DED in Tanzania).http://www.ded-tanzania.de/ accessed on May 2005:

growth of the national economy and to improve the standards of living of population in a sustainable and environmentally friendly manner. While the mission is to provide safe, reliable, efficient, cost effective and environmentally compatible energy services to the wide cross section of the population on a sustainable basis (Sawe, 2004. URP, MEM, 2003).
The Ministry of Energy and Minerals (MEM) is responsible with all energy related matters in Tanzania. To promote the development of rural electrification, the MEM was during the time this report writing, finalizing the establishment of a rural Energy Agency (REA) and a Rural Energy Fund (REF), both of strategies of which would be instrumental to promote access to modern rural energy especially electricity (ECON Analysis, 2004). Under the MEM, Tanzania Electric Supply Company Ltd. (TANESCO), a state owned company is responsible for generation, transmission and distribution of electricity.

The energy situation in Tanzania is characterized by low per capita consumption of commercial energy sources and a high dependence on non-commercial energies, including biomass fuels in the form of firewood, charcoal and bio-waste, which are the main source of energy to both urban and rural areas. Biomass-based fuel accounts for more than 90% of primary energy supply. Commercial energy sources i.e. petroleum and electricity account for about 8% and 1.2%, respectively, of the primary energy used. Coal, solar and wind account for less than 1% of energy used (URT, 2003)

### 1.5.1. Electricity Sub-sector in Tanzania

Electricity sub-sector contributes about 0.6 per cent of total energy consumption (Sawe, 2004). Electricity supply in Tanzania consists of both interconnected and isolated systems, Installed generation capacity on the interconnected transmission grid amounts to 863 MW from both hydro and thermal generation facilities. Hydro accounts for 559MW while thermal contribution amounts to 304MW. Contribution from isolated thermal generation facilities amounts to 29MW, making a total installed capacity of 892MW (URT, 2003).

There is very limited access to electricity. At present, only about 10 percent of the Tanzanian population, mainly urban based has access to grid electricity. In rural areas, where majority of Tanzanians live (80%), only 1 percent of the population was by the time of the thesis production connected to grid electricity. One of the reasons, which cause low access to electricity, is that there are significant technical and non-technical losses in the system and vandalism on power system infrastructure in some places (URT, 2003).

### 1.5.2 Rural Electrification in Tanzania

In Tanzania, rural electrification programme has been going on since the early 1970's, the aim of the rural electrification programme is to provide reliable and high quality electricity supplies which can be used for domestic, industrial and commercial purposes (Kjellstrom, et al., 1992). As explained earlier, rural areas have much less access to the electricity services than the cities, in rural households less than 1% have access to electricity (Arvidson & Gustafsson, 2002).

The government believes that rural Tanzania cannot be transformed into a modern economy and that rural Tanzanians' livelihoods cannot be significantly improved without a dramatic increase in their access to modern energy services, particularly electricity (ECON Analysis, 2004). Most electrified households use electricity services for lighting but those who do not have electricity services meet their lighting demand with other options such as kerosene, diesel, dry cells, biogas, and solar PV.

### 1.6 Impact of Electricity Services on Micro-enterprises

There are varieties of micro-enterprises in the rural areas of Tanzania. These MEs 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 between 394 to 924 per month while for the residential and light commercial consumers, the range is between 100 and 200 per month (Kjellstrom, et al., 1992).

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, et al., 1992).

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, et al., 1994) cited in Rogerson, (1997). In Philippines, many ME's activities transformed their technical and economic efficiency by going over to modern technology powered by electricity.

The key question is: "Do electricity services play an important role in stimulating micro enterprises development in rural areas?" There is not a lot of empirical evidence to support the argument but Rana-deuba, (2001) cited by Meadows, et al., (2003). Example from Nepal shows that increased access to electricity has resulted in or contributed to the establishment of small enterprises like bakeries, photo studios, grocery stores, and saw mills, in addition to agricultural activities such as poultry farming and goat keeping.

Some authors cite findings from the literature and use only qualitative information to indicate the impact of electricity on Micro-enterprises. 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 ME's was observed and there was a definite positive correlation between use of electricity and the emergence of new commercial establishments (Rogerson, op. cit. (1997)

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. Evidence of the impact of electricity from Elandskraal, Northern province in South Africa point out that electricity has a potential input for upgrading the condition of the

ME's economy (Rogerson, op. cit. (1997). Also Fakira (1994, 21) use Elandskraal experience which provides 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.

A study undertaken in Namibia about impact of rural electrification on social–economic development shows that electricity services do not seem to have had a significant impact on growth of income generating activities (Wamukonya & Davis, 2001). The findings from the same study show that the share of households with home-based income generating activities was highest among unelectrified households. Furthermore, few home- based enterprises use electricity for income generating activities, and when they do, mainly make 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 & Devis, op.cit. 2001).

Basing on the evidence from Namibia, rural electrification, whether grid or solar, has not played a significant role in stimulating income generating activities. This shows that there are other factors that have to be in place to support enterprise development and that electricity is at best one facilitating factor. Kjellstrom, et al., (1992) who found that small businesses in rural Tanzania did not depend on grid electricity for operation, but mainly used charcoal, firewood, kerosene and diesel support this argument.
However, more studies need to be conducted since the findings do not show why enterprises located in the place where an electricity service is available have not been connected and do not use the services for production, and why those connected to the services do not use electricity for income generating activities but instead use it only for lighting. There are some factors to be considered because the micro-enterprises themselves are not homogenous; they have different characteristics and different needs; some depend more on electricity services for their operation than others do. Therefore, increasing access to electricity services may be good for some micro-enterprises, neutral for others, and perhaps negative for others (Meadows et al., (2003).

In Tanzania, a survey undertaken by Kjellstrom, et al., (1992) in four districts of Same, Sumbawanga, Babati and Njombe revealed that three quarters of these areas were electrified by diesel generators, which may be a reason for ME's not using electricity services, since reliability is not assured. In addition, it may be due to the high production costs, which lead to selling at high cost (High tariffs) to end-users.

From this analysis, it may be concluded that availability of modern energy services, particularly electricity, has had only a modest impact on creation of small industries. Foley (1990), cited in Rogerson (1997), observes the increased economic activities and higher living standards due to arrival of electricity in certain areas. Therefore, 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.

The supply of electricity in rural areas can have negative impacts on some people, particularly to the most vulnerable people who may be displaced; for them there may be no alternative source of livelihoods Meadows, K. et al., (2003).

Basing on the tasks for households such as milling, weaving or other forms of food preparation, those activities can be converted to income generating activities when they are mechanized so that the scale of their output is increased. This shift to mechanization can have a negative impact since it displaces traditional labour, particularly the unskilled and female home based workers with smaller numbers of men (Meadows, et al., 2003). This argument is supported by Jain (1980) cited in Rogerson 1997) using qualitative evidence from the carpet-weaving sector in the Kashmir valley in India, where the industry attempted to modernize the traditional handloom weaving by introducing new power looms to replace the hand weaving of traditional fabrics. This innovation resulted in redundancy ofworkers, and hence negatively affected employment.
Other evidence concerning the negative impact of electricity is the replacement of hand – milling by small-scale motorized mills which meant that the poorest people in rural villages were often deprived of the small wage-earning opportunities available to them (Baltiwala and Reddy, 1996) cited in Meadows, et al., 2003). The same findings are reported from Bangladesh and Indonesia (OTA, 1991; Timmer, 1998).

According to Borchers and Hofmeyr, (1997), electricity services may have a negative impact on women's welfare in particular. Extended working hours in home-based ME's made possible by electrical lighting may decrease their welfare by simply increasing their working day. They may derive little benefit from the increased income depending on the gender roles within the households (i.e. the male 'head of household' may control how the household income is spent.

Craft persons making handmade goods fear switching to electric operated equipment, which changes the nature of the product, which may result in a low price per product, and finally the product, does not look hand-made anymore.

### 1.7 Growth and Decline of Micro-enterprises

In Tanzania, the most important factors inhibiting growth and decline in the micro enterprises sector are not well known. Based upon research conducted in Africa on micro-enterprises, it is possible to identify specific micro-enterprises that are most likely to either survive or close. The findings show that those micro-enterprises that had added employees since their start-up were more likely to survive than those that had retained the same number of employees. A key finding was that the majority of micro-enterprises do not grow at all, as measured by indicators of employment. Among the estimated 20 percent that do grow, most grow only by a little by adding workers not more than ten people (Rogerson, op.cit. (2001).

The above argument is supported by Grosh and Somolekae (1996:1880) who cite other sources to the same effect: "Most of enterprises which begin on a micro scale remain that way indefinitely and only a few medium-scale enterprises begin as micro-enterprises. In a sample of 237 firms in Botswana, only 2.5% had at any stage grown beyond 10 employees, though 19% of the firms were over 10 years old. Kilby (1993) traced 116 firms in Nigeria after 30 years, only two firms of the 21, which originally had fewer than 10 employees had graduated into a larger category 30 years later. Furthermore, out of 116 firms, 13 employed over 50 employees, but only one of those had begun as a micro-enterprises. Mead (1994) found in Botswana, Kenya, Malawi, Swaziland and Zimbabwe that most firms which started with one to four workers never expanded; and less than 1% grew into the category of over 10 employees". A number of reasons have been given as barriers which block growth graduations for most micro-enterprises. Examples include lack of access to capital, lack of education and lack of market and technology.

Why don't micro-enterprises expand? There are several reasons offered to explain this situation;most MEs have low levels of collateral and even of literacy, also they do not have access to loan capital, so they are constrained to expand via retained earnings (Grosh, and Somelekae, (1996). Somelekae, (1994) supports the argument by asserting that only 1.7% of the entrepreneurs had access to credit from bank. Levy (1991) and Owualah (1990) found similarly low levels of bank borrowing among MEs in Tanzania and Nigeria, respectively.

### 1.8 Conclusion from literature review

In general, the impact of electricity services appears both highly differentiated and important to some enterprises and irrelevant to others. In the literature there are relatively strong statements made concerning the positive benefits of rural electricity services on ME's. A positive correlation has been observed between electricity services and retail activities, services, and manufacturing. The question of how exactly availability of electricity services fits into the range of ME's needs was examined in adequate details in section 5.4 below, which show the effect of electricity services on MEs such as establishment, growth, expansion, decline and closure.

## CHAPTER 2: RESEARCH CONCEPTUAL FRAMEWORK

### 2.1 Problem Statement and Justification

Despite the importance, contributions and potential of Micro-enterprises in the Tanzanian economy, there are several factors that hinder their establishment, growth, decline and closure. One of the factors, which may contribute to these problems is grid electricity services, because without available and reliable electricity services there is no possibility of utilising modern electrical appliances, welding kits, and machinery which may pave the way to small and cottage industries. There also no convenient lighting in businesses such as bars and retail shops, which reduces the number of customers.

Moreover, there is a very little understanding of the linkages between uses and impact of electricity services and micro enterprises establishment, survival, expansion, growth, decline and closure in rural areas in developing countries in general. In addition, there are very few studies, which concretely assessed the actual impact of grid electricity services upon micro-enterprises development in the rural areas of the developing world.
Not all enterprises are able to use electricity services for income generation activities. So lacking reliable data and information about significant positive impact of electricity services on micro-enterprises may limit the room for entrepreneurs to choose this type of modern energy for productive activities like welding, wood processing, grain milling and tailoring. Furthermore, this lack of data and information on the linkages between electricity services and MEs development may have effects on national policy strategies to combat poverty as most of poor people in the rural areas depend on micro-enterprises for their income generating (Sawe, (1998).
In Tanzania, further research is needed in order to get insight of the changes brought within micro-enterprises and between different micro-enterprises by taking up electricity services; who is affected by these changes and why that category of people; to identify barriers and constraints ME's are facing in accessing and using electricity services.

The outcome of this research would lead to an increase in income generating opportunities, women empowerment and finally contribute to poverty reduction. This is possible because the linkages between electricity services and micro-enterprises development in rural areas would be clearly stated and could be used to influence the productive uses of electricity services and bring those opportunities.

The research findings will be considered as general representative of impacts of modern energy services on micro-enterprises in rural areas in Tanzania. In addition, they could be used to influence the change in income generating opportunities, changes in equity and empowerment and finally poverty reduction.

A study done in 1992 by TANESCO jointly with University of Dar es Salaam and Stockholm Environmental Institute in four rural districts in Tanzania (Njombe, Babati, Same and Sumbawanga), revealed that about three quarters of electricity consumers were businesses such as shops, bars and guesthouse and just three percent were light industry consumers such as grain milling, welding workshops and garages. These findings implies that a large number of consumers utilize electricity services for lighting and entertainment like playing music.
Nonetheless, the survey was not able to show exactly the changes brought by taking up grid electricity services. Instead, what was given was just a general observation, which indicates that electricity connections are mainly found among the most affluent (Kjellstrom, et al.,

(1992). Three districts surveyed out of four were electrified by a diesel generator and one district was connected to the national grid. The findings were not at a level to be able to draw general conclusion about linkages of electricity services and micro enterprises in rural areas because of the following reasons:

- The data gathering techniques used were survey and questionnaires. These approaches could not be able to lead into insights on the impact of electricity services on social economic aspects, but give only general and broad understanding of the impact.
- In the areas studied, the rural electrification programme had been implemented between 1978 and 1985. The study was done in 1992, this was a medium term period for electricity services extension to reach many households enough to show the impact, since electricity up take is not a short-term affect. The study did not say either other factors such as access to credit and markets were all in place or not to accompany electrification programmes.
- The studied areas had two different sources of electricity services; diesel generator and national grid. These sources have different operation and production costs and thus resulting into different effects at the end users in terms of tariff. Unfortunately, the authors did not mention or show which findings were from isolated thermal power or from national grid, so that one can analyse and compare the effect.

The information from the few studies focused on electricity services and micro-enterprise might not be relevant for the micro-enterprises in rural areas in Tanzania because the factors contributing to micro-enterprises success or failure in one specific context may be generalized for whole area. However, there are risks because local factors play a major role to influence the variations even within one region, generalisations to other locations and other countries may not be applicable.

Rogerson (1997) observes that some of the international literatures on rural electrification programmes yield mostly general statements of the capacity and effects such activities can have on ME's development. Most of rural electrification programmes put forward promotion of ME's as their rationale but still few research studies undertake a comparison of the pre-electrification situation and post-electrification impact on ME's (World Bank, 1995, 1996; Fluitman, 1983; Foley, 1990) all cited in Rogerson (1997).

In the discussion of technological development among micro-enterprises, Platt et al., (1999: 394) cited in (Meadows et al., 2003: 4) pointed out that the experience show that many enterprises, or micro-scale entrepreneurs, who are invariably poor, self-employed, home-based enterprises have been less studied. The reason for this appears to relate to the complexity of development processes and data gaps that make such studies difficult to conduct (Rogerson, 1997; cited in Meadows, et al., 2003: 4).

Furthermore, information about employees, wages, income levels, etc; in the micro-enterprises sector is scattered, scarce and often unreliable (RWEDP, 1999: 4) cited in (Meadows, et al., 2003: 4 ). In addition, in terms of the environmental impact associated with micro-enterprises and the adoption of clean energy technologies (Blackman, et al., (1998: 1) cited in (Meadows, et al., 2003) state that there has been no rigorous empirical research on why micro-enterprises do and do not adopt clean energy technology such as grid electricity services but instead continue to rely on kerosene or biomass fuel.

At the micro-level, it is very difficult to give explanation for the impact of electricity services on micro enterprises development because there is very limited evidence to show linkages although there are few examples that exist of cases where improved access to electricity service has lead to increased economic activities (Etchevery, 2003; and Martinot, 2005).

The reasons why this research is necessary are explained below:

- It fills the gaps of lacking data and information about linkages between grid electricity services and micro-enterprises in rural areas in Tanzania.
- The study explains the barriers and constraints experienced by micro-enterprises in using grid electricity services
- It further explains the changes brought to enterprises by up taking electricity services

## 2.2 Significance of the Study

The theoretical contribution of this research is in exploring the issues concerning the changes that happened in rural micro enterprises in Tanzania because of taking up electricity services. A good explanation was developed, which is appropriate to micro-enterprises in rural areas in Tanzania and it may be applicable to other areas of the same characteristics within Tanzania or any other developing country. The research findings and explanations are hoped to provide a better understanding to entrepreneurs, modern energy suppliers, policy makers and other modern energy stakeholders on the linkages and impact of electricity services on micro enterprises in rural areas. These findings are further expected to facilitate and stimulate the productive uses of grid electricity for increasing income and consequently reduce poverty.

Furthermore, the research is aimed at contributing towards filling the gap identified by examining how electricity services may or may not facilitate the increased in performance and increase in income of micro-enterprises in rural areas and finally contribute to poverty reduction.
It is believed that the availability and reliability of information from the case study could enable decision-makers, government, donor organizations and other energy stakeholders to support efforts to increase accessibility of electricity for informal sector. It could also stimulate the rural poor who depend much on micro-enterprises as a source of their income to improve their business plan and use electricity services productively.

The focus of this research is micro-enterprises in a specific rural area in Tanzania using grid electricity. The output of this research is a report offering explanations of study findings on linkages between grid electricity services and micro-enterprises development in rural areas in Tanzania. The findings of this research would contribute to a better understanding of the present problems and its causes so that solutions may be proposed between both electricity stakeholders and entrepreneurs on how to overcome the problems. Also the findings are expected to stimulate and facilitate the discussion about the linkages between grid electricity services and home based micro-enterprises on how electricity services can be more available and used more productively.

## 2.4 Main Research Objective

The main objective of the research was to identify the impact of electricity services on Micro -enterprises establishment, expansion, growth, survival, decline and closure in rural areas in Tanzania.

- **Specific Objectives**

To realise the general objective, three specific objectives guided this study:

i. To identify the barriers and constraints experienced by micro-enterprises in using electricity.
ii. To identify the most significant changes brought to enterprises by up taking electricity services.
iii. To explain the changes electricity services brought to micro-enterprises expansion, growth, establishment, decline and closure in rural areas.

## 2.5 Research Framework

In order to realise the research objectives the different steps were taken as shown in the structure below. The research strategies included consultation of relevant literature, documents and reports, as well as to administer semi-structure interview and focus group discussion to village leaders, individual entrepreneurs and observations.

Lyasongoro, Foo and Mahango villages, which located in Moshi, Hai and Rombo districts respectively in Kilimanjaro region, were selected as a case study for this research. This case study involved more than one unit of observation, studying events within their real life context. The research concentrated on collecting, analysing and interpreting qualitative data within the selected areas of interest as shown in chapter four.

The observation units were MEs, which were accessing and using grid electricity services for production or for providing services. Observation and semi-structured interview, were used to assess accessibility of electricity, electricity use in ME's, as well as, recent and expected changes within ME. The framework shown in figure 1 summarises the steps of this research project.

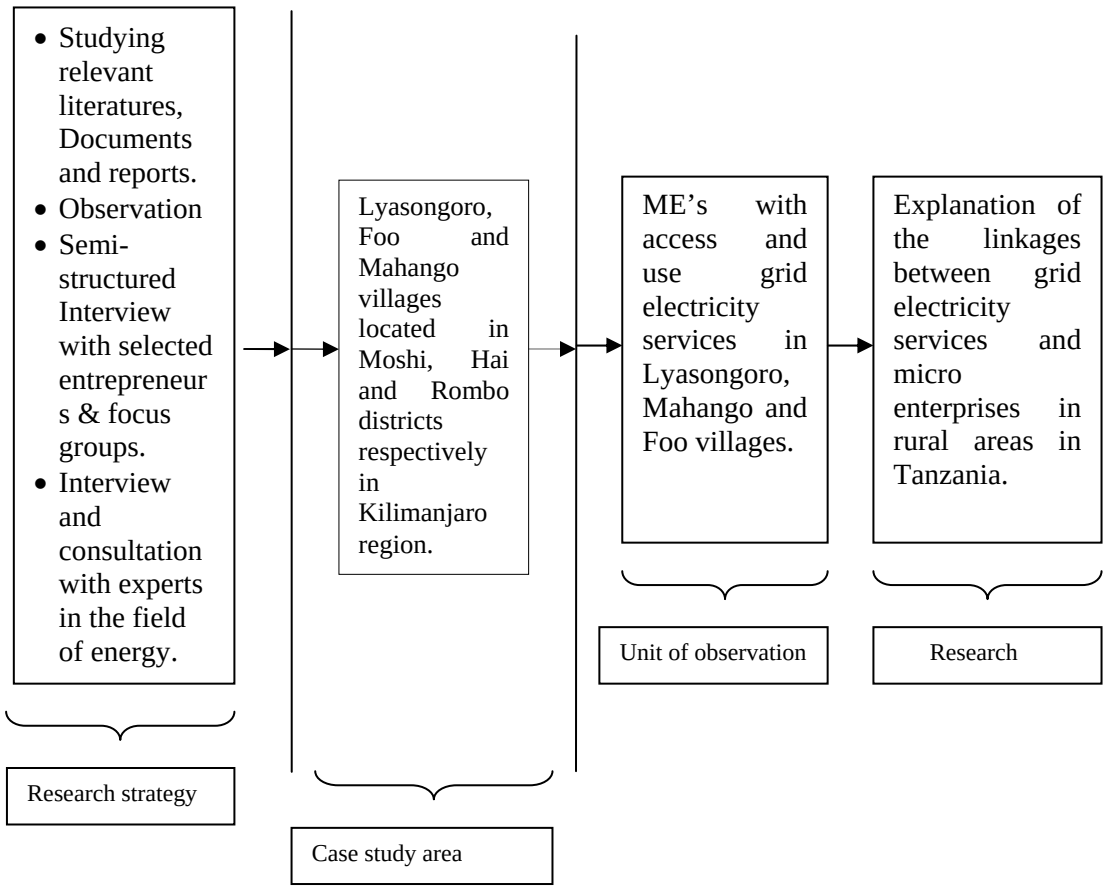


**Figure 1: Structure of the Research Framework**

## 2.6 Research Questions

In order to realise the research objectives and provide good explanation to the general research problem, the research addressed the following specific research questions.

- **Central Research Question**

  What effect(s) do access to grid electricity services have in facilitating and supporting the establishment, growth, expansion, decline, and closure of micro enterprises in rural areas in Tanzania?

- **Research sub-questions:**

i. Which changes in establishment, growth, expansion, decline and closure, and which changes in livelihood take place in micro-enterprises in rural areas in Tanzania by taking up electricity?

ii. Who experiences these changes, and why?

iii. What are the main barriers and constraints experienced by micro-enterprises in rural areas in Tanzania by using grid electricity services?

## 2.7 Expected output

The output of this research is a good report that contained findings and explanation on linkages between grid electricity services and ME's in rural areas in Tanzania.

## CHAPTER 3.0: RESEARCH METHODOLOGY

### 3.1 Introduction

This chapter is divided into seven major sections: Research areas, research design, types of micro-enterprises studied, research and data gathering tools, research strategies, data and compilation methods, and research activity plan.
The findings of this research make a contribution to the EASE project because units of observation were selected from areas where there are EASE programmes. Enabling Access to Sustainable Energy (EASE) is an international initiative that addresses energy and poverty at the local and national level in partner countries (Tanzania, Bolivia and Vietnam). In Tanzania EASE programmes were implemented in rural areas in two regions, which are Coast and Kilimanjaro. For more information about EASE programme ( see Appendix 2).

### 3.2 The Study Area

This section gives an overview of the geographical location of Tanzania and particularly Kilimanjaro region as the focus study area for this research. The explanation about Tanzania in brief is attached as Appendix 3.

According to Country Profile (URT,2005), the country's economy is mainly dependent on agriculture activities, which accounts for 56 per cent of GDP, provides 85 percent of ex-ports, and employs 90 per cent of the work force. Topography and climatic conditions, however, limit cultivated crops to only 4 percent of the land area. Industry accounts for 15 percent of GDP and is mainly limited to processing agricultural products and light consumer goods. Services account for the remaining 29 percent.

#### 3.2.1 Overview of the study area – Kilimanjaro region

According to the National population and housing census (URT, 2002), Kilimanjaro region covers 13,209 $km^2$ and is located in the northern part of Tanzania (refer Figure 2). The region comprises six districts: Moshi Urban, Moshi Rural, Hai, Same, Rombo and Mwanga. The region has 297,440 households, and 1.4 million residents, 668,000 among whom are males and 713, 284 females. The region's population growth rate was at 1.6 percent in august, 2005 the time of data gathering.

About 76 per cent of the residents live in rural areas where 60 per cent of the population depends on crop cultivation and livestock keeping for their livelihoods. Agriculture is the main economic activity, contributing to more than 69.2 per cent of the region's GDP (US$ 362.83 million). The major cash crops in Kilimanjaro include coffee, sugarcane, sisal, flowers and wheat, while food crops include bananas, maize, beans, potatoes, fruits and vegetables.
Other economic activities are light industries such as paper products, wood products, food processing, textiles, leather, trade, tourism and manufacturing. Most industries in the region are small and medium, covering local beer brewing, machinery and metal works.[9]
According to household budget survey (2002), the proportion of population, which lives below poverty line in Kilimanjaro Region, is 11 per cent and those who live below basic need poverty line are 31 per cent (URT, 2002). The region has 449 villages out of them 202 during data gathering stage, were electrified representing about 45 per cent of all villages Therefore, the three studied villages are among the 202 electrified villages.

[9] United Republic of Tanzania, Kilimanjaro Region Socio economic Profile, 2002

Kilimanjaro Region has good infrastructural set up such as good roads, availability of safe water, good health facilities, and availability of electricity as compared to other regions; good telecommunication services, tourist attractions, skilled personnel, cross-border trade and security, which could provide good entry for investment. For that matter, this region has a major role in national economy development in Tanzania. Therefore, failure to apply electricity services productively in this region means that it is more difficult to be applicable in other regions in Tanzania.

### 3.2.2 Common Features of the Study Areas

The economy of the three villages visited is based primarily on agriculture and micro-enterprises activities. Generally, most households are engaged in crops and livestock production, and some are engaged in micro-enterprises only. The exact numbers of households, which are involved in micro-enterprises only, or agriculture only were not available as most of these micro-enterprises were not registered or licensed.
In the study areas, the land for farming is scarce because of high population density. Agriculture is characterised by the coffee-banana intercropping system. Many people have farms for cultivation of food crops like maize and sunflowers.

Women are found to be the most important source of labour because of the hours they spend working especially in agriculture. Apart from agriculture, they also do domestic activities such as milling, fetching water, collecting firewood, cooking, caring for children, and cleaning the house and its surroundings (Kjellstrom, et al., 1992). Although some men were also found to share the farming activities with women, the latter were observed to have higher workloads. The business activities that women are mostly likely to engage in are local beer brewing, hair dressing salon and tailoring.

### 3.2.3 Focus Areas

Identification of the specific areas studied was made basing on secondary information, fully conscious that the rural areas in question were already electrified. Three villages, namely, Foo in Machame in Hai district, Lyasongoro in Moshi Rural district and Mahango in Rombo district were selected for detailed study. Mahango and Foo villages were among the villages used by the EASE programme in Tanzania for research on productive use of electricity and biomass heat energy. In addition, Lyasongoro village was one of the villages where there is EASE pilot project on promotion of improved firewood stoves, charcoal baking ovens and charcoal production kilns for productive uses. Figure 2 is a map of Tanzania showing study areas and neighbouring regions, power stations and transmission lines.

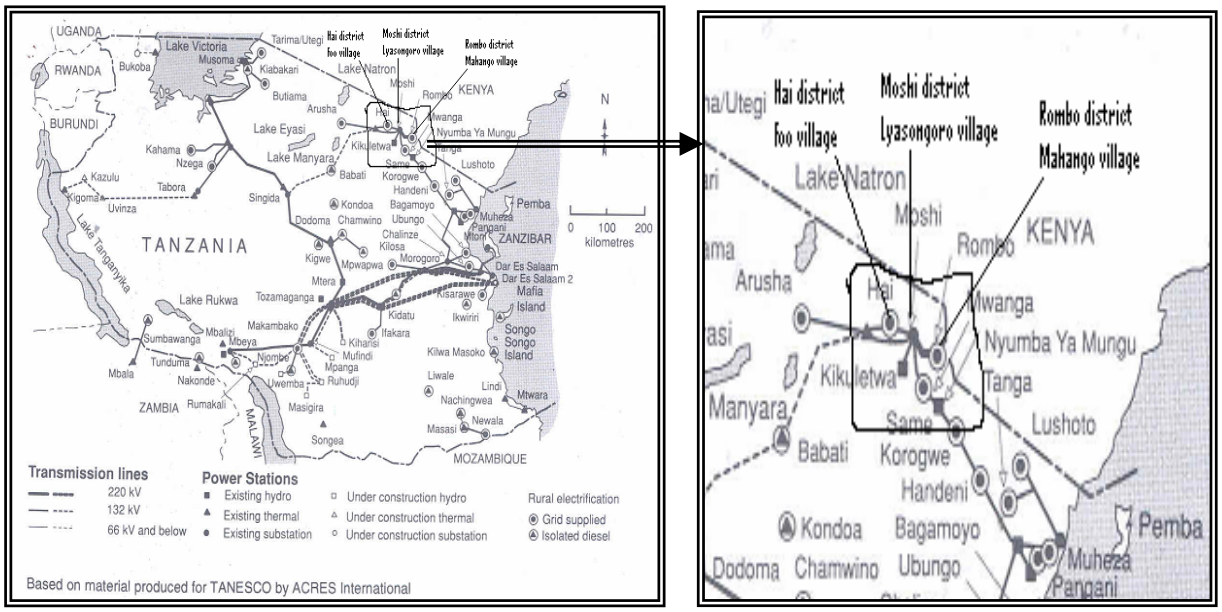


**Figure 2: Study Areas in Relation to Other Regions. Source: Tanzania Electric Supply Company (TANESCO, 1992).**

The criteria for selection of Kilimanjaro region and those villages were based on the following factors:

- The region is among the earliest region to be electrified by national grid; the selected villages were connected to the national grid for a very long time, Foo village was electrified in 1967, Lyasongoro village in 1988 and Mahango village in 1997. This was a medium term period for electricity service extension to reach many households enough to show the impact of productive use of grid electricity services. Micro-enterprises are relevant for the community in the selected areas.
- The region has high population density about 104 persons per square kilometre (URT, Census 2002). So many MEs were established that they could be obtained at a minimal walking distance.
- There is good communication network in terms of infrastructures such as good roads, telephones compared to other areas
- The reason for choosing Lyasongoro, Foo and Mahango villages, was there already EASE programmes implemented in those villages and the findings of this research aimed to contribute to EASE project in Tanzania.

### 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). Another way of defining a research design is "*…an action plan for getting from here to there, where 'here' is defined as the initial set of questions to be answered, and 'there' is some set of conclusions (answers) about these questions"* (Yin, 1994:19) cited in Mahemba (2003).

This research is a single case study, involving more than one unit of observation. Units of observation were selected from the EASE project areas (three villages in rural areas); forty three (43) units of observation for this case study were selected using selection criteria such as nature of production processes/technology used, type of services provided, nature of

ownership, and purpose of electricity use, location, number of employees, and lifetime/year of establishment.

This study uses triangulation approach, where individual and groups interview consisting of open-ended questions were carried out together with observation and consulting reports and documents in order to obtain robust information about the research subject. The case study approach permitted direct observation and participation in discussion to measure and record changes that had taken places in micro-enterprises after up taking grid electricity services.

Strengths of case studies are the ability to measure and record behaviours, both qualitative and quantitative data can be collected from a variety of sources such as documents, interviews and observations. Case studies have some weaknesses for example lack of understanding of what is entailed particularly with validity of data. Also external validity of the results is often constrained; this means that if there are fewer units studied, the more difficult it is to generalize the results beyond those units or to similar cases. To compensate for these weaknesses, a reasonable number of MEs with similarities/minimal variation were selected, research sites visited and where necessary, more than one visit were made and the right people were interviewed. Also documents were studied and observations were made in the studied areas.

### 3.4 Types of Micro-Enterprises Studied

Different types of micro-enterprises that exist in the study area were selected for detailed study. Men and Women who headed enterprises were among the selected informants.

The units of observation for this research were micro-enterprises that have access to and use grid electricity services either for production purposes or for providing services were among the units of observation for this research; example of those enterprises are grain milling, hairdressing and hair cutting salons/barber shop, carpentry/furniture manufacturers, welding shops, retail shops and tailoring shops.
These enterprises were selected on the basis of being there operated in the research areas, being connected to and uses grid electricity service for production, their products and services provided are sold for income earning.

Some enterprises, which were not connected to the grid electricity services but depended mainly on electricity services for lighting and those that use biomass/firewood for production such as local beer brewing, were among the studied enterprises.

### 3.5 Research and Data Gathering Tools

This research used both quantitative and qualitative data, the reliability and validity of data were essential criterion for quality of the data collected and included in this research.
Joppe (2000) defines reliability as "*...The extent to which results are consistent over time and an accurate representation of the total population under study is referred to as reliability and if the results of a study can be reproduced under a similar methodology, then the research instrument is considered to be reliable*". Validity, determine whether the research truly measures what it was intended to be measure or how truthful the research results are.

As the definitions of reliability and validity in this research concerned, the question which remain to be answered was "how to test or maximize the validity and as a result the reliability. This study uses triangulation approaches in order to increase ability to generalise findings to wider groups and circumstances.

### 3.5.1 Data Gathering Tools

Both primary and secondary data were gathered. Primary data were collected from the field, while secondary data collected from existing information available in reports and documents to supplement field data.
In order to ensure the validity and reliability of the data proper and right sources of information/key informants were identified and selected from the study areas. In addition, research techniques like semi-structured interviews, focussed group discussions and observations were properly conducted in the field. There were site revisits for more clarification on various questions that were not clear in the first visit to remove the possibilities of any ambiguities. This was necessary in order to increase the validity of the data.

**The tools used for data collection were as follows:**

**i. Interview**

The checklist questions for semi-structured interviews were designed in such a way that both qualitative and quantitative informations were collected; the quantitative data were used to support the qualitative.

Semi-structured interviews for individual entrepreneurs were performed in order to gain insight into the impact of having access and using electricity services for micro-enterprises in rural areas. About forty-three micro-enterprisers were involved in focus groups (in Foo village fifteen (15) enterprises, Mahango village thirteen (13) enterprises and Lyasongoro village fifteen (15) enterprises).

The key informants (village leaders, elders and influential people) in the field were asked to list all micro-enterprises, which were either using grid electricity for production or for lighting. In addition, the owner of enterprises, which did not use electricity services were asked if they knew the changes that had happened between enterprises after up taking electricity. The selection of respondents was based on his/her relation with micro-enterprises studied, (enterprise owner, servicing employee in that enterprise or family member who knows much about enterprises studied).

In addition, to get broad ideas of what had already been done in other areas related to the topic and what was expected to be done in addition to these, interviews with energy experts were performed as part of data collection

**Observation**

Observation was done during discussion and interview. Observation was used mainly to supplement information collected during interviews and discussion. The level of production or type of services offered, behaviour of customers towards type of enterprises with and without electricity services, general use of electricity services within the enterprises, quality of voltage supplied, blackout of electricity services, influx customers influx time, operational schedule of ME's these were indicators observed.

**ii. Participatory Rural Appraisal (PRA)**

The participatory rural appraisal (PRA)[10] was used as one of the tools to collect information from local people concerning productive uses of grid electricity and changes that happened in MEs as results of taking up electricity services. In order to ensure that the information obtained is valid and reliable, the PRA exercise involved proper and right stakeholders such as influential community members, elders, entrepreneurs, village leaders, farmers, CBOs and NGOs representatives and government institution representatives.

The PRA exercise helped to identify many problems related in one way or another with micro-enterprises and electricity services, furthermore the approach allow discussion on how to address these problems by using locally available resources. In addition, community needs were assessed and the preference ranking was used to list the identified problems. The summary of PRA exercise for the three villages (Foo, Lyasongoro and Mahango), questions discussed, ranking results and people involved in exercise attached as Appendix 4.

**iii. Documents, Literatures and Reports Review**

Available documents and reports concerning grid electricity service and micro-enterprises within the local geographical location of these three villages were consulted as a source of secondary data in order to obtain background information of the linkages between electricity services and micro-enterprises in these areas.

### 3.6 Research Strategies

This research involved studying changes and events in real life context of the micro-enterprisers. The focus of this research was directed towards investigating how electricity services contributed to micro-enterprises establishment, growth, expansion, decline and closure.

- **Approach for Research Questions**

Some livelihood indicators employed in all research questions to help identifying most of the intended information and realization of research objective. For each research sub-question, the sources of data were individual entrepreneurs and focus group and village leaders. The data gathering techniques for the same sub-question were semi-structure interview, observation, document and review. The conclusion from central research question after analysis together with other secondary data were contrasted with the international evidence from literatures about the situation in other countries, then the general conclusion was drawn.

[10] PRA is a data-gathering tool used to generate information and create awareness about a certain issue. It facilitates active engagement of all villagers, including different genders and social groups in providing information.

Table 1 is analytical framework which show list of research questions, methods used to answer them and where the answer is found (section number)

**Table 1: Table of Specification**

| Research Questions | Hypotheses | Causes | Data gatherin Techniques | Answers. |
|---|---|---|---|---|
| 1. Which changes in Establishment, growth, expansion, decline and closure, and which changes in livelihood take place in ME's in Rural areas in Tanzania by taking up electricity? | Increased access to electricity leads to establishment, growth, and expansion of ME's using electricity services in rural areas. | • Money saved on electricity services<br>• Improve turn over of ME's<br>• Time saved through reduce operation and maintenance<br>• Improve quality of products and/or services<br>• Change in production process lead to increase production and product quality. | • Semi-structure Interview<br>• Observation<br>• Documentation and data bases<br>• Discussion | Section 4.3.1 to 4.3.4 |
| | Increased access to electricity leads to decline and closure of ME's. | • Higher initial connection charge<br>• Small localized market<br>• Low purchasing power of community members<br>• Low level of saving money<br>• Competitiveness<br>• Low innovativeness | • Semi-structure Interview<br>• Observation<br>• Discussion | Section 4.3.1 to 4.3.4 |
| | Increased access to electricity leads to changes in livelihood characteristics of people involved in ME's | • Increase income generating opportunities<br>• Change in equity, empowerment.<br>• Time saved<br>• Human energy saved<br>• Employment opportunities | • Semi-structure Interview<br>• Observation<br>• Discussion | Section 4.3.1 to 4.3.4 |
| 2.Who experiences these changes, and why? | The people who benefit are owners of enterprises with an upper class market, employees, and community members where these ME's located. | • Change in Market price<br>• Quality of products/production processes<br>• Market location (local or distance)<br>• Variety of products or services<br>• Type and class of customers<br>• Price of product or services | •Semi-structure Interview<br>•Observation<br>•Discussion | Section 4.5 |
| 3. What are the main barriers experienced by ME's in rural areas in Tanzania by accessing and taking up grid electricity services | ME's in rural areas faces technical and non-technical barriers when accessing grid electricity services. | • Complicated tariff structure resulted high initial connection, Installation charge & monthly bills.<br>• Illegal connection & vandalism of cables and cooling transformer oil in distribution line<br>• Low voltage and fluctuations<br>• Low income for community member to meet TANESCO standards for connection | • Semi-structure Interview<br>• Observation<br>• Discussion | Section 4.6 |

- **Questions for Interview**

The questions used for interview were designed in such a way that all the necessary information needed to give a clear picture of impact of electricity services on micro enterprises was gathered, the list of questions used were attached as Appendix 5.. Qualitative data were used to explain the situation and quantitative data used to back up the qualitative data. Three factors were used as a main guide for designing the questions: availability of electricity services, reliability, and affordability.

Electricity service used in the study areas is mainly generated from Hydro and Thermal plant. During drought season, production of electricity decreases resulting into blackout of electricity/rationing as occurred in late 2005 in Tanzania. Similarly, when the production depends more on fossil fuel like diesel the running and production cost is high resulting in increased cost to end users. At this situation, the service is not affordable by many consumers; therefore, these factors were used to assess the situation of electricity services in the study areas.

In addition, the changes of livelihood assets such as human, social, physical, and financial assets were part of the checklist questions to see how electricity services had influenced the changes within and between different enterprises and improved living standards of the people involved in the selected MEs .

### 3.7 Data and Compilation Methods

Qualitative information about linkages of grid electricity services and ME's was gathered during data collection. In addition, Micro-enterprises changes were analysed in terms of establishment, growth, expansion, decline and closure. The changes were measured by using indicators such as changes in assets of entrepreneurs and other people involved in an enterprise activities, changes in number of workers in the enterprise this measure was often favoured because it is most easily and accurately remembered by entrepreneurs and it does not need to be deflated, production technologies introduced after MEs being electrified, rate of production and changes of production processes.

The data from the entrepreneur about effects of grid electricity on MEs was not taken as the final statement, but tested through seeking contrasting situations in which verbal accounts from different entrepreneurs; local people, experts and observation wereused to correlate data.

### 3.8 Research Activity Plan

The research plan outlines the various activities that have been carried out during the whole cycle of the project. Two groups of activities went parallel to each other. Research development process and the writing process was as shown in the figure.

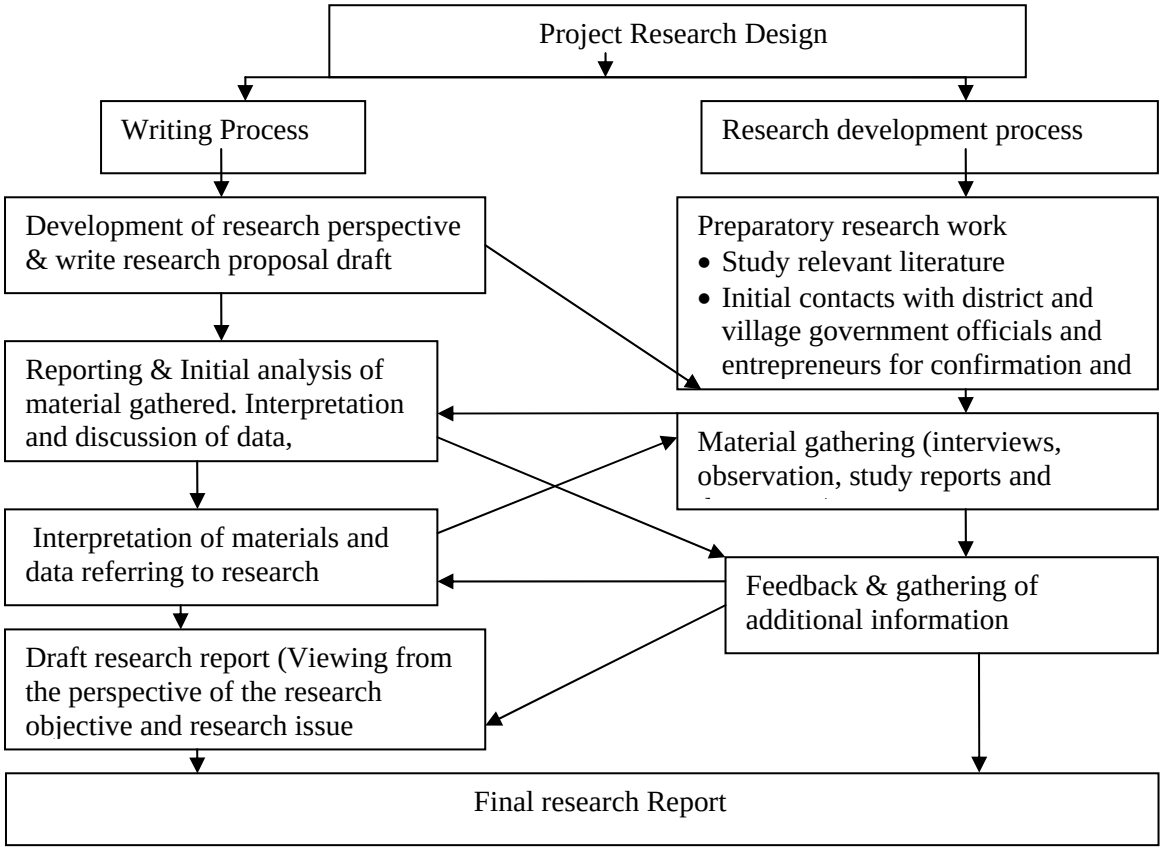


**Figure 3: Research Activity Plan**

## CHAPTER 4: STUDY FINDINGS AND DISCUSSION

### 4.1 Overview of the chapter

This chapter presents the results and discussion of the findings collected in the study areas about impacts of grid electricity services on micro-enterprises in rural areas. Three issues were assessed in detail:

i. Which change in establishment, growth, expansion, decline and closure and which changes in livelihood took place in micro-enterprises in rural areas after taking up electricity services?
ii. Who are beneficiaries of those changes?
iii. Main barriers experienced by the micro-enterprises in accessing and using electricity services for production.

In order to examine properly the issues this chapter presents the results in two main parts, that of enterprises before uptake of the electricity services and situation after uptake of the electricity services.

### 4.2. Situation before uptake of Electricity

Before the introduction of electrification programme in the study areas, few micro-enterprises were found to operate by using either diesel for production or providing services or kerosene and candle for lighting as compared to after the electrification programme. This statement is supported by the fact that the number of micro-enterprises in electrified areas was more than number of MEs in un-electrified areas within the same village. This indicates that though the number of ME's start up per year is small the emerging progress for MEs using electricity is growing.

In the study areas before electrification only four-grain milling were operational. One was in Foo village and three in Mahango, in Lyasongoro there was no milling machine. All these machines used diesel engines for operating. Sometimes the milling services were not available in those areas because of diesel shortage and maintenance problems. When this problem happened people were forced to walk a long distance searching for the services. Apart from grain milling, there were few micro-enterprises such as retail shops, tailoring shops, furniture manufacturer, local beer making and local hair cutting salon.

Before electrification programmes in the study areas, people were using kerosene lamps, candle or torch during the night for lighting, and used biomass energy for cooking and human energy and biomass energy for production. Students and residents were unable to study after sun set due to the lack of good quality lighting.

Further, the key respondents revealed that social interactions among community members were low as there was no movement in the evening hours because there was no street light/security light. Also, accessibility of paths and roads to some sub-villages in the areas at night was not secure. Many respondents said they felt insecure to be out of their homes after sunset. Furthermore, businesses closed early and if necessary, they were forced to use candles or kerosene lamps for lighting.

It was also revealed, via an interview, that lack of electricity services caused poor availability and reliability of communication network such as telephone.

In the study areas, it was learnt through interview that only Foo and Lyasongoro villages used to have private generators, the one in Foo was owned by Machame girl's secondary school

and supplied electricity to the school and few households around the school. Another generator in Lyasongoro village was privately owned for domestic use only.
No micro-enterprise was found to use other alternatives sources of electricity supply for either lighting or operation.

### 4.3 Situation After uptake of Electricity

During focus group discussion, it was revealed that electrification programmes had been implemented between 1967 and 1998. These areas were electrified in different period of time: Foo village in 1967, Lyasongoro in 1988, and Mahango in 1997.
A pattern for grid electricity connection in the study areas started with religious institutions like churches and mosques, as well as government institutions like secondary schools, and hospitals. Then a few households together with micro-enterprises applied for connection. The applications for connection processes grew gradually with a few applications per year. Now at the time of data gathering, the number of households in those areas electrified had reached more than half of total households.

The electricity services coverage was observed to be different for each village, in Foo and Lyasongoro about 75 per cent were electrified out of 1200 and 601 households respectively, in Mahango village, about 38 per cent out of 792 households were electrified. The electricity services coverage in Foo and Lyasongoro villages are almost the same. More than half of total households were during the time of data gathering electrified, but the situation was different in Mahango where the coverage was still less than half of total households.

Observation revealed the reasons for these differences to be:

- Electricity services was introduced in these villages in different period of time, which was in 1967, 1988 and in 1997 for Foo, Lyasongoro and Mahango respectively.
- Infrastructures network such as roads, telephone and modern houses were better in Foo and Lyasongoro than in Mahango. This show that the income and living standards of people in those areas were much better than in Mahango so they could afford high initial installation and connection cost for grid electricity services. Other reasons observed to be barrier in accessing grid electricity was that in some areas in Mahango were still far from the existing grid distribution service line; this situation increased the installation cost because the applicant has to pay all costs involved in connection and installation materials such as poles and cables.
- The economic power of the people was stronger in Foo and Lyasongoro villages than in Mahango village, because most of community members in Mahango depend more on farming activities. The infrastructural status in the latter was not good compared to the former so could not attract or facilitate outside investors/modern energy stakeholder to extend grid electricity coverage.

#### 4.3.1 Grid Electricity Services in the Study Areas

According to National electric Supply Company (TANESCO) in Kilimanjaro region, there are six districts/stations under TANESCO; those were Himo, Moshi, Hai, Same, Rombo and Mwanga. The studied village's (Lyasongoro, Mahango and Foo) are located in Himo, Rombo and Hai stations, respectively. These three stations had a total of 36,903 (19.1%) households electrified out of 193,041. Hai district has 7,608 (13.1%) house holds electrified out of 58,056, Rombo district has 4,434 (8.8%) house holds electrified out of 50,123, and Moshi rural district which includes Himo station has 24,861(29.3%) house holds electrified out of 84,862.
The majority of grid electricity consumers (about 75%) in these districts belong to residential category, while 25% are commercial. This high percentage for residential connections

indicate that there is high mixed up percentage of electricity use activities including micro-enterprise, because most of MEs were home based, unregistered and unlicensed (TANESCO Kilimanjaro regional office, 2005).

The findings from Himo station showing the numbers of households connected to electricity services for the past three years (from 2000 to 2002) are presented in Appendix 6. These findings are summarised in figure 4. The result shows that from 2000 to 2002 the new connections trend increased. At the end of 2002 the tariffs structure changed, the supply company started facing problems of lacking capital and connection materials, this result a big drop in connection trend.

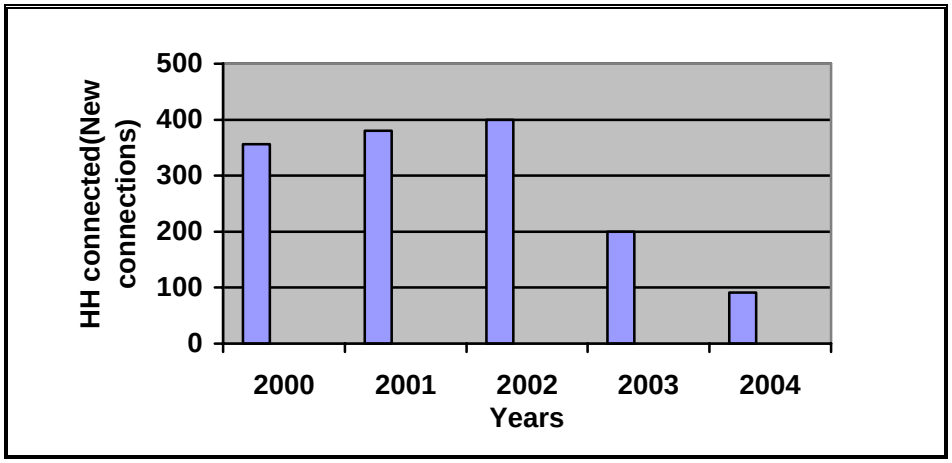


**Figure 4: Number of HH connected in Himo District 2000-2004: Source Tanesco – Himo districts, (2005)**

Himo station, which is located in Moshi rural district was used as an example, for other stations located in others districts. Hai (Machame) and Rombo had no official records available to show the number of households connected to grid electricity services.

As mentioned earlier, the changes of tariff structures was one of factors, which contributed to the drop in number of households, connected to the grid electricity services. From 2003 to 2005, the tariffs structure had changed three times see Table 2.

**Table 2: Trend of Connection Fee for Grid Electricity Services Tariffs (2003 – 2005)**

| Before year 2003 | 2003 | 2004 | 2005 |
|---|---|---|---|
| Tshs. 45,000 | Tshs. 90,000 | Tshs. 140,000 | Tshs. 204,000 |

**Source: TANESCO (August 2005).**

This means that before 2003, the installation and connection fee for single-phase grid electricity services was Tshs. 45,000. In 2003 the cost doubled to Tshs. 90,000 for the same services, in 2004, the cost rose to Tshs. 140,000 and in 2005 the cost rose again to Tshs. 204, 000. These price inflation indicate that the production and running costs for grid electricity is high, resulting into services being expensive to most of rural households and entrepreneurs. According to tariff categories from National Electric Supply Company (TANESCO), the micro-enterprises belong to general usage tariff 1 (T1)[11].

[11] General usage tariff 1 (T1), applicable for general use of electricity including residential, small commercial and light industrial use, public lighting, billboards; where the average consumption is more than 275 per meter reading period. Power is given at low voltage single- phase (230V), and three phases (400V), Tanzania electric Supply Company (TANESCO) Tariffs and service charges (2005).

The trend of tariff structure shows that there is an increase of electricity tariff for the past four years almost doubled each year. However, there is an increase in tariff but people were observed to still be willing and struggling to apply for connection. Many applications were observed to be pending in the TANESCO's zones waiting for connection approval, though Figure 4 shows decline in connection from 2002. This is because TANESCO's stopped new connection due to lack of connection materials.

Another finding from the study areas show that there is an increase in electricity consumption and sales in Moshi and Hai districts for the past eleven years (from 1993 to 2003). This increase indicates that people were willing to use electricity services in their daily activities including income-generating activities. Based on the consumption trend summarized in Figure 5; there was a gradual increase for all types of customers: residential, commercial and light industries. This was because in the areas new residential houses were constructed, as well as expansion of social activities like restaurant, hotels, bars and guesthouses, and expansion of government and community institutions such as churches and mosques.

An insignificant number of people observed or who claimed to use electric services for cooking or use heavy electric appliances in their home indicates that the observed increase contributed can be attributed to more operation of cottage micro-enterprises. Other reasons were that tourism had gone up a lot (especially in Lyasongoro and Foo village where the route to Kilimanjaro Mountain passes through). This situation makes it possible for extending working hours for social activities such as watching TV, and listening to radio.

The data-showing trend of electricity consumption in Moshi and Hai districts are presented in Appendix 7 and summarized in the Figure 5. This increase in consumption indicates that electricity services are important factor for operation in rural areas, and it will be more important if the services are more available, reliable and affordable.

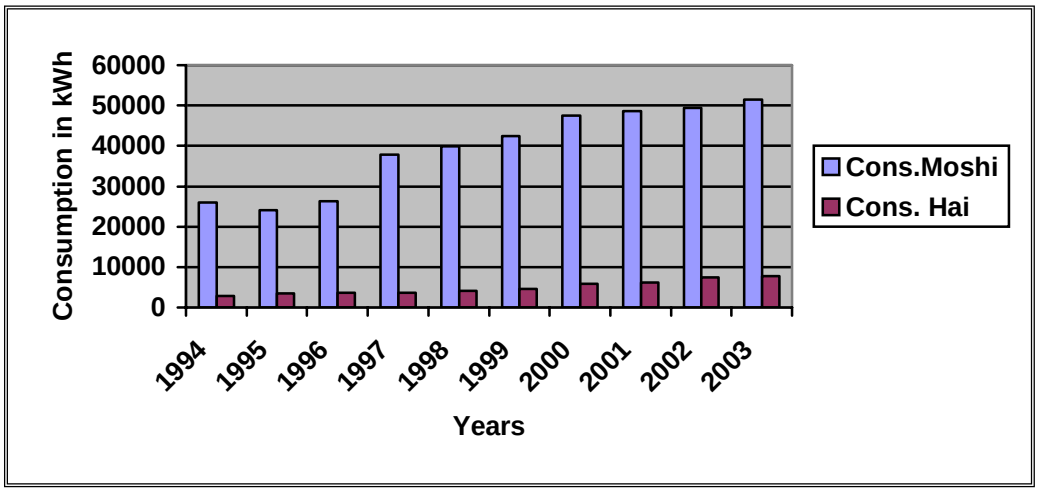


**Figure 5: Trend of electricity consumption in Moshi rural and Hai Districts.Source: Tanesco- August 2005.**

The use of alternative sources of electricity services such as solar PV and generator indicates that electricity service has a role on operation and growth of micro-enterprises.

Most households in the study areas were found during observation to be using biomass-based fuel for cooking; kerosene and electricity are used for cooking to a limited extent, particularly

in electrified households. Electricity is the main source of power for lighting for families connected to grid electricity, and kerosene is used during interruption in the electricity supply, which is frequent.
Micro-enterprises such as grain milling, welding workshops, tailoring and furniture manufacturers were observed to use electricity for production and lighting. Others, however, like retail shops, and local beer brewing, use electricity for lighting only, and MEs like hair salons were using electricity for lighting and running electric equipment such as driers and hair cutting machines.

It was further observed in the study areas that micro-enterprises especially those using electricity services for production used three-phase supply line because the voltage needed by them is high also to avoid the problem of under voltage supplied especially during peak hours. It was difficult to show the enterprises pattern and grid electricity lines since there was no master plan map available for the studied areas.

Micro-enterprises which used electricity mainly for lighting like hair dressing salon, hair cutting salon/barber shops, dressmaker shop, local beer making were located in areas where there was single phase supply line because the voltage needed by those ME is low.

Micro-enterprises such as hairdressing salon, hair cutting salon, grain milling and welding shop depend heavily on the grid electricity services. A blackout means no operation for this kind of enterprises. Only one hair-cutting salon was found in Foo village having a stand by generator for backing up power in case of blackout. For those enterprises that used electricity services for lighting only when there were blackouts they continued with operation because of having back up lighting solutions like kerosene lamps, candles and torch. The entrepreneur's opinion on this situation was that lighting from electricity is better and cheaper compared to other sources of lighting such as diesel and kerosene but the electricity bill is high when compared to what one earned per day or per month. For example, one Interviewee who was a local beer producer in Foo village said she used Tshs 500 per week as energy bill out of her earning which ranged between Tshs 4000 to 6000 per week. Another Interviewee an entrepreneur (hair-cutting salon) in the same village said she used Tshs 15,000 per month as electricity bill out of total earning which range between Tshs 120,000 to Tshs 150,000 per month. Basing on these data the electricity bills average is about 10 percent of total earnings.
The similar findings were observed in Mahango and Lyasongoro but there was no empirical data recorded.

### 4.3.2 Grid Electricity for Productive uses

During observation, it was revealed that there were six (6) retail shops, four (4) tailoring shops and five (5) barbershops found to use electricity services for lighting during a day in their rooms/working places. The reasons given by owners of MEs were that the rooms/working places used by these enterprises observed to be small, the openings such as windows and doors were not big enough to allow much daylight to enter. The photos in Figure 6 show this situation as observed in the study areas.

**Figure 6: ME's which uses grid electric light during a day**

The photos were taken during daytime. Tube lights were on to provide enough light in the room. This indicates that electricity service is important for such type of micro-enterprises because of good light provided which enable goods/products to be seen by customers, and also facilitate operation at any time.

Micro-enterprises like local beer brewing use biomass energy for production and use electricity services only for lighting and playing the radio for entertaining the customers. The respondents, during interview, said they were not using electricity services for production because of high monthly bill charge. However, the electricity units used for lighting and music were few and affordable as compared to units used for running machines. The availability of good lighting and power for radio and cassette players is important in increasing the number of customers, which results into high sells and finally influence the income of enterprises.

Availability of electricity services in the study areas allows people to have more working hours. For example, observations showed that retail shops, local beer bars, tailors shops and sometimes grain milling extending their working hours after sun set. In addition, people especially schoolchildren were found to have more time to read because of the good lighting from the grid electricity services. This situation implies that electricity services are important not only for production but also for social benefits.

### 4.4 Effects of Electricity Services on Micro-enterprises

This subsection is on changes in establishment, growth, expansion, decline and closure of MEs, as a result of taking up grid electricity services. The impact and importance of grid electricity services on micro-enterprises are different from one micro-enterprise type to another. For example, for hairdressing salon, hair-cutting salon, welding workshops, and milling machines lack of electricity services in these micro-enterprises creates significant constraints; that is, if there is no electricity service at a particular time, the enterprises would stop production or operation. Because there were no available alternative sources of electricity to run such machines, the businesses close down if there are blackouts of electricity. Those who used power for lighting only such as retail shops, and local beer brewing were observed to use kerosene lamp, candles, and dry cells torch for lighting during electricity blackout. Twenty-six (26) enterprises, which used electricity for production, out of forty-three (43) enterprises interviewed said that they run no business operation if there was electricity blackout.

Availability of electricity services is one of the factors facilitating the decision of local entrepreneurs to invest in income generating activities such as milling machines, wood works, welding workshops in a specific area because most of these enterprises are found in centres where there is an electricity supply line.

Due to increased access to electricity services in rural areas, some productive uses have been identified through observation; these include lighting in shops and services activities, lighting and providing power in workshops such as carpentry, welding shops and grain milling.

There are evidence from literature which support the above findings; for example, World Bank, (1975, 23) cited in Rogerson (1997) identified productive uses of electricity services such as lighting and refrigeration in small shops and service activities, and for lighting, heating and motive power in rural workshops such as carpentry and welding shops. Other studies in Thailand (Cecelki,1992), Indonesia, Columbia and India (Barnes,1998) have shown that the availability of electric lighting in the households enabled household industries to increase working hours which led to increased output and income. The findings from the studied areas are congruent with this situation.

There are achievements for enterprises members observed as a result of changes that happened within enterprises because of taking up grid electricity services for operation. Some of these changes increased income, which enables them to pay school fees and buy school uniforms for their children, and improve their living standards.

### 4.4.1 Establishment of Micro-enterprises

Different types of micro-enterprises in the study areas have been established since introduction of electricity services. The findings from the field show that while there was no sudden burst of micro-enterprises following the introduction of electricity services. However, enterprises were gradually set up over the years that followed electricity supply.
In the study areas eleven grain milling were identified through observations, and found to use electricity for operation. Three milling machine were found in Mahango village, whileLyasongoro and Foo villages each had four electric grains milling in operation.

Other types of micro-enterprises, which used electricity, were furniture manufacturers/carpentry, welding shops and salons. In Foo village, there are three furniture manufacturers and two welding shops. In Lyasongoro there was one furniture manufacturer and two welding shops and in Mahango there was no furniture manufacturer but there was only one welding shop, which was not operational by the time of visit.

In addition, observation revealed that other types of micro-enterprises existed in the study areas, which were using electricity for lighting. These were retail shops, some tailoring shops, and local beer brewing. In these villages, there were also several micro-enterprises, which did not use electricity for production because of lack of capital to invest in installation and connection to grid electricity service.

Micro- enterprises like welding shops, wood workshops/furniture manufacturers and tailoring shops have been found to have big number of staff including at least one experienced local permanent staff and others found to be apprentices or part time workers. Those who just started training were not paid but those who had stayed for sometimes and had already acquired some skills were considered as semi-skilled people were paid minimal wages or paid under piecework basis. In addition, other enterprises like grain mills and some hairdressing and hair-cutting salon were found to have one permanent employee.

It was further observed that enterprises like retail shops are mostly of one owner type and found to be operated by the owner occasionally without assistance from the family member. The situation was found to force the enterprises to close when the owner got another commitment or emergency. This tended to make the customers shift to another enterprise. In Mahango village, for example, the shop owner who was a respondent went to town to

purchase some items and closed the shop; as the result some customers were found to walk to another shop in search for services.

Table 3 present a list of some MEs interviewed, year of establishment, nature of MEs, and total number of employee(s) involved. (The detailed Table is attached as Appendix 8.) Some information, like date of establishment, was missing because it was difficult to meet owners of all MEs to provide exactly date of establishment. This may not affect the quality and validity of the data because most of information was collected from the right persons. The numbers in the table 3 are summarised in Figure 7 in order to show the pattern of micro enterprises and its employees involved following the years after electrification programmes.

**Table 3: Number of MEs, Year of Establishment & Number of Employees**

| Year of start up | Type of ME | Location (Village) | No. of ME established | Total Employees involved |
|---|---|---|---|---|
| 1989 | Milling Machine | Foo | 1 | 1 |
| 1994 | Retail shop | Lyasongoro | 1 | 3 |
| 1995 | Retail shop and local beer bar | Mahango | 2 | 5 |
| 1996 | Milling Machine | Lyasongoro | 1 | 1 |
| 1997 | Two Furniture manufacturers, Tailoring | Foo &Lyasongoro | 3 | 16 |
| 1998 | Hair dressing, local beer shop, | Foo & Lyasongoro | 2 | 3 |
| 2000 | Retail shop, local beer shop, Tailoring, Hair cutting salon | Foo, Mahango & Lyasongoro | 4 | 13 |
| 2001 | Milling Machines, tailoring, | Lyasongoro | 2 | 2 |
| 2002 | Two retail shop, milling machine, | Mahango & Lyasongoro | 3 | 4 |
| 2003 | Local beer shop, Milling Machines, Hair dressing, welding shop | Foo & Lyasongoro | 4 | 13 |
| 2004 | Furniture manufacturer, | Lyasongoro | 1 | 4 |
| 2005 | Hair cutting Salon | Lyasongoro | 1 | 1 |
| | **Total** | | **25 MEs** | **66 employees** |

The observation from the table show that there was at least one micro-enterprise established in Lyasongoro and Foo village each year. Twenty five (25) micro-enterprises established which observed sixty-six people.

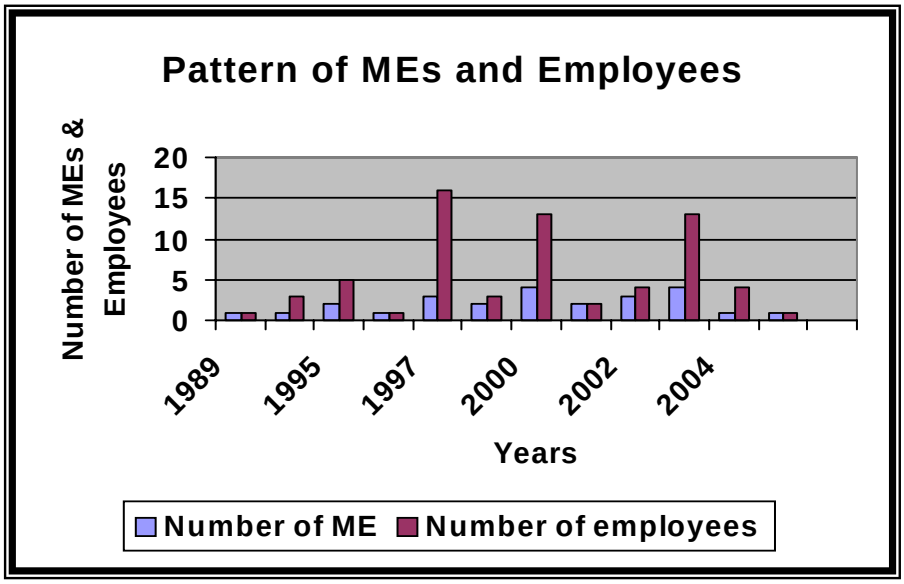


**Figure 7: Pattern of Micro-enterprises after Electrification in the study areas**

The average pattern in figure 7 shows that there is fluctuation in both number of micro-enterprises and total number of employees though at a low rate. In general, the establishment pattern increases up to 2003 when electric supplier (TANESCO) starts facing problems. This is an indication that the availability of electricity services encourage micro-enterprises establishment, which would not have otherwise taken place before electrification programme.

There are two types of micro-enterprises existing in the research areas; the one established as a main source of income for the owner and other as a supplement to the main source of income such as agriculture and livestock keeping.

It was learnt through focus group discussion and interview that there was low rate establishment of MEs using electricity services, though time elapsed since introduction of the services in the study areas is long. This means that there is a limiting factor for establishment of MEs. According to findings from interview in the field, 16 entrepreneurs out of 43 interviewed said they lacked access to markets or there was market saturation, 12 entrepreneurs out of 43 said they lacked capital and there was high initial connection fee for electricity services, and 9 out of 43 said they lacked effective transport and communication systems. These factors are the ones which hinder the establishment of MEs. King and McGrath, (1999) pointed out that many enterprises were found to sell their products in a restricted and saturated markets; therefore if they seek to increase their production, they find it difficult to sell the extra output.

In this study, only a few cases of MEs and entrepreneurs were picked up to represent others as most of them share some characteristics such as are single owned enterprises, dependance on local markets, their of products are wood products (furniture), local beer, maize flours and men and women suites. short account for each of selected entrepreneurs are presented below and descriptions for those selected MEs are attached in Appendix 9.

**a) Millers**

The increase in accesses and uses of grid electricity services for production by micro-enterprises have proved to be an important factor in improving the physical and financial assets of entrepreneurs.

According to the findings obtained through interview from the studied areas, for millers, the maximum earning was reached in harvesting season when most of people had much grain for milling. The profitability of enterprises like grain milling was highly dependent on the cost of electricity services paid as monthly bills. The document reviewed revealed that average bill cost per month was averaged to Tshs 50,000/=, which was almost half of the running costs. This was high compared to what enterprises earned which ranged between Tshs. 70,000/= to 100,000/= per month.

The livelihood analyses confirm that the trend of entrepreneur's income and security of income are increasing at a small rate for millers. It is concluded that the uptake of electricity services has allowed the establishment of micro enterprises. Further growth of grain milling was possible if the millers could be more innovative and creative as the electric motors of the machines are used to provide more than one services.

Some achievements were noticed from different millers because of using electricity services for production. In Foo village one respondent, miller said he started with one milling machine, but has so expanded that he now had a milling machine, wood workshops and sunflower extraction machine. The earning from those enterprises, he said, supports the daily expenditures for his family and other expenses such as paying school fees, and medical charges. He said he was paying about Tshs. 36,000/= and 500,000/= annually for his children in primary school, secondary school, respectively, while the earning per day ranged between Tshs 7,000 to 10,000/= from his enterprises.

Other examples were observed in Lyasongoro village. There were two retired government officials (one was a teacher and other was a Petroleum depot manager) who owned electric grain milling. Their milling expanded and one miller had, at the time of data collection, been able to open a bar, retail shop, and constructed a permanent house for his family. The other miller had opened a retail shop in the same village and computer centre, including internet and fax services, in the near by village. Those retired officials said, "Umeme ni maendeleo" which means "*electricity is development*". Their earning enabled them to afford good medical services and improved their living standards.

All eight grain milling operators, which were interviewed, said that production capacity and speed of attending a customer was higher for electric motor machine than diesel engine machine. They emphasized that the turn over per day was higher for electric motor machine than diesel engine machine. Unfortunately, there were no recorded figures about how much they earned per day. The use of electricity services was observed not to cause any changes in price of a product or services offered but attract many customers, which result in a higher turn over at the end of the day.

All the millers were observed to have permanent houses and could afford grid electricity services connection due to income earned from machines and other productive activities. The benefits of having electricity services in their houses was achieved through access to improved lighting and use some electrical appliances, for example; two respondents out of fifteen in Lyasongoro village said they use refrigerator to store not only food but also medicines. These benefits are thought to be enjoyed primarily by women and children as they spend more time at home.

**b) Tailors**

The comments during an interview from tailors revealed that using electricity for production for electric motor machines are faster than the manual machines, the former could operate in a

short time and meet the customer's requirements quickly; this attract more customers and, at the end, increases turnover. In Lyasongoro village, one tailor who owned one electric machine and specialized in women's dresses said he started with one machine. His business expanded by adding some electrical equipments such as an "over- lock" machine and iron for making good finishing. In addition, he said he bought a television set, mobile phone, radio system, and two goats. He further revealed that he had used part of the income to support his parents and do farming activities.
In the same village another tailor, specialized in men's suits, said he owned a manual machine and hired an electric machine from his friend. His income increased after using the electric motor and enabled him to buy bulk materials and an iron, and started producing a stock of ready- to -wear suits waiting for customers.

Apart from accumulation of physical assets such as working tools and financial advantages, the findings show that there were social advantages as well. For example, those who operated and owned the electric machines said they had increased the skills to operate them, gained experience and knowledge of how to repair the machines.
Additional advantages include electric machines having high speed, comfort, and using little human energy to operate. It was further observed that to owning electric machines leads to higher standards of living for the entrepreneurs and higher customer quality requirements.

Tailoring shops using electricity were observed to have one local permanent experienced staff and apprentices. Most of the apprentices were young women who were not paid because they were considered trainees; they worked to gain experience and knowledge for their future development.
The interviewees reported that the trainees were supposed to move out after completion of their six months to one-year training period, depending on the pace of the trainee's learning.
Interview with the trainees revealed that they had different plans. Some were planning to establish their own tailoring shops after successful completion of their training and get support or capital from their family. Others had a plan to move out of rural area to search for employment in town, as it seems in town the earning is high and possibilities of getting a job is high as well. Given such perception of trainees, we can infer that electricity availability does not combat urban migration.

**c) Welders**

Three welding shop owners were interviewed; one from each village. They said they had a starting capital from their own initiatives. The one who owned welding shop in Mahango had no knowledge on welding activities but hired staff with experience in welding. The other in Lyasongoro, had formal training on welding in the large garage in town and then decided to come back to open the enterprise.

The reasons given by the entrepreneurs as to why they chose to establish the welding shops in rural areas were that there was free working space or, if rented, the costs were cheaper than in town. Also, the competition was low as there were few enterprises of that nature at the time of establishment and that market demands were not yet met.

The financial position of welders as they said during an interview, had improved. They could adequately provide for their homes supplies, manage to pay school fees, pay medical fees and improve their daily living standards. In addition, they said that they managed to purchase new facilities like music systems and mobile phones. One welder in Lyasongoro village reported to have bought two saloon cars and was using them as taxis for additional income generating.

Observation showed that in all the welding shops there were apprentices who were learning welding skills. In Lyasongoro village, one welding shop had five apprentices at the time of visits, two of whom had already qualified and were working under contract bases. Three appratices were still undergoing training and they were earning small amounts of money and were sometimes assigned to work on contract basis.

**c) Hair Salons**

The earnings for salon owners had also increased. For example, in Lyasongoro, one hair cutting salon owner has increased his capital and now has a plan of investing in another business. Observation showed that owners of hairdressing salons had increased the number of driers and bought different types of hair products to meet customers' demands. This was observed in Lyasongoro and Foo villages. The living standards of the salon owners had also improved as for, during data gathering time, expenditure per day in their homes was more than before and part of the income was being used to pay school fees for their children.
The findings show that apart from physical and financial advantages, there were also social advantages. The hairdressers were observed to acquire some skills to operate salons in order to fulfil the customers' requirements. It was also observed that some customers were coming with requests for new hair styles so updating skills is important.

Hair cutting salons owners had permanent employees/experts. Two out of three saloon owners interviewed said they had one permanent employee each. For hairdressing salon the situation was different; no permanent employee was observed to work with these salons because there was no person with skills or knowledge of hairdressing. Those with skills were not willing to work in the villages, as the payment was low so they opted to go to search for job in town.
For haircutting, salon owners established the enterprises without having a cutting skill, but used to employ experts; this was observed in Foo and Mahango village. In Lyasongoro, the owner said he had hair cutting skills and was found to provide good services to his customers.
In the salons, unlike other enterprises, no apprentice was observed to work. When asked why, the hairdressing salon owners said that the customers were not willing to get services from inexperienced people because they feared to be injured as the driers used electricity.

**e) Livelihood of the Community**

The establishment of grain milling, welding shops, salons, and tailoring in the community has had an impact on the community members and community as a whole. This impact is analyzed using livelihood characteristics. The following are some of them, with regard to observation conducted in study areas:

First, the prices for milling had been lowered in some areas where more than one milling machines existed; in those areas, competition for providing services was high. For example, observation showed that in Lyasongoro village there were four grain milling machines one out of which used to receive subsidies from the church and provided services at a low price. The other machines were forced to reduce their price in order to win the customers; so this competition made the community members who were getting services from these machines save money because of low prices caused by competition among milling machines.

Secondly, the presence of electricity services caused the establishment of grain milling at walking distances. This was in comparison to the situation before electrification. Women and children were observed to be the group that benefited most in time saving because they were the ones who went for milling.

Thirdly, people were having more recreational time and sometimes used the extra time for doing other productive activities like caring for cattle and crops farming. Other people used this extra time for studying, especially young people.

Furthermore, the communication network in terms of telephone and wellbeing of entrepreneurs improved because of having access and use electricity services for production. It was observed that some community members benefited from the enterprises having access and use electricity services by charging their mobile phones and paying a small amount of money (about Tshs. 200/= for the service).

Lastly, the entrepreneurs said they were respected in the community; some poorer people were borrowing money or asking for advice from the entrepreneurs and sometimes were requested to be patrons in a ceremony or wedding. Most of entrepreneurs were observed to have modern equipment like radio cassette, mobile phones and a few had managed to buy Television sets or fridge.

In conclusion, basing on the field findings, the increased access to grid electricity services leads to establishment of micro-enterprises using electricity services in rural areas. Different types of MEs had been established as a consequence people are benefiting by getting the services at a short distance as compared to the situation before electrification programme when they were used to go to town or far from their location.
Availability of those services saved human energy and time as the distance from home had been reduced. They also saved money as the prices for the products and services were low in village compared to town.
The increase in access to grid electricity services, therefore, facilitates the establishment of certain types of micro-enterprises and employment opportunities in rural areas.

### 4.4.2 Growth of Micro-enterprises

The observation showed that the increased access to grid electricity services leads to the growth of micro-enterprises using electricity services in rural areas. This situation was assessed by using livelihood characteristics as related to increase access to electricity, which in turn lead to the growth of micro-enterprise in terms of increased out put and increase number of employees.

It was observed that the growth rate of micro-enterprises were noticeably higher in areas with electricity services than in villages without electricity services, but the proportion was low compared to micro-enterprises growth rate and time of electricity introduction. The growth of micro-enterprises was assessed by using the number of people involved in micro-enterprises activities after its establishment. Fifteen (15) out of forty-three (43) micro enterprises owners interviewed said they had added at least one permanent employee since its establishment because there were enough activities and long working hours which needed assistance from these permanent staff, this was better when compared to non-electrified MEs which had none permanent employee.

Others said they had remained stagnant from the time of their start-up to the date of the survey because the business was small in terms of turnover, which was small and could not lead to ability to pay additional salaries. People in those stagnant micro-enterprises were observed to be working either on a temporary basis or were paid in agreement on piecework or signed a short contract, as was the case in furniture manufacturers, welding and tailoring shops in the study areas.

The majority of micro-enterprisers interviewed in the study areas were one-owner micro-enterprises. Thirty seven (37) out of forty three (43) micro-enterprisers interviewed were of one owner type. In Mahango ten (10) out of thirteen (13) MEs owners interviewed were of one owner micro-enterprise type; in Lyasongoro, twelve (12) out of fifteen (15) were one owner, while in Foo, they were thirteen (13) out of fifteen (15). These figures show that the growth rate for MEs by adding employees were low. In general, this implies that micro-enterprises activities in Tanzania are still low in the sense that there are small ranges of activities for existed ME's, and they did not utilize productively the available opportunities such as grid electricity services.

The above situation is supported by King and McGrath, (1999 .65) whose survey in Mozambique showed that the majority of micro-enterprises were very small, only one person was engaged and work for a long hours to make relatively low return.
The authors point out that "*The majority of enterprises that started out as one-person undertakings have subsequently not grown by adding to their work force, and have produced distressingly low returns for those who work in them"*.

Before the introduction of electricity services, there was only diesel engine grain milling for production, other enterprises such as retail shops were using kerosene lamp and candles for lighting. The observation in this study revealed that the availability of electricity services resulted in longer working hours and/or enable the change of machinery from diesel use to electricity use. This is one-step of growth in-terms of technology. James (1995) supports the argument by using the evidence from Indonesia that electrification of businesses led not to a significant increase in employment, but to extended working hours.

The switch from diesel operated to hydro electricity powered machines was found through observation to be more profitable for milling machines than other enterprises. The owners of the electric driven mills experienced an increase in the output because of the of milling a unit of grain was less with electricity as compared to diesel, though the quality of electricity services supplied were poor.
Some micro-enterprises such as retail shops used electricity services for lighting throughout a day. These enterprises realized the saving from monthly bills as compared to the expenses of energy before the time when they used kerosene lamp or candle. For example, in Lyasongoro village one respondent who owned a retail shop said that before electrification he always used not less that Tshs.10, 000/= (Ten thousand) for kerosene, but after electrification now he used only Tshs. 4000/= to 5000/= as electricity bill per month.

According to the entrepreneurs' comments, the availability of electricity made the micro-enterprises to operate all the time. For example, December was a good month for the tailors. They said they received many customers during the preparation of Christmas and New Year festivals. During that time people tend to buy new clothes, so they could extend working hours even after sunset. Other months, they just opened for a few hours only.

It can be concluded that the increased access to grid electricity services facilitate the growth of micro-enterprises in terms of numbers of workers and technology in rural areas at a low rate. This may be more advantageous, if the electricity services supplied are available, reliable and affordable to most of rural poor people.

### 4.4.3 Expansion of micro-enterprises

Increased access to grid electricity services leads to the expansion of micro-enterprises by setting up new premises in other locations. The livelihood characteristics of the entrepreneurs

were used to assess the effects of grid electricity services, which lead to expansion of micro-enterprises in the electrified areas.

The increase in access to grid electricity services facilitates the establishment of new branches of Micro-enterprises within and outside the villages. In the study areas entrepreneurs were found to own several micro-enterprises. For example, in Foo village one respondent said that he started with a very small Kiosk selling salt and kerosene but the business grew and expanded within the village and now has a grain-milling machine, sunflower oil extraction machines, and wood workshop. All these used electricity services for production.

Another example observed in Lyasongoro village where two entrepreneurs said they initially owned grain milling has expanded their business; at the time of data gathering, one had opened a retail shop and a bar within the same village. Both of these enterprises were using electricity services for lighting and refrigeration.

The second entrepreneur as explained earlier opened retail shop within the same village and computer centre including internet and fax services in the nearby village; all these were possible because there was availability of electricity services.

In the same village, another respondent, a woman, said she stated with one tailoring machine, but now had three machines and a hairdressing salon with three driers. In the same areas, yet another male respondent said he started with a welding workshop, but, at the time of data gathering, he owned two salon cars. In Mahango village, a respondent said he started with a small retail shop now owned one “pick up” car, welding workshop and battery charging machine. These are some example observed in the study areas.

It can be concluded that the increase access to grid electricity facilitate and encourage the entrepreneurs to branches/expansion their business. It was observed also that, according to high competition, market saturation and low purchasing power of the community, the new branches opened have different production process and different products from the original businesses in order to widen the opportunities of wining customers and earning more income.

### 4.4.4 Decline and Closure of Micro-enterprises

Decline and closure of micro-enterprises were observed in the study area at a very low rate as a result of increase access to electricity services. Livelihood characteristics were used to assess the decline and closure of micro-enterprises in the study areas.
The entrepreneurs said that the decline of business was 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. This situation was observed in all three villages; for example, the millers complained about the decrease in numbers of customers, which resulted into low turnover. The reasons stated for the decline in businesses during interview were as follows:

- High competition between different micro-enterprises like milling machines in the same areas caused market saturation. The competition was worse in Lyasongoro village where Catholic Church subsidized one grain milling which provided services at lower prices compared to others milling machines. This attracted more customers even from the near villages.
- The electric motor machines were found to be preferred by many customers to diesel grain milling because of good products, and free from pollution/diesel smell. This situation resulted in four (4) diesel grain mills closing down and others two (2) switched

to electric engines. In addition, the running and maintenance costs of diesel engines machines are higher than to electricity engine machine, so the former closed down.

- Another reason given by millers for decline was the decrease in amount of grains harvested from local people because of the shortage of rains.
- Lack of technical know how and low innovation defined as knowledge that can be used to produce goods or services from the entrepreneurs, was another problem observed among entrepreneurs as source of decline for micro-enterprises. For example, the electric motor for the milling machines was not used to run different appliances, though there were possibilities of doing so. This was not familiar to most of the millers. All the millers interviewed in the research areas said they processed only the material brought to them by the customer and stayed idle when there are no customers but they could buy raw materials and process cattle food. This is possible because there was a demand/market for those products since people were found to go for cattle food in town.
- High electricity bill was another reason; in Mahango the welding shop closed down after up take of electricity due to high monthly bills. The owner concluded that the running expenses were high compared to turn over. It was observed that the purchasing power of the customers was low and there was no possibility of increasing the product costs, also it is very difficulty to access outside markets.

We can safely infer that the increased access to grid electricity contributed to decline and closure of some micro-enterprises such as diesel engine grain milling because running costs for electric motor engines become cheaper as compared to diesel engines, others did not switch to electricity, as they do not depend heavily on electricity services. Also the reasons for businesses failures cannot be attributed to electricity in all cases.

### 4.4.5 Impact of Electricity Services on women

Electricity services have major impact on women empowerment which here is defined as enabling women to participate and establish income-generating activities. Electrification system enables women to be involved in social and economic activities, this is possible as electrification brought services such as grain milling and salons to a short distance, this reduce walking distance, waiting time and human energy for carrying load.

The served time and human energy could be used for other productive activities such as farming and cattle farming. In the research areas during a PRA exercise with women from Lyasongoro village some said that before electrification they used to walk long distance and used long time waiting for the service because of big queue for getting services such as milling machines and salons services. However, now due to availability of electricity services these social services were available around a short walking distance, so the saved time and human energy was used for other productive activities such as rearing of cattle and food crops production.

In the study areas, fifteen- (15) out of forty-three (43) micro-enterprises interviewed were headed by women and found to have access and use of electricity services for operation. These enterprises were hairdressing salon, tailoring shops, retail shops and local beer brewing. Some of them were not home based, they are located at the business centre within the village. Five (5) out of the 15 women entrepreneurs were observed to own more than one business. Therefore, it can be concluded that there is a link between electricity services and women's economic development. If women were given opportunities and resources they could improve the living standards of their families and community as a whole and finally contribute in National poverty reduction strategies.

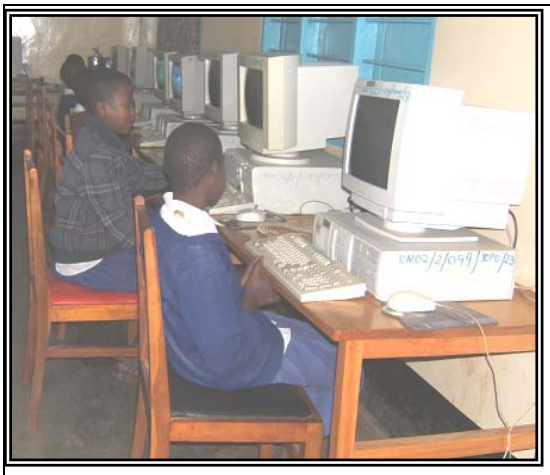

**Figure 8: Computer room Lyasongoro Primary School August 2005**

The provisions of electricity services for lighting increase the time for girls to read in the evening, also increase the opportunities for girls to participate in the modern education like learning computer programmes.

In Lyasongoro, the primary school was observed to have more than twenty computers for pupils; the computer session was conducted in afternoon after normal classes. According to the teacher teaching the computer subject, girls' attendance is better compared to boys. Observations from visit made without prior information support the statement because during a time of visit girls were observed to have more interest to learn computer programmes than boys.

Another electricity related benefit for girls was observed in electrified households. Thirty two (32) out of forty three (43) enterprisers had electricity connection in their homes.They said that due to good lighting, their children had more time to do homework and reading especially girls because during the day they were involved in other tasks such as going for milling, fetching water and collecting firewood. Kjellstom et al., (1992) conducted a study in Tanzania and found out that children in the few houses that had been electrified were doing their homeworks after dark using electric light.

Also the availability of electricity service and use for production made women to be trained and gain different skills and knowledge as many girls attend tailoring training as explained above.

### 4.5 Beneficiaries of the changes in enterprises

The beneficiaries of the changes brought in micro-enterprises after up take of grid electricity services are people within enterprises and community members in which these enterprises are located. This study presents the comparison made between those who benefited within the enterprises and between different types of enterprises in the study areas by using livelihood characteristics.

#### 4.5.1 Differences between Beneficiaries within an Enterprise

There was no enough staff in micro-enterprises studied for making a comparison, as most micro-enterprises were those whose owner was the sole worker type; the field findings show that 37 out of 43 interviewed were of this type of micro-enterprises. For that matter increased turn over and savings from use of grid electricity services the one benefited more is enterprise owner, then follows other staff involved. What other staff earned was very minimal because most of them were working under temporary or contract basis. So there was a big difference between enterprises owner and employees in terms of assets accumulation and even living standards.

Another benefit to entrepreneurs was business knowledge gained after being involved in business activities. The employed staff within those enterprises gained experiences, skills and business knowledge. For example in Mahango and Lyasongoro grain milling operators said they gained experience and skills to run machines using electricity, as well as doing maintenance or repairs. There was no empirical evidence to show whether or not once those

staff trained they left for town and good paid jobs, but the observation show that there was migration of those trained people from the studied areas to other places because they are not available in the areas. In addition, the apprentices' views from studied tailoring shops support the statement of migration as explained in section 4.4.1 that some of them had a plan to move out of rural area to search for employment in town after completing their training.

Electrified MEs realised income increase from energy saving and a higher turn over, an example is mentioned early in section 4.4.2. The savings obtained enabled entrepreneurs to make extensions of electricity services to their homes; this extension benefited the low-income households to charge their mobile phone and be able to get news through watching TV and playing radio cassette. This low-income household cannot afford connection fees for grid electricity in their homes. Thirty-two (32) entrepreneurs out of 43 (74%) interviewed said they have electricity services connection in their houses.

Male entrepreneurs were observed to be benefiting more than female in terms of income since they preferred choosing larger profit making business and women were involved in survival business such as local beer brewing and hair dressing salon rather than business aiming in development.

### 4.5.2 Differences between Types of Enterprises

Increased access to grid electricity services has different levels of impact to micro-enterprises in the study areas. Twenty seven (27) micro-enterprises out of forty three (43) interviewed stated that they were using electricity services for lighting only; fifteen (15) said they were using electricity for both production and lighting.

There was difference in production process and products quality between MEs using electricity services; observation showed that only grain millings produced the same products all over the study areas. By using observations and customer preference, the products quality and speed of production was observed to be high in enterprises using electricity services as compared to those, which did not use electricity services for production. This situation attracted more customers for micro-enterprises using electricity services for operation resulting in increased turnover but not influencing the increase in prices of the products.

Very few micro-enterprises were observed to benefit from the upper class market; for example one furniture manufacturer in Foo village tried to produce high quality door and window frames for high class markets but the selling rate was very low because the purchasing power for most of the community members where these enterprises located were very low. The upper class markets were found to be religious and government institutions like schools, hospitals, and churches. There was no knowledge of upper class markets; capability to access these markets and knowledge of meeting product quality needed for upper class market was lacking to most of entrepreneurs. This upper class market observed to be small but with high impact, because it could involve tourists who visited these areas for the purpose of climb Mount Kilimanjaro.

In general, most of micro-enterprises depended on local markets and there was market saturation, no innovation or creativity between enterprises. They all had the same characteristics of concentrating on local markets, lacking external markets, low knowledge and capability to access upper class markets.

Although most MEs are similar in the manner aforesaid, livelihood characteristics of enterprises members revealed some differences between electrified and non-electrified MEs. Most owners of electrified MEs were found to have more physical assets like music systems

and modern houses defined as houses constructed using cement blocks, roofed with corrugated iron sheets and being connected to electricity services. The living standards of such people are better off as compared to non-electrified MEs because could afford to pay for good medical services, good meals, have good lighting in their houses so no air pollution caused by biomass fuel.

In the study areas there were some micro-enterprises, which did not use grid electricity services at all though the access were available for them. These micro-enterprises were competing with micro-enterprises that used electricity services for production.

The reasons given by these micro-enterprise owners for not being connected and use grid electricity services were as follows:

- An initial connection fee was not affordable.
- The electricity services supplied was not reliable. The electricity supplied was under voltage especially evening hours when it was difficult even to turn on a florescent light.
- There was bureaucracy from the grid electricity supplier staff (TANESCO). This means that there was unnecessary delay because from application date until get, approval for connection is a long period; sometimes people relate this with corruption.
- Lack of connection materials from electric supplier such as cables, poles and metres.
- Lack of capital to buy electrical equipments for their industries.

Non –electrified enterprises were observed to be sometimes good customers to the electrified enterprises. In Foo village it was observed that the non-electrified furniture manufacturer used to process timber for furniture making in electrified enterprises located in the same village.

It can be concluded that electricity services has more positive impact to enterprises using electricity both for lighting and production, seven (7) out of forty three (43) enterprisers interviewed said they had witnessed noticeable growth and 9 out of 43 enterprisers interviewed said they had noticeable expansion as compared to those which used electricity services for lighting only. Also the decline and closure was more for enterprises which did not use electricity services for production as compared to electrified MEs.

In the study areas, two diesel engine grain millings were closed down after the introduction of electricity, one in each village, Mahango and Lyasongoro. When the respondents were asked why, they said that many customers preferred the electric motor engine to the diesel engine. The reasons given were that electric engine grain millings produce good quality products and no pollution/diesel smoke. In addition, the running and maintenance costs of diesel engines machines are high compared to electric motor machines.

### 4.6 Barriers in Accessing and using Grid Electricity Services

There were problems with regard to access and use of electricity for production purposes as observed by the researcher and reported by interviewees. These were:

i. In Mahango village the grid electricity did not pass through the village, therefore the service was still not available in some areas due to lack of service line materials such as fuses, cables, poles and transformers.
ii. Illegal connection and vandalism of cables and cooling transformer oil in the distribution network. This caused blackouts, which discourages new customers to apply for connection.
iii. There was low voltage supplied and fluctuations outside the acceptable range found in the study areas. The electricity services supplied was not available and reliable, and most of the time especially in the evening hours the electricity supplied was under - voltage and there are frequent blackouts.

**Figure 9: Bulb and tube Light connection**

This caused a problem for enterprises operating in the night like tailoring when there were peak demands like Christmas days or harvesting period. This also is a problem for enterprises which used electricity for lighting after sunset for example retail shops, salons, and tailor shops. The situation of increased consumption and connection without changes in supply lines contribute to the low voltage supplies as claimed by most of customers.

Most heavy electricity appliances and even a tube light cannot function during those hours. Customers said they were forced to use both tube light and candescent bulb as shown inFigure 8 where there was both a florescent light frame but the bulb is used.

**iv.** Another barrier observed was complicated tariff structure; document review revealed that there were high initial connection and installation fees. The initial connection fees for residential single-phase meter was Tshs 204,000/= and for commercial is Tshs 492,000/= for three phase meter.[12] According to tariff categories, micro-enterprises belong to domestic low usage tariff, which has two classes: low energy charge per (0-50) costs Tshs.38/= per unit, above 50 costs Tshs.115/= per unit, most of enterprises were observed to use more than 50. For example, the findings from Lyasongoro revealed that electricity consumption per month ranged from 400 to 450 ; So, using the above rate means the monthly bill ranges between Tshs. 46,000/= and Tshs. 51,750/=. This was expensive as compared to average month earning of enterprises, which range between Tshs.70, 000/= and Tshs.100, 000/= this earning figures was according to views of respondent. However, there were no recorded figures to show exactly their earnings.

**v.** Low income for most of community members to meet application standards was another constraint observed in the study areas. In order to qualify for connection the customer must meet certain minimum standards stipulated by TANESCO which are permanent house roofed with iron sheet and completed wiring approved by electrical engineer or technician. This system automatically excludes most of very low-income families. For example, in Mahango village an estimate of 90 households out of 792 households observed were traditional houses, which did not meet TANESCO standards.

**vi.** Since 2000 electricity had become relatively expensive. The initial connection fee and monthly bill increases inhibiting most of villagers to use it for productive activities. For example, in year 2003 the initial connection fees was Tshs. 90, 000/=, in 2004 it rose to Tshs. 140,000/= and in 2005 it rose to Tshs. 204,000/=. Arvidson and Gustafsson, (2002) pointed out that among the households that are connected to the grid only few use the power for production, the primary reason being the high initial cost for the connection to the grid and high electricity prises.

**vii.** The service provided by the electricity utility is not good especially billing systems. Some customers were claiming that the monthly bill was just an estimate. It meant

[12] Tanzania electric supply company (TANESCO), tariff and service charges (2005)

what they paid was not the same as what they consumed. Soalmost all entrepreneurs (about 38 out of 43 interviewed) preferred the introduction and use of prepaid system meters. This option could be used for both production premises and for households. Existing service line and transformers did not satisfy the electricity demand of customers that is why some people started to use other alternative source of electricity like solar PV in Mahango village.

Though there were many limiting factors for not applying for grid electricity connection, many applications were still pending due to lack of connection materials such as cable and fuses. This problem was more severe because electric supply company had limited funds to run its activities. However, there were private electric supply company/organization dealt with providing other viable alternative source like solar PV and biogas but these alternatives provided at a very high cost, which is not affordable to most rural people.

In conclusion, the availability of grid electricity services in rural areas stimulates establishment, growth and expansion of micro-enterprises at a low rate; also contribute to decline and closure of micro-enterprises due to market saturation and high competition. The livelihood characteristics of entrepreneurs and employees had changed as a result of taking up electricity services for production or operating the enterprises for example accumulation of physical assets such as modern houses, radio cassette, cattle, and saloon cars.

Financial assets had changed as well. There was increase in income earning which facilitated change in living standards like being able to pay good medical charges, school fees and good meal. In addition, human assets had increased; as observed, people gained business knowledge after dealing with customers for a long time; Young people gained knowledge and experience after they had participated in training like carpenters, welder and tailors.

The entrepreneurs and employees are the first beneficiaries of the changes obtained in their enterprises as a result of taking up electricity services. The second group is the poor people in the community where these enterprises are located; as these were observed enjoying services in entrepreneur's house by watching TV, listen radio and charging their mobile phone. Also community as a whole where these enterprises located found to benefit because services such as milling, salons were now located at a short distance.
There were some barriers found to be experienced by the micro-enterprises in accessing and using electricity services for production. Electricity services were not available in some areas due to a lack of connection materials like fuses, cables, poles and transformers; In areas where electricity services were available the problem was complicated by the tariff structure such as high initial connection and installation fees and high monthly bills; illegal connection and vandalism of cables and cooling transformer oil, low voltage supplied and fluctuation. These problems caused blackouts which discouraged new customers to apply for connection.
In addition, the low income for most of community members to meet application standards for installation and connection of electricity services in their business was another barrier limiting access to grid electricity services.

## CHAPTER 5: SUMMARY AND CONCLUSION

This part includes summary of main findings and conclusion. Turning to the research questions, question one was about which changes in establishment, growth, expansion, decline and closure, and which changes in livelihood take place in micro-enterprises in rural areas in Tanzania by taking up electricity. The question was assessed and the results show that the increased access to grid electricity services leads to changes such as establishment, growth and expansion of micro-enterprise.
Different types of MEs had been established like grain milling, furniture manufacturer/carpentry, welding shops, tailoring shops, salons and retail shops. In addition, growth of micro-enterprises in terms of numbers of workers and new technology in rural areas and establishment of new branches/expansion of micro-enterprises within and outside the villages were observed at a low rate. This may be more advantageous, if the electricity services supplied were available, reliable and affordable to most of rural poor people.

Decline and closure of micro-enterprises were also observed in the study areas at a very low rate. Two (2) diesel grain mills switched to electric motor engines after realising the benefits of grid electricity services and four (4) diesel engines grain mills closed down due to higher running and maintenance costs of diesel engines machines as compared to electric engine machines.

There were changes observed in livelihood characteristics of enterprises owners, people involved in the enterprises and community members where these enterprises located. For example, there were accumulation of physical assets such as modern houses, radio cassette, cattle, and saloon cars among the interviewed enterprisers. Financial assets had changed as well; there was increase in income earning which facilitated change in living standards like being able to pay good medical charges, school fees and good meal. In addition, human assets had increased; as observed, people gained business knowledge after dealing with customers for a long time; Young people gained knowledge and experience after they had participated in training like carpenters, welder and tailors.

The research question two was about who experiences these changes happened in question one and why. The question was assessed and findings show that enterprise owners, employees and community members where these enterprises located found to benefit.

Enterprise owners and employees involved found to increase their financial and physical assets from earnings and savings obtained from use of grid electricity services in their enterprises. Other benefits they gained were business knowledge, skills and experience after being involved in business activities.
Community members were found to benefit from services such as the electric motor machines for milling, hair driers and hair-cutting machines were observed to be more used and located at a short walking distance in the research areas. This saves time and human energy, which could be used for other productive activities. Other benefits were services from electrified houses owned by entrepreneurs such as charging mobile phone, news through watching TV and playing radio cassette.

The research question three was about what are the main barriers and constraints experienced by micro-enterprises in rural areas in Tanzania by using grid electricity services? The development changes observed in question one were at low rate due to constraints and barriers experienced by micro-enterprises during accessing and using grid electricity services. Those barriers are lack of service line materials such as fuses, cables, poles and transformers,

complicated tariff structure such as high initial connection and installation fees and high monthly bills; illegal connection and vandalism of cables and cooling transformer oil which causes power rationing, low voltage supplied and fluctuation this causes blackouts, which discourage new customers to apply for connection.

Apart from the problems and barriers mentioned above, there are other factors inhibit rapid development of micro-enterprises like lack of access to markets, credits, business knowledge, materials, and effective transport and communication systems.

In conclusion, the availability of grid electricity services supported development of micro-enterprise though at a low rate at village level. There is a direct link between arrival of rural electrification programmes and changes in micro-enterprises such as establishment, growth, expansion and decline and closure in the rural areas in Tanzania. The study findings of this research revealed that there is a possibility of rapid emergence and development of MEs in rural areas of the same characteristics as Kilimanjaro region if the electricity services supplied should be available, reliable and affordable to most of rural poor.

It is believed that with time, it is possible that rural communities would be able to take advantage of the opportunities provided by the introduction of electricity services by establishing more micro-enterprises and use electricity more productively. There was interest observed from both sides, the government through MEM finalizing establishment of a Rural Energy Agency (REA) and a Rural Energy Fund (REF) in order to promote access to modern rural energy especially electricity. Moreover, rural households have the interest to be connected to the grid, but claiming that existing tariff structure was complicated, initial connection and installation fees was high inhibiting them from getting the services.

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**APPENDIXES:**

**Appendix 1: Individual Energy Experts Consulted in the course of this thesis.**

| Full Name | Title | Organization/Company |
|---|---|---|
| Karlijn M. Arkesteijn | Managing Director | Umeme Jua Ltd |
| Wilfred D. Kipondya | Managing Director | FREDKA International Ltd |
| E.N. Sawe | Executive Director | Tanzania Traditional Energy Development and Environment Organization (TaTEDO) |
| Bariki K. Kaale | Chairperson | Tanzania specialists organization on Community Natural resources and biodiversity conservation (TASONABI) |
| Dr. Cuthbert Z.M Kimambo | Senior Lecturer | Department of Energy Engineering and Director of Technology Development and Transfer Center (TDTC). |
| Mr. Bengiel Msofe | Head | Renewable Energy Department TANESCO |
| Mr. Mbonile | Senior Engineer | Distribution section TANESCO Northern zone (Kilimanjaro) |
| Mr. Godfrey Sanga | Head Monitoring and Evaluation Department | TaTEDO, Enabling Access to sustainable Energy (EASE) Project Tanzania |
| Dr. Ulomi | Director | University of Dar es Salaam Entrepreneurship Centre (UDEC) |
| Mr. Masawe | Head SMEs Section | Ministry of industries and Trade. |
| Mr.Lutengano Mwakahesya | Assistant Commissioner | Energy Development – Ministry of Energy and Mineral |

Appendix 2: Information about EASE Programme.

EASE (Enabling Access to Sustainable Enerrg) was developed by ETC in collaboration with partner in Tanzania, Bolivia, Vietnam, and Honduras in 1997.
The overall mission of the EASE programme was formulated to be the enhancement of access of low-income groups to sustainable energy services, by promoting the importance and better understanding of these groups to the national actors in their countries and international actors including donor community. The outputs of this project are intended to make contribution to the:
Insight and understanding of the inhibiting and stimulating parameters and conditions to relevant actors in the target countries
Insight in the issues of sustainable energy services for the low income groups to relevant parties world-wide
Tested approaches and methodologies
Built-up capacity in a network of decision makers and intermediaries

The inception phase of the EASE programme was implemented in Tanzania in two regions which are Coast and Kilimanjaro. The main activities in the inception phase were secondary data review, interview with key informants and conducting field study. Apart from establishing information on the energy-poverty linkages, the field study used to test approach methodologies that would be used in the next phases of the programme. EASE research project is part of the programme implementation phase and it seeks to investigate the linkages

between energy services, and poverty productive uses in selected rural areas and assess how they have contributed to improving livelihoods assets of the people (Sawe, et al,. (2001).

## Appendix 3. Tanzania in Brief

The United Republic of Tanzania located in Eastern Africa, bordering Indian Ocean to the East, Kenya and Uganda to the North, Rwanda, Burundi and Democratic Republic of Congo to the West, Zambia and Malawi to the Southwest and Mozambique to the South. The Capital city is Dar es Salaam and the official administrative capital is Dodoma.
Tanzania has a tropical type of climate. In the highlands, temperatures range between $10^0$c and $20^0$c.during cold and hot seasons respectively. The rest of the country has temperatures never falling lower than $20^0$c. The hottest period spreads between November and February ($25^0$c - $31^0$c) while the coldest period occurs between May and August ($15^0$c - $20^0$c)[13]
Tanzania is the country of great lakes. It is bounded in the North by Lake Victoria, the source of River Nile, in the west is Lake Tanganyika, and the second deepest lake in the world and in the south is Lake Nyasa. There are also inland lakes mainly, Rukwa, manyara, Eyasi and Natron[14].

## Appendix 4. Summery of PRA exercise

- **Foo village**

The PRA exercise was conducted in Foo Village from 07/07/05 to 09/07/05, about twenty six (26) participants attended, 12 out of 26 were females and 14 were males. This exercise facilitated together with EASE research team since the research areas are within the EASE research project in the village cluster 1; at the same time EASE were doing the research on productive use of electricity and biomass heat energy.

- **Lyasongoro village**

The PRA exercise held on 19/07/05 to 20/07/05, twenty (20) people participated in the exercise, twelve out of twenty participants were females and eight were men. The activities and questions discussed were the same as for those used in Foo village.

- **Mahango village**

The PRA exercise was planned to take place on 12/07/05 to 13/07/05 but it was a coincidence that by the time of arrival at the village there was already a planned intensive PRA exercise underway being facilitated by Rombo district officials. The whole exercise known as O & OD (opportunities and obstacles to development and is a part of the major national programmes aiming at rural development and at achieving the millennium development goals (MDGs) by 2025. For that matter, the research team went through some results from the conducted PRA tools and probed some ideas that were not very detailed for the purpose of this research and EASE research. Available information, however, was sufficient to understand the village situation.

- **Questions Discussed**

Different questions discussed in a group, finally one answer obtained after reach a consensus. Those questions discussed are as follows:

- What are the important changes that happened in the village after introduction of electrification programme
- What are the daily activities at the households level (activities for men and women)
- What are productive uses of electricity
- Do people use electricity for production? How and why?

[13] www.tanzania.go.tz/vision_2025f.-Country Profile (2005).
[14] United Republic of Tanzania, Kilimanjaro Region Socio economic Profile, 2002

- What is the status of social services such as water supply systems, education etc.

In addition, some activities done together as one group during the PRA exercise such as drawing a village map and incomes and wealth ranking.

- **Ranking Results**

During PRA exercise, the participants were asked to rank their problems by voting system. The male and females representatives were given different marks to votes in order to differentiate the priorities between men and women, each item/problem were given a maximum of three marks. The voting results are presented in the table below:

**Table1: Results from voting and prioritization in Foo village**.

| No. | Item | Total votes | | | Priority | | |
|---|---|---|---|---|---|---|---|
| | | Males (maize) | Females (beans) | Total votes | Males (maize) | Females (beans) | Total |
| 1 | Education | 38 | 92 | 130 | 1 | 1 | 1 |
| 2 | Poverty: low incomes | 7 | 73 | 80 | 6 | 2 | 2 |
| 3 | Leadership | 33 | 36 | 69 | 2 | 5 | 3 |
| 4 | Health | 11 | 38 | 49 | 4 | 4 | 4 |
| 5 | Income opportunities | 4 | 39 | 43 | 7 | 3 | 5 |
| 6 | Energy | 12 | 28 | 40 | 3 | 6 | 6 |
| 7 | Communication | 9 | 15 | 24 | 5 | 15 | 7 |
| 8 | Water | 4 | 14 | 18 | 7 | 8 | 8 |

**Table 2: Results from voting and prioritization Mahango village**

| No. | Item | Total votes | | | Priority | | |
|---|---|---|---|---|---|---|---|
| | | Males (maize) | Females (beans) | Total votes | Males (maize) | Females (beans) | Total |
| 1 | Health | 148 | 28 | 174 | 1 | 2 | 1 |
| 2 | Water | 99 | 30 | 129 | 3 | 1 | 2 |
| 3 | Poverty: low incomes | 100 | 16 | 116 | 2 | 3 | 3 |
| 4 | Education | 73 | 0 | 73 | 4 | 6 | 4 |
| 5 | Communication | 62 | 0 | 62 | 5 | 7 | 5 |
| 6 | Leadership | 33 | 0 | 33 | 6 | 8 | 6 |
| 7 | Income opportunities | 13 | 15 | 28 | 7 | 4 | 7 |
| 8 | Energy | 10 | 7 | 17 | 8 | 5 | 8 |

**Table 3: Results from voting and prioritization Lyasongoro village**

| No. | Item | Total votes | | | Priority | | |
|---|---|---|---|---|---|---|---|
| | | Males (maize) | Females (beans) | Total voles | Males (maize) | Females (beans) | Total |
| 1 | Health | 34 | 35 | 69 | 2 | 2 | 2 |
| 2 | Water | 2 | 6 | 8 | 6 | 4 | 6 |
| 3 | Poverty: low incomes | 63 | 51 | 114 | 1 | 1 | 1 |
| 4 | Education | 32 | 31 | 63 | 3 | 3 | 3 |
| 5 | Communication | 0 | 2 | 2 | 7 | 5 | 7 |
| 6 | Leadership | 0 | 2 | 2 | 7 | 5 | 7 |
| 7 | Income opportunities | 23 | 6 | 29 | 4 | 4 | 4 |
| 8 | Energy | 3 | 6 | 9 | 5 | 4 | 5 |

The results in the table above show that modern energy services including electricity is not a priority to the community. It does not appear even out of the five most important problems to the villagers. The ranking results indicates that there is low understanding among local people about the link between use of electricity services for production, increase income and poverty reduction, because the first three problems which are lack of good health facilities, low income among community members and lack of water supply systems are related to lack of electricity services in the villages.

To have good health facilities and good systems for water supply, electricity services should be available for refrigeration, pumping water from wells , also for increase income modern technologies are needed which automatically need electricity services to run the machines, this ranking shows that electricity has a major role in development for the rural poor.

- **Table 4. List of People Involved in PRA exercise**

| **Lyasongoro Village** | **Mahango Village** | **Foo Village** |
|---|---|---|
| Helen Hurbert | Francis Damian Urio | Josephate Mushi |
| Jangama Samwel | Policup F. Kimaro | John Nashani |
| Mary Robman Minja | Saveli Kimaro | Mr.Hilal Shuma |
| Evodi Minja | Cosmas Asenga | Udiel Mushi |
| Elichilia D.Minja | Franck Tarimo | Babu G. |
| Elihuruma Teti | Alex leninga | Anold Shuma |
| Gody Solomoni | Jeremi Bakari | Mrs. Hilal Shuma |
| Joseph Minja | F. Tarimo | Wilfred Shuma |
| John Minja | Maisheli Mahunda | Ms. Israel Shuma |
| Dickson Elias Tetee | Godwin Uiso | Rose Shuma |
| Elias Tetee | T.Mosha | Ayeonika Nkya |
| Benjamin Aminiel Minja | Samweli Msuya | Simon Mushi |
| Emanuel silvester | P. Tenga | Muno Joseph |
| Lucy Thomas Kimaro | Joseph Mariki | |
| Daudi Elias | Rose Samweli | |
| Elia Lyimo | Baltazari | |
| Franck Minja | Fabia Tarimo | |
| | Ernest Kimaro | |
| | Selistian Taresi | |
| | John Mmari | |
| | Stela Mture | |
| | Rose Mandari | |

**Appendix 5: Checklist Questions for Interview:**

**A. General Information of Micro-enterprise**

1. Name of respondent …….sex……
2. Enterprise Location
3. Main enterprise activity(ies)
4. Nature of ownership (single, family, cooperate)
5. Where do you sell your products? Local market or distance market and why?

**B. Information about Enterprises which uses electricity Services.**

1. How do you rate the quantity/quality of the electricity services you are using? (Reliability, Availability and affordability).
2. What type of existing technology or machines/ equipments and production process in the enterprise (electricity using machines or appliances for enterprise activities)
3. How many ME's established after introduction of electricity services? In addition, how many ME's decline or closed up after taking up electricity services?
4. If there is no availability and reliability of the electricity, how is your enterprise affected?
5. Is availability of electricity a contributing factor for starting and operating your enterprise? If yes how, if no, what were influencing factors?
6. When did you Connected to National Electricity grid, and when started using electricity. Who influenced this?
7. Is the enterprise share the electricity bill with household? Why?
8. What are the main uses of electricity? And why?
9. Do you use other source of energy? For which activity (ies) and Why?
10. What are the advantages and benefits obtain from connection to the grid electricity?
11. What are the problems/barriers in accessing and using electricity services? Mention and explain them.
12. What were the average production/services per month before connecting to electricity and after connecting to electricity?
13. Which new product/service have you started to produce after connecting to electricity? Mention them

**C. Information about Enterprises without grid electricity services**

1. Why is your enterprises not connected to electricity grid?
2. Do you know that electricity services can be used for productive purposes? Explain.
3. Are you willing to be connected to the grid electricity services? Why?
4. Are you ready to pay per month so that you can get electricity services for your activities? Do you have this money?

**D. Livelihood situation of Enterprise owner**

Changes that takes place within an enterprise after taking up grid electricity services

- **Social assets:**
  i. Is use of electricity improves social relations of the entrepreneur? How
  ii. How was reputation of enterprise owner and employees improve in a community
  iii. What were the effects to enterprise employees and community members after your enterprise has been connected to electricity?
- **Human Assets**
  i. How the enterprises help improve level of education of the owner, Employees, members of households, up to which level?
  ii. What skills have been improved by been involved in ME activities?
  iii. Is taking up electricity services change in working hours of enterprise? And this leads to improve service for other villages? How
  iv. How do the members of the enterprise use their extra time?

- **Financial Assets**

i. Is Use of electricity services improved turnover and income of entrepreneur? How
ii. Is change in production process lead to increase price of products for other villages/markets? Why
iii. By how much the availability and reliability of electricity improved the production, service time to customers, reduce work load, reduce use of biomass energy, explain

- **Physical Assets**

i. Is use of electricity increase innovation of ME? And lead to improve quality of products and / or services?
ii. How many branches opened or new business established, within or outside the village?
iii. What are the major expenditures you have done from the profit of the enterprise? Indicate (TV, Radio, Bicycle, Car, Modern house, pay school fees,)
iv. Is Use of electricity services lead to change in production processes and type of products? How

**Appendix 6: Number of households connected to grid electricity Himo district.**

| Year | Number of households connected |
|---|---|
| 2000 | 356 |
| 2001 | 380 |
| 2002 | 400 |
| 2003 | 200 |
| 2004 | 91 |
| Total | 1427 |

Source: Tanesco - Himo district (2005)

**Appendix 7: Electricity consumption in Moshi rural district.**

| Consumer category | Tariff | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Residential, Commercial and light industries | T1 | 26011 | 24024 | 26215 | 37881 | 39825 | 42475 | 47477 | 48533 | 49336 | 51399 |

**Appendix 7: Electricity consumption in Hai district.**

| Consumer category | Tariff | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Residential, Commercial and light industries | T1 | 2613 | 2866 | 3438 | 3571 | 3701 | 4125 | 4604 | 5925 | 6226 | 7460 | 7757 |

**Source: Regional office Tanesco- Kilimanjaro (2005)**

**Appendix 8: List of people and their Enterprises Interviewed**

| Name of Owner (Entrepreneurs) | Type of Enterprise | Location (Village) | Year of Start up | Number of employees | | Electricity use |
|---|---|---|---|---|---|---|
| | | | | Permanent | Temporary | |
| Anna Amen | Local beer brewing and Retail shop | Foo | 2003 | 1 | 4 | Lighting |
| Maximilian Shuma | Furniture Manufacturer | " | | | | |
| Kunda sawe | Furniture Manufacturer and general Timber works | " | 1997 | 2 | 8 | Production & Lighting |
| Tina Muro | Hair dressing Salon | " | 1998 | 1 | 0 | Running driers |
| Ebeneza Shayo | Milling Machine | " | 2002 | 1 | 0 | Production & Lighting |
| Michael Tarimo | Retail shop | " | 1995 | 1 | 0 | Lighting |
| Ebeneza Shayo | Retail shop | " | 2000 | 2 | 2 | Use Solar PV |
| Judica Joseph Mmasi | Milling Machine and local beer brewing | " | 2003 | 1 | 0 | Production & Lighting |
| Sango Shuma | Furniture Manufacturer | " | 1997 | 2 | | Production & Lighting |
| Ahimidiwe Alfred Ulomi | Barber shop/salon | " | | | | Running cutting machines |
| Willy Lambo | Barber shop/salon | " | | | | Running cutting machines |
| Dia Muro | Milling machine | " | | | | Production |
| Bablon Mushi | Hair Cutting salon | " | 2000 | 1 | 0 | Running Cutting Machine |
| Simon Mushi | Local beer/Pombe shop | " | | | | Lighting |
| Exaudi Isack | Furniture Manufacturer | " | | | | No Electricity |
| Helen Hubert | Local beer brewing | Lyasongoro | 1998 | 1 | 1 | Lighting |
| Mama Kadogo | Hair dressing | " | 2003 | 1 | 1 | Running driers |
| Mama Kadogo | Tailoring | " | 2000 | 2 | 3 | Production & Lighting |
| Evodi Minja | Furniture Manufacturer | " | 2004 | 1 | 3 | Production |
| Elichilia Minja | Tailoring | " | 1997 | 1 | 2 | Production |
| John Minja | Milling Machine | " | 2001 | 1 | 0 | Production |
| John Minja | Retail shop & Bar | " | 2002 | 1 | 1 | Lighting |
| Dickson Elias Tete | Tailoring | " | 2001 | 1 | 0 | Lighting |

| | | | | | | |
|---|---|---|---|---|---|---|
| Benjamin Minja | Retail shop | “ | 1994 | 1 | 1 | Lighting |
| Emanuel Silvester | Hair Cutting salon | “ | 2005 | 1 | 0 | Running Cutting Machine |
| Mrs.Kimaro | Retail shop | “ | 2002 | 1 | 0 | Lighting & refrigeration |
| Mr.Kimaro | Milling Machine | “ | 1996 | 1 | 0 | Production & Lighting |
| Daudi elias Tete | Welding shop | “ | 2003 | 2 | 3 | Production & Lighting |
| Kwa Beach | Tailoring | “ | | 1 | 2 | No electricity |
| Elia Lyimo | Tailoring | “ | 2002 | 1 | | Lighting and Production |
| John Njau | Milling Machine | Mahango | 2003 | 3 | | Production |
| Benezeli Shayo | Milling Machine | “ | 2000 | 1 | | Production |
| Mawishe M. Towo | Milling Machine | “ | 2001 | 1 | | Production |
| Filemon J. Masue | Welding workshop | “ | 2003 | 3 | | Production |
| John Meena | Barber shop | “ | 2003 | | | Running Cutting Machine |
| Mr. Merikiory | Tailoring | “ | | | | No Electricity |
| Serafini C. Kauki | Local beer/ Pombe shop | “ | | | | Lighting |
| Mrs. Ebenezer Shao | Retail shop and Pub | “ | 1998 | | | Lighting |
| Godwin Uiso | Retail shop | “ | 2003 | | | Lighting |
| Michael Tarimo (Kadogoo) | Retail shop, welding workshop and Battery charging | “ | 2000 | | | Lighting and Production |
| Antony E. mtenga | Furniture manufacturer | “ | | 1 | 2 | No Electricity |
| Sabasi Kimaro | Local beer/ Pombe shop | “ | | 2 | | Lighting |
| Godfrey Masuke | Local beer brewing and Retail shop | “ | 2000 | 3 | 0 | Use battery |

**Appendix 9: Description of some Micro-enterprises studied.**

**i. Grain milling.**

Grain milling is one of units in this research. In the study areas two, types of milling machine have been identified, one use diesel engine and another use electric motor for operation. Some grain millings that had been set up some years back started with diesel engines but now have switched to electric engines after the areas being electrified.

In the study areas two diesel engine grain millings were closed down after introduction of electricity (in Mahango and Lyasongoro respectively), because electric motor engine was found to be liked by many customers above the diesel one. The reasons given were that electric engine grain millings produce good quality products and no pollution/diesel smoke. In addition, the running and maintenance costs of diesel engines machines are high compared to electric motor machines.

In mahango village, the diesel engine operated only when there was long electricity service. There are three in Foo and two in Lyasongoro diesel engines in operational.

The impact of electricity services on grain milling was clearly observed, because without electricity services no operation for this type of enterprises therefore the establishment of such enterprises is a conditional that the electricity supply services should be available and reliable.

**ii. Tailor shops**

Tailor shops are another micro-enterprises included in the unit of analysis. Owners of both electrical and manual were interviewed in order to see the impact of increase access to grid electricity services to such kind of micro-enterprises.

The tailor shops were found to be headed by men and women. In Mahango there is no tailor used electricity, In Lyasongoro three out of five tailor shops interviewed were used electricity, one used electricity only for lighting and other one did not use electricity at all. In Foo two out of four tailors interviewed were found using electricity for production.

Those who have taken up electricity services for their machines explained that the services do not increase the prices of the products, but help to simplify the work and increase speed of production, for that matter production increases while production time remain constant. The quality of products is also better when one uses electric machine. This attracts more customers and results into more turnovers for the enterprises compared to enterprises operated manually.

In Lyasongoro one tailor who specialized in women dresses making had customers from both local and distant markets. The number of customers' increases because of good quality of products and the speed of production after starting using electric motor machines.

Therefore it can be concluded that the increased access and use of electricity services for tailors had seasonally increased working hours. When there was a peak demand or high requirements from the customers, all tailors extended working hours.

The reason given by enterprises, which use electricity for lighting, only was low capital to buy electric machines or motor. It was started that it is due to lack of capital and that it is risky to depend entirely on grid electricity.

The tailoring shops were closed in the evenings and often extended working in the night. The following observations were made and reasons given.

- No loose of customers was felt that emanated from closing in the evening because evening hours there was no movements of many people the only movement observed was for people who went out for social events. Secondly, there was no street light, so accessibility of paths and roads to some sub-villages in the areas at night was not secure, and many people assume no security to be out of their homes after dark.
- Another reason for performing work only during daytime was to release early young women who worked as trainees because of low security and poor accessibility to their homes.

- Other reason to working hard during daytime was to meet customer's requirements, reduce production costs as some employees were paid per piece work/contract, and increase savings from electricity consumption.

### iii. Welding workshops

Welding workshops under operational during the study period were found in Lyasongoro and Foo villages. These enterprises were involved in the production of grills, window frames, and other product from steels.

In Mahango village, there was one welding shop but it was not in operational by the time of visit. The reasons given out by the owner was that the monthly electricity bills is very high compared to monthly turnover, so there was no need of running enterprise at loss. In addition, there was no expert to operate the machine as the owner had many activities to do apart from welding business.

The welding micro-enterprises were established on the condition that grid electricity supply is available and reliable. Therefore, the grid electricity services can therefore is the one of conditions for the establishment and survival of such enterprises.

One of the observed problems for these types of micro enterprises was that they did not have a specific power line they share the service line with households. Therefore, during operation, a household claimed to have low voltage and sometimes blackouts. Another problem mentioned was low voltage supplied by electric suppliers, which results into use of more materials such as welding sticks, which eventually affect the quality of the product and reduce turnover.

When there was electricity, blackouts the welding workshops closed down or they did not operate on that particular time. It was observed that for rapid establishment and growth of welding workshops the electricity services must be available, reliable and affordable.

### iv. Hairdressing and Haircutting Salons

In the study areas, there were hairdressing and hair-cutting salon, these enterprises established on the condition that grid electricity supply is available and reliable because they depend heavily on electricity services for lighting, playing radio and running cutting machines and/or driers. The grid electricity service was therefore the main condition for the establishment of these enterprises as it was the case for welding enterprises.

The low voltage supplied and a blackout of power was constraint for development for this type of micro-enterprise. Haircutting salon and hair dressing salon in Foo and Mahango depended on local market. This is different for salons in Lyasongoro village as they depend on local and distant markets, as there are many visitors from outside because of tourisms activities in the village.

One hair cutting salon located in Foo village had a standby generator to operate when there is electricity blackouts. Others when there are electricity blackouts they close down or they do not operate at that particular time. It was observed that for the rapid establishment of hairdressing and hair-cutting salon the electricity services should be available, reliable and affordable.