

**PATTERNS AND DETERMINANTS OF HOUSEHOLD ENERGY  
CONSUMPTION AMONG POOR FAMILIES IN ALTHAD VILLAGE OF  
WOREDA 8, BOLE SUB-CITY, ADDIS ABABA**

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**A THESIS SUBMITTED TO ADDIS ABABA UNIVERSITY, THE SCHOOL OF GRADUATE  
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This is to certify that the thesis prepared by **Birhane Kussa** entitled: **Patterns and Determinants of Household Energy Consumption among Poor Families in Althad Village of Woreda 8, Bole Sub-city, Addis Ababa** and submitted in partial fulfillment of the requirements for Degree of Masters of Arts in Geography and Environmental Studies, complies with the regulations of the university and meets the accepted standards with respect to originality and quality.

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Chair of Department or Graduate Program Coordinator

## **ABSTRACT**

### **Patterns and Determinants of Household Energy Consumption among Poor Families in Woreda 8 of Althad Village, Bole Sub-city, Addis Ababa**

**Birhane Kussa**

**Addis Ababa University, June 2016**

*The advancement of human civilization, economic and social activities, agriculture, mining, industrialization and also improvements in the standard of living and public health are all dependent upon an adequate supply of energy. The main objective of this study is to assess the patterns and determinants of household energy consumption among poor family in woreda 8 of Althad village. The necessary data for this study were obtained from randomly selected 156 sampling households. Questionnaire was administered to these selected households. Percentage and simple correlation techniques have been used to analyze the data. Analysis of the survey data shows that multiple types of energy are commonly used by individual sample households for day to day household energy requirement. These energy sources include, traditional (fuel wood, charcoal, leaves and saw dust) and modern (electricity and kerosene). The households when faced with shortage of energy sources, they cope up with it in different mechanism. The result shows that the largest share of the domestic energy comes from the modern fuels in terms of expenditure and gross energy consumed. However, the majority of the people depend on traditional fuels. The study also reveals that the amount of monthly expenditure on different types of household energy varies depending upon the types of energy sources, which mainly determined by household income, size and appliance. The amount of both gross and useful domestic energy consumed increases with the increase of household income. Relatively higher income households consume more energy, while low income households utilize inadequate energy. Large share of low income groups consume traditional fuels. It is recommended that the low-income group should be encouraged as far as feasible to use modern fuels like electricity and fossil fuels such as kerosene and liquid petroleum gas (LPG) through the use of proper stoves and appliance. The adequate provisions of modern fuels even if subsidized to a certain extents by the government and NGOs.*

**Keywords:** *Poor, households*

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## List of Acronyms and Abbreviations

CSA	Central Statistical Agency
CMC	Cooperative Moratore Cementista /Italian word/
EAD	Energy and Development
EE	Encarta Encyclopedia
EES	Ethiopia Energy Situation
EEPC	Ethiopian Electric Power Corporation
ENEC	Ethiopian National Energy Committee
ESMAP	Energy Sector Management Assistance Program
FAO	Food and Agricultural Organization
GTZ	German technical cooperation /Germany word/
HR	Hectare
IEA	International Energy Agency
IGADD	Inter Government Authority on Drought and Development
ILO	International Labour Organization
KG	Kilogram
KGOE	Kilogram of oil Equivalent
KWH	Kilo watt hour
LDA	Land Development Agency
LPG	Liquid Petroleum Gas
MCA	Mega Calorie Equivalent to 1000 kilocalorie
MoA	Ministry of Agriculture

MWE	Ministry water and energy
MoRD	Ministry of Rural Development
MTOE	Metric Tons of Oil Equivalent
OAU	Organization of African Unity
SPSS	Statistical package for social science
TOE	Tones of Oil Equivalent
UNDP	United Nations Development
UNEP	United Nation Environment program
WEO	World Energy Outlook
WHO	World Health Organization

## **DEFINITION OF TERMS**

**Injera:** Ethiopian local tiny bread.

**Kebele:** a smaller administrative unit within a Woreda.

**Mitad:** an apparatus that used for baking injera and bread.

**Shilito:** Ethiopian local circle small bread.

**Tifitif:** the tiny particle of charcoal with soil mixed by water and beak like shilito and dried by sun.

**Woreda:** an administration unit comprising many kebeles.

**Wot:** Ethiopian local mixed soup eat with injera or bread.

# CHAPTER ONE: INTRODUCTION

## 1.1 Background Information

The development stage of economic foundation of a country determines the type of energy sources the inhabitants consume. The patterns of energy consumption in the country have an impact on the welfare of consumer (Reddy, 2000). Today there is a mounting argument that poverty reduction and development programs have to be reliant on universal access to energy services that are affordable and reliable good quantity (Reddy, 2000). The state of poverty affects the ability of people to purchase the type and quantity of energy and improving the energy consumption pattern that could benefit their living standard and health.

Energy is deeply implicated in each of the economic, social and environmental dimensions of human development. Energy services provide an essential input to economic activity. They contribute to social development through education and public health, and help meet the basic human need for food and shelter. Modern Energy services can improve the environment, for example by reducing the Pollution caused by inefficient equipment and processes and by slowing deforestation. But rising energy use can also worsen pollution, and mismanagement of energy resources can harm ecosystems. The relationships between energy use and human development are extremely complex (WEO 2004).

Human-beings, however, use energy for wider purposes, as solid power in production sector, construction, services, industries, transport and communication, and power generation, as well as for consumption sector like cooking, heating, lighting, recreation and entertainment. According to the World Bank (2014), Ethiopia was categorized as a low-income developing country with a GDP per capita of \$ 550 and an average growth rate of 10.8% per year in 2003/04- 2013/14. World Bank (2011), the country's energy use per capita was about 16 giga-joules (GJ) and the primary energy consumption was 1.3 Exajoules (EJ). Electricity, produced almost entirely from hydropower, accounted for 1%. Fossil fuel burning accounts for 7% while traditional fuel (charcoal and fuel wood) accounts for the remaining 92% energy production.

Hence, in the absence of alternative energy sources, heavy reliance on biomass resources will result in serious long term implications and devastating consequences on the physical environment and the ecosystem at large, which Ethiopia has been experiencing since the last few decades (Omar, 1994; GTZ, 1998). This is shown on the country's wood supply; such has been declining at a faster rate to the point where it could not be able to accommodate the fuel demand of the country. Therefore, all fuels in Addis Ababa are purchased. As income increases and urbanization continues modern fuel will become an increasingly important fuel source. Urban dwellers may be forced to take commercial fuels to meet their daily requirement (Fikre, 1995).

According to the World Bank (2013) only an estimated 12% of the Ethiopian population has access to electricity. With almost 85% of the Ethiopians living in rural areas, there is a significant bias between the power supply of urban and rural population: only 2% of the rural but 86% of the urban residents has access to electricity. The overloading of the network frequently disrupts the power supply of large commercial and industrial customers. There is a need for substantial investments in the power system (EES).

However, many households in Althad village have been suffering from shortage of fuel of any sort. Access to energy is becoming a survival question for most of the households in the study area. This study will try to address the patterns and determinants of household energy consumption among poor family in *woreda* 8 of Althad village.

## **1.2 Statement of the Problem**

According to Getis and Fellman (2000), energy consumption goes hand in hand with increases in per capita income. That is, the greater the level of energy consumption, the higher the gross national product per capita. Countries in the more developed world use greater amounts of energy per capita than countries in the less developed. Traditional fuels are the major sources of energy consumption in Ethiopia.

99% of households, 70% of industries and 94% of service enterprises use biomass as energy source. Households account for 88% of total energy consumption, industry 4%, transport 3% and

services and others 5%. The installed electricity generating capacity in Ethiopia is about 2060 MW (88% hydro, 11% diesel and 1% thermal) and production covers only about 10% of national energy demand. The country is completely reliant on imports to meet its petroleum requirements (EES).

The current population of *Woreda* 8 is more than 12,320 households according to the population record office of *Woreda* 8. The demand for energy is increasing but the supply is declining. The price of most fuels gets high in which the majority could not afford to buy. Taking the above into consideration, it would be important to investigate household energy supply and consumption among destitute families in *Woreda* 8 Althad village of Bole Sub-city.

### **1.3 Objectives of the Study**

#### **1.3.1 General Objectives**

The general objective of this study was to assess the patterns and determinants of household energy consumption among poor families in Althad village of *Woreda* 8 of Bole sub-city in Addis Ababa.

#### **1.3.2 Specific Objectives**

More specifically, the study aspires to:

- investigate the pattern of household energy consumption among poor households;
- look into the determinants of household energy consumption among poor households;  
and
- explore how the target households cope up with the current shortage of domestic energy.

## **1.4 Basic Research Questions**

The purpose of this study was to answer the following questions.

1. What are the existing energy consumption patterns in the study area?
2. To what extent the traditional and modern fuels play a role in the total energy consumption for domestic purposes?
3. What are the major appliances used in the energy consumption?
4. What major determinant factors help explain household energy consumption pattern among the poor in the study area?
5. How the target groups cope up with the high price of energy consumption?

## **1.5 Significance of the Study**

The findings of the study will be very helpful to identify the patterns and determinants of household energy consumption among poor households in *Woreda* 8 of Bole Sub-city, Althad village; it provides information for measures to be taken and strategies to be formulated for patterns and determinants of energy consumption among poor households in urban area. In addition, this study provides empirical findings which are important to identify the patterns and determinants of energy consumption as well as the communities coping mechanisms for shortage of energy sources in Althad village *Woreda* 8 Bole sub city Addis Ababa. Furthermore it can be used as a source of additional material for advanced study.

## **1.6 Scope of the Study**

The scope of the study is limited in both terms of its spatial as well as temporal coverage. Regarding spatial coverage, the study is conducted in Althad village *Woreda* 8, and other villages with similar characteristics were not considered due to time and resource limitations.

## **1.7 Limitation of the study**

The major problem faced was the absence of population data at *Woreda* and village level. The temporal scope was conducted based on the 20-years (1994-2016) energy data analysis from different sources and Ethiopia, Addis Ababa, and sub city population data from CSA 2014

Hesitance and reluctance of selected respondents to be interviewed was another problem faced by the researcher while conducting house hold survey.

### **1.8 Ethical Considerations**

During the research undergo, researcher legality all the feeling, relationships cultural and norms of the community the real environment of the studied area used considered and respected .During the questionnaire distribution to the respondents all sample targets of the population treated in an ethical manner. At the beginning of the data collection the researcher made to explain the overall objectives of the study to make respondents confident enough to their responses .The researcher have told that the data collected will use only for academic purpose and will keep confidentiality all personal secrets.

### **1.9 Organization of the Thesis**

The thesis consists of five chapters. The first chapter covers the introduction of the study. This part consists of background, statement of the problem, objectives of the study, research questions, and significance of the study, limitations, scope, and organization of the study. The second chapter deals with the review of literature that includes both the conceptual and related literature. A brief research methodology and approach, data sources and type, methods of data collection and analysis were discussed in chapter three. Geographical background of the study area also discussed in chapter three. The fourth chapter presents the results and discussions with certain aspects of gross and useful energy consumption patterns in terms of expenditure (in birr) and heat values were discussed in detail. Here, major areas of end-use of household energy utilization, the roles played by traditional and modern fuels. The major types of household energy sources used among poor family, and the major factors that influence the total household energy consumption patterns among poor family was considered. It also deals with the most important substitutes in the shortages and the high price of basic energy resources. The fifth and the last part of this thesis provide conclusion and recommendations.

## **CHAPTER TWO: REVIEW OF RELATED LITERATUR E**

### **2.1 General Concepts and Major Types of Energy**

Energy is usually defined as a power. (EE, 2003) defined energy as the capacity to do work or the stored ability to perform work (produce heat), it exists in various forms, including mechanical, thermal, chemical, electrical, radiant and atomic. Energy categorized as primary, secondary or delivered and end – use energy (Robert, *et al* 1995). The primary category refers to original sources in any fuel before it is converted to delivered energy. Primary energy is the energy that is embodied in resources, as they exist in nature. The secondary one is a gross energy, which is the produced amount of gross input of energy, and the third, useful energy or end-use, is the amount of energy effectively used by any user.

Sources of energy can be categorized as renewable and non- renewable. Sources of energy that are mostly biomass based and are available in unlimited amount in nature. Under this category come such energy sources as fuel wood, petro-plants, agricultural waste like biogas, animal dung, wind energy, water energy, tidal energy, geothermal energy, solar energy, etc. energy sources such as petroleum, coal, natural gas, nuclear power and the like are categorized as non-renewable (EPA,2004, 2003). The non-renewable or exhaustible energy sources are available in limited amount and developed over a longer paired of time and as a result of unlimited use; such resources are likely to be exhausted any day (Aklilu, 2005).

Both commercial and traditional energy sources are vital in the study of energy consumption. Commercial energy sources refer to modern fuels that are traded to the market place and exchanged at going market price while non-commercial energy sources refer to traditional fuels that are collected by the users or by other collector who sell fuel for customer without involving any commercial type financial transaction. However, traditional fuel does not always mean non-commercial since such fuel may have been brought commercially (EE, 2003).

Traditional energy sources usually mean unprocessed fuels including wood fuel, charcoal, dried dung cakes, crop residues, leaves and other similar substances. However, wood fuel and charcoal shortage are likely to occur in many areas of the World. Because of overuse exploitation than they can be renewed especially near cities, crop residues and animal dung became more important with increasing scarcity of wood (Tsegaye, 1986). Fikre (1995), Robert (1995) and Karekezi *et al* (1997) noted that charcoal is essentially a solid residue obtained after carbonization of wood in closed space hereby only a small amount of air is allowed. Many urban dwellers prefer charcoal to wood fuel for a number of reasons. It is easier to handle and produces less smoke, so that it is safer to use than wood. Moreover, due to its lack of moisture and high carbon content, charcoal contains large amounts of energy and involves shorter cooking times.

To conclude, energy, which is defined as the capacity to do work, is clearly of enormous significance to human existence. It is a central to sustainable development and poverty reduction efforts. However, it is not all an end in types of energy service; what human beings want is the services that various types and forms of energy sources provide (UNDP, 1996). It affects vitally and essentially all aspects of development. Energy important in our daily lives it simply derives from the fact that it provides Variety of essential human services. It is the means to the provision of basic needs (such as cooked food, heating, cooling and lighting), the use of appliances, transportation and communication system (such as radio, television, telephones and computers (IEA, 1999).

## **2.2 Global Energy Supply and Consumption**

At global scale more than three billion (nearly half of world human) deprived of access to modern energy alternatives. All of these people live in poor countries and depend on traditional biomass resources to meet their basic energy need. This has caused worsening health and environmental consequences. Central premise of world energy strategy, thus, has aimed at shifting from use of high-cost and environmental damaging fossil fuels to cost-effective renewable energies that can be sourced from renewable resources (biomass, wind, hydro and solar) (Dawit, 2012).

Empirically the African continent while sheltering 15% of the world population, accounts for only 3% of world energy consumption, and the average energy consumption of an African is six times less than that recorded in the world. Contrary to this, USA constitutes 5 percent of the world's population but consume 24 percent of the world's energy. On average, one American consumes as much energy as 2 Japanese, 6 Mexicans, 13 Chinese, 31 Indians, 128 Bangladeshis, 307 Tanzanians and 370 Ethiopians. Sub Saharan Africa account for 9 percent of world population generate 2.5 percent of world economic activity. The region consumes 2.7% of world commercial primary energy. The region has 2% of world proven oil reserves, 3% of world proven gas reserves and 6% of world proven coal reserves. There is a large hydropower potential, even able to export for other region in excess of local need (UNEP, 2006).

Hosier (1985) indicated that wood fuels, (which include firewood and charcoal) are the most significant traditional fuels. And agricultural crop residues and animal dung have become more important with increasing scarcity of wood. Thus, traditional fuels provide a large share of domestic energy needs in developing countries. Developing countries due to their low economic developments rely mostly on biomass, and traditional fuels. As indicated, wood fuel, dung, crop residues, sisal and similar substances are the most significant traditional fuels (Hoiser, 1985).

Energy demand in industrialized countries is over 98 percent of the supply of the modern energy sector; the remaining less than 2 percent from biomass. The same pattern was 48 and 52 percent, respectively in developing countries. However, even within developing countries, there are extremes in which biomass serves as the major energy source (Miller, 1986). On the other hand, the per capita consumption of modern energy in developing world is extremely low, relative to that in industrial countries. For example, in the early 1990's per capita consumption of modern energy in the USA was 8 tons of oil equivalent energy per year, which is 80 times more than that of Africa, 40 times more than that of south Asia, 15 times more than that of East Asia and 8 times more than that of Latin America (World Bank, 1996).

Rarely in this transition can be complete since higher income households also continue to use traditional fuels such as biomass in combination with modern ones. This is partly because some traditional fuels are needed for specified type of cooking (Bereket, 2000). According to the World Bank Report, (1996) globally there are nearly two billion people without access, to modern forms of energy, the overwhelming majority of which are from developing countries. Especially in this part of the world, approximately one-third of all energy consumption is obtained from the burning of wood, crop residues and animal dung (World Bank, 1996). It is further evidence that the consumption of traditional fuel even in towns and cities of the developing world is tremendous. This is especially true if several non-oil producing sub-Saharan African countries where the availability of modern and the costs of distribution of acquiring related appliances often inhibit the use of modern energy sources (World Bank, 1996).

### **2.3 Energy Supply and Consumption in Africa**

Africa is endowed with diverse non-renewable and renewable energy resource. Despite its energy resource potential, however, in Africa has, lack of investment capital and efficient modern technologies, these resources are consumed up to only 5.5 percent of the world energy. The majority of African countries have very low per capita consumption of energy. The per capita energy consumption of 0.5 Toe is far lower than the world average of 0.2 per capita this makes the continent to lag behind all the others in energy use (IEA, 1999). Existing estimates of energy use in Africa indicates a significant and persistent dependence on traditional biomass energy and limited use of modern energy sources (Karwekezi, 1997). The average per capital final modern energy consumption in Africa is less than 300 kg of petroleum equivalent, compared with 7905 kg in North America and the world average of 1434kg (World Bank, 1996).

However, the present demand for electricity in most African countries has been increasing over time because of large number of customers, large industries, governmental offices and so on (Norton 1995). In 2000, the continent electricity consumption was only 524 kwh per capita, lowest of all other world regions (World Bank, 1996). When we look at the monthly domestic electric consumption 28% of the domestic customers consume below 100 kwh per month and less than 1% consumer a maximum of 25 kwh, while 69% consume 500 kwh (Hunegne, 1994).

Oil remains the largest source of modern energy in Africa, with production reaching 441 MTOE in 2000, which represents 11.4% of the world total (World Bank, 1996).

The energy consumption of the household in Africa has preponderance over the total demand of all other sectors put together and relies overwhelmingly on traditional fuels (Bereket, 2000). In countries such as Mali, Burkina Faso and Ethiopia, fuel wood charcoal in national energy consumption is estimated to exceed 90 percent. In the continent as a whole 9 out of 10 people depend on fuel wood for their household energy (FAO, 1997).FAO, 2000 has also estimated that Africa alone produces and consumes about half of the world's charcoal production, which is used as a domestic fuel in many of the urban areas and as a cooking fuel. It has also stated that energy in rural areas of Africa by product charcoal account for 90 to 98 percent of the total household energy consumption. FAO, 1997 has also estimated in this relation that about 100 million tones of wood are annually cut for charcoal production. Charcoal is made by small producers in simple earth kilns or pit kilns where the traditional production techniques lead to low conversion efficiency with high wastage.

Dependence on biomass fuel to meet household energy needs is high in Africa. It contributes over two-thirds of the total annual energy use in most African countries (Hailelul, 2000). Sokona, 1997 further explains that, on aggregate the biomass resource base in sub-Saharan Africa is more than sufficient to cover the annual per capita demand for fuel. The potential of natural forest resources cover 22.2 percent of the total land area and biomass resources are estimated at about 82 billion tones, which have the potential of 168.2 tones per capita. Traditional biomass, mainly wood and charcoal, are by far the most significant fuel, with the exception of south Africa, which accounts for over 70% of total primary consumption throughout the continent (Farienlli, 1997).

The most striking feature of the African energy situation is over-consumption of low-grade traditional energy sources and under consumption of high quality modern fuels. The demand for fuel wood is leading to forest loss in per-urban areas that concentrate on producing fuel wood

and charcoal. Rising demand for fuel wood and charcoal is causing a halo of deforestation around many towns and roads (World Bank, 1996).

## **2.4 Household Energy Supply and Consumption in Ethiopia**

The energy sector in Ethiopia can be generally categorized in to two major components: traditional and modern (traditional biomass usage and modern fuels i.e electricity and petroleum). As more than 80% of the country's population is engaged in the small-scale agricultural sector and live in rural areas, traditional energy sources represent the principal sources of Energy in Ethiopia. Domestic energy requirements in rural and urban areas are mostly met from wood, animal dung and agricultural residues. At the national level it is estimated that biomass fuels meet 88 % of total energy consumed in the country. In urban areas access to petroleum fuels and electricity has enabled a significant proportion of the population there to employ these for cooking and other domestic energy requirements. Access to biomass fuels has declined significantly in all areas of the country and drastically in some parts. Reduced access to woody biomass has had serious developmental and social impacts. Less access to wood means more has to come from other sources of biomass to meet demand for fuel. This has eroded the balance between what goes in for agricultural production and animal manure for fertilizer and what goes out of it, i.e. food for humans and animals (MWE, 2012).

A survey by the Central Statistics Agency (CSA) in 2004 showed that about 71.1% of the total households use kerosene for lighting followed by firewood (15.7%) and electricity (12.9%) in Ethiopia. A higher proportion of urban residents use electricity (75.3%) for lighting, while the use of kerosene (80.1%) and firewood (18.5%) are predominant in rural areas. Major types of cooking fuel used by all households are firewood, leaves, dung cakes and kerosene. The study by CSA, 2004 at the country level, suggests that about 81.4 % of the households use firewood, around 11.5 % cook with leaves and dung cakes and only 2.4 % use kerosene for cooking. The majority of rural households use firewood (84.4 %) and few of them (12.7 %) use leaves and dung cakes. The use of modern source of cooking fuel such as butane gas, electricity and kerosene for cooking is uncommon in the rural areas (0.4 %). Use of kerosene is common in

urban areas and stands at 13.8 % following firewood (65.4 %). Charcoal (7.7 %), electricity (2.4 %) and leaves (5.3 %) are also used by urban households. On the other hand, only 0.2 % of the households in rural areas are observed to use charcoal for cooking (MWE, 2012). As it is compiled by Mekonnen (2002) the total biomass energy supply in Ethiopia in 1997, 1998, 1999 amounted to 673, 687, 701 peta-joule respectively. He further pointed out that fuel wood contributed the major supply with an average share of 82.3%. This is followed by dried dung cakes, agricultural residue and charcoal by about 6.5%, 8% and 1.2%, respectively.

Both the total energy consumption level and share of modern sources of energy consumption in Ethiopia is one of the lowest in the world. In fact the annual per capita energy consumption is only 0.8 tons of biomass, 20 KW of electricity and 20 liters of petroleum fuels (MoRD, 2002). Mekonnen (2002) noted that the per capita modern energy consumption for Ethiopia in 1994 was only 21 kgoe, which was only 8 and 6 percent of the averages for sub-Saharan Africa and low income countries respectively. In Ethiopia 90% of the total national energy consumption is in the household sub sector while industry, agriculture, transport, service and commerce sectors together constitute the remaining 10% of the energy consumption (GTZ, 1998). In terms of the level of sectoral use, households accounts for about 91.3% of the total energy consumption of which the biomass fuels account 98.5% of the total final household energy consumption while the modern fuels accounts only 1.5% (Mekonnen, 2002).

Within the household sector, the rural household energy consumption accounts for about 92.0% of the total household energy consumption of which biomass fuels hold about 99.5% the final rural household energy consumption, while the modern fuels accounted only 0.5% (Mekonnen 2002).

Ethiopia is one of the least developed countries in the world. With an average annual income of 120 US\$ per capita, approximately 40% of its 85 million inhabitants live below the poverty line Ethiopia has one of the lowest rates of access to modern energy services, its energy supply is primarily based on biomass. With a share of 92.4% of Ethiopia's energy supply, waste and

biomass are the country's primary energy sources, followed by oil (6.7%) and hydropower (0.9%) (EES).

Urban households the use of traditional biomass fuels by urban households accounts for goes up to 79.9 percent (55.4% fuel wood, 93% charcoal, 8.4% dried dung cakes and 6.8% of crop residues), while modern fuels account for 20.38% (15.35% kerosene, LPG0.28% and 4.75% electricity) (Tadelech, 2001)

Currently, for the majority of urban households in the country, prices for both traditional and commercial energy sources are already very high in the market. Most of urban residents are found to spend a lot of money on different fuels, as much as 25% of the household's income is spent on wood for cooking. This means a large economic burden on the household budget. For example, in Addis Ababa, 42.6% of the households consume fuel from biomass (wood, charcoal, crop residue, dried dung cakes) and 48.21% rely on fossil fuel and often utilize electricity for cooking (CSA, 2005). The costs of better approaches are beyond the purchasing ability of most of urban households. In fact the end-use technologies used by most households in the country are to the rent. Still the majority of urban households in the country practices are the cooking using traditional three-stone-stoves that are very important (Tadelech, 2001).

However, many urban households of the country are beginning to change their energy consumption from using woody biomass to modern energy fuels by the thing improved stoves such as Lakech (improved charcoal stove), Mirt also improved injera baking biomass stove, electric injera mitad and baking stoves (IGADD, 1992). Lakech charcoal stove 25% fuel saving than the metal charcoal stove. In addition to a single lakech stove saves 0.125 charcoals per household per day. For instance, 1.5 million stoves; the total saving will be around 0.19 million kg of charcoal per year. Translating this number into forest natural resource with realistic source assumption ( i.e.1 meter cubic wood gives 600kg and 1 hectare of substantially used forest resource could give 10 meter cubic of wood per year), the total saving due to lakech charcoal stove is estimated at 21,310 hectare of forest resource per year.

This amount of saving from such small cook stove is quite significance for environmentally degrading country like Ethiopia (Bess, 1995). Such a huge dependence on biomass fuel together with its inefficient and unsustainable utilization techniques has resulted in a massive deforestation and environmental degradation (World Bank, 1996). For example, in early 1990s the total consumption was about 46 million cubic meter wood per year and deforestation rate was estimated between 150,000 to 200,000 hectares. Thus, it has been estimated that forests in the country will be destroyed recently unless drastic measures are taken to reduce its use at the present consumption level (Omar, 1994).

## **2.5 Household Energy Consumption Trend of Addis Ababa**

The household fuels of Addis Ababa can be categorized as traditional and modern. Charcoal, fuel wood, sawdust and dung made up the traditional fuel while kerosene, Liquid Petroleum Gas (LPG) and electricity from hydropower make up the modern fuels. In 1995, the per capita household energy consumption of Addis Ababa was about 6 GJ; traditional fuel share 82% of the primary energy. In 2005, household energy consumption per capita increased by 17% (about 7 GJ); traditional fuel accounted for 76% of this consumption. Relative to 1995, traditional fuel consumption increased by 9% while the rise in modern fuel use was 55%.

A close look at traditional fuel consumption trends reveals that in 1995, fuel wood accounted for 74%, followed by sawdust and charcoal, which accounted for 4% and 3% of the share, respectively. Dung had the lowest share (1%). In 2005, fuel wood consumption declined by 22%, but it continued to supply 56% of the household fuel. The decline in fuel wood consumption was somehow compensated with a rise in sawdust and dung consumption, which exhibited increases of 473% and 832%, respectively, together constituting 5% of the total consumption, higher than that of charcoal (3%). Charcoal consumption declined by 7% during the decade, but the net traditional fuel consumption increased by 6%.

The 19% decline in LPG consumption in 2005 relative to 1995 is very likely due to the quadrupling in price of LPG. During this time, despite the subsidy on kerosene, its price tripled,

which could be the primary reason why consumption declined by almost half. Similarly, the 7% drop in charcoal consumption may be attributed to the 18% rise in charcoal price. With regard to dung, however, consumption increased nine fold while the price rose by 40%. Since dung is mainly utilized in the per-urban areas, there could be factors other than price responsible for this trend. With regard to electricity, consumption increased by a factor of 23 while the price doubled. If the stove efficiency is taken into consideration, electricity is found to be cheaper than kerosene, LPG, and charcoal.

With regards to modern fuel consumption, in 1995, LPG and kerosene each met 9% of household energy needs, while electricity consumption was a marginal 1%. In 2005, however, electricity use increased by an astonishing 2293%. On the other hand, kerosene and LPG consumptions dropped by 46% and 19% respectively. Overall modern fuel consumption doubled primarily due to the dramatic rise in electricity consumption.

Looking at the energy price can shine light on the observed consumption trend. In 2005, compared to 1995, the price of electricity doubled, while that of kerosene tripled and LPG quadrupled. The price of charcoal and dung increased by 17% and 39%, respectively, while the price of fuel wood and sawdust increased by 13%. In 1995, compared to the price of electricity, LPG was close in price, while charcoal was 25% more expensive and kerosene half the price. On the other hand, electricity was six times more expensive than fuel wood and sawdust.

## **2.6 Literature Gap**

Though Ethiopia has abundant natural resources, most of its socioeconomic indicators are extremely low. In Ethiopia the increase in price of energy sources are a quite crucial given the very low income of the people. For instance Bereket *et al* (2001) indicated that electricity consumption is highly unaffordable for urban households in Ethiopia. Shortage has aggravated the already poor economy of the country. So far there is a limited research conducted to elicit the patterns, and determinate of energy consumption among poor urban village households' in detail. Therefore, this study attempts to fill the gap by conducting an empirical research on the energy patterns and determinants of poor urban village households in Althad village, *woreda*8 Bole sub

city in Addis Ababa that is needed to guide policy decisions, device appropriate interventions and integrated efforts to combat energy insecurity.

## 2.7 Conceptual Framework

Following this theoretical illustration, conceptual framework of the study is presented in Figure 2.1. This Figure shows the relationship between energy consumption patterns divided into traditional and modern energy sources. They have their own determinants which are: family-income, size, appliances, high price /shortage/ and the coping mechanisms of the urban village community. Most of the developing countries and their peoples were highly affected by high price or shortage of energy. Energy is a precondition to economic development. The prosperity that economic development brings, in return, stimulates demand for more and better-quality energy services. Many countries have established a virtuous circle of improvements in energy infrastructure and economic growth. But in the world’s poorest countries, the process has barely got off the ground (EAD, 2004).

High price or shortage of energy is a broad and complex concept which is determined by family income, family size, and appliances used and types of energy used. When the reverse situation occurs, the community tries to cope up the impact by using available resources in the area.

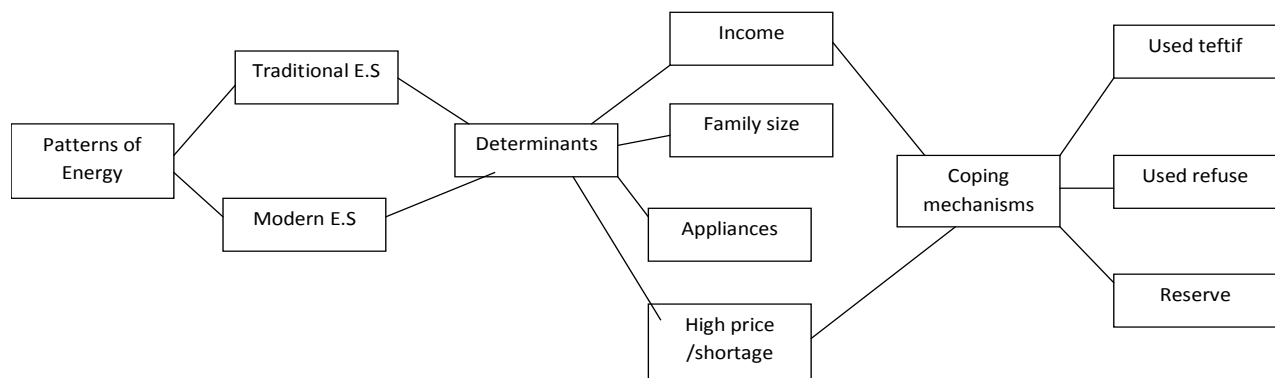


Figure 2.1: Conceptual framework of the study (source: Developed from review of related literature).

## CHAPTER THREE: DESCRIPTION OF THE STUDY AREA AND THE RESEARCH METHODS

### 3.1 Description of the Study Area

Bole sub city district is located in the south eastern suburb of the city. It borders with the districts of Yeka, Kirkos, Nifas-Silk-Lafto, and, AkakyKaliti Bole Medhanealem, or simply Bole is one of the 10 sub cities of Addis Ababa, the capital of Ethiopia, so named after the Medhanealem (Saviour of the World) Cathedral there. As of 2011 its population was of 328,900 ([www.addisababacity.gov.et/sub-cityhtm](http://www.addisababacity.gov.et/sub-cityhtm)).

Bole is a new area expanding to the southeast of the city centre and is a favourite with high-income Ethiopians and the international community; many diplomatic missions and aid agencies are located here. Housing is mostly in new-build houses or slightly older bungalows in leafy, gated compounds; apartments are in limited supply. Bole road running southeast from Meskel square to the airport boasts an excellent selection of shops, supermarkets and fashionable new bars, pubs and eateries, including the landmark Dembel City Center the one and only complete shopping center in Ethiopia offering over 100 shops, a snack bar and restaurant and an underground car park for 500 vehicles. The area is well served by buses, minibuses and taxis; it is also bordered by the ring road. Away from the main roads, it is quiet and there is plenty of space, in stark contrast to the older and more densely populated areas of the city to the north and west. At the centre of Bole on the west Bole Road stands the newly built Bole Medhanealem Cathedral (Ethiopian Orthodox), reputedly the largest church in Addis Ababa and the second largest in Africa surrounded by (currently) open land a veritable cathedral in the desert. Further north, around Haile Gebreselassie road (formerly Asmera road, and renamed after Ethiopia's most popular long-distance runner), lies boles down-market sister Urael, a quiet residential area populated by a mix of middle- and low-income groups living in a variety of housing of old and newer build. ([www.addisababacity.gov.et/sub-cityhtm](http://www.addisababacity.gov.et/sub-cityhtm)).

In bole sub city, there are 14 *woredas*, from those *woredas*, *Woreda* 8 is one. In this *woreda* as the house development director of *Woreda*8 told to the researcher, there are two villages in which poor families are found. From these villages, the researcher selected Althad Village. This

village is found in front of CMC St Michael Church. In this study area, there were 704 houses and covers the area of 160000k.m<sup>2</sup>. From this total population, 156householdswere selected randomly from *kebele* houses because most of the poor are found in *kebeles* houses as explained by the house development office director.

According to different aged people and officials, the poor are segregated to the area or particular geographical area, because they were in around Filuha area where Sheraton Addis Hotel is located now. They were resettled in the present day area Althad village in 1986 and 1987 Ethiopian calendar. Althad mean Alamudi and Tadele cooperation. But the people came to the present area from different *kebeles*, 24, 22, 21 and 25. The people were very poor and live in muddy hut houses. When they were transferred to the present area, Mohammed Alamudi and Tadele gave them modern houses which were built from cement and stone, instead of muddy hut house but their living standard is not that much changed. Though, they are living together as before, as they were segregated to the particular geographical area. The poor families in the village are being supported by different NGOs. So this study area's population came from previous area for development causes, as the area was wanted for the construction of Sheraton Addis Hotel.

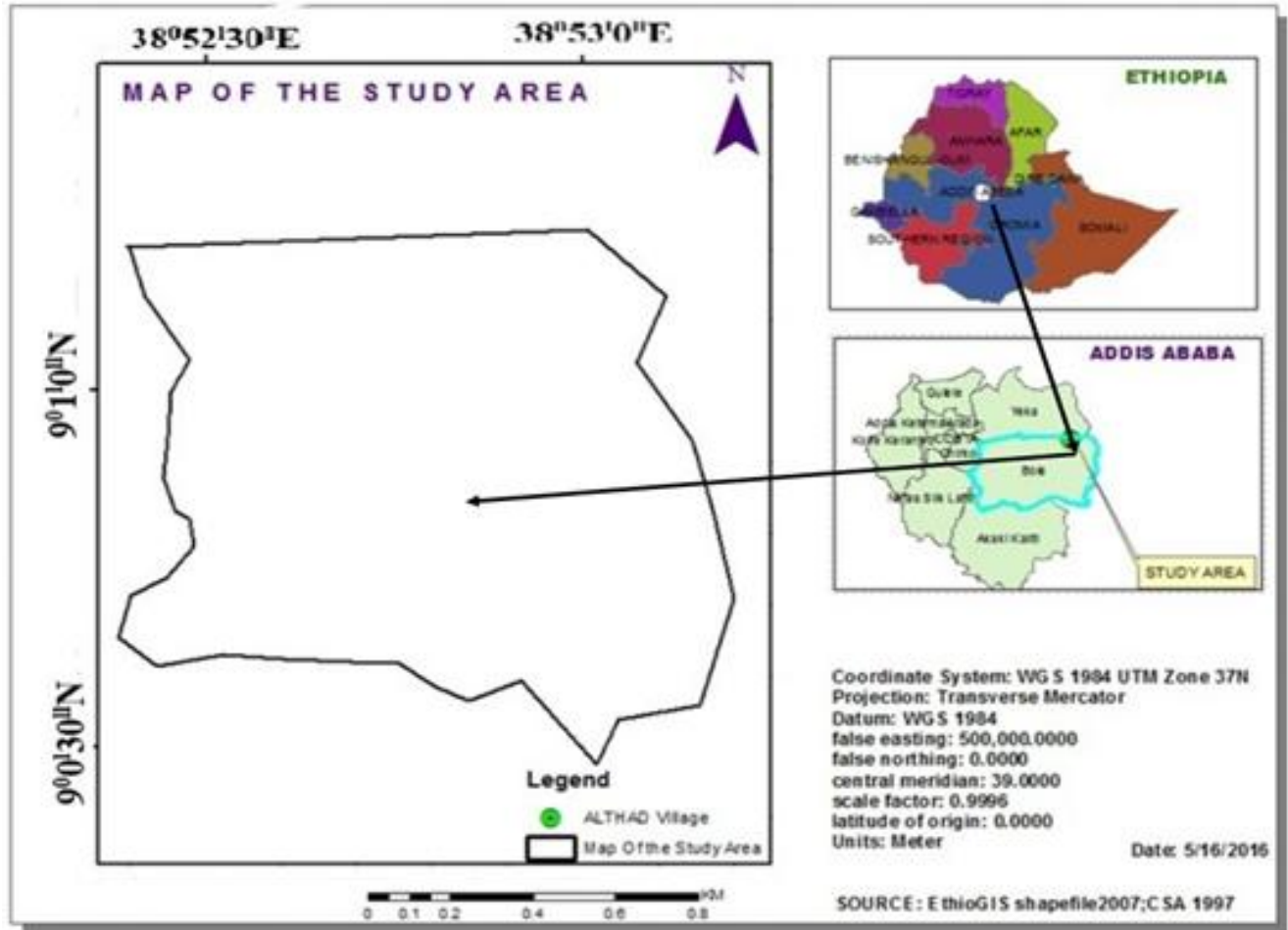


Figure 3.1: Map of the Study Area, Althad Village; Addis Ababa; Ethiopia

### 3.2 Research Approach and Design

In this study the researcher used multiple research approaches from different angles. Based on the nature of enquiry, the researcher applied quasi-quantitative research approach. By applying quantitative principles, the researcher attempted to answer a research question that seeks to describe the existing situations in relation to the patterns and determinants of household energy among poor families, specifically, to describe the shortage of energy and how to cope with this shortage of energy.

Through qualitative research approach, the researcher collected the opinion of respondents about patterns and determinants of household energy consumption. By using quantitative research

approach, the researcher collected objective reality and numeric facts. Finally, based on time span of the study, this study applied cross-sectional research design.

### **3.3 Data Sources and Types**

The major sources of data include both primary and secondary sources. To obtain primary information, data was collected through household survey. The questionnaire was first prepared in English and translated into Amharic. In the survey, the questionnaire was administered through face-to-face interview. The questionnaire has been conducted with the women head of household as there are no male headed household in the sample households. It was designed in such a way that it provides information on the household size and its income level, the types of energy sources used by the household, the magnitude of expenditure made by a household on different types of energy and the types of energy sources used.

To facilitate the survey, team of three field assistances who have completed twelve grades and have a good knowledge of the Woreda were employed. The assistants were oriented for one day on the nature and details of the questionnaire as well as how to approach the interviewee. And they gathered the required information under the supervision of the researcher.

Secondary data were collected from various published and unpublished documents of governmental and non-governmental organizations at different levels; such as SCA, EEPC, GES and etc. To make triangulation with primary data, the researcher used secondary sources such as current reports on household energy consumption among low income family, previous research thesis on energy consumption. Particularly, the secondary data were used from *Woreda 8* governmental officials.

### **3.4 Methods of Data Collection**

In this study the researcher used methods of data collection which are helpful to capture the relevant data for the study. To gather primary data from sampled household female heads, the researcher used household survey. According to Oppenheim (1992), this technique helps the

researcher to contact a large number of people at short period of time and to collect factual information in order to classify people and their circumstances to gather straightforward information relating to causes of patterns and determinants of household energy consumption among poor family. Moreover, interviews were held with community four key informants selected purposively, *Woreda*8 governmental officials to support the data collected from households through questionnaire. Secondary data were collected by reviewing current reports on patterns of energy consumption among poor family, previous research thesis on energy consumption.

### 3.5 Sampling Technique

There are 14 *woredas* in Bole sub-city: *Woreda* 8 is selected purposively as the intention of the researcher was to assess the energy consumption patterns and determinants among the poor. According to the data obtained from *Woreda* 8, there were 12,320 head of households among whom 704 household were residents of Althad Village. Among the 704 residents of Althad village 474 households are very poor as reported to the researcher by the *woreda* leader and latter verified by the researcher. In order to arrive at poor residents the researcher used the criteria of non-own dwelling unit. According to these criteria the researcher selected those household residents that live in *kebele* housing unit. Following this arrangement the researcher made an ascertaining house visit to verify the situation of the residents. The confirmed 474 destitute of the Althad village became the sample frame of the study. Of this sample frame, the researcher selected sample households adopting the sample size determination formula of Yamane (1967) given below. The formula produced the sample size of 156 destitute. The survey was 32 percent of Althad village live in *kebele* unit. Accordingly 156 poor were selected randomly. The sample population was selected out of the total poor population of Althad village by listing all households of the village by the aforementioned criteria.

The simplified formula developed by Yamane (1967) are written as follows

$$n = \frac{N}{1 + N(e)^2}$$

$$\text{Therefore: } n = \frac{474}{1 + 474 (0.08)^2} = 156,$$

According to the criteria, the household should be resident of the *kebele* houses, and should be one who has rent house from the *kebele*. The sample was randomly selected from the list of destitute households so compiled. In this study the researcher used methods of data collection which are helpful to capture the relevant data for the study area. To gather primary data from sampled household heads, the researcher used open-ended and closed-ended questionnaires

### 3.5.1 Sample Size

In this study the researcher determine sample size based on Yamane (1967).The target populations of this study are 474 households in *Woreda* 8. The researcher will be confident at 92% regarding the values of sample in relation to true value of population at specified level of precision ( $e=0.08$ ).This level of significances was estimated by the researcher in order to manage the sample in terms of cost and time and by considering the homogeneity of respondents. As margin of error reduce the confidence level increases and the desired sample becomes too large to manage within the scope of time of study and budget at researches hand.

By inserting above formula this number used for Althad village that selected by cluster sample method and, then household heads used selected through systematic sample methods from this village by using the *woreda* lists. Four key informants from *woreda* and four governmental officials were selected for interview purpose to supply the information obtained from households.

### 3.6 Analysis of Data

The study focused on identification of energy supply and consumption patterns and determinants among poor family in *Woreda* 8 Althad village. Hence, a descriptive statistical technique was employed in the assumption that it would help to search a large variety of data related to the problem under the study. Responses to the structured questionnaire were providing quantitative data for the study.

Data results were organized and summarized by descriptive statistics which were presented in the form of tables and graphs. Computations of percentages and descriptive statistics were used to measure the research outputs. Based on the nature of enquiry, the researcher applied both descriptive and explanatory research approaches. Data which were obtained from the targeted groups was entered in to the computer using SPSS statistics version 20 then it is coded, cleaned and analyzing by using techniques percentages (to look patterns of energy sources distribution), Pearson correlation, (to look if there were an association between energy expenditure and family income, and family size) descriptive research approach principles, the researcher of this study used answered a research question that seeks to describe the existing situations in relation to the patterns and determinants of household energy among poor family. Specifically, it is to describe the shortage of energy and how to cope with this shortage and high price of energy among the poor family.

## CHAPTER FOUR: ANALYSIS OF PATTERNS AND DETERMINANTS OF HOUSEHOLD ENERGY CONSUMPTION

This section covers the detailed description of the sample household profile, details of energy patterns and determinants, such as family size, income, appliances used by family and coping strategies of the households in Althad village.

### 4.1 Demographic and Socioeconomic Characteristics of Respondent Households

Economic activity rate or labour force participation rate is the percentage of the economically active population to the total population of economically active plus not active population. The active rate at national level is about 80%. The lowest activity rate is observed in Addis Ababa city Administration 62.8% (CSA, 2014). The current population number of Addis Ababa is male 1,624,999 and female 1,809,000 total 3,433,999 (CSA, 2014).

Table 4.1: Population distribution in Addis Ababa Sub-cities

No	Sub city	Male	Female	Total	Percent
1	Addis Ketema	155,478	164,575	320,053	9.13
2	AkakyKaliti	110,435	116,747	227,182	6.60
3	Arada	123,445	141,696	265,141	7.60
4	Bole	180,782	206,573	387,355	11.10
5	Gullele	161,078	174,356	335,434	9.60
6	Kirkos	128,841	148,505	277,346	7.90
7	KolfeKeranio	258,480	279,081	537,561	18.40
8	Lideta	119,843	132,999	252,842	7.20
9	Nifas Silk-lafto	185,461	211,025	396,486	11.27
10	Yeka	201,156	233,443	434,599	11.30
	<b>Total</b>	<b>1,624,999</b>	<b>1,809,000</b>	<b>3,433,999</b>	<b>100.00</b>

Sources: CSA (2014).

As the Table 4.1 reveals Bole Sub city stands fourth in its total population (11.1 percent) preceded by Nifas Silk- Lfto (11.3 percent), Yeka (11.3 percent) and KolfeKeranio (18.4 percent) Sub cities. In its population density, according to the above data bole sub city is stands ninth stage. Bole sub city is not as such populated, when we compare with other sub cities.

Regarding the household fuel supply in Addis Ababa, 10.0 percent of housing units used only fuel wood, whereas 8.5 and 1.4 percent use kerosene and charcoal respectively. Only about 0.9 percent of housing units used electricity only (CSA, 1994). But based on sample study, all 156 sample households 100 percent use electricity for domestic purposes.

#### **4.1.1. Age of the household head**

Out of the selected 156 sample households, the maximum age observed from the sample respondents was above 45 while the minimum is less than 25 years. However, the majority of the respondents were found to be above 45 years. A vast majority of these households directly or indirectly depend on traditional means of energy.

#### **4.1.2 Sex composition of the household head**

All respondent of the research or 156 (100 percent) are constitutes only female. Because the all households head by chance are female, that the respondents given to the researcher the accurate answer or information about energy consumption in household.

#### **4.1.3 Marital status**

About 6 (3.8 percent) people single, while 74 (47.4 percent), 14 (9.0 percent) and 63 (39.7) Married, Divorced and widowed respectively. There was no polygamy in the study area. A large number of households of each group use electricity, fuel wood, charcoal and kerosene as energy source.

Table 4.2: Household head marital status

<b>Marital status</b>	<b>No of Respondent</b>	<b>Percent</b>
Single	6	3.8
Married	74	47.4
Divorced	14	9.0
Widowed	62	39.7
Total	156	100.0

Source: Own Survey, 2016

#### 4.1.4 Occupational status

The data show that in Table 4.6 about 13 (8.3 percent) were government employees and the remaining 41 (26.3 percent) are engaged in their own private jobs. And 31 (19.9 percent) are pensioned. In this study, the majority of the respondents or 71 (45.5 percent) are unemployed.

Table 4.3: Household head occupational status

<b>Occupational Status</b>	<b>No of Respondent</b>	<b>Percent</b>
Government employee	13	8.3
Private employee	41	26.3
Unemployed	71	45.5
Pensioned	31	19.9
Total	156	100.0

Source: Own Survey, 2016

#### 4.1.5 Educational background

About 50 (32.1 percent) of the respondents are found illiterate and 10 (6.4 percent) could read and write, 59 (37.8 percent) elementary school, 37 (23.7 percent) high school and diploma. Almost 76.3 of the households have only elementary or below elementary level of education. Due to their educational background have no good opportunity to find better job and live a good life. They have no opportunity to afford the high price and shortage of means of energy.

Table 4.4: Household educational status

Level of education	No of Respondent	Percent
Can't read and write	50	32.1
Can read and write	10	6.4
Elementary	59	37.8
High school, Diploma	37	23.7
Total	156	100.0

Source: Own Survey, 2016

#### 4.1.6 House ownership or tenure

The owner of the house of the study area is *kebele*. All respondents are rented from *kebele*. They pay monthly rental cost; 80 (51 percent) pay from 0.50 cents to 5 birr, 64 (41.0 percent) pay from 6 birr to 10 birr, 11 (7.1 percent) are paid 11 birr to 15 birr and 1 (6 percent) are paid from 20 birr to 25 birr.

#### 4.2 Patterns of Household Energy Consumption and Conversion of Various Energy Sources into Gross Energy in Terms of Heat Value

In the field work conducted, data on the consumption of domestic energy resources for this study were collected on the basis of expenditure on different sources user. However, energy is often analyzed not only in terms of expenditure made on different sources by more preferable in terms of heat values. Hence, the formal domestic energy consumption should be changed into the unit of energy sources consumed by a family. One of the most important characteristics of fuel is item calorific value that is the amount of energy per kg in provides off burning. Energy can be measured in terms of Joules, kilo watt- hours, mega calories (MCA), barrels of equivalent or tones of coal equivalent, kilogram of wood equivalent and so on ( Robert, *et al*, 1995).

#### **4.2.1. Conversion of expenditures on traditional fuel into heat values of fuel wood**

Fuel wood is one of the important domestic energy sources in the study area. Out of the total sample 123 (78.8 percent) households use fuel wood. The main source of supply of fuel wood in the study area is one fuel wood vendor, in small and in large amount. One loaded fuel wood is 200 birr in small amount there is stand from 5 birr. There is no less than 5 birr. All the Households an average price of birr 5 for one kg of fuel wood. This means a buys 0.50 kg by 2:50 birr.

In the evaluation accounts the standard of the Ethiopian National Energy Committee, one kg wood provided 3.6 Mca of energy. (See appendix C). Therefore, a household obtains 9.0 Mca ( $3.6 * 2.50$ ) of energy (heat value) for 5 birr. Thus, a constant of 9.0 Mca of energy, which is equivalent to 2.50 kgwe could obtain for the expenditure of birr 5 on fuel wood. That amount is 9.0 Mca, which is in value equal to 2.50 Kgwe used for the conversion of expenditure into heat value.

As researcher's computed based on the raw data obtained through field work April 2016, in the study area the family using fuel wood were 123 or 78.8 percent and the family were not using fuel wood were 33 or 21.2 percent. These imply that most families in the study area were used fuel wood as sources of energy main they are based on traditional fuel.

#### **4.2.2. Conversion of expenditures on traditional fuel into heat values of charcoal**

Charcoal is the other important source of household energy in the study area. Out of total sample households, 153 (97.4) used charcoal for domestic energy service. There is one main supplier of charcoal in the village and 10 charcoal retailer shops. The above 97.4 percent charcoal users buy from both charcoal vendor and charcoal retailer shops.

The price of a kg of charcoal is 10 birr at charcoal shop retailers while it is birr 8 at charcoal vendor retailers. The average price of a kg of charcoal is identified at birr 8:50. Accordingly, a household buys 0.42kg of charcoal for birr 1.785.

Based on the standard of Ethiopia national energy committee, one kg of charcoal gives heat value of 7.10 MCA of energy (See appendix C). As such, for birr 1.75 a household could get a heat value of 2.98 MCA ( $7.10 \times 0.42$ ) of energy which is equal in value of 0.83 kgwe, to get the heat value consumed by each household.

As researcher's computed based on the raw data obtained through field work April 2016, in the study area the family using charcoal were 152 or 97.4 percent and the family were not using fuel wood were 4 or 2.6 percent. These imply that most families in the study area were used charcoal as sources of energy means they were based on traditional fuel.

### 4.3. Conversion of Expenditures on Modern Fuels into Heat Values

#### 4.3.1. Conversion of expenditure on kerosene into heat values

The price of kerosene was changed monthly because the price of it increased time to time. But in the recent time the changes were stopped because the price became constant. In the study area there is one kerosene vendors. Out of the total households, 24(15.4 percent) households use kerosene as source of household energy. All of them get from fuel stations. A liter of kerosene at a fuel station was birr 14.60 while it is 20birr at retail shops. An average price of one liter of kerosene was taken as birr 17.30. Therefore, 0.14 liter of kerosene is obtained for birr 2.422. Based on the standard of Ethiopian National Energy Committee, one liter of kerosene delivers 8.03 MCA of heat value (See Appendix C). Therefore, 0.14 liter of kerosene delivered 1.12 MCA ( $0.14 \times 8.03$ ) of heat value, which is equal in value of 0.31kg we used for the conversation of expenditure into heat value

Table 4.5: The family using kerosene

Family used or not used Kerosene		No of Respondents	Percent
Answers	used	24	15.4
	Not used	132	84.6
	Total	156	100.0

Source: Own Survey, 2016

### 4.3.2. Conversion of expenditure on electricity into heat value

According to Ethiopian Electric Power Corporation, the price of electricity is based on unchanging rate of payment in recent years. The payment rate of electricity differs in slabs of the total quality of electricity consumed. The monthly rate of payment per KWH varies from birr 0.2730 if the electric consumption is between 0 and 50 KWH to birr 0.6943 for 51 KWH and above

Table 4.6: Electricity energy and service charge tariff for household sector

Consumption And service Charge	Tariff category and block identification						
	Block						
	First	Second	Third	Fourth	Fifth	Sixth	Seventh
Consumption in kwh	0.50	51-201	101-200	300100	301-400	4001-500	>500
Service charge in birr/kwh	0.2730	0.3564	0.4993	0.5500	0.5666	0.5880	0.6943

Source: Ethiopian Electric Power Corporation, July 1999

### 4.4. Distribution of Electric Meter Reader in the Study Area

As Table 4.2 indicates out of the total electric users 138 (88.5 percent) households have their own meter reader. 18 (11.5 percent) of the respondents utilize of by connection of the line and share electricity with their neighbors respectively. But they were not owned the meter reader, shah Alamud when the house constructed, he given the meter reader with home. For this reason the most household in the study area has meter reader. The rests are not only share the meter reader but also they share the house.

Table 4.7: Distribution of electric meter reader in the study area

No	Electric meter	No of Respondent	Percentage
1	Own meter	138	88.5
2	Shared meter with other	18	11.5
	Total	156	100.0

Source: Own Survey, 2016

From the total sample households, 100 (64.1 percent) households use electricity for domestic service. In order to get the average price of electricity per kwh, first, each rate of payment for the different payment range is multiplied by the corresponding proportions of households to get the average price of each. For example, 0.0739 proportion of households pays at the rate of birr 0.2730, so in the changing mechanism, 0.0739 is multiplied by 0.2730. Thus, their result comes to 0.0784. Similarly, the result of others is obtained. Then, the price of each category is added to give the average price of one kWh of electricity which is amounts to birr 0.360.

Since, birr 0.360 is equal in value of 1kwh, birr 1.00 is equal in value of 2.77 kwh. That is a household buys 2.77 kwh of electricity for one birr. According to the Ethiopian National energy committee, one kwh of electricity is equal in value of 0.86 MCA of energy (See Appendix C). Thus, for one birr, a household buys heat value of 2.38 MCA ( $2.77 \times 0.86$ ) which is equal in value of 0.660 kgwe. Therefore, in order to get gross energy consumption of electricity in MCA by a household, the expenditure on electricity was multiplied by the constant 2.38. Most people in the study area prefer to use electricity.

Table 4.8: Energy source most of the time used

<b>Energy sources</b>	<b>No of respondent</b>	<b>Percent</b>
Fuel wood	36	23.1
Charcoal	17	10.9
Electricity	100	64.1
Kerosene	3	1.9
Total	156	100.0

Source: Own Survey, 2016.

The researcher as computed based on the raw data obtained through field work, April 2016, were that, in the study area from 148 (94.87 percent) user of electricity 138 (88.5 percent) have their own meter and 18 (11.5 percent) are share meter with other. So most of the respondents have their own meters and most of them use electricity as modern energy source.

Traditional fuels consisting fuel wood, refuse, charcoal *tiftif*, leaves and saw dust meet the largest share of the total domestic energy requirements, inefficiency mode of utilization of traditional fuels is one of the characteristics of domestic energy consumption patterns in the village. The share of modern energy sources such as electricity and kerosene, whose efficiency level is better, it is very low efficient.

#### **4.5 Useful Household Energy Consumption**

Useful energy represents for energy services in the form of effective energy a household obtains. The amount of useful energy differs from one type of fuel to another depend on the quality of fuels and how it is efficiently consumed. Energy efficiency is a measure of the energy used in providing a particular energy service end and defined as the ratio of the useable energy output to the energy input.

The households in the village get lesser energy services owing to large dependence on traditional fuels that are used at very low efficiency. The rest parts of village are depend on collecting refuse and by making *tiftif* to survive the shortage and the high price of energy consumption. However, some of households in the village are dependent on modern fuels for the same amount of expenditure.

The amount of useful energy received per household rises with a rise in household income. This shows that with a rise in a household income, there is a corresponding increase for useful energy and there is a need for household energy and there is a need for households to use better fuels that are used at high efficiency level by employing modern appliances. The amount of useful energy received at higher income groups are high mainly due to consumption of better fuels and modern appliances whose efficiency levels are relatively much better.

Baking *injera* is by far the most important domestic function in many of the households of the village. It dominates the end uses of fuel wood, leaves refuse and sawdust. The most important of all types of fuels used for *injera* baking 123 (78.8 percent) is electricity, mostly among better income households. It is used for baking *injera* among majority of the users. Fuel wood is the other source of energy used for baking *injera* among households

The proportion of household using fuel wood for baking *injera* declines with a rise in household income and shortage of fuel wood supply. While the proportion of electricity consumers for the same propose increases. The proportion of using fuel wood for baking *injera* were 17 (10.9 percent) form the whole sample population. The use of electric *mitad* is high in the village among between three classes because of the increases of fuel wood prices.

Table 4.9: Proportion of households using various types of energy in the domestic function of baking *injera*

Sources of energy	No of respondent	Percent
Fuel wood	17	10.9
Electricity	123	78.8
Leaves and saw dust	15	9.6
Others	1	.6
Total	156	100.0

Source: Own Survey, 2016

Charcoal and kerosene are used mainly for cooking purposes rather than for baking. Charcoal is the most important energy source, which is used by 105 (67.3 percent) households for cooking *wot*. The remaining proportion were occupied by households, which use electricity 33 (21.2 percent), kerosene 7 (4.5 percent) and fuel wood 11 (7.1 percent). The use of charcoal for cooking purposes was predominance among majority of the high and medium income groups, whereas, fuel wood and kerosene use among low and none income group. Fuel wood is used mainly for baking purposes and it is also used for cooking *wot* in the lower income group *wot* cooking is frequently cooked almost in all households

Table 4.10: Proportion of households using various types of energy in domestic function of cooking *Wot*

Sources of energy	No of Respondent	Percent
Fuel wood	11	7.1
Electricity	33	21.2
Kerosene	7	4.5
Charcoal	105	67.3
Total	156	100.0

Source: Own Survey, 2016

Charcoal and electricity are used for making coffee. Charcoal is the most important energy source, which is used by 144 (92.3 percent) of sample households for making coffee. Electricity and fuel wood were occupied by 6 (3.8 percent) and 3 (1.9 percent) of households respectively. The use of charcoal for making coffee was predominance among majority of the high income groups, whereas, fuel wood, kerosene and *tifitif* are used among many households in the low income group. As already mentioned, electricity was used for baking services in high proportion. The proportion of households using electricity for lighting, radio and television for the whole sample population was (100%)

Table 4.11: Proportion of households using various types of energy in domestic function of cooking coffee

Sources of energy	No of Respondent	Percent
Fuel wood	3	1.9
Electricity	6	3.8
Charcoal	144	92.3
Others	3	1.9
Total	156	100.0

Sources: Own Survey, 2016

The consumption of different energy sources for household function is not only depending on the fuel type but also on the type of appliances used by a family. The low income groups are employed traditional appliance at function of low efficiency level. Such appliances mostly used for the function like cooking *wot*, baking *injera* and making coffee. Due to their quality and better efficiency of utilization better income households use more energy for varied household function than the poor do.

The quality of appliances determines the efficiency level at which different types of energy consumed for household purposes. Average and use energy efficiency for sample population was 110(70.5 percent) due to widely use of traditional appliances. Earth plate and *mirtmitad* presently used in the village for baking *injera*. A traditional *mitad* functions at low efficiency level of only 12% of the gross energy utilized. While *Mirtmitad* which functions at higher efficiency level 12 (7.7 percent), allows proper burning of the wood. *Mirt* stoves save energy and reduce the expenses on fuels by nearly three times that of the traditional *mitad*.

Traditional open hearth *mitad* which is highly inefficiency could be used with fuel wood values and refuse. Fuel wood could also be used for *wot* and coffee. Therefore 110 open earthen stoves and 12 *mirtmitads* giving function with proportion of 2.37% (0.0237) and 1.34% (0.0134) respectively. The electric *mitad* using electricity functions at as high efficiency level of 75%. In the sample, there are 123 electric *mitad* with average efficiency level of 1.94% (0.0194). The use of electricity for domestic function in the study area is very high.

In the sample, there are two types of charcoal stoves used in the study area such as traditional (iron) charcoal stove and *lakech* charcoal stove. Therefore, 19 traditional charcoal stoves and 135 *lakech* charcoal stoves in use with proportion of 1.04% (0.0104) and 5.72% (0.572) respectively. About 86.5% of sample household owned *lakech* improved charcoal stoves, where as only 12.2% households used traditional “iron” charcoal stoves.

To get the average efficiency level of the appliances, first the number and proportion of appliances was identified, secondly the efficiency level of each appliances was multiplied by the

respective proportion of appliances, and thirdly, the products were added to obtain average efficiency level which is 42.76%.

The qualities of appliance used vary from household to household depending upon its income. Total appliances are increase with income of households. However, the number of traditional appliances decreases, while the number of modern appliances increases with the rise in the incomes of the households. The use of traditional fuels and simple appliance in the lower economic group makes them to utilize low amount of household energy to meet their energy requirements particularly cooking and baking. Position of traditional and modern fuels in the consumption of household energy

#### **4.6 Position in the gross energy consumption**

Patterns of household energy consumption could be defined also by considering of individual energy sources. The average monthly expenditure make per household on various types of energy differs regarding to the income of the household. The average monthly expenditure per household was birr 66.7 on fuel wood, birr 106.5 on charcoal, 111 birr on electricity. Similarly, the average monthly expenditure per household is birr 15.4 for kerosene.

Fuel wood constitute the share in the household energy consumption of fuels, it amounts 66.7% of the total household energy utilized in terms of expenditure. The average monthly expenditure on charcoal by a household was birr 106.5. The total monthly consumption of charcoal for the whole sample population was birr 16188. The sample household expenditure on charcoal by low and medium income groups was lower than the high income groups. The reasons is that the low and medium income household make change to other available sources of energy *tifitif* so that they use less charcoal which being replaced by *tifitif* fuels among of the income group. The low income households used less of charcoal for domestic function due to less purchasing power of this energy source.

Electricity, which accounts 111 of the total household energy consumption in terms of expenditure, it is the first important energy source in the study area. The total monthly electric consumption for the total sample is birr 17095 with an average of birr 111. The average expenditure on electricity differs from household to household based on their income level. For the low income group, the average monthly consumption of electricity is birr 111.

The use of electricity is restricted only for lighting purpose owing to the economic problem of the majority of the population in the study. A family has to purchase domestic appliances, which are very costly for the low income of the households.

Kerosene, which is one of the mineral fuels used for domestic purposes, is mainly consumed for cooking purpose at medium and high income groups in a low level. It makes up 15.4 of the total household energy consumption in terms of expenditure. The monthly consumption of kerosene for the sample population is birr 1395 with an average of birr 58.12 per household.

#### **4.7 Determinants of Household Energy Consumption in the Study Area**

##### **4.7.1 Household income, size and expenditure**

Various factors influence patterns of household energy consumption. The most important factors in household energy consumption patterns include household income, household size, number of domestic appliances and their efficiency level at which various sources of energy are consumed. Household energy consumption can be expressed by the socio-economic levels of a household. Based on their monthly incomes, the sample households of the village were categorized into three groups, such as low income household( whose none monthly income and monthly income is less than birr 250), medium income (birr 201-800) and high income households (birr 801 and above).

The lowest monthly income for the sample households is none monthly income while the highest monthly income is birr 1500 per month. There is difference in income ranges among these

groups. This difference in income may have direct influence on the amount and the kind of energy sources as well as a type of appliances used various combination.

Table 4.12: Monthly household Income

Monthly Household Income	No of Respondent	Percent
Less than 250 birr	24	15.4
Between 250-800 birr	52	33.3
More than 801 birr	36	23.1
None	44	28.2
Total	156	100.0

Source: Own Survey, 2016.

In none and low income household of birr 250 and below, most of expenditure values are confined between none up to 150. Instead of none who is the family none monthly income, they use different energy source by collecting refuse and making *tiftif*. But who have the low income between 250 and below, they can buy until 150 birr this means half and above of their income is on energy source expenditure.

In the medium income households birr 250-800 expenditure value are between 150-300. The average monthly expenditure on different types of energy sources was birr 150. This mean that the energy consumption taken half and above household income. In the high income households of birr 801 and above, the highest value of expenditure 600 and the lowest was birr 300. The average monthly expenditure was birr 555. The monthly income varies from 801 to 1500 with an average of birr 850.

Table 4.13: Household sizes with monthly expenditure of family on charcoal.

Household size correlation		House hold Size	The monthly expenditure of family on charcoal
Household Size	Pearson Correlation	1	0.184*
	Sig. (2-tailed)		0.023
	N	156	152
*. Correlation is significant at the 0.05 level (2-tailed).			

Sources: Own Survey, 2016

Table 4.14: Household sizes with monthly family expenditure on electricity.

Household size and expenditure correlation		Household Size	Monthly expenditure on Electricity
Household Size	Pearson Correlation	1	0.315**
	Sig. (2-tailed)		0.000
	N	156	154
**. Correlation is significant at the 0.01 level (2-tailed).			

Source: Own Survey, 2016

The value of correlation, which 1 is indicates that there is corresponding increase in expenditure made on domestic energy with an increase in household income as a whole. The type of domestic energy sources different with variation in the amount of expenditure made by a household on it. Own income households tend to variation in the amount of expenditure made by a household on it. Low income household used to purchase low quality fuels because they have low purchasing power. Household income has a significant and positive effect on the consumption pattern of gross household energy.

#### 4.7.2 The appliance type the household used

The amount of useful energy obtained by a household for a given gross energy input is determine by the efficiency level of energy source. The efficiency level of the use of energy sources

depends on the quality and efficiency of the appliance used and the type of fuel used. The level of efficiency at which a given source of energy was used determines the amount of useful energy a consumer can obtain. Thus, useful energy represents the amount of energy efficiency consumed.

According to the standard of Ethiopian national energy committee (1986), traditional fuels are consumed for different purpose at very low efficiency level. The average efficiency level of traditional fuels consumption totals to 0.14 (14%). Traditional energy sources such as wood and charcoal used to function at the efficiency level of 0.1 (10%) and 0.2 (20%) respectively. While the modern energy sources such as, electricity and kerosene used to function at better efficiency level of 0.75 (75%), and 0.56 (56%) respectively.

In order to change the expenditures of different types of domestic energy sources into useful energy in terms of birr, expenditure on each household on a given source of energy is multiplied by the efficiency level at which the type of energy is consumed. Efficiency value of 10% for fuel wood means that out of a unit (gross) produced by burning the fuel wood, only 0.1 is effectively used in heating while the remaining energy is wasted away.

The efficiency of energy depends not only on the kinds of fuels but also on the quality of the appliances a household used. Efficiencies of use of traditional fuels burned in traditional stoves are typically very low. The appliances, in which traditional fuels such as fuel wood, leaves and saw dust used, include earth plate stove and Mirt mitad or zig mitad with efficiency levels of 12% and 35% respectively. Other appliances, in which charcoal is used, include traditional (Iron) stove and Lakech stove with efficiency levels of 20% and 40% respectively.

In the study area, from the user of fuel wood and charcoal used efficiency appliance only used 12 (7.7 percent) and 135 (86.5 percent) respectively. So in the study area most user of fuel wood used open earth plate or inefficient appliance.

Table 4.15: The family used type of appliances for fuel wood and charcoal

<b>the appliances family used for fuel wood and charcoal</b>	<b>No of respondent</b>	<b>Percent</b>
Open earth plate	110	70.5
Closed efficient stove or mirit	12	7.7
Total	156	100.0
Iron charcoal stove	19	12.2
Lakech charcoal stove	135	86.5
Others	1	6.0
Total	156	100.0

Source: Own Survey, 2016.

The result shows as there is a directly relationship between the two. The amount of domestic energy consumed is positively correlated with the number of energy appliances. High income households afford to better domestic appliances due to their higher purchasing power as compared to low income households. At high income group modern appliances are better choice than traditional appliances owing to the higher efficiency level. That is, expenditure on gross household energy with the number of household sizes. As family number increases there is also an increase in the total consumption of household energy.

#### 4.8 The coping mechanisms of the study area

Table 4.16: The family coping mechanism with high price of charcoal

<b>family coping strategies with high price of charcoal</b>	<b>No of Respondent</b>	<b>Percent</b>
substitute with <i>tiftif</i> and left over fuel wood	94	60.3
store charcoal at time of scarcity	32	20.5
Others	30	19.2
Total	156	100.0

Source; Own Survey, 2016

Table 4.17: The family coping mechanism with high price of fuel wood

<b>families coping strategies with high price of fuel wood</b>	<b>No of Respondent</b>	<b>Percent</b>
Substitute with collecting refuse	86	55.1
Substitute with electricity	49	31.4
Buy readymade food	2	1.3
Others	2	1.3
<b>Total</b>	<b>156</b>	<b>100.0</b>

Source: Own Survey, 2016

Accordingly, households experience high degree of shortages and high price in charcoal, kerosene, fuel wood and electricity depending upon energy option of a household. Degree of scarcity in a fuel wood is also high, while the figures for electricity, Moreover, 100% electricity, dry cell and candle considers reported that no shortages in the utilization of electricity, dry cell and candle.

With the rapid population increase of in the study area, there is a growing demand for more fuel wood and charcoal supply for household use. These traditional fuels are so scarce that the dwellers are forced to use another options of energy sources. In general, with proper stove and better energy options and through developing renewable energy resources, the pressure on forest and soil erosions, could be reduced and the demand for more supply of fuels can be easily fulfill.

In time of shortage of supply, many households are forced to use substitutes. Due to declining of forest cover at all, many households experiencing severe shortage of fuel wood and substitution of electricity, refuse and any types of plants leaves for wood resources is important.



Figure 1: Picture of refuse (source: Researcher's fieldwork, April 2016)

In shortage of fuel wood of the fuel wood consumers reported that kerosene are used as fuel wood substitute. Leaves, sawdust, collecting refuse from the nearby area and other any dried fuels such as refuse sawdust and leaves of any available plants are play important role as substitutes fuel wood. Charcoal are also important substitutes with *tiftif* and the left over fuel wood as reported by 86 (55.1 percent) and 94 (60.3 percent) of the fuel consumers, respectively.

Charcoal is used many for cooking function and in period of its shortage fuel wood and kerosene were common substitutes. *Tiftif* and fuel wood left over are used as major charcoal substitutes as reported by 94 and 60.3 percent households of charcoal consumers respectively. It is made from left over charcoal or tiny pieces of charcoal and soil mixed by water and baking like “*shilito*” and dried by the sun at home.

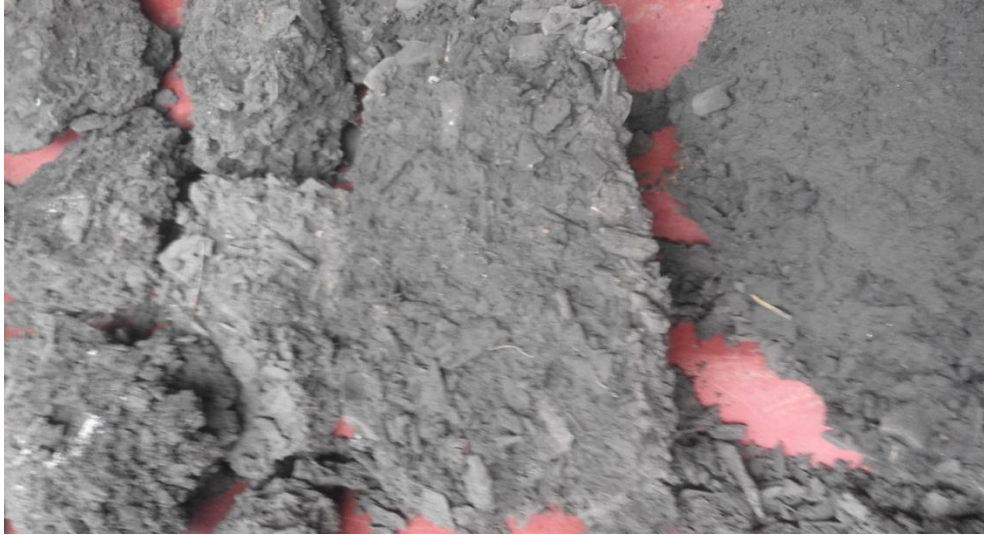


Figure 2: Picture of *tiftif* (source: researcher's fieldwork, April 2016)

The use of electricity as domestic fuel other than for lighting is limited due to low income levels of the majority of the households. When many of the sample households face electric power interruption candle is immediate substitute energy source used for lighting. In period of failure of electricity or non availability or power interruption, electric energy consumers reported kerosene is used as substitutes. In shortage of kerosene, charcoal is found to be the most common substitute as reported and fuel wood.

The bole sub city environmental keeping office director said that about the household energy demand, supply and consumption are not that much satisfied they are not well known about it. They informed about the shortage of energy supply and consumption is that it is not the only area that happened shortage. It is the situation, which are happed at all stage. They informed about the solution to the shortage is the community to use the modern made *tiftif* and the modern appliance, give them by free by aware about how to made and use it. They told about the impact of shortage of energy supply were that it makes society suffer by energy consumption.

The government given the awareness about how cop up with the shortage of energy source by grouping them in 1;5 then give training them, then *tiftif* which made from chat stick and the dried sticky plant and efficient appliances, which made in factory with out of buying it. This trainer

trains the others. Then told to them see by using it, then for future us it by buying. The government distributes the *tiftif* and efficient appliance by buying it from the private company example like Gogle energy saving stove and engineering private limited company. The Efficient Appliance and *tiftif* presented by Government for the low income households. It used for *tiftif*, charcoal and at the bottom for fuel wood burning.



Figure 3: Pcture of differnt appliances (source: researcher's fieldwork, April 2016)

## **CHAPTER FIVE: CONCLUSIONS AND RECOMMENDATION**

### **5.1 Conclusion**

Multiple sources of energy are commonly used by individual sample households for day to day household energy requirement which include traditional sources (fuel wood, charcoal, leaves and dried refuse and modern sources (electricity and kerosene).

The largest share of the domestic energy comes from the electricity, which occupy the first position 123 (78.8) for injera. And for lighting, radio and television, the sample households in terms of expenditure and gross energy consumed. However, most of the people in the study are relying heavily on traditional fuel as its main source of baking 33 (26.5 percent) and cooking 116 (74.4 percent). Among the traditional energy sources, fuel wood and charcoal are the most useful as well as preferred fuel for the household energy requirement, particularly for low as well as medium income group of people. In the 1980's, Ethiopia's population increased by 60% as compared to the 1960's which resulted in 70% and 50% increases in the consumption of charcoal and fuel wood, respectively (World Bank, 2011).

Despite the fact that biomass fuel remains the most important household fuel in the study area, no attempts have been made to increase its supply. However, the amount of expenditure made on traditional fuels declines with the rise in household income consuming more of modern fuels. That means low income households depend on predominantly on traditional fuels as compared to those high income groups who have shifted from traditional for their domestic requirement, to modern fuels relatively.

The share of electricity stands first in the consumption of useful domestic energy in the study area. The consumption of electricity shows a drastic with increasing household income and the rise of prices of other energy source. The general trend indicates that traditional fuels consumption decreases with income rise while modern consumption shows the reverse and increases with income.

Household income is the main variables which explain the kind and the amount in the consumption of energy per head. The amount of both gross and useful domestic energy

consumed increase with an increase of household income. Higher income households consume more household energy. While low income households take low energy service and also spend proportionally large share of their income on fuels relatively.

In the low income group, expenditure on fuel energy contains higher proportion of the household budget than in the high income group. One of the major problems that have been facing the dwellers in the study area is the rise up of the price of traditional and creating a big problem on household's budget particularly among households of the low and none income group. This in turn caused an acute energy crisis that forced to use dried refuse and tiftif. This is the dwellers' coping mechanisms.

From correlation it was observed that total expenditure on all types of household energy is positively correlated with household size household monthly income and type of energy appliances. These are determinants of household energy consumption. Most households' energy uses are confined to simple functions like baking, cooking and lighting by employing simple and traditional appliances. The traditional fuels dominate baking and cooking. A higher proportion of residents in the study area use electricity for baking and lighting, charcoal for cooking. Electricity is used for banking mainly among higher income households. Electricity is largely used for lighting almost among all sample households relatively.

In terms of useful energy service received modern fuels occupy the first position for sample households. Traditional give low energy service due to low efficiency in their utilization. In fact, the present use of traditional energy sources is highly inefficient. The traditional mitad is extremely inefficient (12 percent). Much of the traditional energy is wasted due to using very inefficient appliance. There is a rise tendency to shift towards the modern types of and more efficient appliances. It is clear that households in the economic group receive less amount of useful energy due to low efficiency of energy utilization as compared to households in high income group relatively. The rise in efficiency of energy consumption should result increase consumption of the effective /useful/ energy.

The amounts of useful energy received by a household increases along with an increase in its income. The households of the low income group receive less amount of useful energy has

compared to households in the high income group. Mostly the samples of the research are near each other but there is some difference between them. Households of the low income group generally cannot afford to access modern fuels and efficient appliances for domestic energy consumption. They make relatively more proportion expenditure of the income on gross energy consumers in comparison to the households of high income group relatively.

## **5.2 Recommendations**

On the basis of the outcome of the study and to improve household energy utilization among the household of the study area, the following suggestions are forward.

The study area's most households are Poor; the respondents of the research are poor. So they face in decreasing to affordable energy for daily necessities. Therefore one of the most appropriate strategies to provide a sustainable energy source for the households is to give a considerable focus to alternative sources of energy that can reduce the energy problem that is efficient utilization of renewable biomass based on appropriate technology. Sustainable supply of solar energy materials for household energy source is needed. Give different awareness about the alternative energy source and environmental protection through encouraging conservation of natural vegetation that is growing trees as environmental well being must be strengthened.

The households of the study area, particularly the respondent are low income so they are dependent on traditional fuels and burn the refuse that risky for respiratory organ, globally, two million people die prematurely as a result of indoor air pollution associated with the inefficient burning of biomass. Chronic obstructive respiratory disease resulting from indoor air pollution kills one million people each year. Particulate matter inhaled from indoor air pollution is the cause of 50% of pneumonia deaths among children under the age of five (WHO, 2006) So the stockholders should be encouraged to use modern fuels like electricity and the use of tiftif make in modern way. The pressure on forest and soil resources could be reduced and the demand for more supply of flues can easily be meet. People should aware the modern flues are cheaper than traditional fuels in terms of useful energy services and with high efficiency level. So, lower income households should be provided with appliances of modern fuels with better efficiency at reasonable price to make them use modern fuels. It also environmentally friend practice.

Considerable penetration of fuel saving appliances stove such as the Lakech charcoal stove, Mirt Mitad (zig) stove and electric stove in to the households should be encouraged.

The majority of the household in the study area were users of electricity for baking injera due to the increasing of domestic fuel wood price. Electric tariff for those households are so expensive so they have no other alternative so should get attention to the households.

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## Appendices A

### Appendix A; survey questionnaire

Questionnaire No ----- house hold number ----- date of the survey -----  
/-----/16

The main purpose of this questionnaire is to acquire information relevant for synthesizing a research entitled “An assessment of household energy consumption among destitute families in woreda 8 Althad village of Bole sub city, Addis Ababa, your response will be of great importance to the study therefore, you are kindly requested to fill it honestly. I sincerely express my thanks for your unreserved cooperation in advance. Your information will be strictly confidential.

Name of the interviewer -----

#### **PART I:** personal and household information

1. House hold’s head age {1} 25 > years {2} 25 – 35 years

{3} 36 – 45 years {4} > 45 years

2. Sex of the household head

{1} male

{2} female

3. Marital Status {1} single

{2} married

{3} divorced

{4} widowed

4. Household size {1} 1- 3

{2} 4-5

{3} 6-10

{4} 10<

5. Monthly household income (Birr)

{1} less than 200 Birr

{3} above 801 Birr

{2} between 200 and 800 Birr

{4} I don’t know

6. Household heads educational status

- {1} illiterate                      {2} can read and write  
{3} elementary                      {4} above, high school, diploma, B.A, Ma, Phd.

7. Occupational status of the household head

- {1} government employees                      {3} unemployed  
{2} private                      {4} pensioned

8. Ownership of the house in which you live

- {1} own house                      {3} rented from private owner  
{2} rented from kebele                      {4} other specify

**Part II household energy source and consumption**

9. Which of the following energy source are mostly used for house hold purposes?

- {1} fuel – wood                      {3} electricity {5} other (specify) -----  
{2} charcoal                      {4} kerosene

10. If you are not user of electricity what is the reason?

- {1} electric appliances (stoves and” mitad”) are expensive  
{2} the increasing electric tariff  
{3}the problem with electric meter.  
{4} other (specify) -----

11. From which sourced do you obtain energy (secured) for household purpose?

- {1} from purchase fuel wood                      {3} fuel station/retails/shop/  
{2} from collection of refuse                      {4} electricity/ own, connect/





27. If yes for question 26 then the types of stove (appliances) Traditional method?

{1} open earth plate                      {3} other (specify)

{2} closed efficient stoves/modern (mirt) “mitad”

28. The total monthly family expenditure on fire wood -----

29. Does the family face scarcity of fire wood in this village?

{1} yes                                      {2} No

30. If yes, what is the cause of the scarcity?

{1} because low supply.                      {3} because no forest.

{2} because of high demand                      {4} other (specify)

31. If yes question number 29, how does the family cope with high price of fire wood?

{1} substitute with collection dried rubbish/refuse/.    {3} buy readymade food.

{2} substitute with electricity.                      {4} other (specify).

32. When is fire wood scarce?

{1} regularly                                  {3} the time of holyday.

{2} occasionally                              {4} other (specify)

33. Does the family use charcoal    {1} yes                      {2} No

34. If yes, then how does the family obtain the charcoal?

{1} left over fire wood/artificial charcoal/    {3} whole sells at market

{2} Purchasing                                  {4} other (specify)

35. If you are buying charcoal, what amounts do you buying at a time?

{1} 3 birr                                      {3} 150 birr

{2} 5 birr                                      {4} 250 birr

36. When do you use charcoal?

{1} regularly {3} the time of holyday.

{2} occasionally {4} other (specify)

37. The monthly expenditure of family on charcoal is Birr -----

38. How does the family cope with the high price of charcoal?

{1} Substitute with tiftif {3} store charcoal at time of scarcity

{2} Left over fire wood/artificial charcoal/ {4} Other specify -----

39. IF the family uses charcoal. The type of stove (appliance) used is

{1} Traditional (Iron) Charcoal stove {3} Other specify)

{2} efficient closed stove 'lakech' charcoal stove

40. Which energy source is affordable to you? list them in order of their amount from cheapest to expensive.

{1} Fire wood, charcoal, kerosene, electricity {3} Electricity, fire wood, kerosene,  
charcoal

{2} Fire wood, kerosene, charcoal, electricity {4} Other (specify)

**የዚህ መጠይቅ ዋና ዓላማ በአ.አ ቦሌ ክ/ከተማ ወረዳ 8 አልታድ አካባቢ የሚገኙ ነዋሪዎች የሀይል አጠቃቀም በሚል ርዕስ እየተሰራ ላለው ዳሰሳዊ ጥናት አስፈላጊውን መረጃ ማግኘት ነው።**

የእርስዎ ምላሽ ለጥናቱ የጎላ አስተዋጽኦ ስላለው መልሱን በታማኝነት እንዲሰጡን በትህትና ይጠይቃሉ። ስለ ትብብርዎ ክፍ ያለ ምስጋናዬን አቀርባለሁ።

**ክፍል 1 የቤቱ ባለቤት የግል ሁኔታ**

1/ የቤቱ ባለቤት ዕድሜ            1/ 25>            2/ 24-35            3/ 36-45            4/ 45<

2. የቤቱ ባለቤት ጾታ            1/ ወንድ            2/ ሴት

3. የጋብቻ ሁኔታ            1/ ያገባ            2/ ያላገባ            3/ የተፋታ            4/ የሞተ

4/ የቤተሰቡ መጠን            1/ 3            2/ 3-5            3/ 6-10            4/ 10<

5/ የቤተሰቡ የወር ገቢ

1/ 250>            2/ ከ200-800            3/ 801 ብር በላይ            4/ የለም

6/ የቤተሰቡ ሀላፊ የትምህርት ደረጃ

1/ ያልተማረ            2/ ማንበብና መጻፍ

3/ የመጀመሪያ ደረጃ            4/ ከሁለተኛ ደረጃ በላይ (ዲፕሎማ፣ ዲግሪ ማስተር፣ ፒኤችዲ)

7/ የቤተሰብ ሀላፊው የሥራ ሁኔታ

1/ የመንግስት            2/ የግል            3/ ስራ የሌለው            4/ ጠረተኛ

8/ የቤቱ ይዘታ

1/ የግል            2/ የቀበሌ ተከራይ            3/ ከግል ተከራይ            4/ ሌላ ካለ ይጥቀሱ

ከቀበሌ ከተከራዩ በወር ስንት ይከፍላሉ?

1/ 0.50-5 ብር            2/ ከ6-10 ብር            3/ ከ11-15 ብር            4/ ከ16-25 ብር

**ክፍል 2 በቤት ውስጥ የሀይል ምንጭ እና ፍጆታ**

9/ ከሚከተሉት የሀይል ምንጮች ውስጥ የትኛውን የሀይል ምንጭ በይበልጥ በቤት ውስጥ ይጠቀማሉ?

- 1/ የማገዶ እንጨት
- 2/ ከሰል
- 3/ ኤሌክትሪክ
- 4/ ጋዝ
- 5/ ሌላ ካለ ይጥቀሱ

10/ የኤሌክትሪክ ተጠቃሚ ካልሆኑ ምክንያት ይግለጹ

- 1/ የኤሌክትሪክ ዕቃዎች (ምድጃና ምጣድ) ውድ መሆን
- 2/ የኤሌክትሪክ ክፍያ ውድ መሆን
- 3/ የኤሌክትሪክ መለኪያ ችግር
- 4/ ሌላ ካለ ይግለጹ

11/ ኤሌክትሪክ የሚጠቀሙ ከሆነ ኤሌክትሪኩን እንዴት ያገኙታል?

- 1/ ከራስዎት ቆጣሪ
- 2/ ከሌሎች ጋር በጋራ
- 3/ ከመስመሩ ላይ በመጥለፍ
- 4/ ሌላ መንገድ ካለ ይጥቀሱ

12/ እንጅራ ለመጋገር የትኛውን የሀይል ምንጭ ይጠቀማሉ?

- 1/ የማገዶ እንጨት
- 2/ ኤሌክትሪክ
- 3/ ቅተሎች እና ሰጋቱራ
- 4/ ሌላ ካለ ይጥቀሱ

13. ለወጥ መስሪያ የትኛውን ሀይል ምንጭ ይጠመቃሉ?

1/ የማገዶ እንጨት

2/ ኤሌክትሪክ

3/ ከነጭ ጋዝ ቸርቻሪዎች

4/ ሌላ ካለ ይጥቀሱ

14/ ቡና ለማፍላት የትኛውን የሀይል ምንጭ ይጠመቃሉ?

1/ የማገዶ እንጨት

2/ ኤሌክትሪክ

3/ ከሰል

4/ ሌላ ካለ ይጥቀሱ

15/ ለጥያቄ ቁጥር 13 እና 14 መልስዎት ከሰል ከሆነ ለምን?

1/ የተሸለ ጣዕም ለማግኘት

3/ በፍጥነቱ

2/ በዋጋው

4/ ሌላ ካለ ይጥቀሱ

16/ ቤተሰብዎ ኤሌክትሪክን የሚጠቀመው ለ\_\_\_\_\_ ነው?

1/ ለብርሃን

2/ እንጀራ ለመጋገር

6/ ለሁሉም

3/ ለቴሌቭዥን ለሬድዮ

4/ ለምድጃ

5/ ሌላ ካለ ይጥቀሱ

17/ ወርሀዊ የኤሌክትሪክ ፍጆታ ወጭዎ ምን ያህል ነው?

በ2008 ዓ.ም አማካኝ የወር ወጭዎ በብር \_\_\_\_\_

18/ ነጭ ጋዝን ሀይል ምንጭነት ይጠቀማሉ?

1/ አዎ

2/ አይ

19/ ለ19ኛው መልስዎት አዎ ከሆነ ነጭ ጋዘን ለምን አገልግሎት ይጠቀሙበታል?

- 1/ ምግብ ለማብሰልና ለማሞቅ
- 2/ ውሀ ለማፍላት
- 3/ ከሰል ለማቀጣጠል
- 4/ ሌላ ካለ ይጥቀሱ
- 5/ ሁሉም

20/ ነጭ ጋዘን ከየት ይገዛሉ?

- 1/ ከቤንዚን ማደያ
- 2/ ከነጭ ጋዘ ማደያ
- 3/ ከነጭ ጋዘ ቸርቻሪዎች
- 4/ ሌላ ካለ ይጥቀሱ

21/ በወር ምን ያህል ሊትር ነጭ ጋዘ ይጠቀማሉ?

22/ ባለፉት ወራት ለነጭ ጋዘ መግዣ ያወጡት ገንዘብ በአማካይ ስንት ይሆናል? \_\_\_\_\_

23/ ነጭ ጋዘን የመጠቀም ችግሩ ምንድን ነው?

- 1/ ዋጋው ከፍተተኛ መሆን
- 2/ መርዛማ ጭስ መኖሩ
- 3/ በቀላሉ አለመገኘቱ
- 4/ ሌላ ካለ ይጥቀሱ

24/ በዋጋው መጨመር ምክንያት ነጭ ጋዘን መጠቀም ቢያቆሙ ሌላ ምን አማራጭ ይኖርዎታል?

- 1/ እንጨትና ከሰል
- 2/ ኤሌክትሪክ
- 3/ የደረቁ ተረፈ ምርቶችን መጠቀም
- 4/ ሌላ ካለዎት ይጥቀሱ

25/ በቤትዎ የማገዶ እንጨት ይጠቀማሉ? 1/ አዎ 2/ አይ

26/ ለ25ኛው ጥያቄ መልስዎት አዎ ከሆነ እንጨቱን ከየት ያገኙታል?

- 1/ በመግዛት
- 2/ በመልቀም
- 3/ በመግዛትና በመልቀም
- 4/ ሌላ ካለ ይጥቀሱ

27/ እንጨት ለሀይል ምንጭነት የሚጠቀሙ ከሆኑ የትኛውን አይነት ምድጃ ይጠቀማሉ?

- 1/ የመሬት ላይ ምድጃ
- 2/ ምርጥ /ላቀች/ ምድጃ
- 3/ ሌላ ካለ ይጥቀሱ

28/ ቤተሰብዎ በወር ባማካኝ ምን ያህል ገንዘብ ለማገድ እንጨት ያወጣሉ \_\_\_\_\_

29/ በቤትዎ የማገድ እንጨት እጥረት አጋጥመዎታል?

- 1/ አዎ
- 2/ አይ

30/ መልስዎ አዎ ከሆነ የእጥረቱ መንስኤ ምንድን ነው?

- 1/ የአቅርቦት እጥረት
- 2/ ከፍተኛ ፍላጎት መኖር
- 3/ ደን ባለመኖሩ
- 4/ ሌላ ካለ ይጥቀሱ

31/ ለ31ኛው ጥያቄ መልስዎ አዎ ከሆነ ቤተሰብዎ በማገድ እንጨት የዋጋን ውድነት እንዴት ተቋቁመዋል?

- 1/ ከደረቅ ቆሻሻ ተረፈ ምርት
- 2/ የኤሌክትሪክን በመጠቀም
- 3/ የተዘጋጀ ምግብ በመግዛት
- 4/ የተለየ ካለ ይጥቀሱ

32/ የማገድ እንጨት እጥረት መቼ ይከሰታል?

- 1/ በቋሚነት
- 2/ አልፎ አልፎ
- 3/ በበአላት ሰሞን
- 4/ ሌላ ካለ ይጥቀሱ

33/ በቤትዎ ከሰልን ይጠቀማሉ? 1/ አዎ 2/ አይ

34/ መልስዎ አዎ ከሆነ ከሰሉን ከየት ያገኙታል?

- 1/ ከማገድ እንጨት ተረፈ ምርት /ፍም
- 2/ በመግዛት
- 3/ በጅምላ መግዛት
- 4/ ሌላ ካለ ይጥቀሱ

35/ ከሰል የሚገዙ ከሆነ በየጊዜው በምን ያህል ብር ይገዛሉ?

- 1/ የ3 ብር
- 2/ የ5 ብር
- 3/ የ150 ብር
- 4/ የ250 ብር

36/ ከሰል የሚጠቀሙት መቼ መቼ ነው?

- 1/ በቋሚነት
- 2/ አልፎ አልፎ
- 3/ በበአላት ሰሞን
- 4/ ሌላ ካለ ይጥቀሱ

37/ በቤትዎ ለከሰል መግዣ በወር ባማካኝ ምን ያህል ብር ያወጣል?

38/ የከሰል የዋጋ ውድነት በቤትዎ እንዴት ይቋቋሙታል?

- 1/ ጥፍጥፍን በመጠቀም
- 2/ ከማገዶ እንጨት ተረፈ ምርት
- 3/ ለክፉ ቀን ገዝቶ በማስቀመጥ
- 4/ ሌላ ካለ ይጥቀሱ

39/ ከሰልን ለማንደድ ምን አይነት ምድጃ ይጠቀማሉ?

- 1/ የብረት ምድጃ
- 2/ ላቀች ምድጃ
- 3/ ሌላ ይጥቀሱ

40/ የትኛው የሀይል ምንጭ ነው ለእርስዎ ተመራጭ ከርካሽ ወደ ውድ ይመርጣሉ?

- የማገዶ እንጨት፣ ከሰል፣ ነጭ ጋዝ፣ ኤሌክትሪክ
- የማገዶ እንቸት፣ ነጭ ጋዝ፣ ከሰል፣ ኤሌክትሪክ
- ኤሌክትሪክ፣ የማገዶ እንጨት፣ ነጭ ጋዝ፣ ከሰል
- ሌላ ካለ ይጥቀሱ

ለትብብርዎት አመሰግናለሁ

## Appendix B

### Interview Guide Questions for Key Informants

1. Name of the Respondent \_\_\_\_\_ occupation \_\_\_\_\_ position if any, \_\_\_\_\_
2. Got \_\_\_\_\_
3. Age \_\_\_\_\_
4. Educational level \_\_\_\_\_
5. How long did you reside or serve here \_\_\_\_\_
6. What do you witness about the household energy demand, supply and consumption?
7. What do you think are the factors that shortage of energy supply and consumption?
8. What is your view about the solution of shortage of energy supply?
9. What is your view about the impacts of shortage of energy supply?
10. What do you think the government should do to improve the life of the local people affected by shortage of energy supply? In capacity building, social organization, and strengthen the available institutions

## APPENDIX C

### Caloric Content of fuels

No	fuel	Measurement units	Mega calories(Mca) unit
1	Fuel wood	grams	0.003600/gram
2	charcoal	grams	0.007100/gram
3	kerosene	cc	0.008034/cc
5	Electricity	Watt hrs	0.000860/watt hr.
6	sawdust	grams	0.004000/gram
7	Leaves and barks	grams	0.003200/gram

*Source; Ethiopian National Energy Committee.*

## APPENDIX D

No	Domestic appliance	Source of energy	Efficiency level out of one
1	Earthen plate 'Mitad'	Wood fuel /leaves and sawdust	0.12 grams
2	'mirt zig mitad'	Wood fuel /leaves and sawdust	0.34 grams
3	Traditional 'iron' charcoal stove	Charcoal	0.20 grams
4	'lakech' charcoal stove	Charcoal	0.40 grams
5	Electric 'mitad'	Electricity	0.75 watt hrs
6	Television	Electricity	0.75 watt hrs
7	Kerosene stove	Gas	0.56 cc

*Source; Based on efficiency values from the Ethiopian National Energy Committee.*

## **DECLARATION**

I declared that this thesis is my original work and all sources of materials used for this thesis have been duly acknowledged. I solemnly declare that this thesis is not submitted to any other institution anywhere for the award of any academic degree, diploma or certificate.

Name: Birhane Kussa

Signature: .....

Place: Addis Ababa University, Addis Ababa

Date of Submission: .....