Factors Influencing Choice of Sources for Domestic Energy Used in Households in Thuti Sub-Location, Othaya

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Abstract

Energy is one of the key drivers of economic, social and political development of the world hence its increase in demand. Countries are faced with problems of sustainable energy sources for home use, which will accelerate countries economic growth. During the 2000s several programmes aiming at testing and disseminating energy saving technologies were implemented in Kenya (Smith et al., 2000).One of these technologies was improved cook stoves, which was intended to increase the efficiency of using energy from Biomass and other sources. The purpose of this study is to examine factors influencing choice of sources for domestic energy used in Thuti sub-location in Othaya sub-county, which included among others socio-cultural and economic factors, stakeholders influence, and the switching factors from traditional to more efficient and cleaner fuels and technologies.Descriptive survey   research was design was used to collect required data.The target population of 275 households where systematic random sampling was used to select 27 households. For qualitative data collection, 12 key informants were selected using purposive sampling from Thuti Sub-location were used. The result showed that the source of fuel wood used in Thuti Sub-location from their own farms and Karima forest, representing 73.1% and 26.9% of the total population respectively. This concurs with the objectives of the Green Belt Movement (GBM), which is to encourage sustainable fuel wood usage for the household through planting of trees in their farms while at the same time rehabilitating Karima Forest.On the adoption of alternative sources of energy, the result showed that the households learned of these sources from friends represented at 40.7% followed by Neighbours, 25.9 % and parents at 14.8%. Indicating that there is a close association among the households in their day-to-day activities and choice and sources of domestic energy used. The overall findings underlined the importance in social groups, stakeholders and government advocacy in the choice and sources of domestic energy to be adopted for efficient cooking and sustainability in Thuti Sub-location. This study therefore will be of significant to; policy makers, researchers, residents of rural households to build a case for intervention on the most efficient and clean choice for domestic energy among the rural households in Thuti Sub-location and the environs.

Keywords: Domestic energy, choice, households, adoption, sustainability

1.0 INTRODUCTION

Around 2.6 billion people worldwide rely on biomass (namely firewood and charcoal) as the primary source of energy for cooking and heating (Lambe et al. 2015). The use of biomass fuels, especially from wood sources is immemorial in Kenya. According to the ministry of Energy, 89% of rural households use firewood as their main energy source comparatively to the 7% of the urban families (Githiomi et al, 2012). According to Mugo and Gathui, 2010, about 90% of harvested wood in Kenya is used for wood-fuel. Wood-fuel is harvested in nearby forested areas, purchased or produced on the farm in woodlots or between fields in an agroforestry system. Challenges with the consumption of fuel wood and charcoal include the reduction of forest resources due to unsustainable and often illegal wood harvesting practices. Fuel wood consumption has greatly increased with a steadily growing population from approximately 5 million in 1950 to about 45 million in 2014 (WPP 2015). Furthermore there has been an increase in consumption due to energy demand from factories, for instance for tea and coffee production. This consumption puts pressure on local natural resources and has led to vast deforestation as well as an alarming a57% biomass energy deficit in Kenya (Mugo and Gathui 2010).Karima forest in Karima Location Othaya was once well governed and there was access of the resources. However, during the 80s changes in the ecosystem were evident and this prompted intervention from various stakeholders. In 2005, the Gaia foundation, Porim and the Green belt movement worked to rehabilitate the forest through planting indigenous trees replacing the Eucalyptus planted earlier.

In addition to the potential negative environment impacts unsustainable use of fuel wood and charcoal, there are also important social concerns with the use of fuel biomass, most notably fuel wood. Inefficient cook stoves and poor ventilation lead to harmful air pollution, which those working in the kitchen, women and children are exposed to. Globally it is estimated that 4 million people die annually due to illness caused by pollution of cook stove smoke (Lambe et al., 2015). Moreover, the task of collecting firewood typically falls on the women in the household (Dohoo, 2013), meaning less time to allocate towards the actual cooking of meals and all of the many other daily tasks. Although there are alternatives to fuel wood, the number of people relying on fuel wood stays high in rural Kenya (Githioni et al. 2012).

1.2. Statement of the Problem

Rural households derive their energy from various sources. The factors influencing the choice of fuel for cooking in these households range from social, political, economic and environmental factors. Social factors such as heating, maize roasting and involvement in women groups have an impact on the choice of fuel for cooking from the interaction during meetings. Political factors like government laws, for instance The Forest Act and the Energy Act largely affect the choice of fuel for cooking as some sources may be inaccessible forcing households to adopt alternative sources of cooking fuels. Economic factors like household income level highly influence the type of cooking fuel such a family will use for cooking. Most low-income earner use cheap sources of cooking fuels, which are locally available despite the larger health risk exposed to them. However, the factors influencing the choices of domestic energy used in Thuti sub-location is scantly known.

1.3. Significance of the study

This study has a practical significance in that its results may give insight into the main sources of energy used in the study area as well as what influences their choice.

These factors can help the government and stakeholders to come up with strategies, which will enhance the people's awareness on alternative and cleaner energy methods.

The study involved residents of Thuti sub-location in Othaya sub-county. The researcher used local translators and used every possible means to create a conducive atmosphere for discussion with residents. The researcher convinced them that the purpose of study was not for victimization and therefore any information will be used for research purposes only.

1.4. The study Area

Our study area is Thuti Sub Location in Karima, one of the four locations in Othaya Sub-County, Nyeri. It covers an area of about 7.5 Km^2 and has a population of about 3650 as per the Kenya Government 2009 National census data. The numbers of males are 1,716 and that of women is 1,934. There are a total of 1006 households within this sub-location. The main tribe is kikuyu. The area is well developed in terms of infrastructure; most villages are accessible by murram and tarmac roads, have power, tapped water and primary schools as well as shops for basic necessities.

The main economic activity in the region is coffee and tea farming as well as small subsistence farming. Other crops – for subsistence and cash – include banana, maize, beans, sweet potato, Irish potato, beans, sugar cane, yams and vegetables. Most households have at least one or two dairy cattle.

Many of the residents in this area are unemployed and most of them are poor with a small group, which is in the middle class constituting of teachers, nurses and other public servants. (Kimwatu, 2015).The majority of the population relies on fuel wood as their primary source for domestic energy, with other sources that include biogas, liquid petroleum gas, and charcoal. When it comes to lighting, the people heavily rely on the National grid electricity, solar lights and kerosene. Othaya as a sub county being a tea-growing zone, the tea factories also requires woody biomass to drive their machines.At the same time, the adoption of alternative energy sources is taking shape through various stakeholder forums.

2.1 The Theory of Choice

Individual decision-making forms the basis for nearly all Micro-economics analysis. Ordinarily, rational choice means the process of determining what choices are available and them choosing the most preferred one according to some predetermined and consistent criterion. In other words, optimization-based approach; that culminates to utility function as postulated by Adam Smith (1990). Individuals have preferences and choose according to those e.g. biogas,jikokoa,three stove etc (refer to Appendix III for photos).The choice and preference here will be based on certain fundamentals for example family income, individual income.

2.2. Source of fuel wood in Thuti sub-location

The annual domestic consumption levels and patterns of various common biofuels in Kenya were surveyed. The main fuelwood sources were farmland trees, indigenous forests, woodlands and timber off-cuts from plantations. In 1997, about 15.4 million tonnes of firewood (air-dried) were consumed and an equivalent of 17.1 million tonnes round wood wet weight (w/w) was converted to charcoal. In the same year, 1.4 million tonnes of a variety of crop residues were also consumed as domestic fuel. Biofuel availability was the major factor influencing the reported annual spatial species use and in the year 2000, fuel wood supplied 89% of rural household energy and 7% urban household energy. Charcoal on the other hand was reported to supply 82% of urban household energy and 34% of rural households. Typical fuel wood and charcoal consumption estimates per household are 5-10kg of fuel wood per day and 1kg of charcoal per day respectively (Kerea, 2012).

Accessible wood fuel depends on a number of factors: legal issues, environmental issues, ownership, objectives of management, distances, and infrastructure. Accessible fuel wood was estimated at 13 million tons

in the year 2000 compared to a biomass demand of 34 million tons. This demand is expected to grow to 53 million tonnes by 2020. Indigenous vegetation mainly woodlands, wooded grasslands generates the highest supply of biomass (45%) followed by farmlands with 39%. According to Mwangi, 2013, the fuel wood is becoming scarce with women traveling longer distances to collect fuel wood.

Talks with the stakeholders from the area revealed that the source of fuel wood used to be Karima forest but it's no longer the case at the moment. This is because most of trees were cut down and forest put under high security to prevent further cutting down of trees. Households today have to get fuel wood from their farms or purchase from the market or neighbors. However, people still go to Karima forest to collect firewood but cutting is illegal.

2.3. Knowledge Dissemination and adoption of alternative choice and source of energy

Knowledge dissemination here refers to the source idea that brought to the decision of a household to adopt an alternative source of energy. A discussion with the stakeholders in the area reveals that most of households adopted alternative sources after they were tipped by close people or learned it from the market and agricultural shows. A further discussion revealed that cost, efficiency of using fuel and health factors to have contributed to adoption of the alternative sources. However, the uptake of biogas has been slow in Kenya due to the high capital cost and requirements for maintenance and management support (Mugo and Gathui, 2010).

Improved cook stoves (ICS) were developed initially to address the adverse health and livelihood impacts. Since ICSs improves cooing efficiency compared with traditional cook stoves, ICSs can reduce the amount of fuel required, fuel gathering time and cooking time, all of which have the potential to improve health and increase household income. In addition, these efficiencies can benefit the local environment and global climate because of reduction in fuel wood harvesting and particulate and particulate emissions. Despite clear scientific evidence on efficacy of these innovations, initial efforts to promote these technologies have run into challenges surrounding diffusion, dissemination and implementation (Okuthe&Akotsi, 2014)

2.4. Social-cultural and Economic factors influencing choice of domestic energy

In the year 2000, fuel wood supplied 89% of rural household energy and 7% urban household energy. Charcoal on the other hand was reported to supply 82% of urban household energy and 34% of rural households. Typical fuel wood and charcoal consumption estimates per household are 5-10kg of fuel wood per day and 1kg of charcoal per day respectively (Kerea, 2012).

Social cultural factor refers to household and community structures. While economic factor refer to household income level. Discussion with the local government advocate reveals that most of households in the area are low-income earners and therefore use firewood as their main domestic energy, because it's readily available from their farms and Karima forest. Wpower noted that most of households tend to adopt ideas brought in by the women because they are the family chefs. Wpower notes further that most adopted sources of energy in households have originated from social gatherings attended by women, e.g. women groups.

For example, inefficient stoves require more time to cook and gather fuel, a burden usually borne by women and children which diverts their time from education and income producing activities. Local environmental impacts arise from damages arise from damages to ambient air and local forest ecosystems. Due to the fact that only a fraction of the IAP is deposited indoors, biomass burning contributes to ambient air pollution (Shindellet al., 2011), sometimes even damaging wildlife habitats and watershed functions and contributing to deforestation (Geist and Lambin, 2001)

2.5. Stakeholders and their critical role in domestic energy

Stakeholders are the organization and groups that are involved direct or indirect in matters affecting the people of the area. Actors in Othaya area are Wpower, the Green Belt Movement and with some projects with the German aid organization. Most of these stakeholders have projects designed to make the source of domestic energy sustainable while making it more efficient and safe for human health. These projects ought to have high influence in the choice of domestic energy.

Green Belt Movement (GBM) and Wpower have been the most active in the region. Wpower which receives funding from USA has been involved in promoting cook stoves, reforestation, planting of fuel wood trees on farms and teaching people about clean energy. While GBM whose main objective has been to rehabilitate Karima forest through planting of trees has been helping women to start trees nurseries, which can be sold to GBM for reforestation of Karima forest.

2.6. Environmental and Health Factors influencing the choice of Domestic Energy used.

Nearly half of the global population relies on solid fuel such as biomass, coal, or dung, for their cooking needs (Legros et al, 2009;Rechfuess et al, 2006). Unprocessed Biomass for example charcoal, wood, crop residue remains a key household fuel for most of low income countries particularly the poor (Bruce et al, 2000) for

example in Thuti Sub-location. During cooking, inadequate ventilation and complete combustion through the use of rudimentary stoves or open fire points are common resulting in acute and chronic exposésto air pollutants (particulate matter, Carbon Monoxide, Nitrous oxides and others (Smith et al., 2000).

Indoor air Pollution (IAP) emitted by burning solid fuel indoors in poorly ventilated conditions is responsible for possible poor health for example, 2 Million premature deaths per year or 3.3% of the Global burden of disease, particularly women and children (WHO report, 2009).Local Environmental impacts arise from damages to ambient air and local forest ecosystems. Due to the fact that only a fraction of the IAP is deposited indoors, Biomass burning contributes to ambient air pollution (Shindell et al., 2011). Additionally, the unsustainable harvest of fuel wood degrades local forest. Sometimes even damaging wildlife habitat and watershed functions and contributing to deforestation. Cooking with unmistakably harvested Biomass can affect climate change because inefficient fuel combustion releases products of incomplete combustion with a higher Global warming potential than Carbon dioxide, such as Methane and Carbon monoxide. (Sargar and Kartha, 2007). Biomass and fossil fuel cook stoves also emit 22% and 7% of Global Carbon emissions, respectively, which is the second strongest contributor to current Global warming (Ramadhan, 2008). Our visitGiathenge Health Centre in Thuti Sub-Location, the Health Official confirmed to us that indeed the local residents had been treated for coughing, itching eyes, swollen eyes, swollen abdomen, due to the smoky cooking thus confirming the extent at which health complications as a result of choices of domestic energy for cooking family food is and therefore, urgently require for quick intervention and advocacy for the adoption of cleaner , improved and sustainable cooking ways for the rural households of Thuti Sub-Location.

2.7. Conceptual Framework
According to Mugenda and Mugenda (2003) a conceptual framework helps the reader to quickly see the proposed relationships between the variables in the study. Further, it shows the relationship between the independent variables (input) and the dependent variables (output). The input represents the factors households consider while making a choice for a domestic energy. The output represents the various types of domestic energy sources. The extraneous variables such as environmental factors, time taken to acquire energy for use and environment where one lives although not directly linked to the main reason for use may influence its choice.

3.0 RESEARCH METHODOLOGY
3.1. Research design
This study employed a descriptive survey research design. Descriptive survey research designs are used in preliminary and exploratory studies to allow the researcher to gather information, summarize, present and interpret for the purpose of clarification (Orodho, 2002).The descriptive survey research is intended to produce statistical information about aspects of different factors that are of vital importance to households when choosing the type of domestic energy to use**.**

3.2. Target population
Target population is the specific population about which information is desired. In this study, households form nine villages making up Thuti sub location was the focus. Out of the nine villages three household each were randomly selected. 'One from the left, second from right and third from center to give a true representation.

3.3. Sampling techniques and sample Frame
This section describes the simple size and sampling technique to be used in concluding the study. A population of 275 households was randomly selected for the study as per Kothari (2004) who postulated that 10% of the sample is sufficient representation of the study population. The sample size was obtained using co efficient of variation (Nassiuma, 2000).This is because for most surveys or experiment, a coefficient variation of at most 30%is usually acceptable. The study took a coefficient variation of 10% and a standard error of 0.02.The formula given by Nassiuma(2000) is;

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

Where n = Sample
    N=Population   (275)
    C=Covariance   (10%)
    e = standard error(0.02)

$$= \frac{275(10)^2}{10^2 + (275-1)0.02^2}$$

$$= \frac{275(100)}{100 + (274)0.0004}$$
$$= \frac{27500}{100.11}$$
$$= 274.69$$
$$\simeq 275$$

3.4. Research instruments
The study used both qualitative and quantitative data collection techniques. The data collection tools included:

3.4.1. Questionnaires
The questionnaires were administered to 27 households selected for the study. The questionnaire was divided into three subsections: demographic information of the respondents such as gender, age, position in the household and the questions in group of various study variables such as source of domestic energy and factors contributing to the choice of the domestic energy. The number of questionnaires used was three questionnaires for each village bringing to a total of twenty seven questionnaires for the nine villages sampled.

3.4.2. Semi-Structured interviews
The interview guidelines with questions relevant to the study were developed for the 6 key informants. The interview schedule was considered appropriate for the government officers as well as NGO personnel active in the area working in relation to energy. This was to obtain in depth information from professionals with regard to sources and factors influencing the choice of domestic energy in Thuti.

3.4.3. Focus Group Discussion
The focus group discussion (FGD) was developed for the households selected. One FGD was held with a bias of women only. This was based on the role of women with regard to domestic energy as they are the majority decision makers when it comes to such matters. This FGD was very important as it provided information that would not have been easily obtained from the face-to-face interviews or the questionnaires. A topic guide was developed to aid the discussion as well as brain storming techniques to explore more on the topic.

3.4.4. Observations
To get clarity on the status quo in terms of the type of energy the people use and the practicality of what influences their choice. Photographs were taken during the visits to various households. This was done to gather evidence on what the majority of the households use for cooking and lighting and why they are inclined to some sources and not others.

3.5. Data analysis
The data was analyzed using descriptive statistics utilizing the frequencies distributions and the percentages. This is because the study generated both quantitative and qualitative data. Data obtained through questionnaire was coded and logged in the computer and processed using SPSS. This involved both open and closed ended items in order to run simple descriptive analysis to get reports on data status. Data collected through the open-ended questions, interviews and analysis of documents was analyzed qualitatively through thematic and content analysis. Results of data were presented using frequency distribution tables and graphs.

4.0 RESEARCH FINDINGS AND ANALYSIS
4.1. Demographic characteristics of the respondents
The characteristics analyzed were gender, age and position in the household. It was noted that most of the respondents were females as compared to males. Females constituted most of the respondents while males were the minority. Normally, the study targeted females but in some homesteads the females were not reachable hence the male had to stand in for them. The study showed that the majority of respondents were between the ages of 60-70 Years, which contributed to 37% of the total respondents. This was followed by the age 40-50 years, which contributed, to 18.5% of the respondents. That majority of respondents held the position of a mother in the households. This represented 85.2% of the total respondents.

4.1.1. Gender of respondents
In this section, the study sought to explore the aspect of gender of the respondents in order to compare the most respondents in the research. This is because it was noted that most of the respondents were females as compared to males. The distribution of the responses is as shown in the table below.

Table 4. 1: Gender of respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	4	14.8	14.8	14.8
	Female	23	85.2	85.2	100.0
	Total	27	100.0	100.0	

The results from the Table 4.1 show that in the study, females constituted most of the respondents while males were the minority. Normally, the study targeted females but in some homestead the females were not, reachable hence the male had to stand in for them. This has a positive correlation due to the cultural construction of gender and perception of gender roles- involvement in domestic chores (Muchiri, 2008).

4.1.2. Distribution of respondents by Age

The study sought to find the age distribution of the respondents. This is because different age groups have different household chores. An older age group is most likely to do chores, which are not heavy, and mostly around the homestead and therefore most of the respondent is expected to be of the older group because they are always within when the interview is contacted. The study realized the results as shown in the Table 4.2 for the different ages.

Table 4. 2: Distribution of respondents by age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	10-20	1	3.7	3.7	3.7
	20-30	2	7.4	7.4	11.1
	30-40	2	7.4	7.4	18.5
	40-50	5	18.5	18.5	37.0
	60-70	10	37.0	37.0	74.1
	Above 70	3	11.1	11.1	85.2
	50-60	4	14.8	14.8	100.0
	Total	**27**	**100.0**	**100.0**	

The study showed that the majority of respondents were between the ages of 60-70 Years, which contributed to 37% of the total respondents. This was followed by the age 40-50 years, which contributed, to 18.5% of the respondents.

4.1.3. Distribution of respondents by position in the household

The study sought to study the position of the respondents in the household. Based on the nature of the study majority of respondents are expected to be mothers and wives in the various homesteads. The study realized results as shown in the table below.

Table 4. 3: Distribution of position in the household

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Father	1	3.7	3.7	3.7
	Mother	23	85.2	85.2	88.9
	Son	2	7.4	7.4	96.3
	Grandson	1	3.7	3.7	100.0
	Total	**27**	**100.0**	**100.0**	

The study showed that majority of respondents held the position of a mother in the households. This represented 85.2% of the total respondents.

4.2. Source of Energy inThuti Sub-Location

The study sought to determine the sources of energy used by households in Thuti sub-location. Through the questionnaires, the focus group discussion and the observation tour, the most popular source of energy in the area was fuel wood. Other sources used were charcoal, solar, kerosene, electricity and biogas. Further information as to whether they source it for their own farms or the Karima forest was obtained. The results of the study are as shown in the graph below.

Table 4. 4: Source of fuel wood in Thuti sub-location

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Karima Forest	7	26.9	26.9	26.9
	Own Farm	19	73.1	73.1	100.0
	Total	**26**	**100.0**	**100.0**	

From the table above, a large number of respondents indicated that the source of their fuel wood came from own farm. This represented 19 households, which is 73.1% of the total households sampled. However, 7 households representing 26.9% of the total respondents indicated that their source of fuel wood is Karima forest. Most households were self-sufficient and others bought from their neighbors. One household, which didn't use fuel wood, was not used to answer this question. In several households, it was found that the majority used more than one type of energy. They would use LPG perhaps in the morning, and the three stone stove when they had occasions as they had to cook large amounts of food.

4.3. Knowledge dissemination and adoption of alternative sources of energy

The study sought to establish how knowledgeable the residents are on alternative sources of energy. Sampled households in Thuti were studied in order to determine the reason for adoption of alternative sources of energy. The results of the study are as shown in the graph below.

Table 4. 5: Knowledge dissemination and adoption of alternative sources of energy

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agricultural show	1	3.7	3.7	3.7
	Extension officer	1	3.7	3.7	7.4
	Friend	11	40.7	40.7	48.1
	Knew it herself	2	7.4	7.4	55.6
	Neighbor	7	25.9	25.9	81.5
	Parents	4	14.8	14.8	96.3
	Training	1	3.7	3.7	100.0
	Total	**27**	**100.0**	**100.0**	

The graph above shows that about 11 households out of 27 households learned about the alternative source of energy from a friend. This represented 40.7% of the total households. This was followed by 25.9% of households who learned of the alternative source of energy from their neighbors. Parents contributed 14.8% of the total stake. From the FGD and the observation tour, the women were able to share that they were in various women groups and they had learned such from various forums including the different women groups that they belonged.

4.4. Social-cultural and Economic factors influencing the choice of domestic energy
4.4.1. Social factors

There are social factors that influence the source of energy used in households. The results of the study are as shown in the graph below.

Table 4. 6: Social factors influencing the choice of domestic energy

			Primary stove					
			biogas	energy save	Fuel wood	Improved stove	Kerosene	three stone	Total
Do you belong to Women Group?	Yes		1	5	3	11	0	2	22
	No		0	0	0	1	1	3	5
Total			**1**	**5**	**3**	**12**	**1**	**5**	**27**

The graph above shows that families in which women belonged to a women group adopted use of cleaner energy for cooking. Most of these women used improved stove, which represented 11 households, followed by energy save Jikos, (refer to photos in Appendix III) which represented 5 households. While for women who didn't belong to any women group, majority used three stone Jikos representing 3 households, while others used kerosene. Many of the households had benefitted from trainings and had switched to alternatives. It was alluded to in the observation tours and FGD that households that used the three stone stove were holding on to culture where during cold months the family would sit around the three stone stove for heating. Others claimed that it was impossible to roast maize and bananas using other types of fuels. Some individuals felt that

that the women of such homes may be lazy to implement the improved versions of energy. An important observation was that many households had variety of types and sources of energy and would use either depending on the time or occasion.

Some respondents including the key informants stated that there are health implications with regard to type of energy used. For example, the health officials had said that they have cases albeit few that have required medical attention because of using the three stone stove which emits a lot of smoke harmful for the respiratory tract as well as the eyes.

4.4.2. Economic factor

The results in the graph below show how economics can influence choice of energy.

Table 4. 7: Economic factors influencing the choice of domestic energy

			Main source of energy				
			Fire wood	Biogas	LPG	Kerosene	Total
Household income category	monthly	Below 5,000	16	0	0	1	17
		5,000-10,000	7	0	0	0	7
		15,000-20,000	0	0	1	0	1
		Above 20,000	0	1	0	0	1
		Do not wish to answer	1	0	0	0	1
Total			**24**	**1**	**1**	**1**	**27**

From the graph above, households with income of below 5,000 preferred to use firewood and kerosene. This is represented by 16 and 1 household respectively out of 27 households sampled. While one household with income of above 20,000-used biogas as their domestic energy. Also another household of income level of 15,000-20,000 used LPG as their domestic energy. It was clear that the household income was a great determinant in the type of energy used. It was a common perception of various respondents that biogas was the ideal source of energy but they feared the installation costs.

4.5. Stakeholders and their role in domestic energy in Thuti sub-location

The three stakeholders in Thuti Sub-location were studied in order to determine their role in domestic energy in Thuti sub-location. The result of the study is show in the Table 4.8

Table 4. 8: Stakeholders and role in domestic energy in Thuti sub-location.

		stakeholder's role in domestic energy		Total
		Promoting use of clean energy.	Reforestation and planting of fuel wood trees.	
Name of stakeholder	GBM	0	1	1
	Government advocate	0	1	1
	Wpower	1	0	1
Total		**1**	**2**	**3**

From table 4.8 of frequencies, both the government advocate and Green Belt Movement key role was promoting reforestation and planting of fuelwood trees while the Wpower key role was promoting use of clean energy.

4.6. Environmental and Health Factors influencing the choice of Domestic Energy used.

Our visit to Giathenge Health Centre in Thuti Sub-Location, the Health Official confirmed to us that indeed the local residents had been treated for coughing, itching eyes, swollen eyes, swollen abdomen, due to the smoky cooking thus confirming the extent at which health complications as a result of choices of domestic energy for cooking family food is and therefore, urgently require for quick intervention and advocacy for the adoption of cleaner, improved and sustainable cooking ways for the rural households of Thuti Sub-Location.

5.0 SUMMARY, CONCLUSION AND RECOMMENDATION
5.1. Conclusion

The economic capacity of households highly influenced the type of energy used. Low-income earners used firewood and kerosene exclusively while the high-income earners had electricity for lighting and used biogas for cooking.

A majority of Thuti residents have trees on their farms from which they source their firewood and for those without they can buy from those that grow them. Thus getting firewood for energy is not difficult. Most are self- sufficient. Most people shy away from using various sources because they lack the knowledge of

alternatives. Biogas for example can be installed for much less than most people are aware of. It was seen during the observation tours that a homestead made one using locally available materials which is much cheaper.

5.2. Recommendation
It is evident that various factors influence choice and there is a preference with regard to uses. It is therefore important that more awareness be enhanced to the local people of Thuti. Biogas is an unexplored and the area has much potential for this. It is imagined that there are high financial implications but various stakeholders should come together and change the mindset of the people to embrace it and see it as a worthy investment as there are no subsequent charges after installation. The government in collaboration with CBOs, Micro-finance and financial institutions can provide subsidized rates 0f interest on loans for those who are willing to install biogas. Local based technical and intuition training centers need to be supported to provide capacity building personnel to provide efficient energy technology solutions in terms of service, appliances and practices. Apart from awareness creation and provision of technical extension services, the Central government in coordination with the County government, should provide incentives through special programmes under relevant line Ministries.

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