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Ministry of Energy
Republic of Kenya

FEASIBILITY STUDY
ON
SMALL HYDROPOWER PROJECT
FOR 12 SITES FOR TEA FACTORIES
IN KENYA

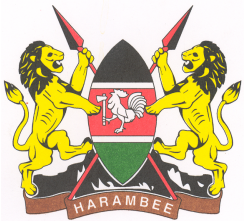
Final Report

Volume III.
Supporting Report (2)
(Social Impacts Assessment)

Kipsonoi Kapkoros

AUGUST 2009

Q-Energy
Que Energy Limited
Nairobi, Kenya



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This Report consists of

Executive Summary

Volume III Supporting Report (2)

(Social Impacts Assessment)

This Study was fully Supported by Government of Kenya in a 10 month Feasibility Assessment of some 12 sites for Tea Factories in Kenya.

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1.1 Introduction

1.1.1 Survey objective

The objective of this survey is to investigate the social and economic conditions of people living around tea factories so as to establish the impact of developing local small hydro power schemes to improve their livelihoods

1.1.2 Methodology

A semi-structured questionnaire was used to collect primary data from 161 respondents.

The survey targeted potential beneficiaries of a small hydro scheme with the sample comprising all the households within a 3km radius from the Kapkoros Tea Factory, as well as those living along the area where the canal will be constructed.

Stratified sampling technique was used, where the sample was divided into four strata and random sampling done in each stratum with equal distribution in all the parts of the strata. On this site, 161 households were randomly selected, which included 120 households within a 3km radius of the factory and 40 households along the canal.

A structured questionnaire was developed, pre tested and reviewed. This was then used to collect primary data on the social and economic status of the respondents. These were administered face to face by the interviewers who were local residents of the area and also the potential beneficiaries.

Questionnaires were administered to each randomly selected household and responses recorded. It took an average of 30 minutes to gather the necessary information for each household.

The collected data was then coded, cleaned and entered into SPSS software to build a database that was subjected to data analysis. Descriptive statistics such as percentages, correlation analysis and graphs were used to describe, analyze and present the survey findings. The survey was carried out in various homesteads in the Bomet Central Division in Bomet District.

Out of the 161 survey respondents 139 were men (86.3%) and 22 women (13.7%)

1.1.3 Limitations and opportunities of the study

The study coincided with the rainy season when residents were busy planting food crops and picking tea, therefore it took more time to locate the respondents.

The heavy rains mostly in the afternoon affected the interviewing process and it therefore took more time than expected; the interviewers had to contend with rain and cold weather to collect the data.

Most respondents could not fill in the questionnaires because they could not understand it, while those who tried to fill were not exhaustive. They were therefore interviewed and their responses recorded on the questionnaire. This also enhanced probing for further information.

Most respondents could not understand the English language and the interviewers had to translate the questions to their mother tongue or Kiswahili language.

The interviewers had to convince the respondents to get the land register number which was impossible in most cases. There were also challenges getting information on the income levels and sources. Nevertheless, most of the information was obtained.

2.0 Summary of findings

Only 8 households (4.97%) out of the 161 sampled use electricity for lighting, while none use electricity for cooking The main sources of energy used for lighting are kerosene which is used by 94 households comprising 58.9%; followed by firewood -47 households (29.19%); solar 18 households-(11.18%); LPG gas 3 households -(1.86%), and generators –2 households (1.24%). The main source of energy for cooking is fuel wood comprising 96.89% of the households; kerosene -1.24% and LPG Gas -1.24%. The main source of energy for space warming and water heating is firewood (95.65%) and kerosene (1.24%). Decisions on the type of energy to use for lighting are mainly made by husband alone (58.3%); both husband and wife (25.8%); wife alone (15.9%). Decisions on appliances used for cooking are mainly made by husbands (47.7%); wives (32.5%); both husband and wife (19.9%).
Regarding household expenditure on energy for lighting, households using kerosene and firewood spend more than those using electricity. Expenditure on charcoal is also higher than expenditure on electricity.
For respondents who do not have access to electricity, the approximate average distance from the nearest electricity line is 1.6km, with a minimum of 0.1km and a maximum of 6km. 69.7% of the respondents are less that 2km from the electricity line.

The average acreage of land owned by each household is 1.94 acres, with the maximum of 12 acres and a minimum of 0.2 acres. 4.43% of the households sampled own less than 1 acre of land. Over 50% own from 3 and above 5 acres.
Tea is the only cash crop cultivated by the members of the sampled households with 158 out of the 161 households cultivating The average acreage of land under tea is 1.5 acres and tea cultivation is mainly a collective responsibility for both women and men.

Tea contributes an average of Kshs. 53,114/= per year for the sampled households and a minimum of Kshs. 5000/= per year. The highest earnings from tea are up to Kshs. 250,000/= per year. The Majority of the households (65.17%) earn below Kshs. 50,000/= annually. Decisions on cash crop income expenditure are mainly made by both husband and wife (73.72%).

Major food crops cultivated by households are maize, beans, potatoes, *sukumawiki*, cabbages, millet, sweet potatoes, bananas. Others include tomatoes, sorghum, peas, avocadoes, pumpkins, onions and French beans. In most cases, food crops are grown for both subsistence and sale (76.32%).

Average annual earnings for the households growing maize for sale or both sale and subsistence is Kshs. 15,819/=; potatoes - Kshs. 20, 822/=; beans - Kshs. 10,426/=; *sukumawiki* - Kshs.

15,600/=; cabbages - Kshs. 19,117/=. Decisions on how income from food crops is spent are mainly made by both husband and wife comprising 81.63%.

The major livestock types reared are cattle, poultry, sheep, donkeys and goats. Rabbits are reared at a lower scale. 92.5% of the households sampled keep cattle. The main livestock products mentioned are milk (92.3%) manure (4.9%), and meat (2.8%). The average number of cattle per household is 3 animals. Poultry rearing is practiced by 62.1%. The average number of poultry per household is 8 chickens.

Sheep rearing is practiced by 26.7% of the households with the average number of sheep per household being 3. 7.5% of the households are involved in goat rearing with the main products being milk (93.8%) and meat (6.3%). The average number of goats per household is 4.

The average earnings from cattle is Kshs. 22,002/=; poultry Kshs 8,776=; sheep Kshs. 6,843/=; goats is Kshs 9,029/=; donkeys is Kshs. 1,633 with a minimum. The animal products are mainly used for both subsistence and sale (83.22%); subsistence only (12.75%), sale only (4.03%). Decisions on how income from livestock is spent are made by both husband and wife comprising 77.24%.

In addition to farming, most of the members the households sampled engage in various other economic activities ranging from running day casual labour (31.94%); retail businesses (27.08%); running agricultural commodity businesses (23.61%); formal employment (15.97%); and remittances from relatives (1.39%).

Majority of the households (17.32%) earn between Kshs.10, 000/= and 20,000/=; followed by those earning between Kshs. 30,000/= and 50,000/= (15.75%); between Kshs. 20,000/= and 30,000/= (14.96%); below Kshs. 10,000/= (14.96%); between Kshs. 50,000/= and 70,000/=(13.39%); between Kshs. 70,000/= and 110,000/=(7.87%); between Kshs. 110,000/= and 150,000/=(9.45%); above Kshs. 150,000/= (6.30%).

With regard to average overall annual income 37.76% of the households earn between Kshs. 50,000/= and Kshs. 100,000/=; followed by 22.38% earning less than Kshs. 50,000/=; 19.58% earn between Kshs. 100,000/= and Kshs. 150,000/=; 11.19% earn Kshs. 250, 000/= and above; 7.69% earn between Kshs. 150,000/= and Kshs. 200,000/=; 1.40% earn between Kshs. 200,000/= and Kshs. 250,000/=.

The average number of houses per homestead is 3 houses while the average number of rooms per household is 7 rooms. In majority of households the walls are constructed with wood (115 households), mud (40 households), stones (17 households) and iron sheets (4 households). 158 households have houses that are roofed with iron sheets; 8 households have houses roofed with *makuti*/grass; 2 households have houses roofed with bricks.

The most commonly owned electrical appliance is a radio found in 80.75% of the households. In 86.0% of the households radios were bought by men and boys. The radio is mainly located in the sitting room and is mostly used by all family members.

49.07% of the households sampled own a radio cassette player. The radio cassette player is mainly located in the sitting room. 47.83% of the households own a torch; 9.94% of the sampled households own rechargeable batteries; 14.9% of households own a colour TV; 4.35% of households own a video player; 9.32% of the households own black and white televisions; 4.97% own light bulb tube type (fluorescent); 1.24% of the households own an electric iron while 0.62% owns an electric cooker /coil.

With regard to coloured TVs and other electrical appliances (video player, torches, rechargeable batteries, TV black and white, light bulbs, electric iron and cookers), men and boys are mostly involved in their purchase. However husbands and wives are also involved in the purchase of the electrical appliances but in very few cases. All family members mostly have access to and use of all electrical appliances

Men are mostly involved in the purchase of all electrical appliances with very few instances where women alone are involved in the purchase and sometimes together with the husbands.

Women and girls are mainly responsible for firewood collection. The average time spent collecting firewood is 1.8 hrs. Considering that firewood is not only used for cooking by most households but also for lighting and heating, access to electricity will contribute to reduction of drudgery for women and girls. This will also allow more study time for girls and more time for productive activities for women.

Majority of households (66.67%) have noticed change in the type and volume of energy they consume in relation to their family needs, while 33.33% have not noticed any change. Key changes include: demand for energy has increased in the household (48.68%); firewood and kerosene are very expensive (19.74%); high cost of energy sources (10.53%); changed to use of solar bulbs and LPG Gas since they are cheaper (6.58%); time saved to access these energy sources (3.95%); energy not sufficient to cater for family needs (5.26%); shortage of energy sources in the market (2.63%); and collection of firewood takes a lot of time and is tiresome (1.32%).

96.73% of the respondents said they would like to change to a different form of energy while 3.27% said they are satisfied with the kind of energy they are using comprising those already using electricity and some with Solar Home Systems.

Reasons given for not changing to energy type of choice are: electricity is not accessible/ home is far from the transformers (79.82%); electricity is expensive (8.26%); electricity connection fee is too high (7.34%) and lack of electricity connection fees (4.59%)

55.28% of respondents have access to merry go rounds and social networks as a financial facilities while another 31.06% have access to Cooperatives; 17.39% have access to credit from MFIs; and 13.66% have are aware of government funds such as CDF, and LASDAP as financing sources.

With regard to household energy expenditure the average monthly expenditure on energy accounts for a high percentage of the household budget. The average monthly expenditure on electricity for those using is Kshs. 278/= with the minimum being Kshs. 180/= and the maximum Kshs. 500/=. The average monthly expenditure on rechargeable batteries is Kshs. 195/= with the majority of households spending between Kshs. 80/= and Kshs 160/=. Expenditure on firewood is Kshs. 1836/= with the majority of households spending between Kshs. 500/= and Kshs. 3000/= on firewood. Average monthly expenditure on kerosene is Kshs. 453/= with majority of households spend between Kshs. 200/= and Kshs. 500/=.

Expenditure on dry cells on the average is Kshs. 194/= with majority spending between Kshs. 100/= and Kshs. 200/=. Average monthly expenditure on LPG Gas is Kshs. 483/= with majority of households spending Kshs. 100/=. Average monthly expenditure on charcoal is Kshs. 360/= with majority of households spending between Kshs. 250/= and Kshs. 500/=; candles - Kshs. 108/= with majority of households spending Kshs. 100/=.

Average monthly expenditure on solar PV is Kshs. 208/= mainly in the purchase of battery water. Majority of households spend Kshs. 200/=. Expenditure on a generator had only one mention with an amount of Kshs. 2,000/=.

The average number of rechargeable batteries bought by 37 households in the last five years is 2. The cost range was mainly between Kshs. 4001 to Kshs. 5000/= comprising 50.0%; Kshs. 5000 and above (22.5%); Kshs. 3001 to Kshs. 4000/= (12.5%); Kshs. 2001 to Kshs.3000/= (7.5%); Kshs. 2000/= and below (7.5%). Most of the batteries were purchased new (75.0%) and the second hand ones (25.0%). The average distance to the nearest battery charging facility is 1.96 km, with a minimum of 0.2Km and a maximum of 5Km.

The average distance travelled to the nearest market place is 2.08Km, with majority of households travelling between 0.5-4Km; average distance travelled to the nearest hospital is 12.19Km with majority of households travelling between 3- 13Km; the average distance to the Maternity facility is 2.17Km with majority of households travelling between 0.5- 3Km; the average distance to the nearest shopping centre is 1.01Km with majority of households travelling 0.1-2Km. The average distance to the nearest Health Centre/Dispensary is 2.1Km majority of households travelling between 0.5-3Km. The average distance to the nearest water point is 0.563Km with majority of households travelling between 0.1-1Km.

The average distance to the grain mill is 0.572Km with the majority of households travelling between 0.1 and 0.5Km. The average distance to the nearest Primary School is 1.3Km with majority of households travelling between 0.5Km and 2Km. The average distance to the nearest Secondary School is 1.4Km, with majority of households travelling between 0.5-2Km. The average distance to the nearest Church is 0.9Km with majority of households travelling 0.1-1Km.

Majority of households rely on rain water comprising 54.7%; boreholes/wells (24.6%); rivers (19.7%), and dams (1.0%). During the dry season majority rely mainly on rivers comprising 79.8%; boreholes/wells (17.5%); dams (1.1%); rain water (1.1%) and water vendors (0.5%). Responsibility for fetching water falls mainly on women and girls. Water supply mainly runs by

gravity (81.95%).Diesel pump (4.51%) and electricity (13.53%). Typhoid and Cholera are prevalent in this area comprising 11.81%.
Majority of residents (84.93%) feel that local Dispensaries and Health Centres are not well equipped to handle cases of complicated conditions and maternal deliveries. 15.07% of residents said that the local Dispensaries and Health Centres can handle complicated conditions and deliveries. Reasons given to support inability of Dispensaries and Health Centres to handle complicated cases include: not well equipped- lack of proper structures, equipment and facilities; lack of trained personnel to handle the cases; shortage of staff; lack of electricity and poor transport/ roads.

Local Dispensaries and Health Centres mainly use generators (29.49%), electricity (15.38%), pressure lamps (12.82%), and solar energy (0.64%) while 41.67% of the Dispensaries and Health Centres don't use any energy. Local primary Schools use generators (48.34%), pressure lamps (7.95%), electricity (1.99%), solar energy (0.66%), with 41.06% of Primary Schools not using any energy type. Local Secondary Schools mainly use generators (38.71%); electricity (22.58%); pressure lamps (5.81%); with 32.9% of Secondary Schools not using any energy type. Local Churches include generators (67.72%); electricity (2.53%); pressure lamp (1.9%); with 27.85% of Churches not using any energy type.

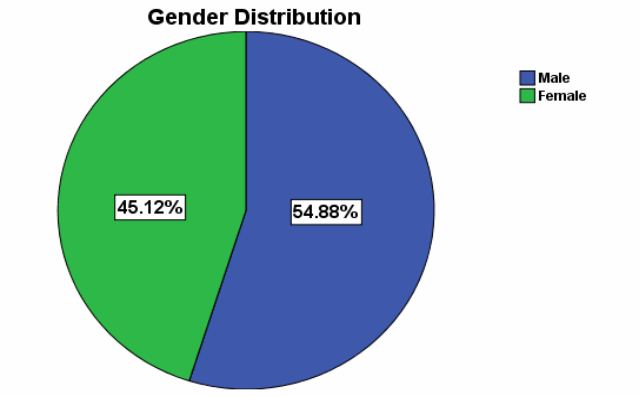
The main businesses operated by respondents include kiosks and canteens, groceries, wholesale shops, barber shops, hair salons, general shops, *jua kali,* boutiques, hotels, butcheries, carpentry shops, grain selling, welding and panel beating, grain milling, vehicle repair, clubs/bars/pubs, video shows, health clinics and chemists, supermarkets and radio/TV repair among others.

For most residents access to electricity would improve livelihoods of people in their community through: making work easier since it will be done by machines (14.4%); reducing cost, time and energy spent in search of services (12.9%); increasing business opportunities (11.4%); creating employment opportunities (9.4%); improvement of infrastructure (8.0%); improving peoples overall economic base (6.4%); environmental conservation/sanitation (6.4%); making people more enlightened e.g. viewing TV and using computers (4.0%); improving *jua kali* sector (4.0%); improving lighting in homes (3.8%); improvement of markets (3.5%); improvement of agriculture (3.5%); improvement of Schools (3.2%); improvement of Hospitals and dispensaries (2.7%); improvement of factory (2.4%); improving security in homes and market centres (1.6%); establishment of electrical services (2.7%); increasing working hours since people can work day and night (0.5%); and reduction of stress due to listening to music (0.5%).

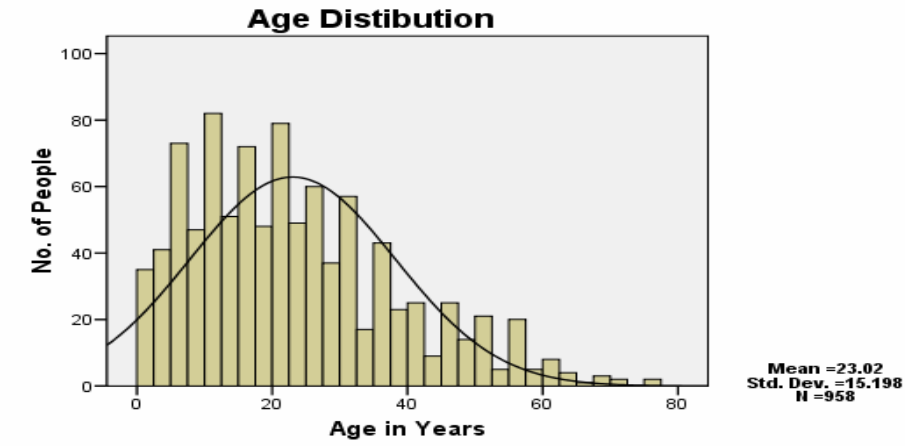
3.0 Survey findings

3.1.1 Household characteristics

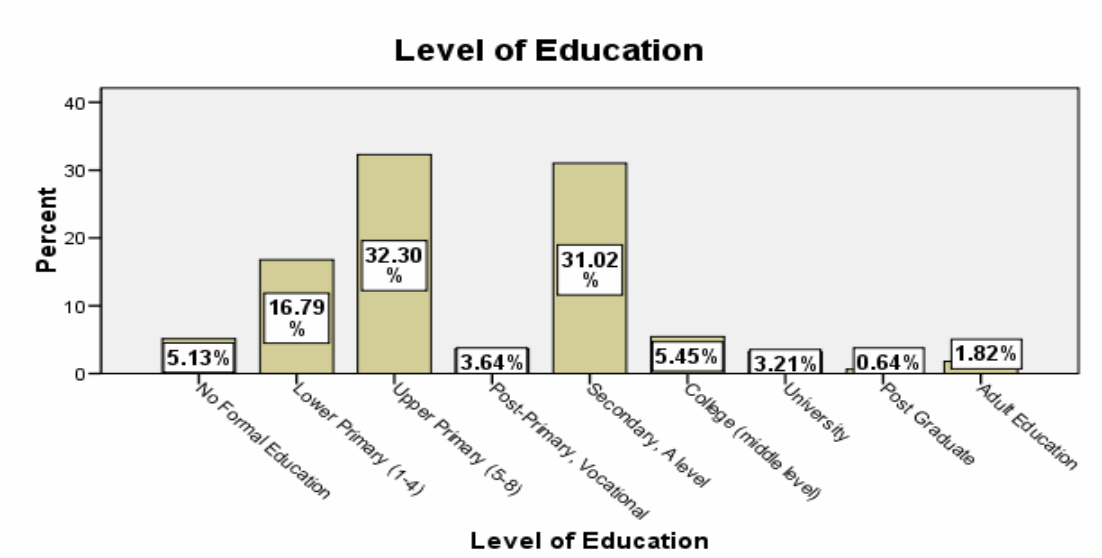
The mean household size is 6 people per household with an almost equal gender distribution of males and females with 54.88% and 45.12% respectively.



The average age of the population in the target area is 23.02 years with the majority being children and teenagers between ages 5-19 years followed by those between 20 and 35 years. The elderly make up a small part of the population as shown in the histogram below.



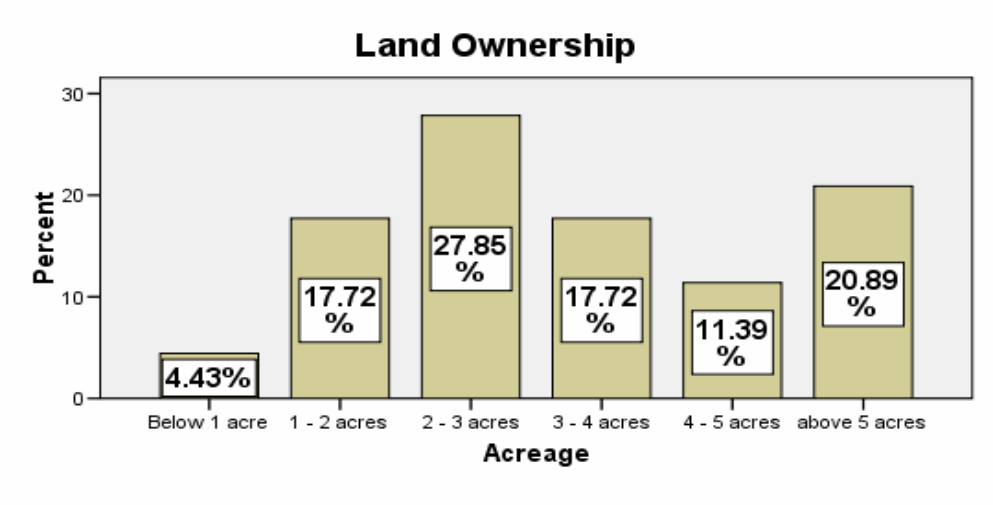
The current education level of the majority of the people in the community is Upper Primary comprising 32.30%, followed by Secondary and A-Level (31.02%); Lower Primary (16.79%), and College (5.45%). About 5.13% of the population have no formal education, 3.64% have post-primary education, 3.21% university, 1.82% adult education while 0.64% have post graduate education.



The majority of the population are students comprising 44.9 % of the sampled households while 33.3% are farmers. Other occupations include running businesses (2.4%), casual workers (1.3%), teachers (1.0%), self-employed (0.9%), retired (0.5%), housekeepers (0.3%), Doctors (0.3%), Drivers (0.3%), Tea pickers (0.2%), Engineer (0.2%), Public Health Officers (0.2%), watchmen (0.2%), carpenters (0.1%), coffee clerks (0.1%), preachers (0.1%), electricians (0.1%), managers (0.1%) and journalists (0.1%). 6.6% are unemployed while about 6.4% did not specify their employment status.

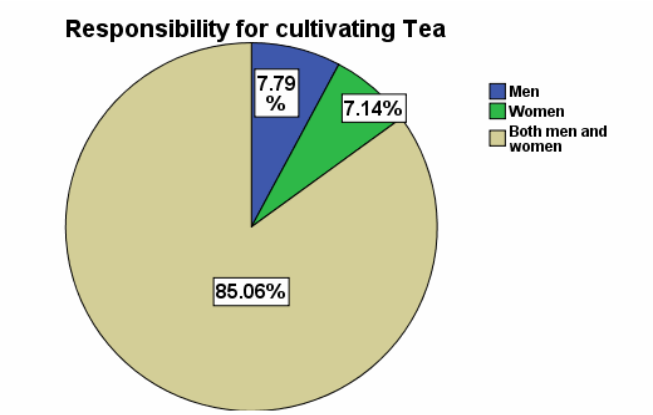
3.1.2 Household income/assets

The average acreage of land owned by each household is 1.94 acres, with the maximum of 12 acres and a minimum of 0.2 acres. 4.43% of the households sampled own less than 1 acre; 17.72% own between 1-2 acres; 27.85% own between 2-3 acres; 17.72% own 3-4 acres; 11.39% own 4-5 acres and 20.89% own above 5 acres.



Tea is the only cash crop cultivated by the members of the households sampled with 158 out of the 161 households cultivating.

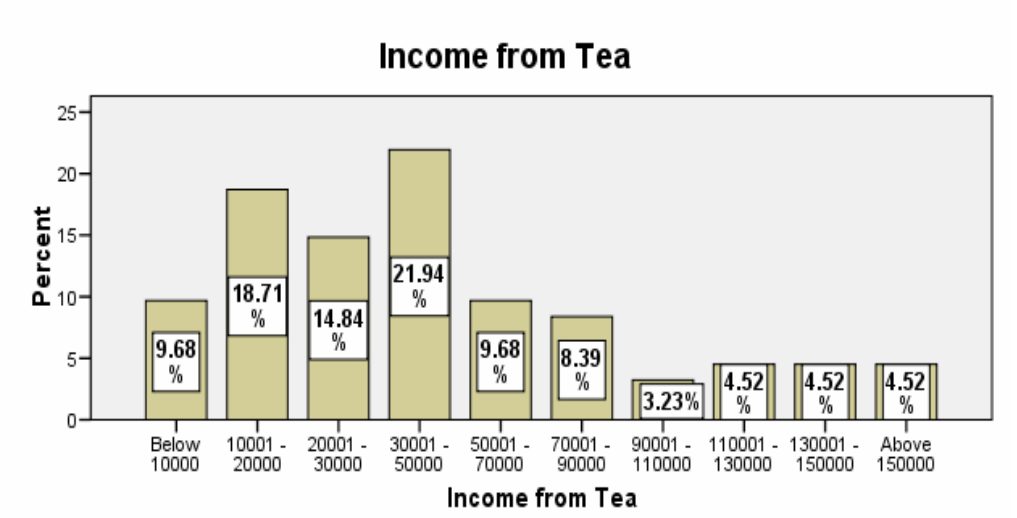
The average acreage of land under tea is 1.5 acres; the largest acreage under tea is 8 acres, while the minimum is 0.25 of an acre. The majority cultivate between 0.5-3 acres of land. Tea cultivation is a collective responsibility for both women and men most of the times (85.06%), while in a few instances only men cultivate (7.79%) and women alone (7.14%).



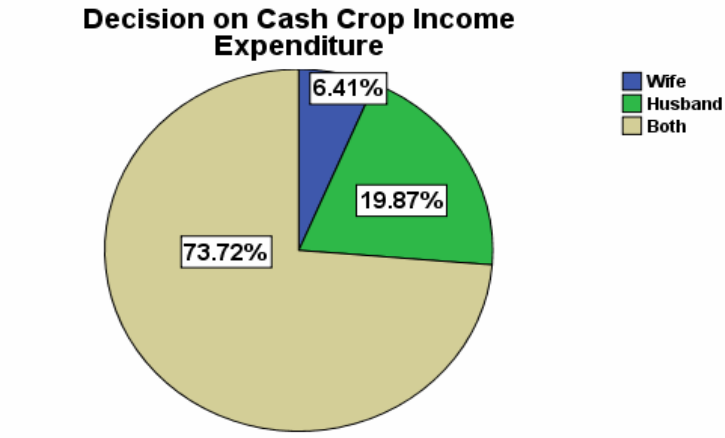
3.13 Cash crop income

Tea contributes an average of Kshs. 53,114/= per year for the sampled households and a minimum of Kshs. 5000/= per year. The highest annual earnings from tea are up to Kshs. 250,000/=.

4.52% of the households earn above Kshs. 150,000/=annually; 4.52% earn between Kshs. 130,000/= and Kshs. 150,000/=; 4.52% earn between Kshs. 110,000/= and Kshs. 130,000/=; 3.23% earn between Kshs. 90,000/= and Kshs. 110,000/=; 8.39% earn between Kshs. 70,000/= and Kshs. 90,000/=; 9.68% earn between Kshs. 50,000/= and Kshs. 70,000/=; 21.94% earn between Kshs. 30,000/= and Kshs. 50,000/=; 14.84% earn between Kshs. 20,000/= and Kshs. 30,000/=; 18.71% earn between Kshs. 10,000/= and Kshs. 20,000/= and 9.68% earn below Kshs. 10,000/=.



Decision making on use of income from cash crops is mainly made by both husband and wife (73.72%). In 19.87% and 6.41% the decisions are made by husband and wife respectively.



3.1.4 Food crops

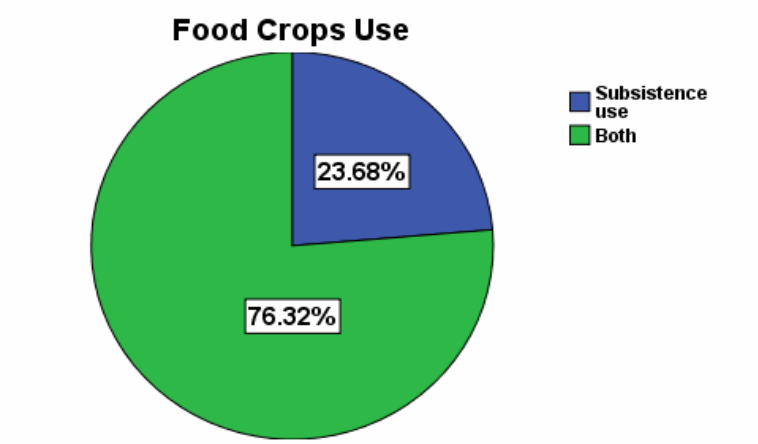
The major food crops cultivated by households sampled are maize, beans, potatoes, *sukumawiki*, cabbages, millet, sweet potatoes, and bananas. Others include tomatoes, sorghum, peas, avocadoes, pumpkins, onions and French beans.

Maize is the main food crop cultivated by the majority of the respondents (144 households) followed by beans cultivated by 130 households and potatoes (129 households), *sukumawiki* (39 households) and cabbages (30 households).
Both men and women are involved in the cultivation of all the food crops. A larger percentage of women are however involved in cultivation.

Food crops grown

Crop	Frequency HHs	Total HHs	Percent %
Maize	144	161	89.44
Bananas	13	161	8.07
Beans	130	161	80.75
Avocadoes	4	161	2.48
Potatoes	129	161	80.12
Sweet potatoes	13	161	8.07
Pumpkins	2	161	1.24
Cabbages	30	161	18.63
Millet	19	161	11.80
Sukumawiki	39	161	24.22
Onions	1	161	0.62
Tomatoes	8	161	4.97
Sorghum	5	161	3.11
French peas	1	161	0.62
Peas	6	161	3.73

In most cases food crops are grown for both subsistence and sale (76.32%). 23.68% of the crops are grown purely for subsistence.



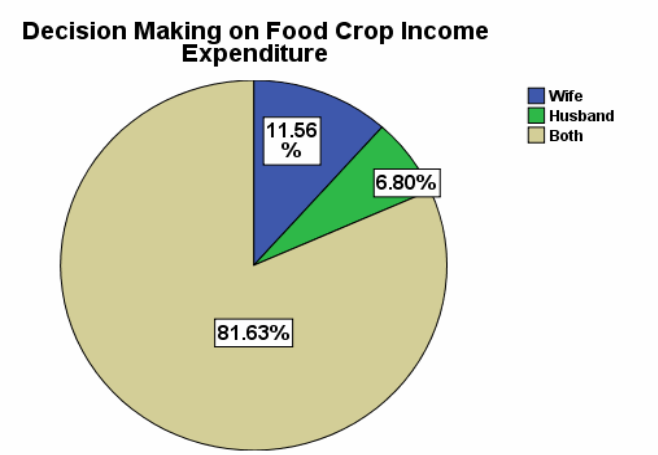
3.1.5 Incomes from major food crops

Average annual earnings for the 117 households who grow maize for sale or both sale and subsistence is Kshs. 15,819/=; 106 households growing potatoes - Kshs. 20, 822/=; 103 households who grow beans - Kshs. 10,426/=; 23 households growing *sukumawiki* - Kshs. 15,600/=; 23 households growing cabbages - Kshs. 19,117/=. More details are provided in the table below.

Average annual household income from food crops (in Kshs.)

Food crop	No of HHs	Minimum (Kshs)	Maximum (Kshs)	Average (Kshs)
Maize	117	1400	90000	15818.51
Bananas	4	1000	20000	12750.00
Beans	103	1000	70000	10426.12
Potatoes	106	1500	68000	20822.08
Sweet potatoes	6	1400	25000	9066.67
Pumpkins	1	15000	15000	15000.00
Cabbages	23	1000	120000	19117.39
Millet	7	1000	20000	9571.43
Sukumawiki	23	1000	15600	4939.13
Tomatoes	7	2500	20000	8214.29
Sorghum	1	1500	1500	1500.00
Peas	2	5000	10000	7500.00

Decisions on expenditure on income from food crops are mainly made by both husband and wife comprising 81.63%. Wives alone however make decisions more often than husbands alone (11.56% and 6.80% respectively).



3.1.5 Livestock incomes

The major types of livestock reared are cattle, poultry, sheep, donkeys and goats. Rabbits are reared at a lower scale. 92.5% of the households sampled keep cattle. The main livestock products mentioned are milk (92.3%) manure (4.9%), and meat- (2.8%). The average number of cattle per household is 3 animals, with the highest being 15 animals and the lowest 1 animal.

Poultry rearing is practiced by 62.1% with the main products mentioned being eggs (80.0%), meat (20.0%). The average number of poultry per household is 8 chickens with the maximum being 30 chickens and the minimum 1 chicken.

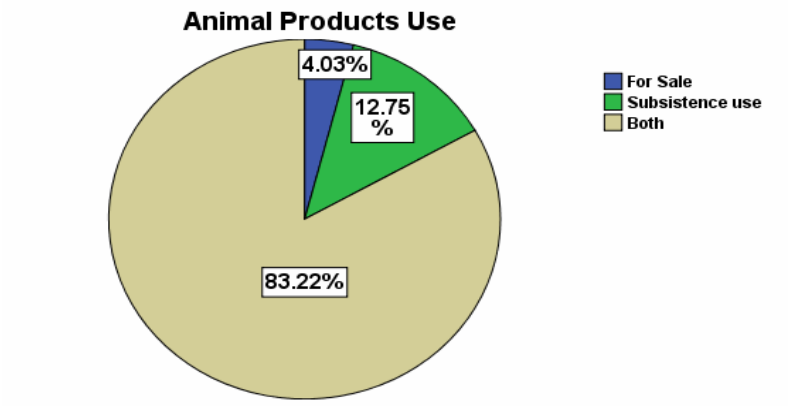
Sheep rearing is practiced by 26.7% of the households sampled with the main products being wool (57.9%), meat (26.3%), milk (10.5%) and manure (5.3%). The average number of sheep per household is 3 sheep with the highest number being 5 and the lowest 1.

7.5% of the households are involved in goat rearing with the main products being milk (93.8%) and meat (6.3%). The average number of goats per household is 4 with the highest number being 10 goats and the lowest 2. Donkey rearing is practiced by 14.9% of the households with each keeping only one donkey. Only 1 household rears rabbit with only one rabbit.

Average number of animals per household

Animals	No of HHs	Minimum No.	Maximum No.	Average No.
Cattle	146	1	15	3
Sheep	41	1	5	3
Goats	9	2	10	4
Poultry	100	1	30	8
Donkeys	24	1	1	1
Rabbits	1	1	1	1

The animal products are mainly used for both subsistence and sale (83.22%); subsistence only (12.75%), sale only (4.03%)



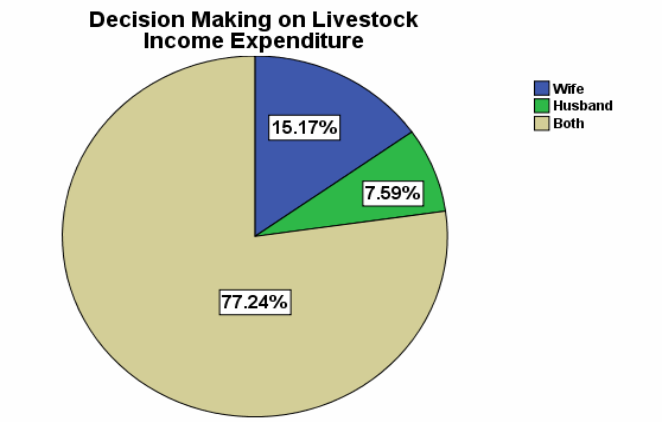
The average earnings for 130 households from cattle is Kshs. 22,002/=, the lowest being Kshs. 1000/= and the highest Kshs. 120,000/=. Average earnings for 84 households from poultry is Kshs 8,776= with a minimum of Kshs. 500/= and a maximum of Kshs.42, 000/=. 22 households earn an average of Kshs. 6,843/= from sheep with the minimum being Kshs. 550/= and the maximum being Kshs. 30,000/=. Average earnings for 7 households from goats is Kshs 9,029/= with a minimum of Kshs. 2000/= and a maximum of Kshs.20, 000/=. Average earnings from 6 households from donkeys is Kshs. 1,633 with a minimum of Kshs. 200 and a Maximum of Kshs. 5,000/=.

Average Income from sale of livestock and products

Livestock/products	No. of HHs	Minimum (Kshs)	Maximum (Kshs)	Average (Kshs)
Cattle/Products	130	1000	120000	22001.77
Sheep/Products	22	550	30000	6843.18
Goats/Products	7	2000	20000	9028.57
Poultry/Products	84	500	42000	8776.43

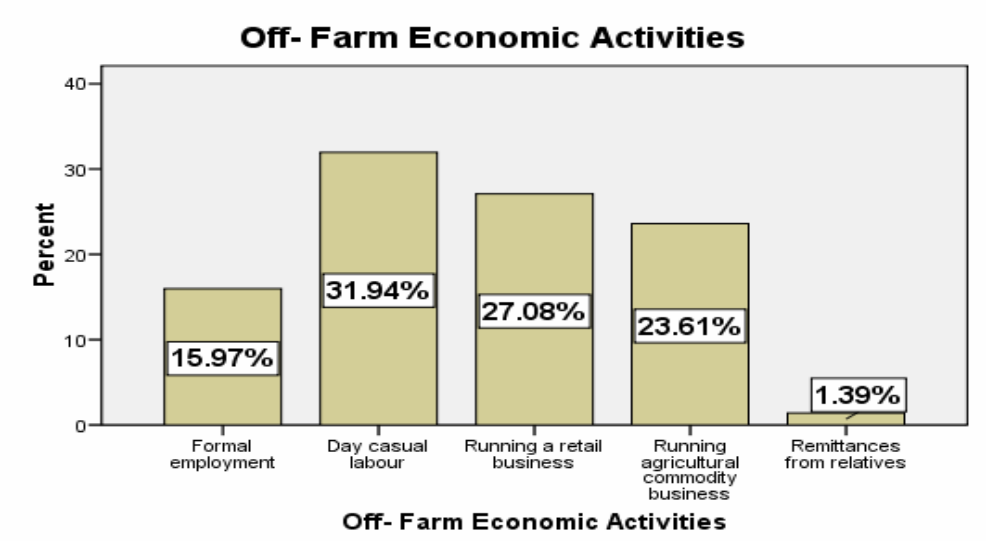
Donkeys/Products	6	200	5000	1633.33

Decisions on how income from livestock is spent are made by both husband and wife (77.24%); wife only (15.17%); husband only (7.59%).



3.1.7 Off-farm economic activities

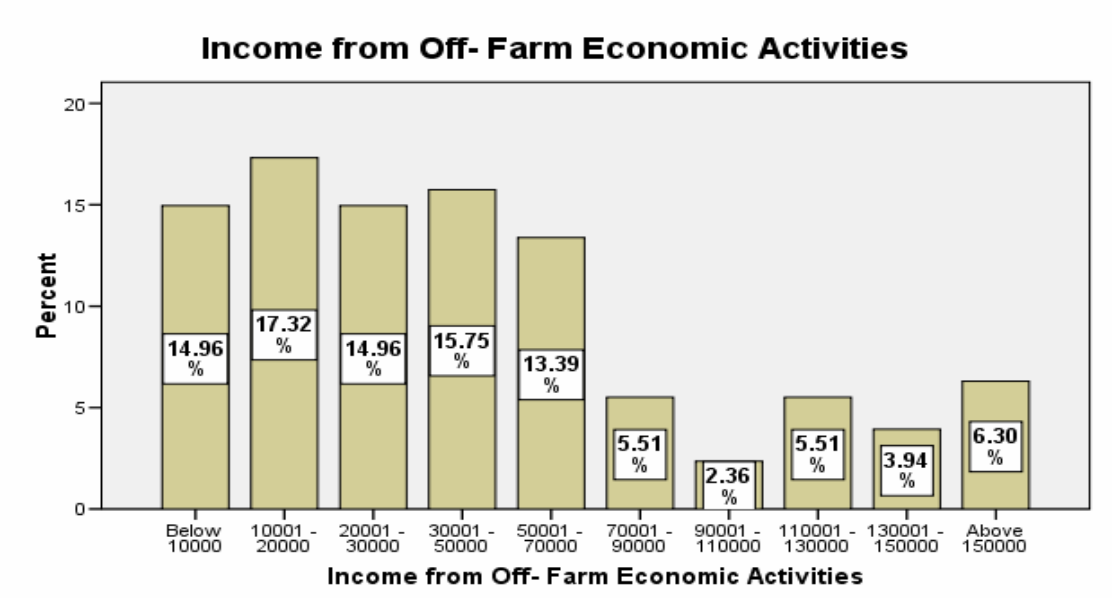
In addition to farming most of the members the households engage in various other economic activities ranging from running day casual labour (31.94%); retail businesses (27.08%); running agricultural commodity businesses (23.61%); formal employment (15.97%); and remittances from relatives (1.39%).



Average earnings per year are Kshs. 56,816/=, with minimum of Kshs. 2000/= and a maximum of Kshs. 300,000/=

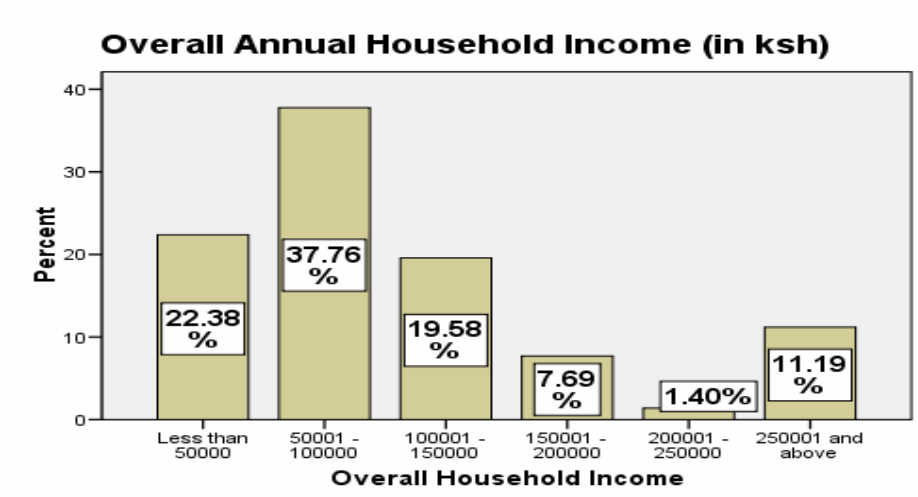
Majority of the households interviewed earn between Kshs.10, 000/= and 20,000/= (17.32%); followed by those earning between Kshs. 30,000/= and 50,000/= (15.75%); between Kshs. 20,000/= and 30,000/= (14.96%); below Kshs. 10,000/= (14.96%); between Kshs. 50,000/= and

70,000/=(13.39%); between Kshs. 70,000/= and 110,000/=(7.87%); between Kshs. 110,000/= and 150,000/=(9.45%); above Kshs. 150,000/= (6.30%); More details can be seen in the graph below.



3.1.8 Overall Household Income

37.76% of the sampled households earn an average overall annual income of between Kshs. 50,000/= and Kshs. 100,000/=; followed by 22.38% earning less than Kshs. 50,000/=; 19.58% earn between Kshs. 100,000/= and Kshs. 150,000/=; 11.19% earn Kshs. 250, 000/= and above; 7.69% earn between Kshs. 150,000/= and Kshs. 200,000/=; 1.40% earn between Kshs. 200,000/= and Kshs. 250,000/=. More details are shown in the graph below.



3.1.9 Housing

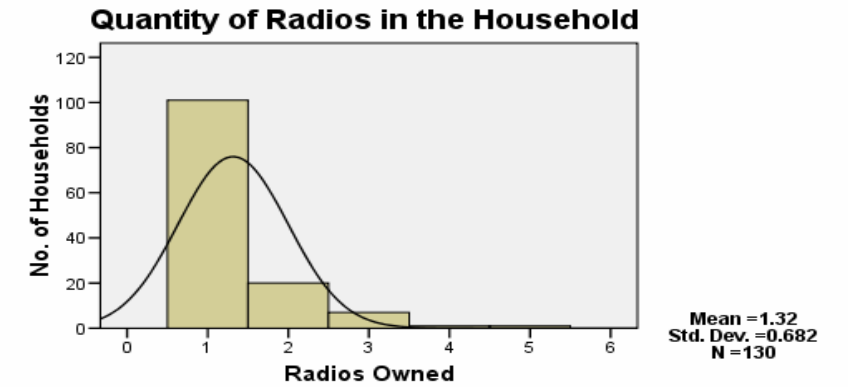
The average number of houses per homestead is 3 houses with a minimum of 1 house and a maximum of 8 houses. The average number of rooms per household is 7 rooms with the lowest being 1 room and the highest being 21 rooms.

Out of the 161 households interviewed, the walls are constructed with wood (115 households), mud (40 households), stones (17 households) and iron sheets (4 households).

158 households have houses that are roofed with iron sheets; 8 households have houses roofed with *makuti*/grass; 2 households have houses roofed with bricks.

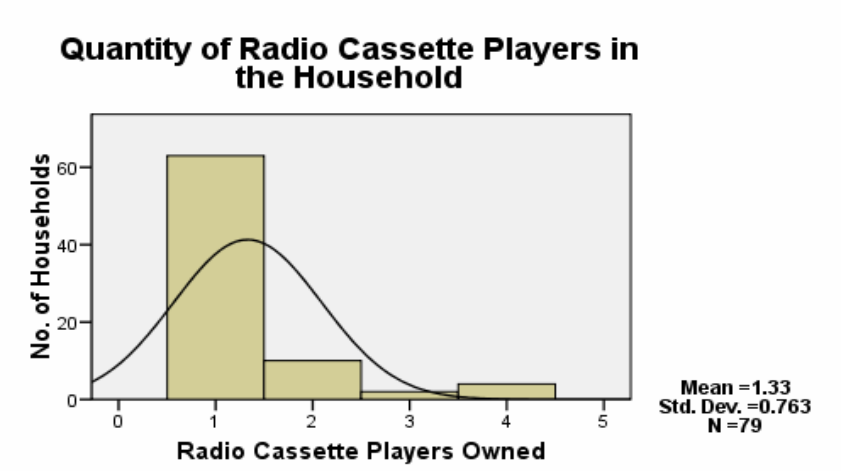
3.1.10 Ownership of electrical equipment

The most commonly owned electrical appliance is a radio representing (80.75%) of the households. The average number of radios per household is 1 radio, a minimum of 1 and a maximum of 5. In 86.0% of the households radios were bought by men and boys; 7.8% were bought jointly by husband and wife and in only 5.4% of the households radios were bought by women and girls.



The radio is mostly used by all family members comprising 75.2% of the sampled households; men and women- 12.0%; men and boys-9.4%; women alone – 1.7%; women and girls – 0.9%; girls and boys – 0.9%.

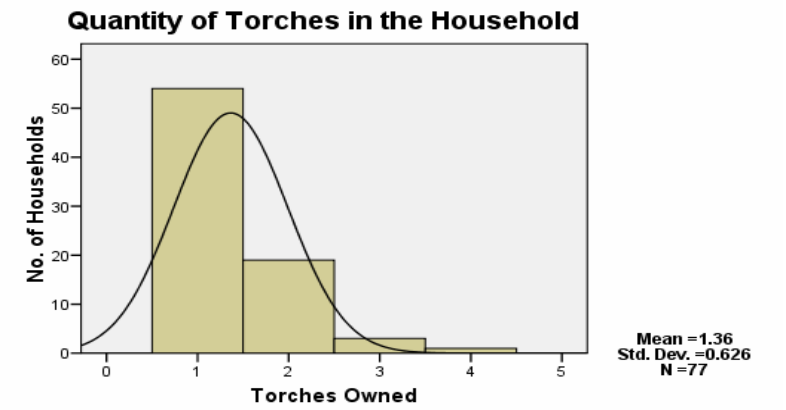
The radio is located in the sitting room in 83.1% of the households; in 13.7% of the households the radio is located in the bedroom and 3.2% in the kitchen. 49.07% of the households sampled own a radio cassette player with the average number being 1 per household, the minimum 1 and maximum 4.



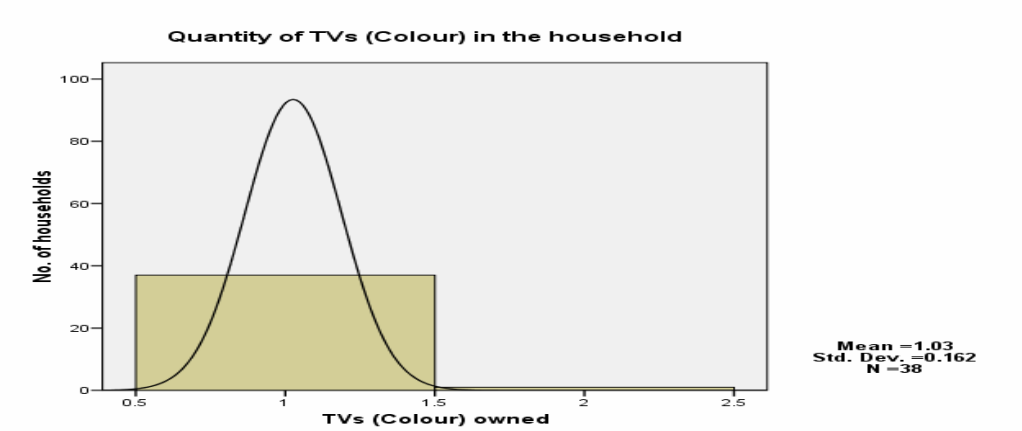
Radio cassette players are bought by men and boys in most households comprising 87.7%; followed by both husband and wife- 9.6%; men and girls -2.7%.

In majority of the households the radio cassette is used by all family members comprising 84.1%; men and boys -5.8%; women and girls – 4.3%; girls and boys- 2.9%; men and women- 1.4%; women alone – 1.4%. The radio cassette player is mainly located in the sitting room in 86.5% of the sampled households; bedroom- 13.5%.

47.83% of the households own a torch with the average being 1 torch; the minimum being 1 torch and the maximum being 4 torches.

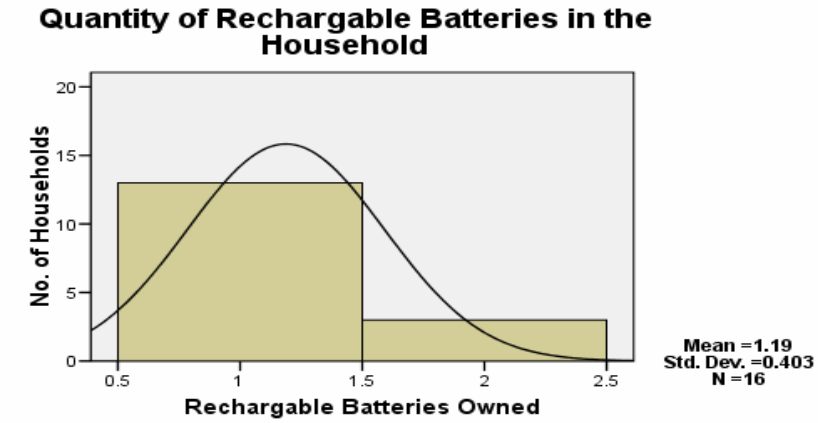


In most cases torches are bought by men and boys comprising 86.3%; women and girls – 5.5%; both husband and wife – 4.1%; all family members- 4.1%. Torches are mostly used by all household members comprising 70.7% of the households; boys and men 10.7%; husbands and wives- 6.7%; women and girls-6.7%; boys and girls- 2.7%, women alone-2.7%. Torches are located in the bedroom in 40.0% of the households; 30.8% in all rooms; 26.2% - sitting room and only 1.5% in the kitchen. 14.9% of households own a colour TV, the average being 1 TV, minimum of 1 and a maximum of 2.



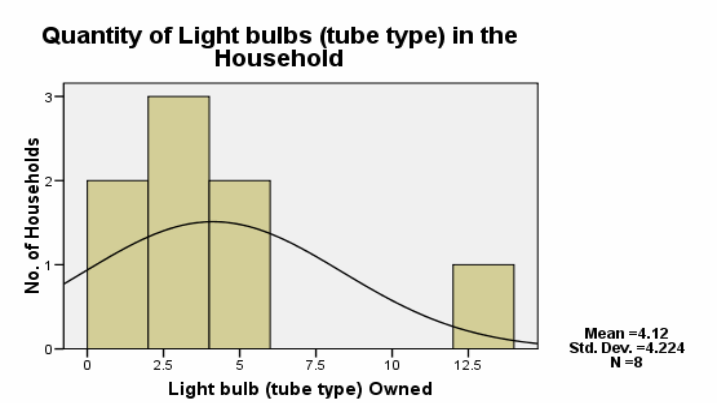
With regard to coloured TVs and other electrical appliances (video player, rechargeable batteries, TV black and white, light bulbs, electric iron and cookers), men and boys are mostly involved in their purchase. However husbands and wives are also involved in the purchase but in very few cases.

9.94% of the sampled households own rechargeable batteries with an average of 1 battery per household, a minimum of 1 and a maximum of 2.

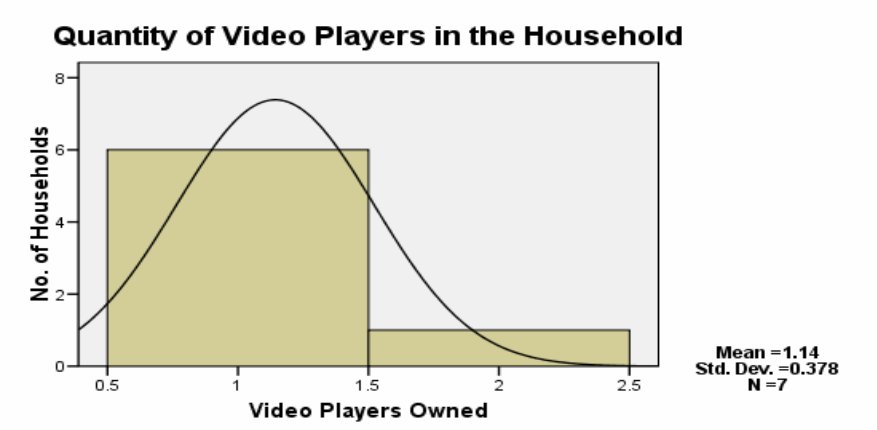


9.32% of the households own one black and white television each.

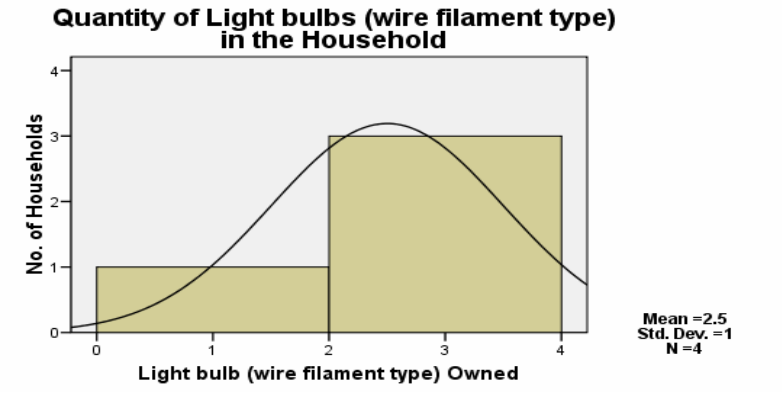
4.97% of the sampled households own light bulbs (fluorescent); the average being 4, minimum of 1 and maximum of 14.



4.35% of households own a video player with the maximum of 2, a minimum of 1 and an average of 1.



2.5% of the sampled households own light bulbs (filament type) with the average being 3, minimum of 1 and maximum of 3.



1.24% of the households own an electric iron with each household owning only one while 0.62% owns an electric cooker /coil with one cooker. With regard to use of electrical appliances, all family members mainly have access to and use of all appliances.

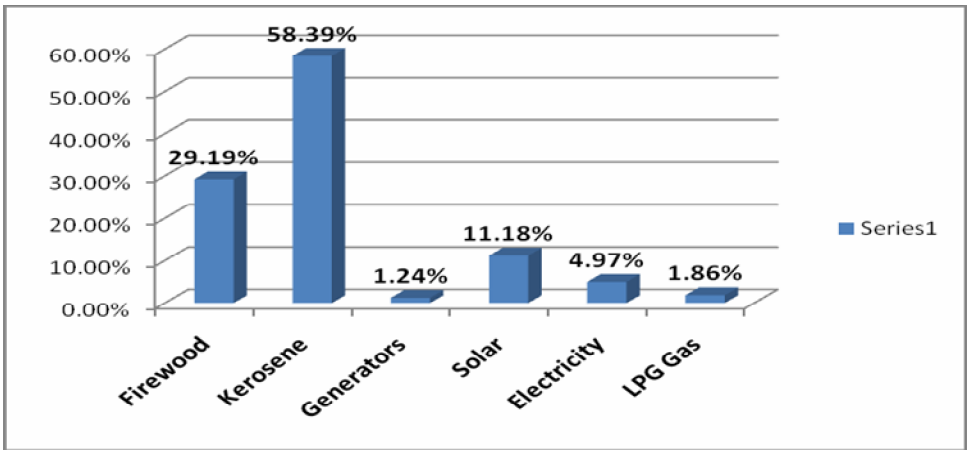
Most appliances are located in the sitting room in most households, very few in the bedroom with the exception of the electric iron and the electric cooker/ coil. The electric iron is located in the bedroom in all cases while the electric cooker is located in the kitchen.

3.1.11 Energy and energy services

The main types of energy for lighting in the sampled households are kerosene which is used by 94 households comprising (58.39%); firewood -47 households (29.19%); solar 18 households-(11.18%); electricity 8 households (4.97%), LPG gas 3 households (1.86%); and generators –2 households (1.24%).

Main sources of energy for lighting

Energy type	No. of HHs	Total HHs	Percent (%)
Firewood	47	161	29.19
Kerosene	94	161	58.39
Generators	2	161	1.24
Solar	18	161	11.18
Electricity	8	161	4.97
LPG Gas	3	161	1.86

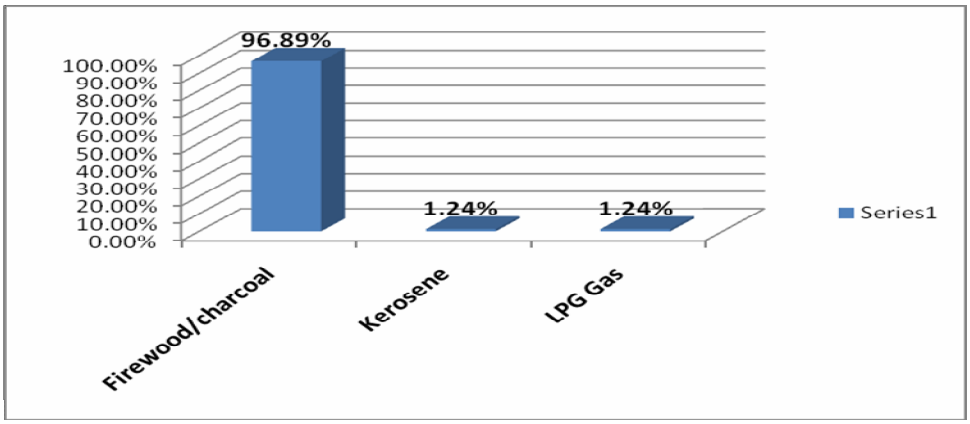


Decisions on the type of energy to use for lighting are mainly made by husband alone (58.3%); both husband and wife (25.8%); wife alone (15.9%). The lighting is mainly located in the sitting room, bedroom and kitchen with 81.37%, 14.91% and 29.81% of households respectively. Only 1.24% of households have outside security lights.

The main source of energy for cooking is fuel wood comprising 96.89% of the households; kerosene -1.24% and LPG Gas -1.24%.

Main source of energy for cooking

Energy type	No. of HHs	Total HHs	Percent (%)
Firewood/charcoal	156	161	96.89
Kerosene	2	161	1.24
LPG Gas	2	161	1.24

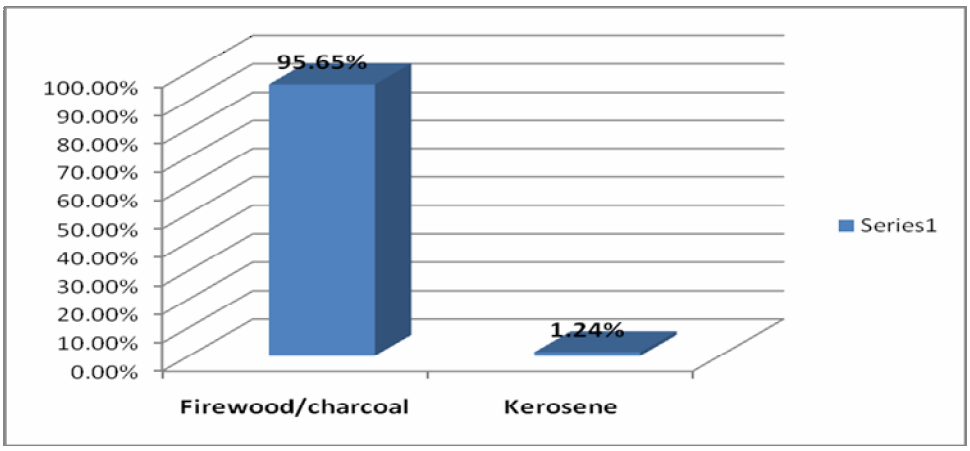


Decisions on appliances used for cooking are mainly made by husbands (47.7%); wives (32.5%); both husband and wife (19.9%).

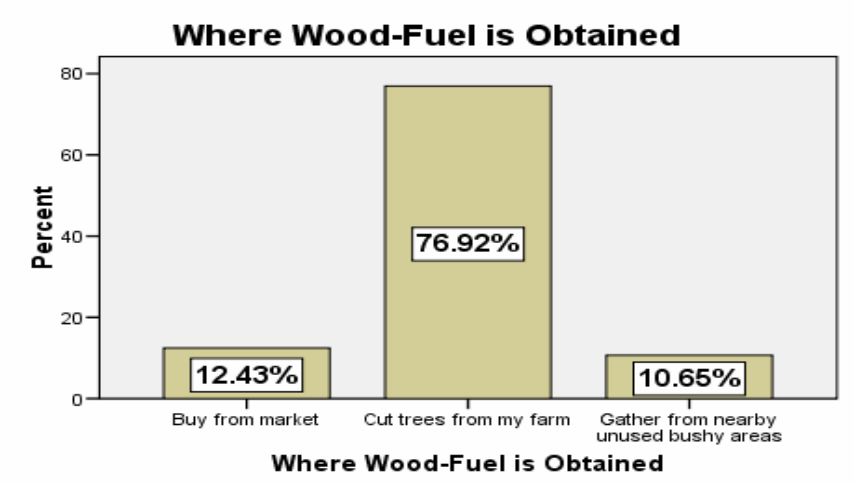
The main source of energy for space warming and water heating is firewood (95.65%) and kerosene (1.24%).

Main sources of energy for warming

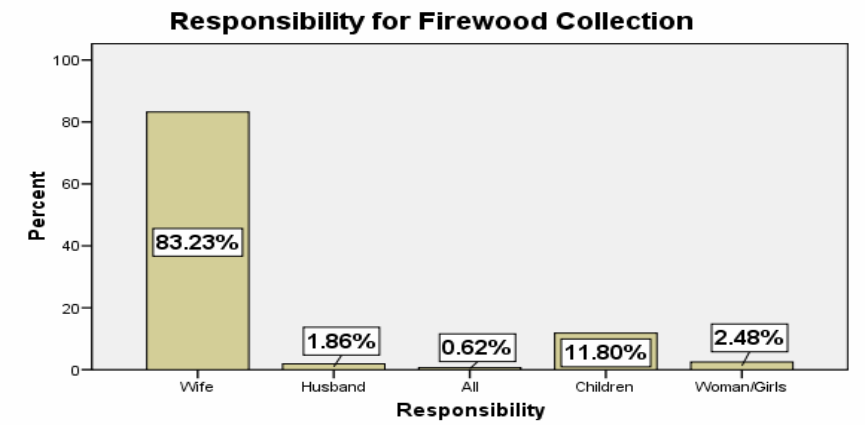
	Frequency	Total HHs	Percent (%)
Firewood/charcoal	154	161	95.65
Kerosene	2	161	1.24



Majority of respondents obtain wood fuel from trees in their own farms (76.92%); buying from the market (12.43%); gathering from nearby unused bushes (10.65%).



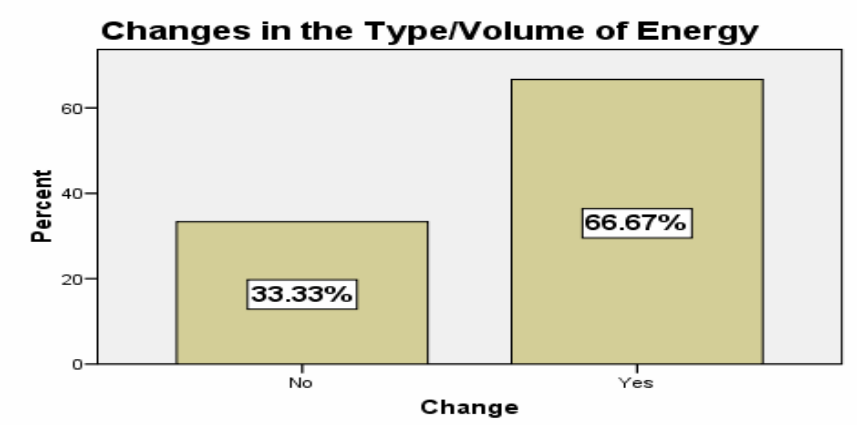
Women are mainly involved in collecting firewood (83.23%); followed by women and girls (2.48%); men (1.86%); children (11.80%): all family members (0.62%).



The average time spent collecting firewood is 1.8 hrs with a minimum of 0.08hrs and a maximum of 4hrs.

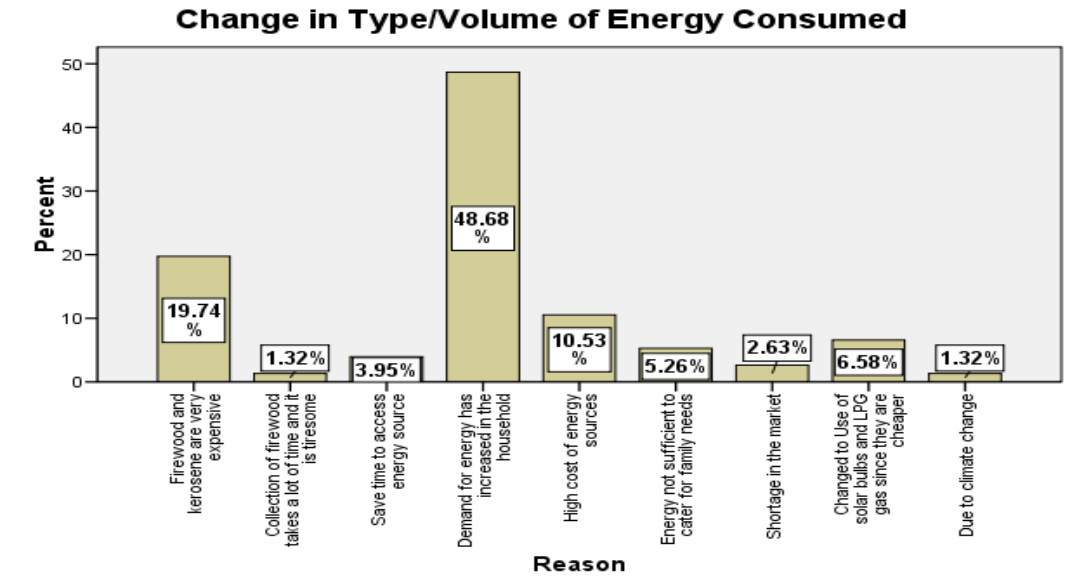
For respondents who do not have access to electricity, the approximate average distance from the nearest electricity line is 1.6km, with a minimum of 0.1km and a maximum of 6km. 69.7% of the respondents are less that 2km from the electricity line.

Majority of households (66.67%) have noticed change in the type and volume of energy they consume in relation to their family needs, while 33.33% have not noticed any change.

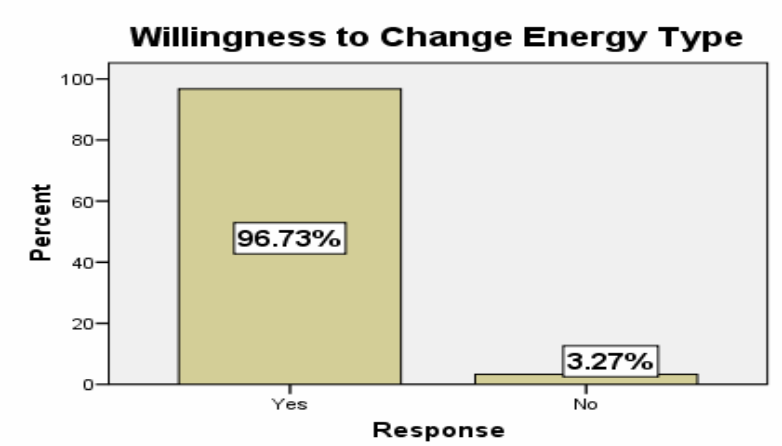


Changes include:

- Demand for energy has increased in the household (48.68%)
- Firewood and kerosene are very expensive (19.74%)
- High cost of energy sources (10.53%)
- Changed to use of solar bulbs and LPG Gas since they are cheaper (6.58%) which saves time to access energy sources (3.95%)
- Energy is not sufficient to cater for family needs (5.26%)
- Shortage of energy sources in the market (2.63%)
- Collection of firewood takes a lot of time and is tiresome (1.32%)
- Due to climate change (1.32%)

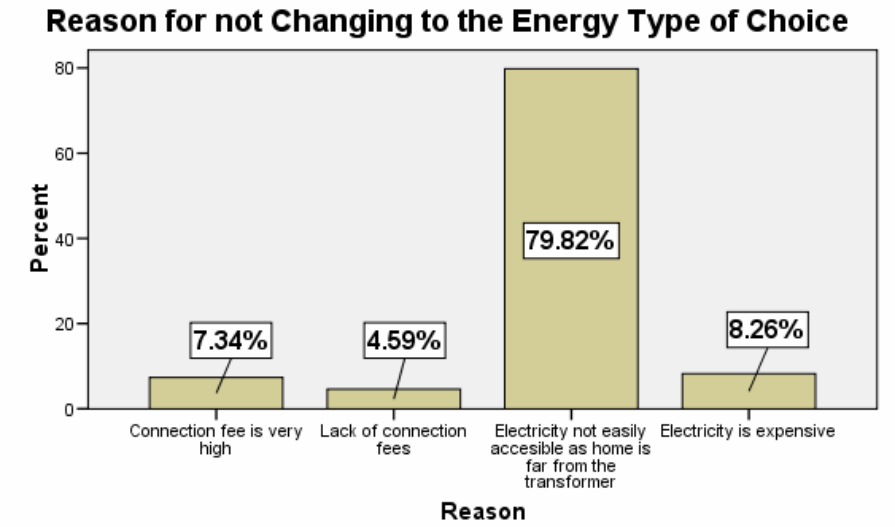


96.73% of the respondents would like to change to a different form of energy while 3.27% are satisfied with the kind of energy they are using comprising those already using electricity and some with Solar Home Systems.



Reasons given for not changing to energy type of choice are:

- Electricity is not accessible/ home is far from the transformers (79.82%)
- Electricity is expensive (8.26%)
- Electricity connection fee is too high (7.34%)
- Lack of electricity connection fees (4.59%)



3.1.12 Monthly energy expenditure

The average monthly expenditure on electricity for those using is Kshs. 278/= with the minimum being Kshs. 180/= and the maximum Kshs. 500/=. The average monthly expenditure on rechargeable batteries for the households using is Kshs. 195/= with a minimum of Kshs. 40/= and a maximum of Kshs. 500/=. The majority of households spend between Kshs. 80/= and Kshs 160/=.

Expenditure on firewood for households using is Kshs. 1836/= with the minimum being Kshs. 100/= and the maximum being Kshs. 6000/=. Majority of households spend between Kshs. 500/= and Kshs. 3000/= on firewood. Average monthly expenditure on kerosene is Kshs. 453/= with a

minimum of Kshs. 80/= and a maximum of Kshs. 1300/=. Majority of households spend between Kshs. 200/= and Kshs. 500/=.

Household expenditure on energy

Energy type	No. of HHs	Minimum (Kshs)	Maximum (Kshs)	Average (Kshs)
Electricity	8	180	500	277.50
Battery charging	25	40	500	194.80
Firewood	110	100	6000	1836.43
Kerosene	135	80	1300	452.89
Dry cells	98	50	600	193.90
Gas	6	100	1600	483.33
Charcoal	58	100	600	360.34
Candle	6	50	200	108.33
Solar PV	6	100	300	208.33
Generators	1	2000	2000	2000.00

Expenditure on dry cells on the average is Kshs. 194/= with a minimum of Kshs. 50/= and a maximum of Kshs. 600/=. Majority spend between Kshs. 100/= and Kshs. 200/=. Average monthly expenditure on LPG Gas is Kshs. 483/= with a minimum of Kshs. 100/= and a maximum of Kshs. 1600/=. Majority of households spend Kshs. 100/=.

Average monthly expenditure on charcoal is Kshs. 360/= with a minimum of Kshs. 100/= and a maximum of Kshs. 600/=. Majority of households spend between Kshs. 250/= and Kshs. 500/=. Average monthly expenditure on candles is Kshs. 108/= with a minimum of Kshs. 50/= and a maximum of Kshs. 200/=. Majority of households spend Kshs. 100/=.

Average monthly expenditure on solar PV is Kshs. 208/= mainly in the purchase of battery water. Majority of households spend Kshs. 200/=. Expenditure on generators which had only one mention is Kshs. 2,000/=.

The average number of rechargeable batteries bought by 37 households in the last five years is 2, with a minimum of 1 and a maximum of 4. The cost range was mainly between Kshs. 4001 to Kshs. 5000/= comprising 50.0%; Kshs. 5000 and above (22.5%); Kshs. 3001 to Kshs. 4000/= (12.5%); Kshs. 2001 to Kshs.3000/= (7.5%); Kshs. 2000/= and below (7.5%).

Most of the batteries were purchased new (75.0%) with 25.0% purchased second hand. The average distance to the nearest battery charging facility is 1.96 km, with a minimum of 0.2Km and a maximum of 5Km.

3.1.13 Social and other amenities

The average distance to the nearest market place is 2.08Km, the minimum being 0.1Km and the maximum 8Km. Majority of households travel between 0.5-4Km to the nearest market place.

Average distance to the nearest hospital is 12.19Km with the minimum of 2.5Km and a maximum of 33Km. Majority of households travel between 3- 13Km.

Average distance to the Maternity facility is 2.17Km, minimum of 0.1Km and a maximum of 8Km. Majority of households travel between 0.5- 3Km. The average distance to the nearest Shopping centre is 1.01Km, with a minimum of 0.1Km and a maximum of 4.10Km. Majority of households travel 0.1-2Km.

The average distance to the nearest Health Centre/Dispensary is 2.1Km with a minimum of 0.1Km and a maximum of 6Km. Majority of households travel between 0.5-3Km. The average distance to the nearest water point is 0.563Km with a minimum of 0.03Km a maximum of 3Km. Majority of households travel between 0.1-1Km.

Average distance to the grain mill is 0.572Km with the minimum of 0.1Km and a maximum of 2Km. The majority of households travel between 0.1 and 0.5Km. The average distance to the nearest Primary School is 1.3Km with a minimum of 0.1Km and a maximum of 7Km. Majority of households travel between 0.5Km and 2Km.

The average distance to the nearest Secondary School is 1.4Km, with the minimum being 0.1Km and the maximum of 5Km. Majority of households travel between 0.5-2Km.
The average distance to the nearest church is 0.9Km with the minimum 0.1Km and a maximum of 6Km. Majority of households travel 0.1-1Km to the nearest Church.

Average distance in kilometres to the nearest social amenity

Social Amenity	No. of HHs	Minimum (km)	Maximum (km)	Average (km)
Market place	153	0.10	8.00	2.0804
Hospital	149	2.50	33.00	12.1872
Maternity facility	134	0.10	8.00	2.1746
Shopping centre	148	0.10	4.10	1.0135
Health centre/ dispensary	147	0.10	6.00	2.0912
Water point	147	0.030	3.000	0.56313
Grain mill	148	0.10	2.00	0.5720
Primary school	151	0.10	7.00	1.2632
Secondary school	143	0.10	5.00	1.3570
Church	126	0.10	6.00	0.9135

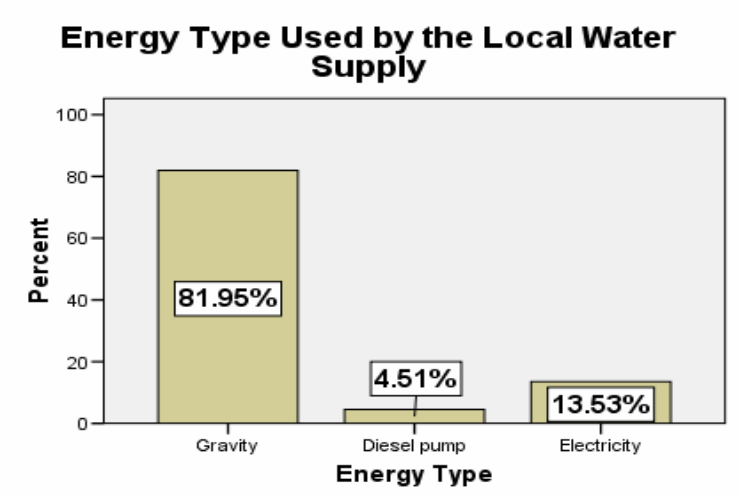
Majority of households rely on rain water during the wet season comprising 54.7%; boreholes/wells (24.6%); rivers (19.7%), and dams (1.0%). During the dry season majority rely on rivers as the main source of water comprising 79.8%; boreholes/wells (17.5%); dams (1.1%); rain water (1.1%) and water vendors (0.5%). 43 respondents who pay for water spends an average monthly expenditure of Kshs. 260/=, a minimum of Kshs. 100/= and a maximum of Kshs.800/=.

Responsibility for fetching water during the wet season falls on the women (66.3%) and girls (20.5%), boys (10.7%) and father (2.0%) and water vendors (0.5%). During the dry season, women fetch water most of the times (57.2%), followed by girls (26.0%), boys (12.5%), men (3.8%) and Water vendors (0.5%).

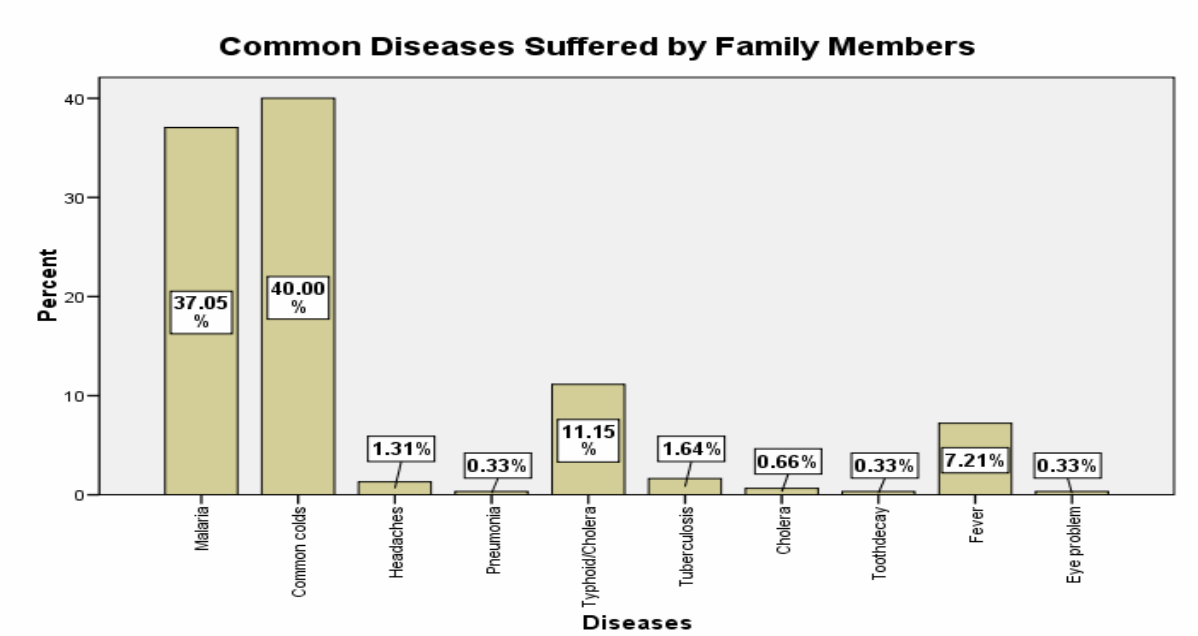
Water fetching responsibilities

Responsible	Wet season		Dry season	
	Frequency	Percent	Frequency	Percent
Father	4	2.0	8	3.8
Mother	136	66.3	119	57.2
Boys	22	10.7	26	12.5
Girls	42	20.5	54	26.0
Water vendors	1	.5	1	.5

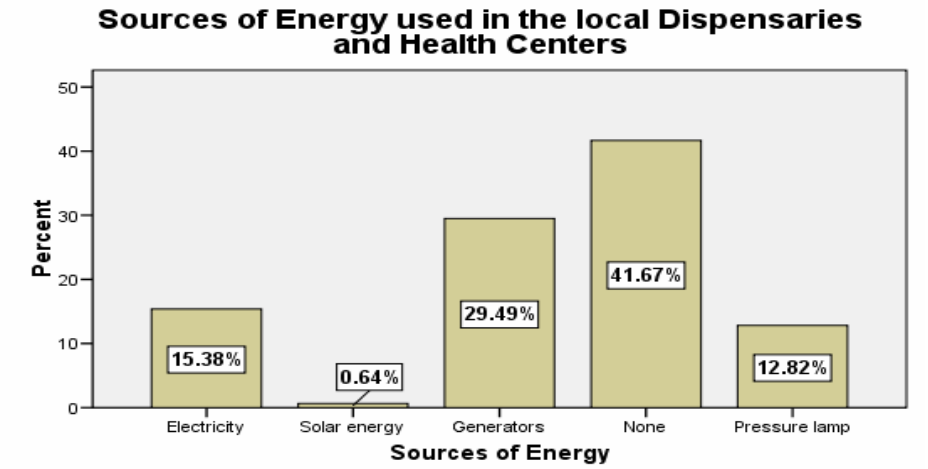
Water supply mainly runs by gravity (81.95%); diesel pump (4.51%) and electricity (13.53%).



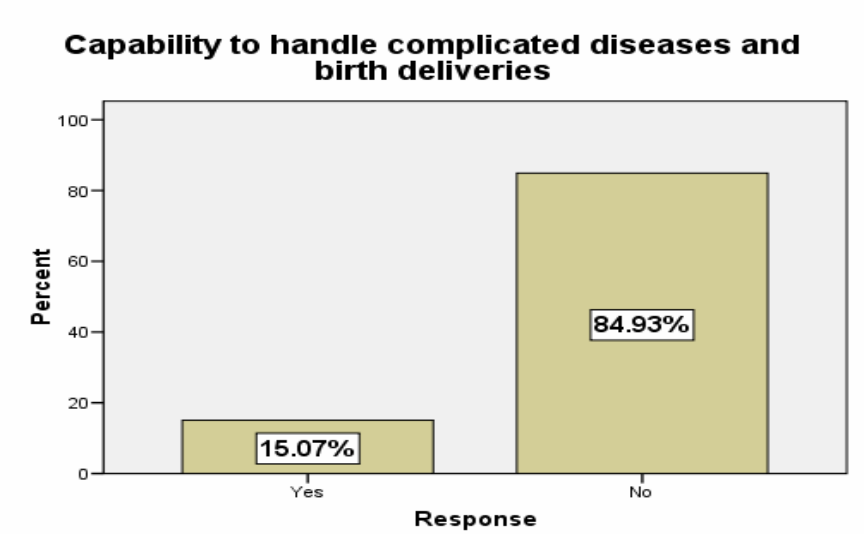
The most common diseases are common colds (40.0%), malaria (37.05%), Typhoid and Cholera (11.81%), and fever (7.21%). Others with negligible mentions include headaches, pneumonia, TB, tooth decay and eye problem.



Local Dispensaries and Health Centres use generators (29.49%), electricity (15.38%), pressure lamps (12.82%), and solar energy (0.64%) while 41.67% of the Dispensaries and Health Centres don't use any energy.



According to 84.93% of respondents, the local Dispensaries and Health Centres are not well equipped to handle cases of complicated conditions and maternal deliveries. 15.07% of respondents said that the local Dispensaries and Health centres can handle complicated conditions and deliveries.

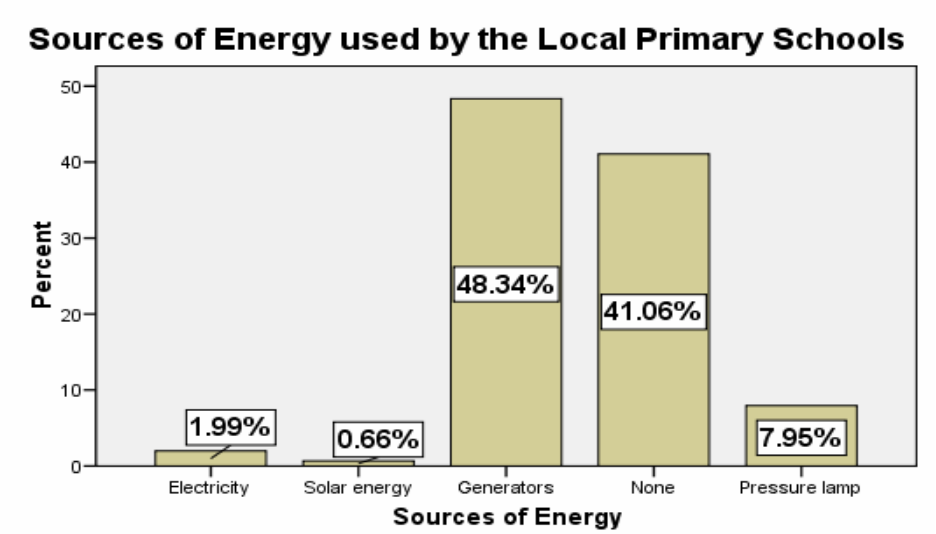


Reasons given to support inability of Dispensaries and Health Centres to handle complicated cases include:

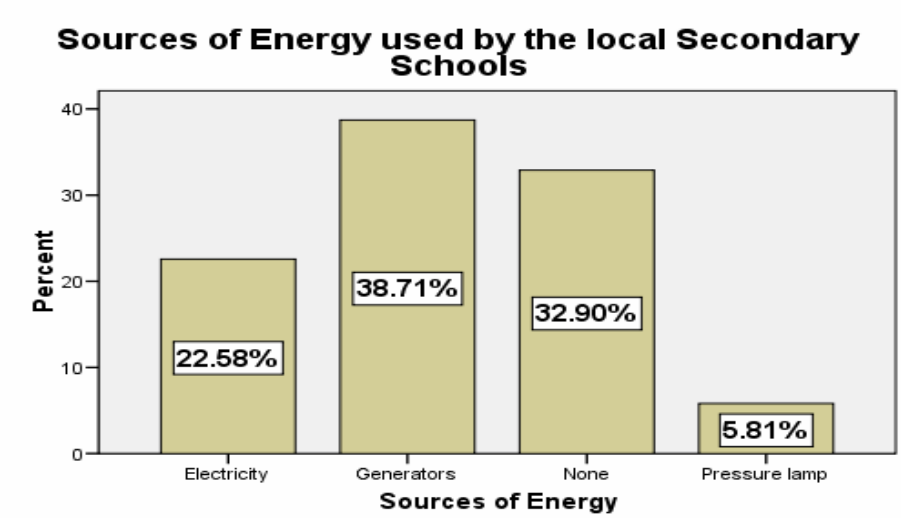
- Not well equipped- lack of proper structures, equipment and facilities
- Lack of trained personnel to handle the cases
- Shortage of staff
- Lack of electricity
- Poor transport/ roads

The reason given to support ability of the facilities to handle complicated cases is that they are well equipped and have enough resources available.

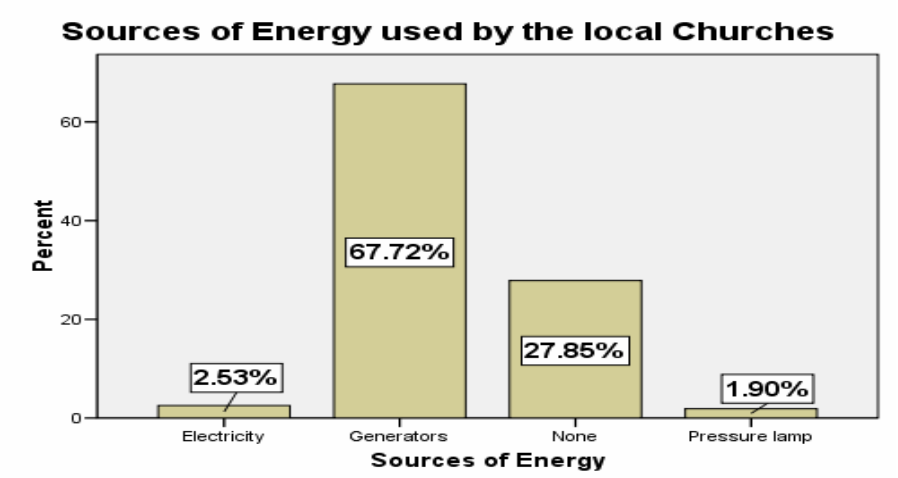
Local Primary Schools use generators (48.34%), pressure lamps (7.95%), electricity (1.99%) and solar energy (0.66%), with 41.06% of Primary Schools not using any energy type.



Local Secondary Schools mainly use generators (38.71%); electricity (22.58%); and pressure lamps (5.81%); with 32.9% of Secondary Schools not using any energy type.



Local churches use generators (67.72%); electricity (2.53%); and pressure lamps (1.9%); with 27.85% of Churches not using any energy type.



3.1.14. Businesses operated at market centres

The main businesses operated by respondents include kiosks and canteens (11.3%), groceries (9.9%), wholesale shops (8.0%), barber shops (7.1%), hair salons (7.0%), general shops (5.7%), *jua kali* (5.7%), boutique (4.7%), hotels (3.8%), butcheries (3.7%), carpentry (3.5%), grain selling (3.1%), shoe making (3.0%), hardware (2.8%), open air markets for clothes (2.4%), charcoal selling (2.4%), electronics repair (2.3%), grain milling (1.7%), vehicle repair (1.2%), agro-vet (1.2%), video showing(1.0%), clubs/bars/pubs (0.9%), roasting maize (0.7%), livestock trading (0.7%), pool tables (0.5%), welding and panel beating (0.5%), bodaboda (0.5%), health clinics and chemists (0.3%), supermarket (0.3%) and hawking (0.2%)

Female operated businesses/activities

Majority of respondents (26.4%) mentioned groceries as the main businesses run by women followed by salons (25.9%), tailoring (9.4%), selling maize and beans (8.3%), general shops (6.9%), hotels (5.7%), open air market for clothes (5.7%), boutique (4.1%), retail business

(2.5%), kiosks/ canteens (1.8%), banks (0.7%), clubs/pubs/bars (0.5%), health clinics and chemists (0.5%), hawking (0.2%), wholesale shops (0.2%) and grain milling (0.2%).

Male operated Businesses/activities

Majority of respondents (17.2%) mentioned barber shops as the main businesses run by men followed by kiosks/canteens (11.8%), hotels (8.9%), livestock trade (7.3%), carpentry (6.1%), *jua kali* (5.9%), tailors (5.2%), butcheries (4.0%), general shops (3.5%), grain milling (3.1%), saloons (3.1%), selling food crops (2.6%), battery charging (1.9%), shoe repair (1.9%), driving cars (1.9%), open air market for clothes (1.6%), wholesale shop (1.6%), video showing (1.4%), pool tables (1.2%), welding and panel beating (0.9%), charcoal selling (0.9%), groceries (0.7%), health clinics and chemists(0.7%), clubs/bars/ pubs (0.5%), banks (0.5%), *Mpesa* services (0.5%), hardware (0.5%), tobacco selling (0.2%), shoes selling (0.2%), selling tea baskets (0.2%), building houses (0.2%), radio/TV repair (0.2%) and garages (0.2%),

3.1.14 Value of electricity to improvement of livelihoods

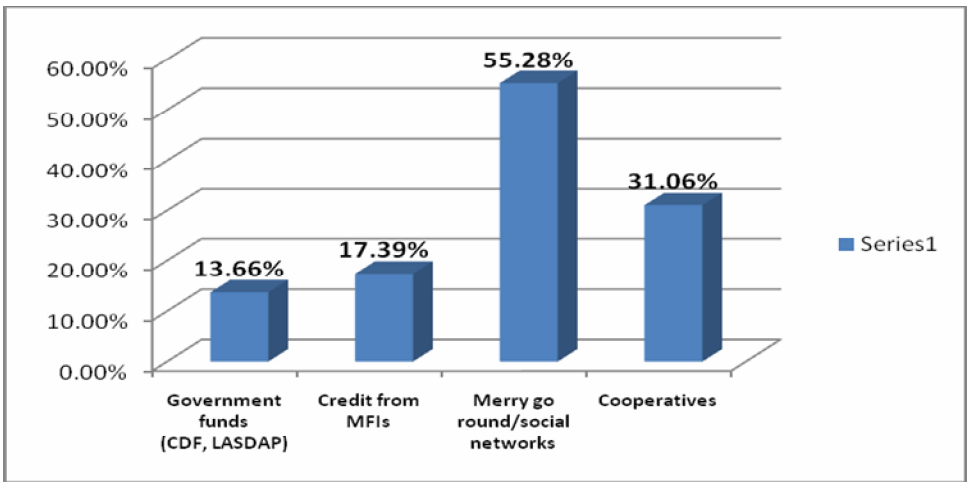
Respondents felt that access to electricity would improve people's livelihoods through:

- Making work easier since some work will be done by machines (14.4%)
- Reducing cost, time and energy spent in search of services (12.9%)
- Increasing business opportunities (11.4%)
- Creating employment opportunities (9.4%)
- Improvement of infrastructure (8.0%)
- Improving peoples overall economic base (6.4%)
- Environmental conservation/sanitation (6.4%)
- Making people more enlightened e.g. buying and viewing TV and using computers (4.0%)
- Improving *jua kali* sector (4.0%)
- Improving lighting in homes (3.8%)
- Improvement of markets (3.5%)
- Improvement of agriculture (3.5%)
- Improvement of Schools (3.2%)
- Improvement of Hospitals and Dispensaries (2.7%)
- Improvement of Factory (2.4%)
- Improving security in homes and market centres (1.6%)
- Improvement of livestockproduction (0.8%)
- Establishment of electrical services (2.7%)
- Increasing working hours since people can work day and nights (0.5%)
- Reduction of stress due to listening to music (0.5%)

3.1.16 Access to financial facilities

55.28% of respondents have access to merry go rounds and social networks as a financial facilities while another 31.06% have access to cooperatives; 17.39% have access to credit from MFIs; and 13.66% have are aware of government funds such as CDF, and LASDAP.

Access to Financial Facilities



4.0 Conclusions and recommendations

Only 8 households (4.97%) out of the sampled 161 use electricity for lighting, while none use electricity for cooking. Although majority of residents (96.73%) would like to change to a different form of energy, most cited the fact that electricity is not accessible/ homes are far from the transformers as the reason they are not connected. For respondents who do not have access to electricity, the approximate average distance from the nearest electricity line is 1.6km which may exclude them from benefiting from rural electrification programmes.
This clearly indicates that many households would be ready to get connected to electricity once the electrification project is underway. The project would be of great benefit to the community in addressing their energy needs and improving their livelihoods.

Over a quarter of respondents would like to change to electricity but are not able to because of the initial high cost for connection and wiring. Efforts should be made to come up with innovative financing mechanisms to address these barriers among others, during the implementation of the electrification project. Furthermore, majority of residents have access to financial facilities such as Cooperatives and MFIs. Households could be encouraged to source resources from these to finance connections to households. Some community members are even familiar with other financial sources such as CDF, and LASDAP which could be mobilised. For those who believe that using electricity is expensive, there will be need to educate the households who believe that electricity connection fee is expensive that the initial costs in connection will be recovered quickly through savings from reduced kerosene and firewood use. The survey revealed that households using kerosene and firewood for lighting spend more than those using electricity. Expenditure on charcoal is also higher than expenditure on electricity. With the other energy types currently being used being expensive, there is possibility that increased access electricity will result in increased use of electricity for lighting since it is cheaper. This implies that access to electricity by most households would result in a reduction in household energy budgets in the long term. Electricity is also a cleaner energy compared to kerosene and firewood and also does not contribute to environmental degradation.

A large percentage of households have been investing substantial amounts on rechargeable batteries with most of the batteries being purchased new. They have to invest time and money to travel to centres to charge the batteries. This clearly demonstrates that people in this community are keen to acquire alternative energy options and would therefore be ready to invest in electricity connection. Majority of community members have regular incomes from cash crops, food crops and other non farm activities and would therefore be able to pay for electricity if connected.

Electrical appliances are mainly located in the sitting room in most households and most family members mainly have access to and use of all the electrical appliances. Access to electricity will encourage more people to purchase electrical equipments that will make work easier and increase access to entertainment and information for more households.
Men and boys tend to have higher access to all appliances compared to women while girls seem not to be involved in purchase of appliances or use of all appliances with the exception of the electric cooker. The project should aim at sensitizing the community to ensure that all family members participate in decision making regarding appliances to be purchased. Efforts should be

made to ensure both men's and women's views are listened to during implementation in order to ensure all benefit from the electrification project.

Providing electricity to homes and ensuring that there are light bulbs in all rooms including the kitchen would provide better working conditions for women who are responsible for cooking. Efforts should be made to ensure that each household has a light bulb in the kitchen. Further, considering that firewood is not only used for cooking by most households but also for lighting and heating, access to electricity will contribute to reduction of drudgery for women and girls. This will also allow more study time for girls as well as free time for women to engage in productive activities.

For majority of households, demand for energy has increased in the household and it is not sufficient to cater for family needs. Firewood and kerosene are very expensive which has resulted in some changing to solar and LPG Gas since they are cheaper. With overdependence on firewood, collection takes a lot of time and is tiresome. This would give incentive to many to switch to electricity if it was available.

Almost all the sampled households own radios, over half own radio cassette players and coloured or black and white TVs. Access to electricity would provide an alternative and cheaper energy for powering the equipment and increase access to entertainment and information. Access to information may also lead to an increase in earnings from cash crops as well as food crops grown for sale through links to new markets.

Community members travel an average of 2Km to social amenities such as schools, health centres, markets and schools. Majority of respondents travel an average of over 12Km to the nearest Hospital. Majority feel that the local Dispensaries and Health Centres are not well equipped to handle cases of complicated conditions and maternal deliveries. Availing electricity to more health facilities will ensure better health services. Providing electricity in staff quarters will also attract qualified staff thereby ensuring quality health services for the community members. Typhoid and Cholera are prevalent in this area and access to electricity will help to pump treated water for use by communities to reduce the incidence of the two diseases.

Access to electricity in market centres will support the wide range of businesses being operated by both women and men such as salons, hotels, tailoring, and carpentry; electrical shops etc. as well as create opportunity for new businesses to be established. Access to electricity for schools, hospitals, health centres and Churches currently without as well as those using generators would result in savings, as well as improved services and performance in schools.

Most people are very aware of the wide range of benefits that electricity could bring to them, top among them, creation of employment opportunities, and improvement of social services as well as better working conditions in the home.