

Bioenergy and Poverty in Kenya: Attitudes, Actors and Activities



WORKING PAPER

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Cover Images:	Main: A woman demonstrates how she carries firewood during the Mandera focus group discussion in peri-urban Mandera (Practical Action/Wilkister Ombidi) Inset top: Turkana rural women focus group and Practical Action Consulting (PAC) staff with Turkana youth in the foreground (Practical Action/Wilkister Ombidi) Middle inset: A Somali woman outside a typical hori, usually constructed by the women in Mandera Bottom inset: A light moment during the Nakuru rural women focussed group discussion (Practical Action/Stella Mapesa)

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Glossary

ACTS	African Center for Technology Studies
AIDS	Acquired Immune Deficiency Syndrome
ASALs	Arid and Semi-arid Lands
COCOP	Consortium of Cooperating Partners
DFID	Department for International Development
FGD	Focus Group Discussion
GIS	Geographic Information Systems
GPS	Global Positioning System
HIV	Human Immuno Deficiency Virus
ICRAF	International Center for Research in Agroforestry
KEFRI	Kenya Forestry Research Institute
MOA	Ministry of Agriculture
MSSRF	M. S. Swaminathan Research Foundation
NGOs	Non-governmental Organisations
PISCES	Policy Innovation Systems for Clean Energy Security
RETAP	Renewable Energy Technology Assistance Programme
RPC	Research Programme Consortium
SACCO	Savings and Credit Cooperative
SLEA	Sri Lanka Sustainable Energy Authority
SCODE	Sustainable Community Development Services
UDSM	University of Dar es Salaam
UK	United Kingdom

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Foreword

Policy Innovation Systems for Clean Energy Security (PISCES) is a five-year Research Programme Consortium (RPC) funded by the United Kingdom's (UK) Department for International Development (DFID). It is implemented internationally through five core partners in India, Sri Lanka, Kenya and Tanzania, along with a range of associate institutions and a high-level Consortium Advisory Group (CAG). The idea behind the PISCES project is to generate new knowledge on bioenergy that policy makers can use to formulate or enhance respective national policies and strategies on bioenergy. PISCES has broadly categorised bioenergy into three types: bioresources (e.g. woodfuel and charcoal); biofuels (e.g. crops specifically grown to produce energy such as *Jatropha Curcas* for biodiesel or sugar cane for the production of bioethanol) and bioresidues (e.g. agricultural residues such as maize cobs or stalks as well as animal dung which can be used for the production of biogas for household use). The current global debate on sustainability of biofuels (especially biodiesel and bioethanol for the transport sector) production provides added impetus for PISCES.

This report presents the findings of socio-economic baseline surveys carried out by the Eastern Africa office of Practical Action Consulting in Kenya between March and December 2008. This was part of a broader baseline data creation exercise carried out across the respective PISCES countries around the same period to help provide a better understanding of some of the current issues relating to bioenergy use, access and delivery at the community level. In order to get a 'peoples' perspective, a qualitative approach was adopted by carrying out Focussed Group Discussions (FGDs) with target communities from five parts of the country, namely Nairobi, Nakuru, Kisumu, Lodwar and Mandera.

The discussions looked at the key interrelated issues of food, water and energy security in relation to bioenergy at the household level. Questions were asked about the types of bioresources typically used for household energy needs; how these resources were accessed; the technologies currently used; gender and socio-cultural dimensions of household energy; and constraints and trends in access and use of the types of bioenergy over the years. Meetings were held with stakeholders in the same areas to establish their role and activities in bioenergy in the respective regions. Interviews were also held with a range of selected institutions in the urban areas of the survey sites, such as schools, hospitals, small hotels etc., on their bioenergy usage at the institutional level.

The overall objective of this study was to identify community opportunities and constraints in the access and use of bioenergy, with a view to identifying some of the ways in which these opportunities and constraints can be harnessed and/or overcome during the life of the PISCES project.

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1. Introduction

1.1 Background to PISCES Project

Policy Innovation Systems for Clean Energy Security (PISCES) is a five-year initiative funded by the Department for International Development (DFID) of the United Kingdom (UK). The project aims to enable poor people in the developing world to have improved access to better and more affordable energy, in a way that reinforces their livelihoods and protects the local and global environment. PISCES target audience is mostly those who are working in the energy sector and the target countries include India, Sri Lanka, Kenya and Tanzania, and its overall goals are to contribute to widely transferable knowledge and understanding of bioenergy and to contribute to policy development in the target countries so as to maximize the contribution of bioenergy to clean energy access and livelihoods. PISCES has broadly categorised bioenergy into three types: bioresources (e.g. woodfuel and charcoal); biofuels (e.g. crops specifically grown to produce energy such as *Jatropha Curcas* for biodiesel or sugar cane for the production of bioethanol) and bioresidues (e.g. agricultural residues such as maize cobs or stalks as well as animal dung which can be used for the production of biogas for household use). The project is implemented through research partnerships established by the PISCES Research Consortium (RPC), which comprises of the following institutions:

- African Centre for Technology Studies (ACTS), Consortium Head
- Practical Action Consulting United Kingdom, Eastern Africa and South Asia
- University of Edinburgh, United Kingdom
- University of Dar es Salaam (UDSM), Tanzania
- M. S. Swaminathan Research Foundation (MSSRF) - India

PISCES is based on the following four principles: a) that livelihoods are contingent on Food, Water and Energy Security; b) that bioenergy is the pivotal issue intersecting these issues; c) that it is vital to look at bioenergy holistically; d) that there is need for better data and an improved framework for decision-making on bioenergy issues. In the Kenyan context, energy security at the local level means energy being available affordable and accessible in a way that is sustainable. Key bioenergy trade-offs to be considered include food versus fuel; growth versus environment; centralisation versus decentralisation; productivity versus accessibility and export versus domestic use. To provide these datasets and frameworks for the target countries, PISCES has identified three key research themes and four crosscutting themes, which are aimed at addressing the gaps in knowledge and practice, as follows:

- **Technology:** to analyse, develop and test new and existing technologies, including plans, processes, appliances and practices, to provide policy makers with improved information to analyse bioenergy pathways and outcomes.
- **Access and delivery:** to determine the types of models, incentives and regulations that can create and sustain access and delivery of bioenergy services to poor people through socio-economic and market analysis
- **Climate and environment:** to investigate and evaluate the relationship between: a) the production and utilisation of bioenergy and b) the global climate and local environment.
- **Cross cutting themes:** Research-Into-Use, South-South-North knowledge exchange and transfer, capacity strengthening, and gender and equity.

1.2 PISCES Socio-economic Baseline Survey Design and Objectives

The socio-economic baseline surveys were carried out as part of the PISCES Research Theme 2 on Access and Delivery. The goal of this research activity was to identify the bioenergy needs, gaps, status and opportunities for poor people in Kenya. The specific objectives were:

- a) To identify the socio-economic linkages and patterns of bioenergy use, access and delivery for the poor in Kenya;
- b) To generate baseline socio-economic data that will support the PISCES project, sector actors and policy makers to make decisions relating to bioenergy use, access and delivery in the country with particular reference to the needs of the poor.

Based upon the theme of Energy Access and Delivery, a research design document was prepared in Kenya in consultation with the relevant national stakeholders and shared with PISCES partners in the other research countries. Details of the research design are available in PISCES Research Design: Socio-Economic Survey on Bio-Energy Delivery and Access by the Poor in Kenya on the PISCES website www.pisces.or.ke

Research tools were also developed by each of the partners in Tanzania and India based upon their key themes, which are Technology and Climate and Environment respectively. These tools were then shared between partners and fine-tuned. In each country the research theme focus was maintained but with key thematic questions from the other partners incorporated. In Sri Lanka, the Sri Lanka Energy Association, SLEA, was already undertaking a national energy survey and Practical Action Consulting in Sri Lanka intend to use the data generated by this survey to create their baseline data for PISCES.

The Kenya baseline research and data collection was subsequently implemented between March and December 2008 through identification of existing bioenergy types, consumption patterns, current status, use, costs, constraints and opportunities, among other aspects. The research sought to address the following key questions:

- How do poor people in Kenya access and use bioenergy at the village and institutional levels?
- Who are the stakeholders involved in bioenergy production, supply, and conversion, processing and service provision?
- What are the types of bioenergy resources currently used by poor people?
- What are some of the current bioenergy initiatives in Kenya?
- What are the barriers, gaps and opportunities around bioenergy options for the poor in Kenya?

The socio economic baseline research included literature review, stakeholder analysis, a centralised stakeholder workshop, Focussed Group Discussions (FGDs) and in-depth interviews at the community level. Literature review was carried out prior to fieldwork and included an analysis of stakeholders in the bioenergy sector in Kenya. The findings of this review are available in Current Status of the bioenergy sector in Kenya and associated stakeholder analysis: a literature review, March 2008.

Following the literature review and stakeholder analysis, a stakeholders workshop was held in April 2008 to obtain feedback on field survey tools developed for the socio economic baseline research in Kenya as reported in the PISCES Socio-Economic Survey Design for Kenya, Stakeholders Workshop Report, 23rd April 2008. Development of research tools was carried out in consultation with stakeholders. Details on the stakeholders' consultation process are available in the PISCES Stakeholders Workshop Report.

2. Survey Approach and Methodology

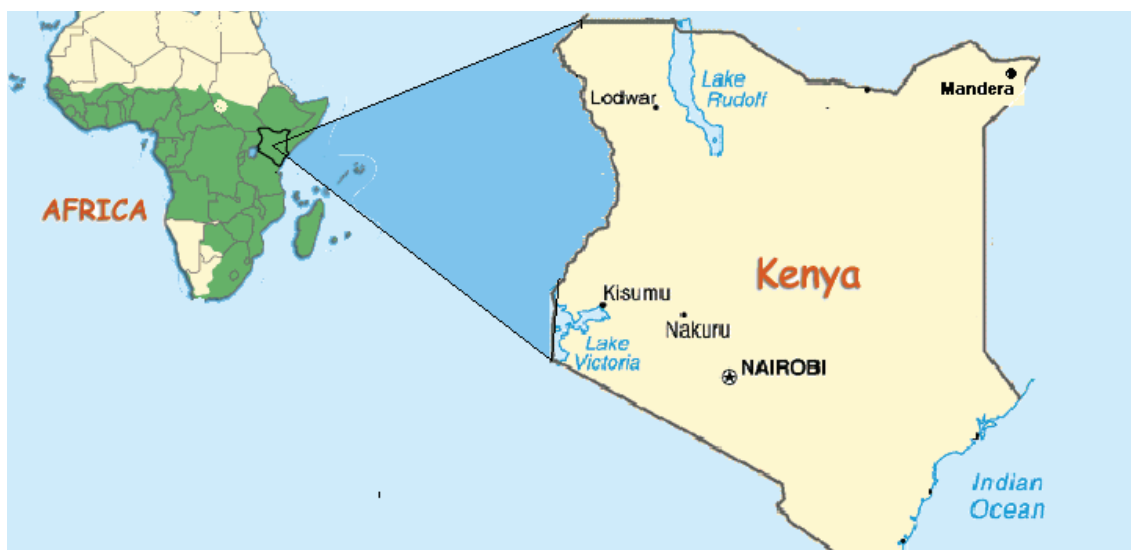
2.1 Overall Approach, Scope of Coverage and Selection of Survey Sites

The research was designed as a qualitative study to address the issues of bioenergy access and delivery in the bioenergy market chain. The study adopted the sustainable livelihoods approach that tries to link bioenergy to total livelihood systems at individual and household levels. Questions on technology and climate were included with the aim of harmonising the research between partner countries. Questions in the research tools revolved around access and delivery in these three resource categories. FGD participants were asked about issues relating to food, water and energy access. The cross cutting theme of gender and equity was carefully integrated throughout the research.

The PISCES baseline survey was originally planned to cover six different regions in Kenya. However, the research covered only four regions and research in Mount Kenya and Coastal regions was not carried out due to time constraints. The four regions covered in the baseline survey include Kisumu in Western region (representing the Lake Victoria region); Lodwar, Turkana, in the North Rift (representing Arid and Semi-arid Areas or ASALs); Mandera in North Eastern region (also representing ASALs); Nakuru in the Rift Valley and Kibera in Nairobi (representing peri-urban and urban areas in larger Nairobi).

The research sites, which are shown on Figure 1 below, are located in regions where Practical Action in Eastern Africa operates. Practical Action facilitated and supported field data collection as well as identification of the focus groups and key stakeholders in bioenergy in the target regions. The basic selection criteria for the research regions included agro ecological zoning and poverty levels. Initial literature review and existing demographic data such as national censuses and other surveys were used to guide the selection of research sites.

Map of Kenya Showing the PISCES Research Sites



2.2 Recruitment of FGD Participants

Recruitment of FGD participants was based on criteria developed and shared with the respective Practical Action cluster offices that supported identification of the target groups. Key among factors considered in the composition of the Focus Groups was age, gender, household size, socio-economic status including representation of rural, urban and peri-urban groups. Further details the selection criteria for recruitment of FGD participants are provided in PISCES Research Design: Socio-Economic Survey on Bio-Energy Delivery and Access by the Poor in Kenya. A gender stratification strategy was adopted and a screener was developed to ensure that FGD participants were as representative as possible to allow for generalisations in the results.

Focus Group Discussion guidelines were developed to ensure that key information on bioenergy access and delivery was collected. The guide was designed to capture information on socio-demographics, food security, farming and other economic activities, land and water issues, energy services and key bioenergy resources, uses and costs. The guide also sought information on gender roles in bioenergy access as well as factors influencing the level, model and choice of delivery and access to bioenergy and barriers and opportunities at the user level. Gender was incorporated throughout the guide as a crosscutting theme of the study.



Mandera rural women during the FGD held at Bur Aborr

2.3 Identification of Institutions and Key Informants for In-depth Interviews

Identification of institutions and key informants in the cluster areas was carried out in consultation with the respective Practical Action cluster offices in the four target regions. Some of the key informants were identified during the FGDs. The key informants included stakeholders and professionals representing various institutions and community initiatives. A majority of the interviews targeted respondents from selected institutional stakeholders in bioenergy, such as government ministries, Non-governmental Organisations (NGOs), schools/health centres and private firms, among others, and this was linked to the Stakeholder Analysis.

2.4 Data Collection, Analysis and Reporting Methodology

2.4.1 Data Collection

PISCES adopted a comprehensive methodology for data collection, which included development of guidelines for conducting FGDs and conducting in-depth Key Informant Interviews as well as a questionnaire for profiling bioenergy initiatives. The process of data collection included field observations, note taking, photography and audio recording for the FGDs as well as the in-depth interviews. PISCES researchers sought permission from FGD participants and key informants before taking pictures and doing audio recording. During the FGDs, Kiswahili, which is Kenya's national language, was used in combination with local languages wherever appropriate, and a local language interpreter was present during the discussions. A moderator and a note taker were both present for each of the 13 FGDs and the various key informant interviews. This ensured comprehensive data was collected. To avoid bias the person who was taking notes did not participate in the discussions while the audio recordings were used as a back-up during data analysis to follow-up any gaps and/or omissions in the notes. The following is a summary of data collection processes through FGDs, key informant interviews and profiling of bioenergy Initiatives.

2.4.1.1 Focus Group Discussions: A total of 13 FGDs were carried out with 142 participants including rural women, urban women and peri-urban mixed groups composed of men and women.

Due to the nature of prevailing gender roles in the target areas, a majority of the FGD participants were women, while there were only five mixed groups and no men-only groups. The age of FGD participants was 26-45 years while household size ranged from four to six. All households had a monthly income of less than eight thousand Kenya shillings. FGD group size was generally 9-13 members with an average of 11 persons per group, except for Nakuru rural women and Kisumu urban women, which recorded 14 and 7 participants, respectively. Table 1 shows the number of FGD participants by site, gender, category and dates.



Nakuru women FGD participants in a jovial mood during discussions

Site	RuralWomen	Urban Women	Peri-urban Mixed Groups		
			Men	Women	Total
Kisumu	12	7	4	4	8
Nakuru	14	-	5	8	13
Nairobi	-	9	4	7	11
Turkana	11	12	6	6	12
Mandera	13	9	6	5	11
Total	50	37			55

Table 1: Number of FGD participants by site, gender and socio-economic orientation

2.4.1.2 In-depth Interviews with Institutional Consumers: The objective of the interviews was to identify bioenergy use at the institutional level. A total of 11 in-depth interviews were conducted with institutional consumers including schools, colleges, hospitals and hotels sampled as part of the survey. Each interview took an average of 45 minutes and was recorded in writing and on tape. Appendix 1 shows the number of depth interviews by site and institution.

2.4.1.3 Key Informant Interviews with Stakeholders: A total of 9 Key Informant Interviews were carried out with stakeholder representatives in the research sites. Each interview took an average of one hour and was recorded in writing. Appendix 2 shows a summary of interviews with stakeholder representatives by institution and location.

2.4.1.4 Profiling of Stakeholder Initiatives in Bioenergy: Information on local initiatives on bioenergy was gathered as part of the FGDs and Key Informant Interviews and wherever possible the initiatives were visited and key informants interviewed. Through this process, five initiatives were identified and interviews were conducted with key informants in Nakuru, Kisumu, Mandera and Lodwar. Appendix 3 shows a summary of information obtained from interviews with stakeholder representatives by institution and location. Other stakeholder initiatives were also identified through secondary research and information on these initiatives and key information was compiled as part of the PISCES baseline survey. The initiatives are projects or activities of groups, individuals or organisation and provide an indication of how Kenyans are currently providing and accessing a range of bioenergy types and services in various parts of the country

2.4.2 Data Analysis and Reporting

The process of data and information analysis included transcription of the audiotapes and analysis of the information into different categories guided by the study objectives and key information areas. Comparative analysis of findings from different regions was carried out using a grid and is included in the findings. The report provides details on findings emerging from all aspects of the study, such as stakeholder analysis and FGDs, and includes illustrations such as photographs and tables.



Mixed group FGD at Nadapal in Lodwar, Turkana

3. Survey Findings

3.1 Food, Water and Bioenergy Access and Delivery in Households

3.1.1 Food

The survey findings indicate that subsistence agriculture, pastoralism and fishing are the main socio-economic activities and sources of food in the survey regions. In most cases rain-fed agriculture is practised although there is some irrigation in Mandera, Turkana and around the Lake Victoria. Agroforestry for production of food, timber and firewood is a common phenomenon especially in Nakuru and Kisumu. The survey findings also indicate that majority of land in Kisumu and Nakuru has been subdivided into relatively small privately owned plots and scarcity of land is a major constraint to food production. In Turkana and Mandera, although communal land has been sub-divided into small private plots, people have access to communal grazing lands and public land.

In Kisumu and Nakuru a variety of subsistence crops are grown for example grains, legumes, indigenous and exotic vegetables and fruits and other crops. In the Kisumu rural cluster for example, subsistence crops include maize, bananas, cowpeas and kales, among others. They also rear chicken and keep animals such as cattle. In most cases the harvest is supplemented with food from the market, which residents cited as expensive.



Example of agroforestry in Kisumu showing maize intercropped with eucalyptus species. Inset: a stand of bananas, which are planted in the region for food security

Referring to the harvests they get from their crops, a woman from the Nakuru rural cluster said: “But they don’t last long. If you have money then you can buy food from those who have enough.” The women explained that whereas they can afford to have three meals a day during the harvest period, they take only two meals per day during the dry season. They also indicated that they sometimes opt for waged labour on large-scale farms. The survey findings also indicated that scarcity of agricultural land in rural Nakuru and Kisumu has resulted in declining livelihoods and food shortages while unauthorised logging, charcoal production, agriculture and grazing are commonly practised on public land including forests. FGD participants from Kisumu cited drought and floods as other factors contributing to poor harvests. The participants explained that they might get a good harvest only once in three years.

In the ASAL regions of Turkana and Mandera, animal production for local consumption and sale is the main socio-economic activity while the main source of food is domestic animals and the market. Goats, sheep and camels, which were cited by FGD participants in dry regions as more drought and disease resistant, dominate livestock production in the ASALs. In Turkana rural areas, women FGD participants said families depend on animal products such as milk and meat and also sell their animals in order to buy food from the market: “There are no food crops planted here...we do not have water to plant food crops.” The women emphasised: “We buy food from the shops, but we don’t know where it comes from.”

FGD participants in Turkana and Mandera regions indicated that many animals have died as a result of drought and disease leading to reliance on relief food and a worsening poverty situation. In rural Turkana for example, women FGD participants said they used to have many animals, which they used to sell and buy food. Now, however, the animals have died and they rely on relief food. “Even for those of us who have farms, there is nothing in the farm,” said a woman from the Mandera rural FGD. The women explained that although they know how to plant crops, there is no rain or water for irrigation while the soils are poor and unable to support healthy crops.



Carcass of a cow at Burabb in Mandera

The main socio-economic activity in the urban and peri-urban regions of Nairobi, Kisumu and Nakuru is waged labour and self-employment in small-scale business while the main source of food is the market. Although some urban residents practice livestock rearing and kitchen gardening, the amount of food produced is minimal. In the urban and peri-urban regions women engage in small-scale businesses such as selling vegetables, cooked food and fish.

In both rural and urban clusters, scarcity of food and poverty is manifested in the number and types of meals residents consume per day. In Mandera for example, a majority of rural households rely on one meal per day while residents in the urban areas rely on two meals per day. Some of the coping mechanisms cited by participants in both rural and urban FGDs include seeking casual jobs, joining food for work programmes or selling some of the food meant for their children to prevent their small businesses from collapsing. A woman from Kisumu rural region said they rely on food for work programmes to feed their families: “We work on the roads and straighten drainages...we are given food in return for labour.” A woman from Turkana rural cluster said in relation to the food situation: “You know we sometimes sell the food we rely on to feed our children. So we limit the number of meals we have per day to be able to have some food to sell. If we eat everything our business will collapse. Therefore we eat only once per day.” The women explained that their families also rely on wild fruits for food. For example the *Hyphaena compressa* (duom palm) which is locally known as Mkoma grows naturally along the banks of river Turkwell and provides fruits that women harvest for food.

Ecologically the doum palm is an important soil stabilizer and is evergreen. Although its wood is hollow and retains a lot of water, which means it is not a good source of bioenergy; the species provides abundant fruits - which are mainly available during the rainy season. It also provides seeds and leaves. FGD participants said women harvest the fruits and bring them home to be eaten, especially by children. Doum palm seeds are also peeled and soaked in water to form a tasty liquid that can accompany maize meal in case vegetables and meat are not available. FGD participants in Turkana peri-urban region also said they dry doum palm seeds and use them as fuel. The seeds were also cited as a good source of charcoal while fishmongers use the seeds to smoke fish. However FGD participants said the seeds produce immense heat that damages cooking utensils, especially if they are of poor quality. Dry doum palm leaves are used for weaving mats and baskets as a source of cash income for women. The leaves are also used for lighting, fencing and construction of the traditional Turkana manyatta.



Duom palm fruits and leaves in Turkana

The desperate struggle to feed families was similarly echoed by FGD participants in the urban regions of Nairobi, Nakuru and Kisumu. A woman from the Kibera peri-urban mixed FGD said: “Nowadays you don’t choose. Whatever you get, you do. Some men wash clothes for money. If you choose, you will die poor.” The participants said they have to buy food or take from the kiosks on credit and pay later, which perpetuates the poverty cycle. A male participant from the same cluster said: “Life is hard so you have to try hard. I wake up to go and look for casual jobs. My wife also has to go and look for something to do. When children come from school, they wash utensils. At the end of the day, we sit together and see what we have got for the day.”

3.1.2 Water



Young Turkana men at dry water well in Naisinger

Although access to clean water is a common constraint in all the clusters surveyed, the situation is most critical in Turkana region where most people obtain water from distant rivers and remote wells. Fetching water for domestic use is primarily viewed as a woman's job although children help sometimes. The water sources are very far from home and women walk long distances to fetch and carry the water back home. They also take great risks accessing precarious wells.

A woman from Turkana rural region said: "We go somewhere very far. I leave home in the morning at around 6 am to fetch water and return home at around 2.30 pm. Twelve people get into the well because it is very deep. We arrange ourselves from the top to bottom and the water is passed from the person at the bottom to the person at the top." The women explained that when it rains they dig wells near their homes.

In Mandera rural region women FGD participants said they obtain water from the nearby river and carry it home. Alternatively the women buy water from donkey cart vendors who sell it at 10 shillings per 20 litres of water. In contrast, a majority of FGD participants in Mandera urban region said that although water is easily available from the river it is not clean and they prefer to buy clean water from vendors; however, they do occasionally fetch water from the river. In Lodwar peri-urban region in Mandera, water is obtained from a pump managed by a local church and fetching it takes about one hour. In both Mandera and Turkana irrigation is practised on small plots along the river but the returns are meagre.



River Dauwa in Mandera district

In Nakuru rural region FGD participants said they obtain piped water and pay 200 shillings per month, which they regard as expensive. The women indicated they usually take about two hours to fetch and carry the water, while men sometimes contribute money for buying the water. They also indicated that when water shortages occur people are forced to do without or to buy from those who have storage tanks. Others walk long distances in search of water.

FGD participants from the Nakuru urban region said they have access to several sources of water including harvesting rainwater, buying water from vendors or accessing tap water from the municipal council. The participants said they trek for about two kilometres to buy and carry water. Sometimes they pay someone to transport the water but the cost of transport is prohibitive.

In rural Kisumu some of the FGD participants said they obtain free water for irrigation from the National Irrigation Board and this enables them to grow vegetables for sale and domestic consumption. They however incur the costs of piping and pumping the water by generator while those who own land far away from the irrigation channels rely on wells, which dry up during the dry season. In some cases those who grow crops near the lake said they access free water for irrigation from the lake.

In Kibera urban region the main source of water is tap water and both men and women fetch water. Tap water is sold by vendors and costs about two shillings per 20 litres. Streams running off from the Langata area act as an alternative source of water especially when there are shortages. The streams are however polluted and this poses a health hazard for residents of Kibera and other similar informal settlements. A resident in the urban Kibera mixed group said: “If there is no water, you walk long distances. But when there is water, you take two minutes.”

3.1.3 Bioenergy

3.1.3.1 Types of fuel used in households: FGD results indicate that bioenergy is the main type of fuel used for cooking in all the regions covered during the survey. This confirms the high level of reliance on bioenergy resources for cooking in Kenya. For example, the Kenya Integrated Household Budget Survey (Basic Report) – 2005/2006 (Revised Edition) indicates that 68.3% of all households in Kenya use firewood as the source of cooking fuel. The most common types of fuel used for cooking in households across the regions include firewood, charcoal, cow dung and agricultural residues such as maize and sorghum stalks and maize cobs. Firewood is most commonly used for cooking in the rural regions and occasionally in the peri-urban regions while charcoal is mostly used in the urban regions as well as in Mandera and Turkana rural regions. Paraffin is used for cooking in Kisumu and Kibera urban and peri-urban regions and for lighting in many households within the rural and urban regions covered in the survey. Other types of fuel used for cooking in households include papyrus roots, plastic containers, duom palm seeds, charcoal dust balls, cow dung and sawdust. Table 2 below shows a summary of FGD responses on the types of fuels used for cooking in households.

FGD participants in both rural and urban regions demonstrated a wide range of perceptions on the advantages and disadvantages of the different types of fuels used in households. In Mandera urban region for example, FGD participants said firewood is cheap and easily accessible; firewood is substituted with charcoal which is perceived as relatively easy to use and economise. A woman from Turkana rural cluster said: “Everyone uses charcoal. When there is no firewood we buy small quantities of charcoal, which we use for cooking. Sometimes we take a little bit of charcoal from the one we are selling and use it for cooking.” Women from the same region said they sometimes burn charcoal, which they either use at home or exchange for food.

Site	Rural Regions	Urban Regions	Peri-urban Regions
Kisumu	Firewood Crop residues (e.g. maize cobs/stalks and sorghum stalks) Cow dung Papyrus roots Charcoal dust balls Plastic containers	Charcoal Paraffin Firewood	Charcoal Charcoal dust balls Sawdust Firewood Paraffin Plastic containers
Nakuru	Firewood Crop residues (e.g. maize cobs and stalks) Cow dung Sawdust		Charcoal Firewood Charcoal dust balls
Nairobi		Charcoal Paraffin Charcoal dust balls	Charcoal dust balls Charcoal Paraffin
Turkana	Firewood Charcoal	Firewood Charcoal	Firewood Duom palm seeds Charcoal
Mandera	Firewood Charcoal	Charcoal Firewood	Firewood Charcoal

Table 2: Summary of FGD Findings on Types of Fuels Used for Cooking in Households



A firewood vendor in Mandera

As the following quotation from a woman in Turkana rural region attests to, the women use traditional methods to burn charcoal for domestic consumption: “We cut firewood into small pieces. We dig small pits and arrange firewood in the ditches then put goat’s droppings on top and light. The charcoal burns slowly without being disturbed by the wind.”

Women from Nakuru, Kisumu and Kibera have also devised a way of making charcoal balls for fuel. The balls are made with a mixture of charcoal dust, soil or ash and water as a binding agent. Once dry the charcoal balls are used in combination with charcoal to ensure they light well. For example, participants in Nakuru and Kibera FGDs said they make and use the charcoal balls, which are economical.



In Mandera two tiny pieces of firewood like these ones cost 25 shillings

Women from Nakuru, Kisumu and Kibera have also devised a way of making

In the Kisumu urban region FGD participants indicated that charcoal is expensive at 900 shillings per bag weighing 50 kilogrammes. Participants narrated how the high cost of firewood and charcoal sometimes forces people to use old shoes and used plastic containers as fuel. They said the cost of charcoal has been rising steadily: “Last year a 50

kilogramme bag of charcoal was costing 250 shillings,” explained a participant. As one woman’s voice attests to, the energy situation in the region is quite desperate: “My last born is a little girl. She collects used plastic tins with which we light fire. There is a serious problem of firewood in this area. Many people in this area use plastic. Even a broken basin becomes firewood.” In Nairobi, FGD participants in Kibera urban region said charcoal is economical and fits into the urban lifestyle. Referring to charcoal, an FGD participant from Kibera peri-urban mixed group said: “Quality determines price. Tins with big pieces cost 30 shillings, tins with small pieces cost 25 shillings and charcoal dust costs 15 shillings. There is no waste in charcoal.” The participants however indicated that the cost of charcoal increases during the rainy season due to poor supply while prices rose steadily following the post-election violence in 2007-2008. “Last year [2007] we were buying [a tin of] charcoal at 15 or 20 shillings, there was no charcoal for 25 or 30 shillings,” said another participant from Kibera peri-urban mixed group.

FGD results also indicated that many people especially in the urban and peri-urban regions are aware of alternative sources of fuel such as electricity and gas but such fuels are priced out of their reach. Even in the relatively better off urban regions only a few participants said they can afford to use electricity for lighting. A woman FGD participant from the Kisumu urban cluster said: “We long to use electricity but we cannot afford.”



Upesi energy saving stove cooking food in one of the survey regions

In some cases FGD participants expressed awareness of alternative sources of fuel such as solar and biogas but cited lack of information on whether such fuels are affordable or easily accessible. Some have also heard of energy saving technologies such as the basket cooker but they do not have any information on how it is used or where they can access it.

In the rural areas firewood technology has always been, and continues to be the main source of fuel and the traditional three-stone fireplace is still common. “That three-legged Jiko [stove] is in every home,” stated a woman during the Kisumu rural FGD upon viewing a picture of the traditional three stone stove; other women in the group did not object to her views. In the urban and peri-urban areas three stone fires are not commonly used and some cooking devices now only rarely used include the mabati [metal] stove, which has gradually been replaced by energy-saving stoves including those with clay liners. “Not many people use the mabati [metal] stove these days because it wastes fuel. Now we use the improved Maendeleo stove that saves fuel,” said a woman from Kibera. The sawdust stove, which was frequently used in the past, is no longer as common. This is due to availability of improved technologies such as energy saving stoves as well as shortage of sawdust resulting from depletion of forests, which are the main sources of timber for milling. FGD participants cited the rising cost of fuel and the need to economise as the main reasons for adoption of improved stoves.

3.1.3.2: Advantages and Disadvantages of Frequently Used Energy Services/Fuels:

Levels of awareness on the advantages and disadvantages of using different types of bioenergy services/fuels are quite high in both rural and urban. For instance, charcoal is generally regarded as a clean, easy to use fuel that also helps to reduce the risk of diseases such as coughing, chest problems and deterioration of the eyesight.



A typical Somali hori constructed by women

In the Turkana rural region for example, women take the initiative to produce their own charcoal for domestic use and this demonstrates a preference for charcoal. In regions such as Mandera and Turkana where grass thatched houses such as the Turkana and Somali hori are common, FGD participants expressed a keen awareness of the hazards of using firewood with the three stone technology. “If you go to fetch water and you leave a child at home to look after the food, by bad luck the fire can spread and light up duom palm leaves and thus burn the

whole boma [homestead]” explained a Turkana woman. “There was a time when the three stone Jiko [stove] burned my boma. When I lit the fire it spread and burned my homestead,” narrated another woman from the same region.

In the urban regions of Nakuru, Kisumu and Kibera in Nairobi, charcoal is regarded as the most easily accessible fuel. In contrast, firewood is regarded as the most easily accessible fuel in the rural regions while charcoal is in most cases regarded as expensive and used only during the rainy season. Fuel collection is even more difficult during the wet season and if accessible the firewood is wet and difficult to use. Although crop residues are used during the harvest season in the rural regions of Kisumu and Nakuru, they are regarded as a low quality fuel. Table 3 summarises the advantages and disadvantages of the most frequently used energy services/fuels.

3.1.3.3: Types of Energy Services/Fuels Used for Income Generating Activities:

In the rural, urban and peri-urban areas, the main types of energy services/fuels that are used for income generating activities are charcoal and firewood. In the Nakuru urban area for example, charcoal is regarded as a convenient energy service/fuel since the stove can fit into small confined spaces. In the Kisumu rural region women FGD participants engaged in preparation and sale of food items for income generation expressed a preference for charcoal. They noted that although charcoal is expensive the heat is easy to control and this improves the quality of food products such as mandazi and chapati. In the same region, FGD participants who expressed a preference for using firewood in income generating activities said it is cheaper, lasts longer than charcoal and attracts higher profits because the costs are lower.



Moderating the Kibera women focus group

Table 3: Summary of FGD Findings on the Advantages and Disadvantages of Frequently Used Energy Services/Fuels

	Energy service/type	Regions/areas where energy service/type is used	Uses
1	Charcoal	<ul style="list-style-type: none"> • Urban and rural areas 	<ul style="list-style-type: none"> • Cooking
2	Firewood	<ul style="list-style-type: none"> • Rural and peri-urban areas 	<ul style="list-style-type: none"> • Cooking • Lighting
3	Paraffin	<ul style="list-style-type: none"> • Rural and peri-urban areas 	<ul style="list-style-type: none"> • Cooking in Kisumu urban and peri-urban and Kibera peri-urban regions • Lighting in urban and rural areas
4	Agricultural residues (eg. sorghum, maize cobs/maize stalks)	<ul style="list-style-type: none"> • Kisumu and Nakuru rural areas • Kibera informal settlement 	<ul style="list-style-type: none"> • Cooking
5	Cow dung	<ul style="list-style-type: none"> • Rural areas 	<ul style="list-style-type: none"> • Cooking
6	Discarded plastic containers	<ul style="list-style-type: none"> • Kisumu rural 	<ul style="list-style-type: none"> • Cooking and lighting
7	Papyrus roots	<ul style="list-style-type: none"> • Kisumu rural 	<ul style="list-style-type: none"> • Cooking
8	Electricity	Used by a few FGD participants in: <ul style="list-style-type: none"> • Kibera peri-urban region • Mandera peri-urban region 	<ul style="list-style-type: none"> • Lighting • Charging mobile phone
9	Duom palm leaves and seeds	<ul style="list-style-type: none"> • Lodwar 	<ul style="list-style-type: none"> • Lighting • Food (fruit)
10	Charcoal dust balls	<ul style="list-style-type: none"> • Kisumu rural and peri-urban regions • Nakuru peri-urban region • Kibera urban & peri-urban regions 	<ul style="list-style-type: none"> • Cooking
11	Saw dust	<ul style="list-style-type: none"> • Nakuru rural 	<ul style="list-style-type: none"> • Cooking

Advantages	Disadvantages
<ul style="list-style-type: none"> • Clean • Easy to use • Flexible – embers can be used for ironing • Easy to economise • In Turkana rural region can be exchanged for food 	<ul style="list-style-type: none"> • Expensive • Smoke can kill if stove is not put out while sleeping • Contributes to cutting down of trees • Can affect health especially in confined urban housing • Supply diminishes during the rainy season
<ul style="list-style-type: none"> • Cheap and economical • Flexible – the wood can be used for building houses and animal enclosures • Can be sold off in difficult times to buy food 	<ul style="list-style-type: none"> • Expensive especially in some regions and scarce during the rainy season • Smoky and affects health • Difficult to use in confined urban housing • Difficult to transport in both rural and urban areas and exacerbates women’s workload • Risky for women to access in remote bushy areas
<ul style="list-style-type: none"> • Fast and saves time • Easily accessible in urban areas 	<ul style="list-style-type: none"> • Expensive • Smoky and affects the chest
<ul style="list-style-type: none"> • Lights fast and saves time • Easily available during the harvest period 	<ul style="list-style-type: none"> • Seasonal • Burns fast and is sooty
<ul style="list-style-type: none"> • Easily available where animals are kept • Cooks well and preserves fire especially on the three stone stove 	<ul style="list-style-type: none"> • Smells bad and can only be used outside the house • Not available in urban areas
<ul style="list-style-type: none"> • Catches fire fast and can be used to light other fuels such as papyrus roots 	<ul style="list-style-type: none"> • Smoky • Smells bad • Requires keen attention to the fire to avoid burning down the house
<ul style="list-style-type: none"> • Better than agricultural residues • Requires less attention • Flexible – papyrus embers can be used for ironing 	<ul style="list-style-type: none"> • Produces too much heat that wears out cooking utensils • Only found around Lake Victoria • Difficult to access and carry during the wet season
<ul style="list-style-type: none"> • Convenient • No smoke 	<ul style="list-style-type: none"> • Expensive • Can burn down the house if not properly connected
<ul style="list-style-type: none"> • Easily available for free • Plentiful 	<ul style="list-style-type: none"> • Requires keen attention to fire as it can easily burn down the house • Produces too much heat which ruins cooking utensils
<ul style="list-style-type: none"> • Charcoal dust, soil or ash easily available for free • Can be made at home • Burns slowly and helps to conserve charcoal 	<ul style="list-style-type: none"> • Requires to be used in combination with charcoal to ease lighting • Smoke can kill if stove is not put out while sleeping • Fumes can affect health
<ul style="list-style-type: none"> • Helps to conserve firewood 	<ul style="list-style-type: none"> • Sawdust stove expensive • Requires to be used in combination with firewood

In the Turkana peri-urban region the three-stone fire is preferred for cooking food for sale because it is easier to light, versatile and produces plenty of heat. The main disadvantages of using firewood were identified as soot, smoke and excessive heat that can affect health; firewood also requires a lot of space for storage and is difficult to use in the open during the rains.

3.1.3.4: Fuel Collection by Households: Fuel collection by households is primarily regarded as a woman's job although children assist sometimes. Women transport the majority of the fuel consumed in the rural and peri-urban regions, carrying it either on their head or back. Stories narrated by women from across the regions demonstrate that fuel collection and transportation takes a lot of time and, besides being a major burden for women, it also affects their health and marital relations. Examples on the impact of fuel collection on women's workload, health and marital relations are discussed below.

In the Turkana rural region for example, women trek up to 20 kilometres to fetch firewood and carry it back home on their heads. The journey is long and tedious and the women indicated that after fetching firewood they are so tired that they are unable to undertake any other work. "My legs normally pain a lot when I walk for long distances to fetch firewood," said a woman from Turkana. "Someone has to massage me after I walk long distances to fetch firewood. After the massage, I feel as if my body is light and I start working again," said another woman from Turkana. The women stated that if they could fetch firewood nearer home, they would not experience any pain.

In Kisumu rural region, women walk for up to two hours to the lake and after collecting papyrus roots they either carry them home on their heads or in some cases pay someone to transport the fuel home. However, this is an expensive option that only a few can afford. "We sometimes tie papyrus roots in a sack and carry on our heads but you cannot carry a lot of it because it is heavy. We sometimes use bicycles to transport papyrus roots home for firewood," said a woman from Kisumu rural region.

In the urban areas of Nakuru, Kisumu and Nairobi, charcoal and firewood are mostly purchased from local vendors in small quantities that are relatively affordable and easy to carry home. In urban Mandera on the other hand, women who can afford it obtain firewood delivered by donkey carts and off-loaded either near the house or within 20 minutes walking distance from where the women use either their arms or a wheelbarrow to carry it home.

Where firewood is obtained for free, for example in the rural regions of Kisumu, Mandera and Turkana, the frequency of collection is generally determined by household size, availability of food, distance to the source of fuel as well as the type of activities that can be combined with fuel collection. For example, in the Turkana rural region where women obtain firewood up to 20 kilometres away from home, fuel collection is not normally combined with other activities. The women are only able to carry enough firewood to last a few days and the stock is replenished after three or four days. Although there are regional and seasonal variations in the types of food accessed and cooked, a relatively large proportion of the food that people typically consume across the regions requires to be cooked, for example grains, legumes, fish, vegetables and meat. The frequency of fuel collection may therefore diminish greatly when there is little or no food to cook and increase during communal activities such as weddings, funerals and feasts, when there are visitors or more food is available for cooking.

In the Mandera rural cluster, women FGD participants said firewood collection is not usually combined with other activities and women transport the firewood although some have access to the family donkey cart while others may occasionally hire one for transport. In Mandera urban cluster on the other hand, women who have access to family donkey carts said they use them for transporting firewood for home use and for selling and the stock may last for one week, one month or two days, depending on how quickly it sells. In some cases women transport firewood for selling on their backs but it fetches less profit since they carry much less in comparison to a donkey cart.

In situations where fuel is purchased, for example in the urban areas, the frequency of collection is generally determined by household size, availability of food, cost and location of the source of fuel. In Kibera urban area for example, while some FGD participants said they can only afford to buy small quantities of charcoal on a daily basis, others indicated they buy enough to last for two or three days. A participant from Kibera mixed group indicated those who can afford buy a full bag of charcoal, which lasts for the whole month. In Nakuru region where temperatures are relatively low during the rainy season, FGD participants in the urban mixed cluster said they use a lot of charcoal during the rainy season since they need to heat their homes. In Kisumu rural and peri-urban regions where fuel collection near the lake is combined with activities such as planting, weeding and irrigation of vegetables as well as sourcing of food, it is undertaken on a daily basis. "Since our shambas [farms] are far away, we normally leave to go to the shamba and collect wood in the process. It is the children who leave home straight to collect firewood and back home. Adults go to the shamba as a main activity, and then collect firewood in the process," said a woman from Kisumu rural cluster.

Similarly, in Nakuru urban area, FGD participants said small amounts of fuel are purchased or collected on a daily basis, for example on the way home from income generating activities or waged labour. Fuel collection is also sometimes combined with activities such as buying vegetables, washing clothes or picking children from school. In contrast, in situations such as Turkana and Mandera rural regions where fuel collection is not normally combined with other activities women miss out on household tasks such as sourcing food and income generating activities such as weaving mats. The following quotation from a woman in Turkana rural region suffices to illustrate the opportunity cost that women in such regions incur as a result of spending much time on firewood collection: "Now [after collecting firewood] I have more work waiting to be done. I realize that I have not fetched water, I have not washed utensils, I have not swept, and when I leave the firewood collection site I feel so tired and all I do is to cook and we eat. I carry forward all the remaining work to be done the following day."

As indicated by the research findings above, the cost and/or scarcity of fuel is already a major constraint for many families. The findings also highlight the lack of alternative sources of fuel once the few available sources of fuel are depleted. For instance, women in Kisumu cited charcoal as an alternative source of fuel once the firewood supply is depleted; yet they simultaneously identified the cost of charcoal as a major constraint. There is however some level of awareness on the need for tree planting to ensure sustainable supply of fuel, as the following quotation from a woman in Turkana demonstrates: "We use firewood because it is a renewable source of energy. The government is encouraging us to plant trees. This means we can get more firewood."

3.1.3.5 Health and Other Effects of Fuel Collection and Use in Households:

Women from rural regions cited various health effects of collecting and using fuels such as firewood, agricultural residues, papyrus roots and cow dung. The most common health effects of collecting and carrying firewood include extreme tiredness, headache, a stiff back and pain in the legs, back, chest, ribs and shoulders. The most commonly cited health effects of using firewood are coughing, teary eyes, loss of eyebrows, dehydration, chest and eye problems resulting from continuous exposure to smoke, loss of appetite as



A woman (standing) from Turkana FGD demonstrates how the women usually massage each other's back to ease the pain of fetching firewood. At the foreground is a woman lying flat on her stomach as her back is massaged

well as cuts, bruises and other injuries resulting from collection or splitting of firewood. "If you use mabebe [maize stalks] for cooking the food smells of smoke so one lacks appetite," said a woman from Nakuru rural cluster. In some instances the women said sitting in a smoky kitchen for prolonged periods of time causes asthma. The most common health effects of using firewood among children were cited as danger of children getting burned or burning down the house, coughing and teary eyes. In Kisumu rural region, the women said smoke from plastic, cow dung and shoes makes both children and adults cough and can lead to chest problems.

The baseline survey results also indicate that fuel collection in combination with other work done by women not only impacts negatively on their health but also affects marital relations. Women FGD participants said that after collecting and carrying heavy firewood, they are unable to respond to their husbands' needs. The women explained that after collecting and carrying a heavy load of firewood all they want is to do is rest, but men expect the meals to be ready on time; they also expect women to respond to all their needs. "Men do not realize we do a lot of work," said one woman. The women explained that although they get angry over this state of affairs, they suffer in silence since issues related to sex are not discussed openly. The women also indicated that carrying heavy firewood and doing other work makes them age fast and look ugly and their husbands begin looking for other women who look better.

Male participants in mixed FGDs echoed similar sentiments on the effects of fuel collection by women. The men expressed concern that women complain of fatigue after collecting firewood and are unable to respond to their husbands. While some of the male FGD participants acknowledged that their wives get very tired and age very fast because of the amount of work they do, they reiterated that it is not a man's duty to carry firewood or to cook. The men cited polygamy as an option some of them take to help cope with the situation. However, some of the men expressed concern and sympathy towards the plight of women. "This tired woman comes with so many complaints: backache, tiredness and headache. I even move away. I can tell the children to cook for me and I leave her alone," said a male FGD participant. "When my wife brings firewood she really gets tired and her body aches. I feel pity for her. I am still thinking of her even now, can't you see her hair is turning white?" said another man pointing at his wife.

3.1.3.6 Gender Roles and Decision Making in Household Energy: FGD results indicate that culture, socio-economic environment and level of income are the major factors influencing gender roles and decision making in household energy as well as access to resources, food and livelihoods. The results indicate that gender roles and responsibilities differ from region to region but division of labour is practised in all the regions. For example, in the urban areas of Kisumu, Nakuru and Kibera in Nairobi, where jobs and means of livelihood are scarce, both men and women provide money for purchasing fuel but women are the key decision makers on the types of fuel used. In rural regions where traditional attitudes still persist, women bear the burden of fuel collection and other household labour as well as farming. Both boys and girls contribute to household labour including fuel collection in the rural and urban clusters but girls play a more prominent role.

In Turkana, Mandera and Kisumu rural regions where cultural traditions still hold strong and income levels are relatively low, women bear the burden of fuel collection and transportation while men are not expected to play any role in fuel collection. Similarly, culture dictates that household tasks such as cooking, cleaning, caring for the young as well as small-scale businesses such as weaving mats, selling cooked food and firewood are women's work while men engage in activities such as farming, and casual jobs in sectors such as selling animals and construction. Although women are the key decision makers on the types of fuel used in the urban areas of Kisumu, Nakuru and Kibera in Nairobi where the prevailing attitudes are more modern while jobs and means of livelihood are scarce, both men and women provide money for purchasing fuel.

3.1.3.7 Sources of Information in Households: The research findings indicate that there are few sources of information on energy services especially in the rural areas. Yet judging from comments elicited by pictures of various energy services/appliances, the women are eager to learn more about alternative energy services, for example the fireless basket cooker and biogas. A few sources of information cited by women include women's groups, friends, supermarkets, displays and demonstrations. It also emerged that lack of information and follow-up extension service is a deterrent to adoption and sustained use of modern energy services/appliances. For example, a woman from Kisumu urban region narrated how they learned to make the energy saving stove but after some time their interest waned; as a result they did not make any stoves for sale and they abandoned the technology altogether.

3.1.3.8 Sources of Credit for Households: As part of the baseline survey FGD participants were asked whether there is anywhere they can borrow money to buy energy saving stoves and pay the money back over time. The survey findings indicated that in the Kisumu and Turkana urban region there are several agencies offering credit but it is not specific to the bioenergy context. "No group has come in that line of funding for bioenergy. Banks can only give you funds for your business but not for bioenergy," emphasised a participant from Kisumu urban region. Sources of credit cited by FGD participants in Kisumu include the Kenya Rural Enterprise Programme, Kenya Women Finance Trust, Small Enterprise Programme, Community Mobilization Empowerment for Development and Advancement and a catholic micro-finance organization known as Adok. In Turkana urban region FGD participants said that an organisation known as Turkana Education for All mobilised a group of women to form a group. Some of the women registered themselves and received loans for business. However the participants indicated that only a few women had benefited; while many others are eager to start businesses, they lack capital. "We have the urge to start businesses but we lack capital. If we got assistance to get capital we can start a business," concluded a woman from the Turkana urban cluster.

FGD participants from Kibera, Mandera and Nakuru urban regions said they do not have any access to sources of credit. Similarly, participants from Turkana, Nakuru and Kisumu rural regions indicated lack of access to sources of credit. A woman who sells charcoal in Turkana rural region said: “There is nowhere we can get a loan. If I bring two sacks of charcoal I have to wait until I sell the charcoal, maybe one sack and that will be my food. There is no one who can give us money. One can only be given food but not money.” Another woman from Turkana rural region re-affirmed: “You know people take loans knowing that they will pay back. We don’t have income so we cannot form groups to take loans - that is why we fear loans.” Said a woman from Nakuru rural region: “Loans are not available and there are no people who have come here to inform us about loans but it is not like we don’t want loans, we wish to develop like the other areas.” Women from Kisumu rural region expressed similar sentiments. “We have not been able to form any groups that can push for credit to do business,” emphasised a woman from Kisumu rural region.

3.2 Food, Water and Bioenergy Access and Delivery in Institutions

3.2.1 Food



Example of an energy saving Institutional stove with fitted pots developed by Mussoo Engineering on display at Kisumu. Mussoo is an income generating initiative implemented by a youth group in the urban and rural areas of Kisumu, Nyanza and Baringo districts

As part of the PISCES baseline research, in-depth interviews were conducted with a sample of institutions using bioenergy with the aim of assessing energy access and delivery in the institutions. The sampled institutions include three primary schools, three youth training institutions, two public hospitals and three hotels. While hotels have a more flexible budget and can access a wider variety of food, the majority of public institutions especially schools operate a relatively small budget and access only a few types of food especially maize and beans, pulses, maize meal (ugali), rice, kales and beverages. Public schools rely on the school-feeding programme that is run by

the government. They have a set menu and meals are expected to be ready on time so as not to interfere with learning activities.

Profit making institutions such as hotels and public hospitals have a relatively large budgetary allocation and can afford a wider variety of food as well as energy services/technologies. The survey findings indicate that in particular, hotels as profit making institutions access a wide variety of foods and while breakfast is a set meal for residents and a few meals are prepared in advance, other meals are cooked on demand. For example, Jams hotel in Nakuru prepares meals for an average of 50 – 100 persons per day depending on the volume of business. In comparison, schools access a limited choice and quantity of food types and energy services/technologies due to cost implications. In addition, while hotels, hospitals and youth training institutions serve breakfast, lunch and dinner, only one meal is prepared in the sampled primary day schools.

The findings also indicate that institutions normally tender for supply of both food and fuel, which is delivered by middlemen using vehicles or donkey carts. This affects access to food and fuel as well as the type and quality of meals served due to the high cost of transport, especially among the sampled schools. The survey results also indicate that in regions such as the ASALs where famine is a common phenomenon, schools rely on relief food while fuel supply is often precarious due to the low budgetary allocations.

3.2.2 Water

Sources of water among the sampled institutions include rivers, wells and boreholes, dams, underground water and rainwater harvesting, among others. A majority of institutions are connected to piped water from permanent sources such as rivers and boreholes, and some harvest rainwater. In some cases, water supply is disrupted during the dry season, and the affected institutions tend to rely on water storage tanks and water vendors. The water supply is however sometimes disrupted due to lack of electricity at pumping stations or the breakdown of a generator, forcing institutions to rely on water vendors.

The above findings imply that while majority of institutions have made effort to ensure a regular supply of water, there are variations in the quantity, cost and quality of water accessed by different institutions especially during the dry season. The findings also indicate that cost of water varies greatly between institutions and from season to season. Hotels and large public institutions including hospitals and training institutions are metered and billed on a monthly basis; therefore the overall cost of water depends on the quantity of litres consumed. For example institutions such as Turkwell Lodge in Lodwar, Kisumu Gee CDC and Lodwar Polytechnic have a regular supply of clean water from sources such as the Ministry of Water and local water supply systems, for which they are billed on a monthly basis. In contrast, Madaraka Primary School in Nakuru and Lodwar Polytechnic in Turkana are connected to piped water for which they are billed on a monthly basis but sometimes they buy water from vendors when supply is disrupted. Although a few schools indicated they receive free water supply, they incur the cost of pumping the water while others may incur the cost of transporting water during periods of shortage.

3.3 Bioenergy

3.3.1 Types of energy services/fuels used for cooking in sampled institutions: Findings from the key informant interviews indicate that the types of energy services used for cooking in the sampled institutions include energy saving stoves, improved charcoal stoves, traditional charcoal stoves, the three stone fireplace and, in one case, a gas cooker. Firewood is the main type of fuel used for cooking in the sampled public hospitals while the hotels tend to use a combination of charcoal and gas for cooking and electricity for lighting. Similarly, the sampled hospitals use electricity for lighting.

Table 4 summarises the types of energy services/fuels used for cooking in the sampled institutions. The findings indicate that institutions such as hospitals have to a large extent adopted modern energy saving technologies such as improved stoves. For example, both Kisumu and Manderu general hospitals have adopted energy saving firewood and charcoal burning stoves with fitted cooking pots. In contrast, some of the sampled schools still rely on the traditional three stone stoves. For example, the traditional three stone fireplace and firewood technologies are used at Manderu Boys Town Primary School and at Madaraka Primary School in Nakuru.

Key informants from public institutions including schools identified the prevailing high cost of food, fuel and transport as a major constraint. In particular, respondents from schools in rural regions described how despite the school feeding programme they strive to maintain the feeding programmes at great cost due to scarcity of fuel. Some of the coping mechanisms used by day schools include asking children to bring fuel to school, which inadvertently increases women's workload due to increased frequency of fuel collection in households.

The findings also imply that cost is one of the key factors affecting adoption of energy saving stoves among schools. For example, Lodwar Primary School adopted improved cooking stoves, which were donated by an NGO. However, the findings also indicate that even where institutions have adopted energy saving stoves they sometimes revert to the traditional three stone fireplace during emergencies or in cases where they need to prepare small quantities of food. For example, Lodwar Youth Polytechnic uses Bellerive energy saving stoves for cooking with firewood but sometimes they resort to the traditional three stone stove for preparation of small quantities of food. As the following comments from the key informant at Lodwar Youth Polytechnic indicate, the institution is aware of the need to maximise energy conservation and is planning to address the problem: "When the number of students is small we face problems making food for them but we are looking for a way of getting smaller stoves that can cook for a small number of students."

Table 4: Summary of Types of Energy Services/Fuels Used for Cooking in Sampled Institutions

Site	Institution	Types of Energy Services	Types of Fuel Used
Kisumu	Kisumu General District Hospital	Energy saving stoves with fitted cooking pots	Firewood Charcoal
	Kisumu YMCA	Energy saving stoves with fitted cooking pots Traditional charcoal stove	Firewood Charcoal
	Kisumu Gee CDC	Three stone fire Jiko with liner Traditional charcoal stove	Firewood Charcoal (rarely) Gas (for the office)
Nakuru	Jams Hotel	Charcoal stove Gas cooker	Charcoal Gas
	Madaraka Primary School	Three stone fireplace	Firewood
Turkana	Lodwar Polytechnic	Charcoal Paraffin Charcoal dust balls	Firewood
	Lodwar Primary School	Energy saving stoves Three stone fire (for emergencies)	Firewood
	Turkwel Lodge Hotel	Energy saving stove with clay liner Traditional charcoal stove Electric cooker	Charcoal Electricity
Mandera	Mandera Boys Town Primary School	Three stone fire	Firewood
	Mandera Hospital	Energy saving stoves with fitted cooking pots Traditional charcoal stove	Charcoal
	Mandera Hotel	Energy saving stove lined with cement	Firewood Charcoal

3.3.2 Cost and other aspects of food and fuel consumption by sampled institutions:

The findings indicate that institutions access and use large quantities of food and fuel, which is in most cases locally purchased from middlemen on the basis of tendering systems. For example Mander District Hospital uses about two bags of charcoal per day to prepare meals for an average of 70 – 80 patients per day. On the other hand, Lodwar Polytechnic in Mander purchases three lorry loads of firewood per term at 7,000 shillings per lorry load while Mander Boys Town Primary School uses three donkey carts of firewood per term at a cost of 1,400 shillings per donkey cart.

Key informants from the sampled institutions especially schools and other learning institutions cited the rising cost of food and fuel as a major budgetary constraint. “Everything is going up in price; even food is very expensive these days. We don’t get good quality firewood the way we used to get previously. We get small pieces of wood that get finished very fast and we have to be careful so that we don’t use a lot of firewood,” said the key informant from Mander Boys Primary School. Similarly, key informants from other sampled institutions cited high costs of food and fuel.

It is difficult to assess the volume and cost of food and fuel used by different institutions based on data from the key informant interviews due to the great variations in the number and type of meals cooked, number of people served as well as the lack of standardised measurements for assessing cost per volume/quantity of food or fuel. It is however possible to draw some general conclusions. For example, the findings indicate great variations in the quantity of food and fuel accessed and used in both institutions and hotels since it depends on the number of people served, the types of meals prepared as well as the types and quality of fuel used. Kisumu General Hospital has a bed capacity of 300 patients and prepares three main meals as well as beverages for an average of 150 - 200 patients per day, depending on the number of admissions. In contrast, Mander Boys Town Primary School cooks only one meal per day (lunch) for approximately 1,550 pupils aged between 5 – 18 years.

Key informants from institutions identified health effects of using firewood such as deterioration of eyesight and pain in the chest. Sometimes institutions receive wet or green firewood, which is smoky and difficult to light, and this affects the health of those using the firewood. The informants also demonstrated awareness that health effects can be addressed through the use of improved energy services. For instance, one of the key informants at an institution in Nakuru expressed a wish for “those jikos (stoves) that don’t produce a lot of smoke”.

3.4 Bioenergy Stakeholders

3.4.1 Background

As part of the PISCES project socio-economic baseline survey, information on stakeholders in bioenergy was documented through in-depth interviews in Turkana, Mandera, Kisumu and Nakuru. Stakeholders in bioenergy include government institutions, local and international NGOs and charitable organisations. Some of the stakeholders, particularly those that are government oriented such as the MOA and KEFRI are working in the whole of Kenya, while others like Oxfam GB and World Vision Kenya have region specific coverage. On the other hand, stakeholders such as Consortium of Cooperating Partners (COCOP) and SCODE are working in only one or two regions. Stakeholder activities in bioenergy vary greatly and include policy and advocacy, afforestation, community forestry, promoting energy saving stoves and eco-charcoal, among others.

3.4.2 Summary of Stakeholder Profiles

A summary of stakeholder information is provided below and on table 5. Appendix 4 provides detailed stakeholder profiles.

3.4.2.1 Kenya Forest Service (KFS): This is a Kenya state corporation working all over Kenya with the specific role of encouraging afforestation with the aim of increasing forest cover to enable communities to sustainably access firewood and charcoal for households energy and income generation. Its general activities are community sensitisation on forest conservation, forest policy and advocacy, afforestation, supporting non-wood forest products production and implementation of Community Action Plans related to forest conservation. The sampled regions include Turkana, Mandera and Kisumu. KFS activities in the sampled regions include the following:

- In Turkana KFS is supporting community access to seedlings and also addressing food security issues by supporting farmers to access fruit trees seedlings.
- In Mandera district KFS is sensitising the local community on the importance of conserving trees, creating awareness on the importance of forests and promoting environmental conservation. KFS is also working in collaboration with ALRMP, other NGOs and schools to encourage water harvesting, establishment of tree nurseries and land rehabilitation.
- In Kisumu KFS is working with farmers in Kogony area to promote production of tree seedlings, catchment area planting, tree painting on public land and rehabilitation of invaded land, among other activities. Other activities are establishment of tree nursery groups in Kadibo and promotion of improved charcoal burning kilns in Madiany to enhance the quantity and quality of charcoal production.

3.4.2.2 Oxfam GB Kenya: This is an international charitable organization that links humanitarian work with livelihoods. Oxfam has an office in Lodwar in Turkana, and also works in Wajir and Nairobi where it implements an urban programme in informal settlements, among other programmes. In Turkana, Oxfam promotes eco-charcoal derived from dead wood, which is plentiful in the district. It supports women groups to establish tree nurseries to replace the dead wood, among other activities.

3.4.2.3 World Vision Kenya in Turkana: World Vision is an international NGO, which works in over 100 countries worldwide and all over Kenya. In Turkana the organization in collaboration with KEFRI distributed 1000 jatropha seedlings mainly for planting along the Turkwell river. The initiative trained 60 women and 50 men and sponsored an exposure tour to KARI in Machakos for 20 community representatives.

3.4.2.4 Arid Lands Resource Management Programme (ALRMP) in Mandera: ALRMP is an independent project funded by the Government of Kenya in collaboration with NGOs. It works in 28 districts within the ASALs of Kenya and the main activities are capacity building and resource utilization in agriculture and livestock production sectors. Other activities are in the education sector, which addresses water and sanitation, health and nutrition, conflict resolution and organizational management. In food security ALRMP supports irrigation schemes, lining of irrigation canals, promotion of improved animal breeds and provision of irrigation pumps, seeds and ox-ploughs. ALRMP also addresses natural resource management, drought management, wet and dry season grazing management. There are plans to introduce energy saving stoves in Mandera to control excessive cutting of trees for firewood and charcoal.

3.4.2.5 Consortium of Cooperating Partners (COCOP) in Mandera: COCOP is a local NGO working with the community in Mandera and of three agencies: Emergency Pastoralist Assistance Group (EPAG), Northern Region Development Agency (NORDA), and Rural Agency for Community Development Assistance (RACIDA). Through the FFA programme COCOP has revived the Border Point 1 Irrigation Scheme through lining about 1.5 kilometres of the irrigation canal using concrete. Similar activities are being undertaken in Auresha, Gadudia, and Ramodintu, all of which lie along the Dauwa river course.

3.4.2.6 International Centre for Research in Agro-forestry (ICRAF) in Kisumu: ICRAF is an international NGO working in 114 countries worldwide. In Western Kenya ICRAF works in 22 districts for example Kisumu, Bondo, Siaya, Vihiga and Kakamega, among others. ICRAF's activities include soil fertility improvement and management, supporting community income generation activities and environmental conservation. ICRAF is undertaking a programme in bioenergy production with the aim of improving wood fuel production. In the Dago area, ICRAF has supported groups to establish woodlots and also supported Keyo women's group to produce ceramic stoves through information dissemination.

3.4.2.7 SCC VI Agro-forestry in Kisumu: SCC VI Agroforestry is an international NGO consisting of two organizations - the Swedish Co-operative Centre and VI Agro-forestry. In Africa it uses VI Agroforestry as the working name and works in Kenya, Uganda, Tanzania and Rwanda. VI works in various regions in Kenya. In the Lake Victoria Basin VI is working with smallholder farmers to improve their livelihoods specifically in the areas of agri-business development, environment and climate change, nutrition, HIV/AIDS, gender and a micro-finance component called Village Savings and Loaning; it also implements a small component on vulnerable children called Children of the World. VI works in the Kisumu, Nyando, Rachuonyo and Siaya districts where it has so far distributed tree seeds to farmers in various divisions.

3.4.2.8 Ministry of Agriculture (MOA): This is a government institution working in the whole of Kenya. It deals with soil conservation, cash and food crops production and marketing of agricultural produce. The MOA aims to reduce poverty levels through increased food production and creation of self-employment and business. MOA activities cover a wide range of areas for example farmer training and provision of extension services, information dissemination, soil improvement, crop management and harvesting technologies, soil improvement and conservation, among others.

In Kisumu MOA is implementing bioenergy initiatives including two production centres for improved stoves in Winam. MOA also works with the community groups in Kogony, Kanyakwar, Dago and Mkendwa (KOKADAM) sub-locations. The MOA has a district office in Lodwar and activities in Turkana where it is promoting dairy goats to encourage zero grazing and thus dung collection for biogas production although uptake is very slow due to the nomadic lifestyle of the Turkana people.

3.4.2.9 SCODE: This is an NGO located in Nakuru North, Bahati division, but it has countrywide activities. In other countries SCODE works with partners and is part of a network that goes beyond Kenya. SCODE's mission is to improve the quality of life of people by enabling them to have access and use of technology and approaches that are environment friendly and that contribute towards sustainable development. It has adopted a private sector approach to many of its activities.

SCODE is an NGO involved in capacity building and implements an agro-forestry project that trains individuals on tree planting for energy provision. It has a biogas component that is involved in the actual construction and installation of biogas.

3.4.2.10 Kenya Forestry Research Institute (KEFRI) in Turkana: KEFRI is a parastatal that carries out forestry research in six regional centres, namely coastal, eastern, and central, Nairobi, Rift Valley and western regions. Lodwar is the substation of Londiani regional centre dealing specifically with dry land forestry. KEFRI's activities in Lodwar include dry land research both in wood forest products and non-wood forest products such as gums and resins and also wood by-products. In Turkana KEFRI covers an ecological zone that is 100% arid and is promoting dry land forestry species.

Table 5: Summary of Bioenergy Stakeholders

Stakeholder	Orientation	Role/area of operation	Sampled region/ongoing activities in bio-energy
1 Kenya Forest Service (KFS)	Government institution (corporation)	Working in Kenya with the specific role of encouraging afforestation to enable communities to sustainability access firewood and charcoal for household energy and income generation.	In Lodwar (Turkana), Mandera and Kisumu districts, KEFRI is involved in community sensitisation on forest conservation, forest policy and advocacy, afforestation, support of non-wood forest products production and implementation of Community Action Plans related to forest conservation.
2 Oxfam GB in Kenya	International charity organisation	A humanitarian organization addressing livelihoods and food security, relief, livestock, peace building, education, public health and business support. Works in Lodwar (Turkana), Wajir, and Northern Turkana and in Kibera informal settlement in Nairobi.	In Turkana Oxfam promotes eco-charcoal because it is derived from dead wood, which is plenty in Turkana district. Supports women groups to establish tree nurseries to replace the dead wood.
3 World Vision Kenya	International NGO	Works in the whole of Kenya including Turkana in education support, food security, HIV/AIDS response, children sponsorship and programme management.	In Turkana, World Vision produced 1000 jatropna seedlings from KEFRI and distributed them to farmers mainly for planting along the Turkwell river.
4 Arid Lands Resource Management Programme (ALRMP)	Government institution	Works in 28 districts in the ASALs of Kenya, including Mandera.	In Mandera activities include promoting the use of energy saving stoves, promoting clay bricks making machines to control use of firewood in brick making and educating the community on the use of clay pots for energy conservation.
5 Consortium of Cooperating Partners (COCOP)	Local NGO	Works in Mandera in relief distribution and irrigation schemes	They do not have any specific activities in bioenergy but were able to provide information on prosopis and its impacts of its use on livestock and people.
6 International Centre for Research in Agro-forestry (ICRAF) in Kisumu	International NGO	Works in 14 countries worldwide. In Western Kenya ICRAF works in 22 districts which include Kisumu, Bondo, Siaya, Vihiga, Kakamega, Rachuonyo, Nyando and Sotik, among others.	In the research regions activities include soil fertility improvement and management, supporting community income generation activities and bioenergy production for improving wood fuel production. Has assisted farmers by linking them to tea factories to enable them market logs for use as firewood
7 SCC VI Agro-forestry in Kisumu	International NGO	Working in Africa/Kenya under the name VI Agroforestry. Working with smallholder farmers around the Lake Victoria Basin to improve livelihoods.	Has been distributing tree seeds to farmers in Nyando division, Miwani division, Muhoroni, Upper and Lower Nyakach, Kadibo division, Winam division, Kabondo division, East Rachuonyo division, and this year VI moved to Maseno division.
8 Ministry of Agriculture (MOA)	Government institution	Working in the whole country in the areas of soil conservation, cash and food crops production and marketing of agricultural produce, among others.	MOA is promoting environmental conservation through bioenergy initiatives in Kisumu town and Turkana Central and plans to continue promoting jatropna and biogas.
9 SCODE	Local NGO	Located in Nakuru North. Works countrywide to improve the quality of life by enabling people to access and use technology and approaches that are environment friendly and that contribute towards sustainable development.	Work countrywide. Established in 1998 for promotion and installation of domestic and institutional biogas systems as alternative sources of clean energy in off-grid areas of rural Kenya.

3.5 Stakeholder Initiatives in Bioenergy

3.5.1 Background

A total of five stakeholder initiatives were identified during the fieldwork and PISCES researchers held key informant interviews with stakeholder representatives. Information on another five stakeholder initiatives was sourced through secondary research and included in the baseline survey report.

3.5.2 Summary of Stakeholder Initiatives in Bioenergy

The initiatives are highly innovative and play an important role in establishment of renewable bioenergy services/technologies, income generation and food production in specific rural and urban regions. Beneficiaries of stakeholder initiatives include community groups, farmers/individuals, households and institutions such as schools. Secondary research on the other five initiatives indicates they are also highly innovative; however it is difficult to judge their impact in the absence of adequate information. A summary of stakeholder initiatives in bioenergy identified during field surveys is provided below and on Table 6. A detailed description of the initiatives is shown in Appendix 5. Table 7 shows a summary of information on stakeholder profiles sourced from secondary data

Following is a summary of information on stakeholder initiatives in bioenergy based on field surveys:

- Lanet Farmers Dairy SACCO: Implemented by SCODE, this initiative enables dairy farmers in Nakuru District to access domestic biogas systems through a local dairy cooperative society. SCODE provides initial business and technical training to enable farmers to make informed decisions about taking loans for biogas, as well as installation services once a loan is taken.
- Manufacture of Institutional Cookstoves: Implemented in Kisumu by Musso engineering, a private enterprise started in 2006 for production of energy saving institutional stoves. Covers Kisumu and most parts of Nyanza region and Baringo District in Rift Valley Province of Kenya
- Prosopis: Implemented by COCOP in Mandera and provides information on Prosopis juliflora, an invasive weed that grows abundantly in the ASALs that can be used to produce charcoal, firewood and building materials.
- KOKADAM: Implanted in Kisumu by KOKADAM Youth Group and was initiated in 2007. Undertakes installation of upesi energy saving stoves for households, establishment of woodlots for firewood and timber, environmental conservation and food production through agroforestry.
- Kochuka Women Group: Works in Kisumu to provide financial assistance to group members through micro-credit community schemes (merry-go-round) and to generate income from agroforestry and energy saving devices.

Following is a summary of information on stakeholder initiatives in bioenergy sourced from secondary data:

- Community Driven Commercial Afforestation (CODCA): Implemented in Bondo and Kisumu districts and initiated in 2002 for fuelwood contract farming. KEFRI and other collaborators are in the process of looking for more funds to up-scale the afforestation project.
- Promotion of sustainable production and consumption of woodfuel in boarding schools: Implemented in Mt Kenya region to assist schools establish woodlots and to acquire energy saving stoves through a micro-credit scheme.
- Sustainable energy supporting people affected by HIV/AIDS: Implemented in Kitui district at Nyumbani Village. Promotes sustainable charcoal and woodfuel production for own cooking requirements, production of household cookstoves, and production of liquid fuels from castor and jatropha for lighting and other needs.
- Biodiesel production: Implemented in Naro Moru in Nyeri district as a business enterprise involved in production of biodiesel from croton seeds.
- Rural Electrification: Implemented in Murang'a south district by Ministry of Energy (MOE) in collaboration with United Nations Industrial Development Organisation (UNIDO) to generate electricity from banana waste. A biogas digester that feeds a 12 KVA Generator has been installed and uses 20% diesel and 80% biogas.

4. Constraints

In all the regions surveyed PISCES identified key constraints/barriers to bioenergy access, which include poverty and high cost of living, lack of information, lack of awareness, culture and climate.

4.1 Poverty and High Cost of Living

FGD participants identified poverty and the high costs of basic commodities including cooking fuels as a major constraint. Judging from FGD findings, poverty and the high cost of living are manifested in factors such as scarcity of food and water, lack of access to modern energy services and technologies, poor living conditions and lack of viable alternatives for income generation among others. FGD participants also identified factors that have led to increased levels of poverty; for example, the high cost of basic commodities, drought leading to the death of large numbers of animals in pastoralist areas and crop failure in agricultural areas.

4.2 Cultural Barriers

In the rural regions culture dictates that fuel collection is a woman's job. While the research indicates that men are aware of the desperate struggle women experience in their efforts to provide fuel for cooking along with other duties such as housework and farming, this awareness has not resulted in any support for women due to strong cultural barriers. Culture also dictates that in an overwhelming majority of cases men own land and other production resources. While women can make decisions on the types of crops grown, tree planting is generally associated with ownership of land and regarded as a man's job. Likewise, ownership of trees is in majority of cases the domain of men and women must seek the man's permission to cut down any trees for fuel. Other barriers include communal attitudes towards some tree species, which inhibit their use as fuel. For example in Kisumu, FGD participants said that

certain trees bring a bad omen for example the umbrella tree, which the community said causes death and sickness such as malaria and anaemia if it grows towards the house. The participants also indicated that a species locally known as chamama is bad because it is used for witchcraft.

4.3 Land Productivity

FGD participants in rural regions were requested to indicate if there had been any changes in the productivity of their land and crop yields. Participants cited changes in weather patterns such as prolonged drought leading to failed harvests and the death of large numbers of animals. Other changes include drying up of water sources such as wells and rivers as well as depletion of forests leading to scarcity of fuel. The women said they are forced to walk further and further away of forests leading to scarcity of fuel. The women said they are forced to walk further and further away from home in search of water and fuel. PISCES researchers identified the use of crop residues for fodder and fuel as common practices, which leads to removal of sources of nutrients from the soil and affects land fertility.

Table 6: Summary of Stakeholders Initiatives in Bioenergy (Based on Field Surveys)

Initiative	Region/Location	Implementing Agency/information source	Bioenergy Type	Description
1 Lanet Farmers Dairy SACCO	Lanet, Nakuru	SCODE	Biogas (Bioresidues)	Started in 2006. Dairy farmers pay the full cost of the domestic biogas systems through loans given by the dairy cooperative. The Cooperative has linked up with KUSCCO, a financial institution support funding. The project has done about 10 biogas units and is gearing up to the 50 units it is targeting.
2 Manufacture of Institutional Cookstoves	Kisumu	Musso Engineering	Fuel wood (Bioresource)	A private enterprise. Started in 2005. Produces energy saving institutional stoves. Covers Kisumu and most parts of Nyanza region and Baringo District in Rift Valley Province of Kenya
3 Prosopis	Mandera	COCOP	Fuel wood Bioresource	Provides information on Prosopis juliflora, an invasive weed that grows abundantly in the ASALs that can be used to produce charcoal, firewood and building materials.
4 Kokadam	Kisumu	Kokadam Youth Group	Fuel wood (household cook stoves) - Bioresources	Initiated in 2007 by Kokadam Youth Group to generate income through installation of UPESI energy saving stoves for households, establishment of woodlots for firewood and timber, environmental conservation and food production through agroforestry.
5 Kochuka Women Group	Kisumu	Kochuka Women Group	Fuel wood Bioresource	To provide financial assistance to group members through micro-credit community schemes (merry-go-round) and to generate income from agroforestry and energy saving devices.

Table 7: Summary of Stakeholder Initiatives in Bioenergy (Sourced from Secondary Data)

Initiative	Region/Location	Implementing Agency	Bioenergy Type	Description
1 Community Driven Commercial Afforestation (CODCA)	Bondo in Kisumu district and Tinderet in Kericho district	Thuiya Enterprises Ltd	Fuel wood Charcoal	Initiated in 2002 for fuel wood contract farming. The trees reached the six-year maturity stage in 2008 and KEFRI is currently carrying out charcoal firing studies to recommend the most efficient processing method. The collaborators are in the process of looking for more funds to up-scale the afforestation project.
2 Promotion of sustainable production and consumption of woodfuel in boarding schools	Mount Kenya region	Rural Energy Technology Assistance Programme (RETAP)	Energy conserving stoves	The project has been helping schools to establish woodlots and is also running a tailor-made micro-credit scheme that gives schools loans with which to acquire the energy saving stoves.
3 Sustainable energy supporting people affected by HIV/AIDS	Kitui district	Nyumbani Village/Children's Home	Fuel wood Charcoal Household stoves Biodiesel	Bioenergy activities include sustainable charcoal and woodfuel production for own cooking requirements, production of household cookstoves, and production of liquid fuels from castor and jatropha for lighting and other needs.
4 Biodiesel production	Naro Moru, Kieni in Nyeri district	The Help Self Help Centre (an NGO)	Biodiesel	Production and sale of biodiesel from croton and castor seeds. The Bio-diesel has become so popular among operators of local public service vehicles that the processor is unable to meet rising demand.
5 Rural Electrification	Muranga South, Central Province	UNIDO Rural energy initiative	Electricity	The Kamahuha energy Kiosk uses banana waste to run a Biogas digester that feeds a 12 KVA Generator. The Generator uses 20% diesel and 80% biogas. The energy generated is used for productive end uses.

5. Opportunities

Key opportunities emerging from the study include the availability of bioenergy stakeholders and initiatives, locally available resources and a felt need for information on alternative technologies and sources of fuels.

5.1 Availability of Stakeholders and Bioenergy Initiatives

As demonstrated in Section 3.4, there is a recognisable presence of bioenergy related stakeholders and related bioenergy initiatives in the survey regions. The stakeholders include government institutions, international and local NGOs as well as private firms. The study however indicates minimal collaboration among stakeholders and this reveals an urgent need for establishment of mechanisms for networking and collaboration among stakeholders with a view to accelerating development in the sector. The study also presents opportunity for the stakeholders' initiatives to be studied in detail with the aim of enhancing their activities for the benefit of communities in their catchments. It is also highly desirable to link specific initiatives with potential donors who can support them to improve efficiency and to benefit more people.

The study also presents opportunity for replicating the most viable bioenergy initiatives in regions with similar conditions, and a few examples may serve here for illustration. Stakeholders in Nakuru region, for example, have the opportunity to learn from and adopt the technologies that have successfully been promoted by RETAP in Mount Kenya region. Likewise, there is potential for further research on *Prosopis* in Mandera district and the findings could be replicated in Turkana and Lodwar. The experiences of Naro Moru Diesel demonstrate that production of biodiesel as a cheaper alternative fuel for owners of diesel operated vehicles is a possible option in regions where croton and castor species grow in abundance, for example Nakuru and in some of the ASAL areas.

5.2 Locally Available Resources

Locally available resources include human resources, land, water and vegetation. However, the availability and distribution of such resources is region specific. In addition, access, sustainability and use of these resources in both the short and long-term may be affected by constraints such as land degradation, drought and increasing deforestation. In Mandera and Turkana for example, the invasive species *prosopis juriflora* grows abundantly and could be exploited as a source of fuel. However, there is need for further research on the thorny species to determine how it can be harnessed for production of charcoal as a biofuel. Also located within the same districts are large tracts of land that can be exploited for production of drought resistant tree species for fuel and income generation.



Women and children at a home in Mandera during the survey

5.3 Willingness to learn about Alternative Technologies/ Sources of Fuel

FGD participants demonstrated a strong sense of willingness to learn if given the opportunity. They expressed the need for information on alternative technologies/ sources of fuel such as the fireless basket, solar and biogas as well the cost and affordability of such fuels.



A joyful Turkana lad at Naisinger village

6. Recommendations

6.1 General Recommendations

The research findings strongly indicate that drought leading to scarcity of food, water and fuel is a major problem in the research regions. This means that however well intended, any intervention that does not take into consideration peoples' basic needs especially food, is unlikely to succeed. In regions such as Mandera, for example, where scarcity of food and famine is a constant threat to the survival of families, the researchers found that interventions in bioenergy can only be relevant if they go hand in hand with other basic unmet needs such as food and water.

6.2 Recommendations on Bioenergy Access and Delivery in Households

Explore ways in which to enhance collaboration among stakeholders to promote sustainable use of bioresources, biofuels and bioresidues at the household level and share these experiences with policy makers. Interactions - involving exchange, trial and error, feeding back of experiences and continual improvement of initiatives - are a fundamental component of a successful "Innovation System" in a given technology sector and PISCES explicit Innovation Systems approach may therefore be important in stimulating these processes.

There is need to further analyse how best to address information gaps and lack of awareness on alternative bioenergy technologies/resources in the rural and peri-urban areas. This can best be done by working with stakeholders who already have ongoing programmes on efficient bioenergy provision in the country.

The study re-affirms that acquisition and delivery of food, water and fuel for households aggravates women's workload. Indeed the perils women undergo in their search for water and firewood, especially in Turkana, are overwhelming. The health of women and other members of the family are affected by inhalation of firewood fumes while marital relations are affected due to extreme pressure on women. This calls for awareness creation among communities in order to foster change in attitudes so that provision of fuel for household use can be seen as a joint responsibility for all members of the household. PISCES can support stakeholder ongoing efforts towards implementation of programmes that specifically address household energy and gender as a development issue. Training of communities on low cost technologies for production and use of energy saving stoves, tree planting and promotion of other bioenergy initiatives should be incorporated into such efforts.

6.3 Recommendations on Bioenergy Access and Delivery in Institutions

There is need for awareness creation on the long-term impact of firewood and charcoal use by institutions as well as establishment of mechanisms for ensuring that consumption is matched by replanting of felled trees.

Continued use of traditional stoves within institutions implies a combination of factors including gaps in knowledge on energy saving measures, resistance to change, lack of availability and poor marketing of available energy saving stoves. This calls for stakeholders to incorporate marketing of available energy saving technologies as well as further awareness creation on the need for universal adoption of such technologies. Such efforts should also incorporate sustainable planting and harvesting of trees as renewable sources of bioenergy.

The primary focus of PISCES is to highlight the contribution of bioenergy to energy access and livelihoods and at present, further research regarding institutional use of bioenergy can perhaps be at the level of exchange of information with stakeholders such as RETAP who are actively involved in the area.

6.4 Recommendations on Bioenergy Stakeholders and Initiatives

Discussions with stakeholders have indicated that there are many ongoing activities that PISCES may wish to collaborate with to establish next steps for the project in Kenya. This collaboration should support investigation of delivery models and value chain analysis of selected types of bioenergy being used in the country. Some recommendations include:

1. Identify at least one initiative in each of the key bioenergy types e.g. fuelwood, charcoal, agricultural residues (including biogas) as well as biodiesel and bioethanol that PISCES can link up with during the life of its project. This partnership with the respective stakeholders should undertake value chain analysis and the development of improved delivery models and value chain analysis, which can subsequently be shared with policy makers to feed into ongoing policy development processes such as current discussions on national strategies for biodiesel and bioethanol.
2. Explore how successful bioenergy initiatives can be replicated in regions with similar conditions.
3. Investigate *prosopis juliflora* to determine how far it has been researched and how it can be harnessed for production of charcoal in Mandera and Turkana.
4. Investigate further the role of doum palm and its impact on rural communities in ASAL areas with a view to identifying any interventions around its use as a household fuel in the ASAL areas of Kenya.

Appendix 1: Number of Interviews with Institutional Consumers by Site and Institution

Site	Institutions
Kisumu	Kisumu General District Hospital Kisumu YMCA Kisumu Gee CDC
Nakuru	Jams Hotel Madaraka Primary School
Turkana	Lodwar Polytechnic Lodwar Primary School Turkwel Lodge Hotel
Mandera	Mandera Boys Town Primary School Mandera Hospital Mandera Hotel
Total	11

Appendix 2: Number of Interviews with Bioenergy Stakeholders and Location

	Institutions	Site
1	Kenya Forest Service (KFS)	Turkana Mandera
2	Oxfam GB in Kenya	Turkana
3	World Vision Kenya	
4	Arid Lands Resource Management Programme (ALRMP)	Mandera
5	Consortium of Cooperating Partners (COCOP)	Mandera
6	International Centre for Research in Agro-forestry (ICRAF) in Kisumu	Kisumu
7	SCC VI Agro-forestry in Kisumu	Kisumu
8	Ministry of Agriculture (MOA)	Kisumu
9	SCODE	

Appendix 3: Number of Interviews with Bioenergy Initiatives and Location

	Institutions	Site
1	Lanet Farmers Dairy Sacco	Lanet Nakuru
2	Manufacture of Institutional Cookstoves	Kisumu
3	Prosopis	Mandera
4	Kokadam	Kisumu
5	Kochuka Women Group	Kisumu

Appendix 4: Stakeholder Profiles

Appendix 4.1 - Kenya Forest Service (KFS): This is a state corporation working all over Kenya with the specific role of encouraging afforestation with the aim of increasing forest cover to enable communities to sustainably access firewood and charcoal for households energy and income generation. KFS was established through an Act of Parliament to provide for the establishment, development and sustainable management, including conservation and rational utilisation of forest resources for the socio-economic development of the country. KFS's general activities include community sensitisation on forest conservation, forest policy and advocacy, afforestation, support of non-wood forest products production and implementation of Community Action Plans related to forest conservation. KFS programmes include Farm Forestry Programme, the Drylands Forestry Programme, Industrial Forest Plantation Programmes, Partnership and Agreements, which promote community participation in forest management and conservation through capacity building of communities and KFS staff as well as mobilisation of Community Forest Associations.

The farm forestry programme covers 55 districts in the high potential areas and operates outside gazetted forests in farmlands with the objective of supporting and facilitating farmers to raise trees and forest products in their farms in order to release pressure on gazetted forests and also to diversify their income and contribute to environmental conservation. Its activities include farmers training, tree seedlings production, forest/trees management, marketing and processing of forest products, catchments protection and rehabilitation of degraded sites. KFS Drylands forestry programme covers 22 ASAL districts. The main activities are rehabilitation and protection of catchments sites; riverbank protection; seedlings production; support to production and sustainable use of Non-wood Forest Products; biodiversity conservation; technology transfer and micro-enterprise development. The sampled regions include Turkana, Mandera and Kisumu.

- In Turkana district, KFS, in collaboration with Oxfam GB and the community; supports the community to put up efficient kilns for burning charcoal. This activity is on-going in Riokomoru and Eukan'g Kipur areas in Turkana North. KFS offers technical support in sustainable tree harvesting for charcoal production. *Prosopis juliflora* is a fast growing species in the larger Turkana district and covers vast areas of land. To prevent its spread and colonization of potential farmlands as well its invasion of areas that may serve as grazing land and homesteads, the KFS is trying to assist the community to curb the spread of *prosopis*. *Prosopis* clearing is done at Lokangai, Lokichoggio, Kalokol, Katilo and Nakurio. *Prosopis* branches are pruned to control tree species seeding and canopy extension. *Prosopis* clearing at the household level will result in woodlots maturing to become poles for charcoal production. KFS is supporting community access to seedlings such as *Cordia sinensis*, *zizyphus mauritania* and *Dobera Glabbra* to enhance tree cover. KFS is also addressing food security issues by supporting farmers to access fruit trees seedlings, specifically paw paws, oranges and mangoes, which they plant on-farm. Farmers experience lower survival rates for tree and fruit seedlings planted due to water scarcity.
- In Mandera district KFS is trying to create awareness on the importance of forests. Activities include environmental conservation through creating awareness on the conservation of trees, encouraging tree planting on degraded sites and evaluation of environmental activities that are already being taken up by NGOs and other sectors. KFS staff is mobilizing the community to identify areas where water is

available for planting drought resistant trees and food crops along the Dauwa river line. KFS has a tree nursery for supplying the community with seedlings but lacks enough staff to water the seedlings and to protect them from disease and withering. Another challenge is lack of adequate water for the tree nurseries especially if there is prolonged drought. KFS is working in collaboration with ALRMP, other NGOs and schools to encourage water harvesting, tree nurseries establishment and planting of trees to rehabilitate the degraded areas in the region. Among the tree seedlings KFS Mandera is encouraging the community to plant is the neem tree. The local community also prefer it because it can be used as fodder for livestock and has medicinal value. Another major challenge is continuous destruction of trees in Mandera region, which the KFS is addressing. Many people in Mandera do not understand the laws governing environmental conservation and this makes implementation of conservation activities difficult.

- In Kisumu district KFS works with farmers in the entire district mainly in tree seedlings production, catchment area planting, public land planting, rehabilitation of invaded land, tree planting in schools and churches, training of the local community - mainly forestry groups - and hill top afforestation. It also informs farmers on market availability for tree resources. KFS is working with groups who have taken up tree growing. In Kadibo the groups are Okana Miti Mingi, Kariaru tree nursery, Atekio tree nursery, and individual farmers with their own nurseries. In Madiany KFS is trying to promote the improved charcoal burning kilns that will enhance quantity and quality of charcoal. KFS is also trying to introduce kilns at Maseno and Kombewa; these are some of the areas that supply Kisumu district with charcoal and fuel wood. KFS Kisumu is faced by challenges such as financial shortages, transport problems, understaffing, and lack of supportive collaboration by some NGOs.

Appendix 4.2 - Oxfam GB in Kenya: Oxfam GB is an international charity organization that links humanitarian work with livelihoods. It is registered in the UK. Oxfam began as a humanitarian organization responding to human crisis caused by natural calamities such as floods, earthquakes and droughts. In Turkana Oxfam GB has an office in Lodwar. It works in Turkana and Wajir and also has an urban programme in Nairobi where it works in informal settlements. Oxfam GB has a Peace building component mostly in Northern Turkana and the greater Karamajon'g and is working with Riam Riam in cross-border capacity peace building. Its specific roles are livelihoods and food security, relief, livestock, education, public health and business support. Oxfam GB promotes eco-charcoal because it is derived from dead wood, which is plenty in the Turkana district. It supports women groups to have tree nurseries to replace the dead wood.

Appendix 4.3: World Vision Kenya in Turkana: World Vision is an international NGO, which works in over 100 countries worldwide, including Kenya. Major activities include education support, food security, HIV/AIDS response, and children sponsorship and programme management. World Vision procured 1000 jatropha seedlings from KEFRI and distributed them to farmers in Turkana mainly for planting along the Turkwell river. However the project is in transition and will be ending within one month. So far World Vision Kenya has trained one hundred and sixty women and fifty men and supported a learning tour for 20 representatives to KARI in Machakos.

Appendix 4.4: Arid Lands Resource Management Programme (ALRMP) in Mandera: ALRMP is an independent project funded by the Government of Kenya in collaboration with NGOs. It works in 28 districts in ASALs of Kenya and its main activity is resource utilization management in the agricultural and livestock sectors. It is also an education

programme which deals with water and sanitation, health and nutrition, conflicts resolutions and organizational management. ALRMP specializes in agriculture in the areas of capacity building, Farmer Field Schools, land preparation, disease and pest control, crop and livestock husbandry, and fodder bulking.

In food security ALRMP supports irrigation schemes, lining of irrigation canals, pump sets provision, seeds provision, and ox-ploughs provision. In livestock there are improved goats like the Toggenberg, the Sahiwal bulls, tissue culture bananas for livestock fodder and human consumption. ALRMP trains community animal health workers and also deals with tsetse fly, ticks and worms. Improvement is sought through construction of classrooms, and provision of desks and chairs. In the health sector ARMP helps the Ministry of Health to carry out core functions, such as cholera logistics support, and the running of mobile clinics. In water, ALRMP in collaboration with the Ministry of Water and the Ministry of Public Health is sinking boreholes, earth dams, and water pans and supporting Drought Early Warning Systems for drought management. It works with the KFS on forest and trees management.

Besides encouraging the community in Mandera to use energy saving stoves, ALRMP has also introduced clay brick making machines to control use of firewood to burn bricks and has educated the community on using clay pots to cook because they retain energy while cooking and thus use less firewood. In beekeeping ALRMP has started introducing the Langstroth hive and is training beekeepers on the value chain addition of honey and other hive products, as well as on the value chain addition of perishable crops such as mangoes through processing. ALRMP also addresses issues of human conflict and the environment; by working with forums of elders to discuss peace issues and conflict mitigation over conflicts arising from pasture use, water and salt licks use. With regard to the environment, it addresses natural resource management, drought management, and wet and dry season grazing management. The current indiscriminate felling of trees for firewood, charcoal, and timber production is enhancing the spread of drought, which results in famine and flash floods, livestock death, crop failure and eventually human death in ASALs. ALRMP has plans of introducing energy saving stoves in Mandera to control excessive cutting of trees for firewood and charcoal.

Appendix 4.5: Consortium of Cooperating Partners (COCOP) in Mandera: COCOP is a local non-governmental organization working with the community in Mandera. In March 2006, COCOP took over from ALRMP as the lead agency in Mandera. COCOP comprises three agencies: Emergency Pastoralist Assistance Group (EPAG), Northern Region Development Agency (NORDA), and Rural Agency for Community Development Assistance (RACIDA). Its main task is distribution of relief food to the local community and it is currently feeding about 117,000 people. COCOP also has a Food for Asset (FFA) programme where it gives the community food so that they can create assets. Through the FFA programme COCOP has revived the Border Point 1 Irrigation Scheme through lining about 1.5 kilometres of the irrigation canal using concrete. COCOP is doing the same in Auresha, Gadudia, and Ramodintu, all of which lie along the Dauwa river course.

Appendix 4.6: International Centre for Research in Agro-forestry (ICRAF) in Kisumu: ICRAF is an international non-governmental organization working in 114 countries worldwide. In Western Kenya ICRAF works in 22 districts which include Kisumu, Bondo, Siaya, Vihiga, Kakamega, Rachuonyo, Nyando, Homabay, Busia, Bomet and Sotik. ICRAF's activities include soil fertility improvement and management,

supporting community income generation activities and environmental conservation. ICRAF is undertaking a programme in bioenergy production in the line of improving wood fuel production. In the Dago area, ICRAF has supported groups to establish woodlots. It has also supported Keyo women's group in Dago to produce and sell ceramic stoves through helping the group to disseminate information. The group has worked with quite a number of organizations such as Western Kenya Energy Network on the issue of energy consumption. This is an NGO that began in 2007 to assist women such as the Keyo Women's group.

ICRAF is promoting on-farm planting of fruit trees, medicinal trees and timber producing trees such as Calliandra, Leucaena and Sesbania. ICRAF has linked some farmers to tea factories to enable them to market logs for use as firewood. Challenges include slow uptake of the initiative and the need to reach more farmers through information dissemination.

Appendix 4.7: SCC VI Agro-forestry in Kisumu: SCC VI Agroforestry is an international NGO made up of the Swedish Co-operative Centre and VI Agro-forestry. It is funded by individual donors from Sweden and SIDA and has been operational for the last 25 years. In Africa it uses VI Agroforestry as the working name and works in Kenya, Uganda, Tanzania and Rwanda. VI Agro-forestry works around the Lake Victoria Basin with smallholder farmers, trying to improve their livelihoods specifically on issues to do with agri-business development, environment and climate change, nutrition, HIV/AIDS, gender and has a micro-finance component called Village Savings and Loaning, and a small component on vulnerable children called Children of the World. VI Agro-forestry works in the Kisumu district, Nyando district with its five divisions and in two divisions of Rachuonyo and has outreach programmes in Siaya. It has a sister project in Kitale which is working in West Pokot and Trans-Nzoia districts. In Western Province VI Agro-forestry works in parts of Bungoma, Malava and Lugari and has Field Officers working with the community to mobilize and train them for marketing of their produce and helping them form umbrella groups for bulking and marketing of their produce.

VI Agro-forestry is working with 55,000 households but its efforts to enhance farm agro-forestry for food security and energy production are hindered by lack of clear policies on bioenergy. Gender and cultural issues in relation to land ownership and access of raw material for energy affect women and youth and engendering agro-forestry development is a key focus in VI Agro-forestry's activities in the region. In its efforts to promote *Jatropha* planting as an IGA, VI Agro-forestry faces the challenge of inadequate support from collaborating organizations and lack of clear pricing mechanisms for *jatropha* seeds since there are no policies to regulate and protect producers, consumers and processors. So far VI Agro-forestry has been distributing tree seeds to farmers in Nyando division, Miwani division, Muhoroni, Upper and Lower Nyakach, Kadibo division, Winam division, Kabondo division, East Rachuonyo division, and has moved to Maseno division.

Appendix 4.8: Ministry of Agriculture (MOA): The Ministry of Agriculture is a government ministry working in all districts in Kenya. It deals with soil conservation, cash and food crops production and marketing of agricultural produce. It is also involved in nutrition and works with community groups of women, men, youth and mixed groups involved in agriculture as well as other sectors such as health and sanitation, appropriate technology and energy.

- In Kisumu the MOA office oversees activities in Kisumu West and East districts. In bioenergy, there are two production centres for improved jikos in Winam led by two

groups known as Keyo and Nyamasaria. The Keyo group has travelled as far as Uganda and Tanzania to build producer capacities there. Youths in Winam produce mabati (metal) jikos and have provided production training to other people in the area. In the bioenergy sector, MOA has, with the assistance from GTZ, trained youths in 12 locations on the marketing and installation of Upesi jikos. The MOA has also supported a group called KOKADAM, which was initiated by youths from Kogony, Kanyakwar, and Dago and Mkendwa sub-locations of Kisumu West District in Nyanza Province, Kenya and which generates income through installing UPESI energy saving jikos in households. The ministry needs to reach more farmers but faces the challenge of inadequate staff and limited means of transport. It aims to reduce national poverty and aspires to improve national food production. It also targets the creation of self-employment and business development by establishing a good environment for food production through agro-forestry and additional forestry activities.

- In Turkana Central MOA has a main office in Lodwar but works in the larger Turkana district. In Turkana Central it is active in the Turkwel and Central Divisions, while in the North, concentration is in Kokum and in the South in Kaisulu and Kainuk. At the district level, the MOA has five departments: Crop production, Agri-business, Environment and Land Development, Home Economics, and Monitoring and Evaluation. In Crop Production the MOA trains farmers, gives them extension services on how to grow better crops and after-harvest storage. It also provides farmers with a wide range of technologies on food collection, the type of seeds they are supposed to grow, how to manage the seeds and general crop management from planting to harvesting.

In Agri-business the MOA trains farmers on how to produce for the market and product value addition. The Environment and Land Development section deals with soil improvement and conservation, water and environmental conservation. There is a strong focus on promotion of agroforestry and prevention of forest destruction. In Water Harvesting, the MOA trains and supports farmers to construct water harvesting structures such as water pans and water banks. In Home Economics, the MOA is mandated to train farmers on how to better utilize crops, manage home hygiene as well as address gender and HIV. The Monitoring and Evaluation section facilitates self assessment and helps track the ministry's achievements at the end of each year. The Environment and Lands Development Department has promoted household energy conservation amongst farmers and has encouraged use of the energy saving Maendeleo stove, although it has been difficult to promote the jiko due to the cost of production and installation among other constraints. The department has also tried to introduce solar cookers.

The MOA, in collaboration with KEFRI, also promotes the growing of jatropha via the Turkwel Irrigation Scheme Association (TISA), which was started in late 2006. The MOA trains farmers while KEFRI provides seeds. It is also supporting the Katundo Fruit Tree Nursery Group to produce and distribute fruit tree seedlings and to plant and sell fruits. The ministry is also trying to introduce dairy goats to encourage zero-grazing to encourage dung collection for biogas production, although uptake is very slow due to the nomadic lifestyle of the Turkana people. Despite these efforts, the MOA has been unable to reach out to many farmers because of insecurity issues in the area, coupled with a belief by some of the people that Jatropha could become a troublesome weed like Prosopis. Another hindrance is farmers asking for payment for adopting new technologies. However, the MOA plans to continue promoting jatropha and biogas in the region.

Appendix 4.9: SCODE: SCODE is a non-governmental organization located in Nakuru North, Bahati division and works countrywide. In other countries SCODE works with partners and is part of a network that goes beyond Kenya. SCODE's mission is to improve the quality of life of people by enabling them to access and use technology and approaches that are environment friendly and that contribute towards sustainable development. In the East Africa region SCODE is part of a network called East Africa Region Technology Development Network. Its function is to act as a regional focal point and at the secretariat it is the country focal point. SCODE has an office in Uganda and in Tanzania it has a focal point. SCODE has an agro-forestry project that trains individuals on planting trees on their farms for energy. Biogas is its most recent project, with SCODE training people on how to install and construct biogas plants through a team of trained and experienced technicians.

SCODE adopts a private sector approach to many of its activities. It does not promote biocrops such as jatropha, croton and castor since there is inadequate information about these species, and their potential impacts on people's lives and on food security are not yet very clear. SCODE is focused on continuing to play two major roles in the future: capacity building, especially for communities and consumers and the promotion of extension services in bioenergy access and use.

Appendix 4.10: Kenya Forestry Research Institute (KEFRI) in Turkana: KEFRI is a parastatal under the Kenyan government, within the Ministry of Environment and Mineral Resources. It operates in six regional centres in various parts of the country including the Coastal region at Gedi; the Eastern region at Kitui and Kibwezi; Central region with the headquarters Muguga near Nairobi; in the Rift Valley with the headquarters at Londiani and Western region with the headquarters at Maseno regional sub centre, which covers activities in the western part of Kenya. Lodwar is the substation of the Londiani regional centre dealing specifically on dry land forestry. KEFRI's activities in Londiani are to carry out dry land research both in wood forest products and non wood forest products such as gums and resins and also wood bi-products.

In the Sagret location of Kokum in northern Turkana, KEFRI has planted about 30,000 square meters of indigenous trees. KEFRI has also realized that *Prosopis juliflora* is a major issue in Turkana and are looking at better management through collective use and harvesting of marketable products from the species. KEFRI has set up demonstration sites from which local communities can learn crop management techniques. They then support the formation of local committees together with environmental working groups in various areas, which comprise 40 people representing a village and who elect their own leaders. KEFRI is also piloting *Jatropha* in Turkana. *Jatropha* was first introduced on a small scale to farming communities along the river Turkwel in 2005 and focussed on seed production as KEFRI had yet to acquire the machines to process oil from *Jatropha* seed. In May 2008, KEFRI trained about 100 farmers from Laipekel community on *Jatropha* growing and is now working in collaboration with World Vision and the Kenya Agricultural Research Institute, KARI, to promote planting and processing of bio-oil from *Jatropha* seeds in Turkana.

Appendix 5: Description of Stakeholder Initiatives

KEYO WOMEN GROUP – KISUMU REGION	
Initiative Name	KEYO WOMEN GROUP: A community based self help group.
Location	Nyanza Province, Kisumu District in Kenya
Contact Person(s)	N/A
Initiation Date and Duration	The group was formed in 1984 with 28 women who came together to pool up their skills to earn a living. Some members have since retired and currently they are 15 in total.
Funder(s)	Group members contributed start-up capital and have been running the group from the income they make. In the late 1980's they were trained on improved stove production with support from Practical Action (then known as ITDG) and GTZ.
Project Initiator	Women potters came together to form and register the group with the Ministry of Social Services in Kenya.
Objectives/Goal/Core Values	To generate income from making and selling energy saving jikos.
Current status/Activities/ Coverage area	The group specializes in construction of clay jiko liners for both charcoal and wood burning household stoves and sells them in Kenya as well as in Uganda. The jiko liners are made in modern kilns that can hold up to one hundred and twenty (120) liners. There are bigger kilns that hold up to 200 jiko liners. If smaller ceramic type liners are made, the kiln can carry 750 liners. Liners are sold in wholesale at 150 Kenya shillings and on retail at 200 Kenya shillings.
Successes	The group started with ceramic liners on a small scale but has since expanded. The group is currently making three types of liners. There is the liner for KCJ (Kenya Ceramic Jiko) that uses charcoal. This liner is fixed to a metal cladding with metal pot rests. There is also the liner for the two versions of the Upesi wood burning jikos; the portable type where the liner is embedded into a metal cladding, which now makes the stove movable and the fixed type where the liner is installed in a fixed position in a kitchen. The third type is the Uhai; an improved version of the KCJ that has ceramic pot rests and which is then fixed into a metal cladding. Group members continue receiving invitations to train other stove producers both in Kenya and Uganda.
Challenges	The group is currently faced with the difficulties in harvesting clay along river banks as well as obtaining firewood for use in their kilns. The National Environment Management Authority (NEMA) in Kenya requires the group to adhere to strict rules and regulations that govern sustainable harvesting of clay and tree resources in Kenya. Another challenge is complaints from many trainees of the high training fees charged by the group. However, it was, difficult to ascertain whether the high cost of training has deterred potential trainees from accessing the training.
Beneficiaries	Group members, trainees, KOKADAM Youth Group that buys ceramic liners from Keyo Women Group, and end-users of the products.
Future plans	The group would like to expand its market across the borders of Kenya. There are also plans to acquire land to establish its own woodlot.

KOCHUKA WOMEN GROUP– KISUMU REGION	
Initiative Name	KOCHUKA WOMEN GROUP; A Community-based Self Help Group.
Location	Nyanza Province, Kisumu District , North Kisumu Location, Bar A sub-location, Kenya
Contact Person(s)	Monica Otiende
Initiation Date and Duration	This group started much earlier as a family welfare group structured as a “merry-go-round” but became active in the year 2006.
Funder(s)/Stakeholders	‘Freevoken’, a German company, gives the group seeds for French beans, insecticides, planting fertilizers and also top-dressing fertilizer and provides free transport for harvested French beans. VI Agro-Forestry provides the group with seedlings and also gives them free training in agro-forestry. Members contribute money through “merry go-rounds” to run other group activities.
Project Initiator	Women came together to form and register the group with the Ministry of Social Services.
Objectives/Goal/Core Values	To provide financial assistance to members through merry-go-rounds and income generation from agroforestry activities and sale of energy saving devices.
Current status/Activities/Coverage area	About 30 members are active. The group has a chairman, secretary and treasurer. Group members plant maize, trees, bananas, have tree nurseries, vegetables, French Beans, keep poultry, and also make stove liners. Maize is planted for subsistence. Members of the Kochuka Women’s Group also provide HIV and IDS home-based care, with the support of trained counsellors and Community health workers, under a separate group is called Kinda Home-based Care. The Kochuka Women’s group sells the stove liners directly to community members and at the local markets.
Successes	The group already has a variety of tree seedlings in its tree nursery. They include Moringa oleifera, Prunus africana and Nandi flame. The group is working hard to increase its stove liner production capacity and customer base. The group has also been able to benefit from profits made from crop sales, after deducting the cost of seeds and insecticides. Members have attended training seminars after which they share the acquired skills with fellow members to allow other members to develop.
Challenges	The group buys soil and wood for firing the liners and this is expensive. The group relies on rain fed agriculture for their 1 acre plot and drought has adversely affected crop production. In 2007, for example, the group planted French beans on 15 by 15 meter plots and expected an income of Ksh 7000 per plot but only received Ksh3000-4000 because of crop failure. There have also been difficulties in terms of commitment to work by some members, especially during harvest times, when sometimes members do not turn up to pluck the beans as required. In addition, irregular member financial contributions have affected the morale of other members. The members also experience problems in obtaining materials during planting such as tins and they find the cost polythene bags is high.
Beneficiaries	Group members
Future plans	The group plans to set-up a woodlot in the future so that it has wood to cut and sell for firewood. Members look forward to getting assistance from willing individuals and organizations to enable them to forge ahead.

KOKADAM YOUTH GROUP – KISUMU REGION	
Initiative Name	KOKADAM YOUTH GROUP (Kogony, Kanyakwar, Dago and Mkendwa sub-locations).
Location	Kisumu West District, on the outskirts of Kisumu town, in Nyanza Province, in Kenya.
Contact Person(s)	Abu Bialy, Group Secretary.
Initiation Date and Duration	Formed in June 2007.
Funder(s)	Contribution from 3 active members. Amount not available. The members planted and sold vegetables, onions and tomatoes to acquire start-up capital.
Project Initiator	Initiated by youths from Kogony, Kanyakwar, and Dago and Mkendwa sub-locations of Kisumu West District in Nyanza Province, Kenya. Technical support provided by the Ministry of Agriculture (Home Economics Department) with support from GTZ.
Objectives/Goal/Core Values	<ul style="list-style-type: none"> -To generate income through installation of Upesi energy saving jikos in households; - To generate income through establishing woodlots for sale of firewood and timber - To protect the environment through tree planting. - To increase food production through practising agro-forestry.
Current status/Activities/Coverage area	The group comprises 27 members, all young men, initially trained by GTZ but of whom only 3 are currently active. The main activity is installation of energy saving jikos (the wood burning Upesi jiko) in 4 sub-locations and other areas where the group's service is in demand. They buy the ready jiko liners from Keyo Women's Group, and install for a fee. Other activities besides stoves installation are the establishment of woodlots, mainly of Eucalyptus gummifera and Grevillea robusta species. In addition they practice agroforestry by intercropping bananas, kale, tomatoes, maize, and Napier grass with agroforestry trees such as Leucaena leucocephala and Calliandra callorthisus.
Successes	So far Upesi jikos have been installed in over 40 households within the 4 sub-locations and in neighbouring districts including Homabay, Bondo, Nandi Hills and Bungoma. Installations have comprised both single and double Upesi stoves. Active members of the group have also developed skills and experience in designing and installing a range of designs of wood burning jikos, including the hut, fish and wheel barrow designs. Members have installed some in schools in Siaya, for example in Kanyamogaa High School and Nyan'gori High School where they are currently in use. The group has exhibited its products in the Kisumu Agricultural Society of Kenya show, where they attracted many customers to their products and services.
Challenges	In Dago sub-location the cost of an Upesi liner is Ksh 300 but this doubles when it is transported elsewhere. Many end-users prefer the Upesi stove compared to the traditional three stone fire but are unable to afford it. Acquiring food is given priority over installing an upesi jiko. Setting a standard fee for installation is a challenge and, in some cases, people demand the service only to reject it when the service providers arrive at their door step.
Beneficiaries	Active group members, households in the 4 sub-locations, and other households and institutions that have had the jikos installed. Keyo Women's Group is a beneficiary since the group members buy upesi jiko liners from the Keyo Group and/or those who want jiko liners installed may buy them from the Keyo Group and get the youths to install them at a fee.
Future plans	The group requires support to provide them with ideas on how to improve their business by the expanding market. The group would like to have an office and a demonstration site so as to exhibit its products and services to potential users/ consumers.

MUSSOO ENGINEERING WORKS– KISUMU REGION	
Initiative Name	MUSSOO ENGINEERING WORKS
Location	Migosi Estate in Kondele area on the outskirts of Kisumu town, in Kisumu District in Nyanza Province, in Kenya.
Contact Person(s)	John Ochien'g Jonyo, Sales and Marketing Executive.
Initiation Date and Duration	Started in 2005.
Funder(s)	This is an initiative of individual young men who joined hands and contributed money to employ themselves.
Project Initiator	Group members.
Objectives/Goal/Core Values	<ul style="list-style-type: none"> -To help poor households minimize their energy expenditure. -To reduce pressure on forests due to excessive charcoal burning and felling of trees for firewood. -To make available cooking techniques that will help conserve the environment and enable institutions to cook effectively and save on energy expenditures.
Current status/Activities/Coverage area	Musso Engineering Works is an engineering company that fabricates, supplies, services, repairs and maintains a range of energy saving stoves and catering and kitchen equipment and furniture to individuals and institutions in Kenya. They also produce a range of other metal equipment such as animal feed mixers, food warmers etc. They promote their products and services by giving out information and creating awareness through their staff and by handing out brochures and fliers. They also attend exhibitions and hold demonstrations to market their products. Musso operates in both urban and rural areas covering Kisumu and most parts of Nyanza region and the whole of South Nyanza region. They have also provided services and products in Baringo District in Rift Valley Province of Kenya.
Successes	Individuals and about 30 institutions in various parts of the country have purchased their energy efficient stoves.
Challenges	The high cost of raw materials has necessitated Musso to specialise in the institutional stoves, with less focus on stoves for individual households. They have been trying to partner with organizations to provide support in the form of subsidies, to enable individual households to access energy saving stoves, although Musso is yet to succeed. The biggest constraint has been capital financing and lack of relevant information among potential financing and other partners.
Beneficiaries	Schools, colleges, orphanages and a few individuals. Some of the schools in Kisumu that have recently benefited from Musso stoves include Kanyakwar, St. Mary's Maenya, and St. Ann academy in Mambleo. The older beneficiaries include Homabay High school, Ramba high school, and Lwak Mission.
Future plans	Musso continues to look for funding support from development agencies and other organisations to schools through appropriate funding mechanisms to enable them to purchase energy saving institutional stoves. Musso is also seeking funding for the purchase of land to grow trees to ensure sustainable supply of firewood and also plans to look into possibilities of fabricating a diesel powered cook stove.

PROSOPIS JULIFLORA – MANDERA REGION	
Initiative Name	PROSOPIS JULIFLORA AS A SOURCE OF BIOENERGY
Location	Mandera District in North Eastern Province of Kenya.
Contact Person(s)	Abbas Mohammed, Director, Consortium of Cooperating partners (COCOP) Mandera. (COCOP is a local non-governmental organization working with the communities in Mandera..)
Initiation Date and Duration	Formed in June 2007.
Objectives/Goal/Core Values	Goal is to enhance livelihoods and increase food security.
Geographical distribution/ coverage area	Prosopis juliflora is a perennial deciduous thorny shrub or small tree that can grow up to 10m tall with a trunk up to 1.2m in diameter. Prosopis, which has many species, is a fast growing, salt tolerant and drought tolerant tree that can grow in areas receiving as little as 50mm rainfall per year. Mandera is one of the districts with the greatest Prosopis populations in Kenya. 20-30 years after its introduction into the country, there is growing concern and debate on the negative impacts of Prosopis juliflora and on its control.
Current status and Socio-economic impacts	The local community regards Prosopis juliflora as a noxious species. The community perceives its thorns as poisonous because wounds inflicted by it either take a very long time to heal or never heal at all. Livestock, especially goats that regularly feed on Prosopis juliflora pods reportedly suffer from having their teeth fall out. In severe cases the plant has been reported to colonize homesteads, farms and buildings, thus displacing people and damaging foundations and walls of buildings. It has also reportedly caused serious injuries to watchmen who guard institutions in the evenings and some have boycotted going to work if the plant is not removed. The local community utilizes Prosopis juliflora for firewood, charcoal production, fencing and building poles. Building poles are susceptible to termite attacks but value addition can help to solve this problem. Charcoal production from Prosopis is practiced in the central division in Mandera and costs Ksh250-300 per bag. Charcoal is produced individually or by informal groups and is sold together with firewood, fencing and building poles in Mandera town. Some Prosopis products, especially charcoal and firewood, come into Mandera from Somalia.
Method of spread and ecological impacts	The spread of Prosopis in Mandera district is attributed to the following reasons: a) Incomplete digestion of pods in the gastro-intestinal tract of livestock, which causes the seeds to pass during defecation. Livestock droppings provide favourable conditions for fast seed germination and the plant quickly spreads; b) Prosopis thrives well along water ways, and flooding spreads the seeds to vast bare areas. Prosopis also does not allow undergrowth. Although commonly viewed as an invasive species, it can be used sustainably with better management through collective use and harvesting to produce a variety of marketable products. The plant has actually helped to reduce dust storms, acted as a wind break and controlled soil erosion by water in areas that were formerly bare in Mandera.
Future Plans	Charcoal producers in Mandera use the traditional open air burning system to make charcoal. This causes air pollution and the charcoal produced is of low quality. COCOP would like local Mandera charcoal producers to be trained on efficient charcoal production and proper harvesting methods so that the whole tree does not need to be cut down when making charcoal.

SCODE (AGRO-FORESTRY) – NAKURU REGION

Initiative Name	SCODE AGRO-FORESTRY PROJECT
Location	Outskirts of Nakuru town, in Nakuru District, Rift Valley Province of Kenya.
Contact Person(s)	John Maina, Co-ordinator-SCODE.
Initiation Date and Duration	The first phase was 1998-2001, with intentions to go up to 2010.
Funder(s)	It was initially funded by CDTF (Community Development Trust Fund). CDTF is a joint initiative of the Kenya Government and the European Union with the objective to contribute to poverty alleviation in the country by offering support to community based projects which address social, economic and environmental priorities.
Project Initiator	SCODE
Objectives/Goal/Core Values	To enable farmers, through training, to start raising their own trees on their own farms for firewood and charcoal.
Current status/Activities/ Coverage area	The programme is implemented on private land and involves tree planting on agricultural land, specifically that of small scale farmers. SCODE assists them with technology, with basic inputs like seeds, and trains them on how to raise seedlings and on how to plant and manage the planted trees on the farms. Farmers manage the trees, use them for timber, and harvest the seeds. Currently SCODE promotes the planting of croton and castor seeds for firewood. SCODE has targeted 6,500 families via distribution of about 2.5 million seedlings. Community members have formed groups, which are involved in agroforestry activities. The groups have developed their own management systems including appointment of group leaders.
Successes	At the community level, the groups consist of more women than men. The groups have been able to generate income through the sale of seedlings while awareness has been created and people are now much more conscious about the need to conserve energy through efficient utilization of household fuel. This has had a positive impact on the purchase of stoves, firewood and charcoal.
Challenges	If trees are planted on farms and are harvested for firewood, the women have a say; if the trees are used for timber, the men dictate what tree is cut, for what is it used, and who does what. The programme is weather dependant especially when raising seedlings and thus fails when there is no rain. Seeds are relatively expensive, and local people are not able to raise the required level of money to acquire them.
Beneficiaries	The beneficiaries are small scale farmers or the people who plant the trees.
Future plans	Biogas and tree planting will supplement over 85% if not 100% of energy used by households. Some of the community members are planning to adopt biogas production for use as an alternative fuel.

SCODE (BIOGAS PROMOTION) – NAKURU REGION	
Initiative Name	SCODE BIOGAS - LANET FARMERS DAIRY SACCO (Savings and Credit Cooperative Society)
Location	Nakuru District, Rift Valley Province of Kenya.
Contact Person(s)	John Maina, SCODE Coordinator.
Initiation Date and Duration	This programme was started in 1998 as a pilot. This was followed by the current implementation phase which started in 2006.
Funder(s)	100% funded by beneficiary households, under a financing arrangement through the Lanet Dairy Farmers SACCO.
Project Initiator	SCODE
Objectives/Goal/Core Values	<ul style="list-style-type: none"> -To provide people with alternative source of energy for cooking, lighting and heating other than the charcoal and firewood -To provide people with a way of processing residues from their livestock and agricultural activities -To incorporate biogas as one of the core household energy options for rural communities
Current status/Activities/Coverage area	This project covers Nakuru District, although SCODES overall biogas activities in the country cover Rift Valley, Western, Central, Lower and Upper Eastern Provinces of Kenya, as well as surrounding areas of Nairobi (Ngong & Karen). Clients are responsible for operating and maintaining their own systems. SCODE has experienced installers and supervisors who provide installation and training services and any other technical input that is required.
Successes	The project has done about 10 biogas units and is gearing up to its target of 50 units. Beneficiaries pay the full cost for installation of the domestic biogas systems. Loan repayment has been 100% so far. Community response to the biogas initiative has been positive and the implementers indicate increasing demand for more units as people now have more confidence in biogas than before. SCODE is building internal capacity to be able to address the rising demand.
Challenges	Initially, the SACCO did not have enough finances to help in pre-financing the installations. SCODE helped the management to identify a financier. The finances availed by the financier were limited and only allowed the SACCO to finance installations in batches of 10-15 plants at a time. SCODE is also testing locally available construction materials in areas with high biogas potential in an effort to bring down initial installation costs.
Beneficiaries	Target beneficiaries/clients with biogas units.
Future plans	To reach more provinces like Nyanza province in Kenya and reach the target of having more than 50 biogas units installed. SCODE plans to spend more time trying to test locally available materials in those areas where there is demand so that we can use them to reduce the cost of installing biogas.

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