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Energy for Sustainable
Development Limited*

Fuel Substitution: Poverty Impacts on Biomass Fuel Suppliers

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Glossary

ARI	Acute Respiratory Infection
ALRI	Acute Lower Respiratory Infection
BLT	Branches, leaves and twigs
Chai	Swahili colloquialism meaning 'a small bribe'
ETB	Ethiopian Birr
Githeri	Traditional Kikuyu dish (Kenya), involving the slow-cooking of beans and maize
Injera	Traditional Ethiopian flat bread made of tef
KES	Kenyan Shilling
Kgoe	Kilograms of oil equivalent
Matooke	Ugandan staple food prepared by steaming on charcoal the matooke bananas
Mitad	Ethiopian stove used to bake injera bread
PM ₁₀	Particulates smaller than 10 µm in diameter
UGS	Ugandan Shilling
µm	micron corresponds to 10 ⁻⁶ meters

Approximate exchange rates (all based on January 2003 rates):

Ethiopia	£1 = ETB 14
Kenya	£1 = KES 124
Uganda	£1 = UGS 2,789

Executive summary

Background

Over two billion people in developing countries rely on biomass fuels to meet their household energy needs. These fuels include firewood, charcoal, crop residues and animal dung and are known to have negative impacts that range from environmental degradation, especially deforestation, to the health effects of combustion smoke and fuel handling (e.g., respiratory diseases, back injuries). Governments and organisations recognise the importance of reducing these negative impacts and, to this end, are promoting a shift from traditional fuels for cooking and heating to other fuels such as kerosene, gas and electricity.

However, these interventions themselves have the potential to negatively affect the livelihoods of traditional biomass suppliers, since they are intended to reduce demand for wood-based fuels. This is of particular concern, since suppliers and marketers of traditional fuel are largely comprised of the urban or peri-urban poor, including a high proportion of women for whom there are very few alternative employment options.

The objective of this project, funded by the UK Department for International Development (DFID), was to determine the full livelihood and poverty impacts of fuel substitution and to make recommendations to policy makers on how negative impacts can be mitigated. The project was undertaken by ESD, in partnership with a team of experts¹ from Ethiopia, Kenya and Uganda, and focused on traditional fuel suppliers in Addis Ababa, Nairobi and Kampala in order to identify and characterise the traditional fuel supply sector from a livelihood point of view. The team then used this information to inform an evaluation of the various alternatives to traditional biomass fuel use on the basis of a number of key sustainability indicators, including health, environment, economy and social aspects. This made it possible to identify which options are most favourable for reducing the negative effects of traditional biomass fuel, whilst at the same time minimising other potential social, economic and environmental impacts.

The project's hypothesis was based on the assumption that governments and organisations are generally unaware of, or do not take into account the possibility that interventions such as fuel substitution can have far-reaching impacts. These are likely to extend, not only to the problems they are intended to solve, but to a number of other social and economic circumstances. In this case, these include livelihood impacts on people who are engaged in supplying and selling traditional fuels in urban areas. This project has, therefore, sought to close this gap by producing a number of practical recommendations for policy makers to consider these possible effects when considering future policy interventions.

Project Findings

1. Livelihood circumstances of fuel suppliers

The analysis of fuel supplier livelihoods shows that there is great diversity in the fuel supply sector, in terms of age, gender, livelihood circumstances, degree of success in the business and livelihood strategies employed in this highly decentralised and informal sector. Despite this diversity, however, some key common themes have been identified:

¹ Megen Power Ltd. and Forum for Social Studies in Ethiopia, Energy Alternatives Africa, ITDG Kenya, Rural Technology Enterprise Ltd. and KEFRI in Kenya, and Renewable Energy Development Centre and NEMA in Uganda.

Women are generally engaged in the lowest paid, least secure and most arduous categories of fuel supplier activities.

- **Transporters:** The motorised sector is dominated by male actors in all three countries, whilst women are mostly active in manual transportation of fuel. In Ethiopia, women play a crucial role, especially by transporting branches, leaves and twigs (BLT), one of the cheapest and most widely used fuels (for traditional flat bread baking). In the other two countries, where the transportation sector is dominated by motorised means, women are concentrated in vending activities.
- **Vendors:** Women tend to engage in sales activities that feature at the bottom of the supply chain. Although patterns are different in each country, it is clear that women are not numerically representative as wholesale suppliers, but rather sell wood, charcoal or BLT in markets, kiosks, roadsides and in informal spaces located close to large numbers of consumers.

The livelihood status of each category of supplier can be described in terms of their access to various assets or resources. A full analysis of fuel suppliers' access to a range of assets was undertaken and the results indicated that women are generally disadvantaged in this sector, because they have limited access to certain assets that are key to securing a livelihood in the traditional fuel supply sector. Access to health and education, shelter and sanitation confirmed that those fuel suppliers who operate at the very bottom of the supply chain have the fewest assets on which to draw in difficult times and therefore present the highest degree of vulnerability to external changes. Other resources assessed included:

- **financial assets** – male-dominated activities are the most highly rewarded in financial terms, and
- **social assets** – women have fewer bargaining powers than men and benefit least from preferential supplier and customer relationships. For this reason, they are also less likely to be able to obtain credit.
- **physical assets** such as vehicles, vending premises and strategic location, were of particular importance. For transporters, the availability of motorised or non-motorised means of transport is very valuable because high volumes of fuel can be transported with minimal physical effort and, in times of fuel shortage, or when fuel demand decreases, vehicles can be used to transport other, non-fuel goods. For vendors, location is the most important livelihood asset. Availability of secure and legal vending premises ensures security of supplies, limited damage during inclement weather, improved physical security, and reduced harassment from authorities. For women, access to these important assets was particularly limited, and the struggle to survive in this sector greater.

2. Vulnerability of fuel suppliers

Problems that jeopardise the ability of fuel suppliers to secure an adequate livelihood fall into two main categories:

- a. The **vulnerability context** in which suppliers operate, i.e. the external conditions over which people have no control. These include:
 - **Economic shocks** and the resulting fluctuations in prices of fuel;
 - **Technological trends** leading to increased take-up of modern cooking appliances and increasingly motorised modes of transportation;
 - **Population trends** and consequent competition for limited urban space and from more suppliers entering the business;
 - **Seasonality** and the problems of poor access to roads and lower charcoal production during the rainy season, seasonal fluctuations in demand and supply and damage to supplies during wet weather.

- b. Socially-generated **structures and processes**, which include laws, policies and social conventions, including:
- **Biomass regulations** and particularly the attempts to ban wood and charcoal production, transport and sales, thus periodically making this activity illegal, and sending it “underground”, where corruption and harassment from officials thrive.
 - **Fuel substitution** and increasing alternatives to traditional fuels, the marketing and distribution of which offer few employment opportunities for traditional fuel suppliers. This is mainly due to the more formal structure of the modern fuel distribution sector and the comparatively fewer number of people required to commercialise fuels with higher energy content.
 - **Lack of sustainable forestry policy** resulting in diminishing and more distant supplies of fuel, and the consequent greater necessity for motorised modes of transportation.
 - **Social conventions** and attitudes that result in exclusion of those who operate in what is considered to be a ‘dirty business’, and deny women rights and opportunities equal to those of male fuel suppliers.

3. Livelihood impacts of fuel substitution

It is difficult to infer any direct links between fuel substitution measures and traditional fuel suppliers’ livelihoods. When asked about changes in the business over time, most suppliers did not consider such macro-level policies as having a direct impact on them, but referred rather to the changes in their day-to-day activities. Nonetheless, historical data on national import quota of modern fuels and appliances show that fuel substitution policies have resulted in the widespread adoption of electricity, kerosene and LPG. In Addis Ababa, consumers from all income categories have adopted modern fuels, particularly electricity² and kerosene, thanks to subsidised tariffs and import tax exemption measures during the 1980s. Over half a million households in Nairobi use LPG today, compared to fewer than 50,000 in 1995, whilst in Kampala, adoption of kerosene has been increasing steadily over the last three decades.

Lack of conclusive evidence to connect loss of livelihood with such measures may be indicative of a number of things:

- Suppliers do not, or cannot, attribute changes in their day-to-day living and livelihoods to macro level policies to promote stoves, reducing tariffs and taxes on petroleum imports, etc., and therefore do not associate changes in their business with policies that are often not even formally announced.
- Livelihoods of biomass suppliers are, so far, not at risk from the introduction of modern fuels because many people still use traditional fuels, possibly as a consequence of:
 - low income levels;
 - preferences over cooking traditional types of food with biomass fuels.
- The measures adopted to reduce traditional fuels consumption have so far been ineffective in completely displacing them in urban areas (this is certainly the case for rural areas where penetration of modern fuels and appliances is constrained by several factors) as a consequence of:
 - urbanisation and increased urban population;
 - increased number of lower income households in urban or peri-urban areas who are unable to afford modern fuels and appliances;
 - increased diversification and amount of fuel used by middle and upper income households as part of climbing the “energy ladder”.

² Around 90% of urban population is connected to the grid in Addis Ababa.

Despite this, it is certainly true that impacts on the livelihood of suppliers are not considered by policy makers when they introduce fuel substitution, or fuel saving measures and, therefore, no alternative options are suggested to limit the effects of livelihood displacement that may arise.

4. Impacts of mitigating interventions on selected livelihood and development indicators

Alternatives to traditional biomass fuel use were identified, and grouped into five categories as follows:

1. *setup and appliances* such as improved stoves, chimneys, hoods, outdoor cooking hut etc;
2. *user behaviour* such as appliance maintenance;
3. *fuel substitution* including use of fossil fuels (kerosene and LPG) and electricity;
4. *supply management* measures;
5. *regulatory measures*, such as restrictions on charcoal production and transportation ban;

Highlights of a sustainability impact analysis of each alternative option are summarised below.

Health impacts:

- Positive impacts on health can be achieved as a result of specific improved cooking and heating setup options and appliances that significantly reduce indoor air pollution.
- User behaviour also has the potential to positively affect health, since well maintained appliances present fewer safety risks, as well as potentially reducing noxious emissions.
- Fuel substitution offers the most positive impacts on both respiratory and handling related health hazards, though it must also be noted that some modern fuels also have health impacts.
- Supply management measures have no directly positive impacts on health.
- Although regulatory measures such as bans on use of biomass fuels may indirectly improve health - both for consumers and suppliers - these are only effective if they are enforced *and* if viable alternatives are offered to consumers of all social groups.

Environmental impacts:

- Adoption of specific cooking setup options and appliances has either a limited positive or neutral effect on the environment. The adoption of efficient stoves can reduce the pressure on forestry resources, and they were and still are promoted for this reason among others. On the other hand, research has shown that, in many cases, the final amount of fuelwood used by households adopting improved stoves does not necessarily decrease. Rather, households tend to take advantage of the increased efficiency, using the same amount of fuel for additional purposes, such as heating water or cooking larger quantities of food³.
- Fuel substitution measures, such as the use of LPG and kerosene can have positive impacts on forests and local air quality, but risks to water and soil quality are also associated with unsafe disposal, mainly due to user behaviour. Wider environmental impacts related to the use of fossil fuels need to be taken into account (e.g. climate change, resource depletion etc). Environmental impacts of electricity are primarily restricted to how that electricity is generated.

³ Department for International Development KaR Project R7368 Poverty reduction aspects of successful improved household stove programmes

- Supply management measures (e.g., improved efficiencies of charcoal production and handling) can reduce or even stop the rapid and uncontrolled depletion of national forest resources, whilst ensuring a sustainable supply of traditional fuel.
- Regulatory measures, unless enforced, have negative impacts as they provoke the adoption of unsustainable and illegal practices.

Economic impacts:

- Among the setup and appliance options, improved stove production can boost the local economy, particularly in terms of employment, while ventilation measures and chimneys may also provide job opportunities in terms of production and installation.
- In terms of fuel substitution, apart from briquettes and pellets made from local biomass, import costs for fossil fuels can be very high for countries without oil reserves. If subsidised, national costs are even greater. In addition, these fuels are supplied by multinational organisations, with formal distribution channels. Therefore, employment in this sector is unlikely to favour the poor and most marginalised.
- With regard to biomass supply management options, both national and local governments have the potential to benefit from a sustainable biomass sector in that revenues may be accumulated through tax and licensing measures and local employment created.
- Further negative impacts on the economy are linked to regulatory measures when these are not enforced. Charcoal trade is practised despite restrictions (e.g., banning), resulting in loss of official tax revenues from production and commercialisation.

Social impacts:

- Households can benefit from improved appliances by using the same amount of fuel for additional purposes, thus improving quality of life at no extra cost. In addition, the health improvements associated with reduced indoor air pollution have positive gender impacts. There are also employment opportunities for women in the production of improved stoves, while employment in the biomass sector is not at risk.
- Wider access to modern fuels can improve quality of life for those who can afford them, and lighting from kerosene and electricity can improve income-generation or educational opportunities. The associated gender impacts are likely to be positive for consumers, whilst for those employed in the traditional biomass fuel supply trade, the loss of livelihood amongst women may be significant.
- Charcoal bans have had a clear negative impact on the livelihood and social status of those engaged in the business, mainly resulting from harassment from officials, bribery, loss of income and negative attitudes from the general public and authorities.

Conclusions

- The use of biomass fuels is increasing, both in rural and urban areas and this trend is not expected to change in the near future. Although governments and donor organisations have made a number of attempts to reduce the use of biomass fuels, the uptake of modern fuels has not been successful in displacing the absolute amount of traditional fuel produced and used.
- The traditional fuel sector in all three countries is highly decentralised, relatively easy to enter and highly competitive. The sector is a significant source of employment for many people in urban areas, particularly those in the lowest income categories.
- This research has been unable to show conclusive evidence of negative livelihood impacts of fuel substitution policy on fuel suppliers, indicating that policies in place have been ineffective at reducing the amount of biomass that is being consumed in urban areas. A further reason is related to the subjective views of suppliers themselves. Most suppliers relate observations about past changes in the business and current concerns to day-to-

day activities, rather than changes brought about by macro-level interventions. Nonetheless, widespread and successful fuel substitution policies and measures are very likely to result in loss of livelihood for many, and will particularly affect the most vulnerable of suppliers.

- The more formalised nature of modern fuel supply indicates that it is extremely unlikely that most traditional fuel suppliers would be able to make a transition from the informal traditional fuels sector to the more formalised modern fuels sector.

In light of these conclusions, the project's research has identified a number of improvements that can be made both generally, and within the traditional biomass fuel sector itself. If implemented in conjunction with sustainable biomass production, this sector could continue to be an important source of livelihood for many urban dwellers.

Recommendations

- When technical and economic barriers need to be overcome to promote improved stoves and modern fuels, collaboration between agencies responsible for health, energy, environment, housing and rural development is required. An integrated approach to the adoption of fuel substitution measures is essential in order to ensure that impacts are not simply transferred from one area to another. A combination of different measures is likely to yield the most positive health, social, economic and environmental results for society as a whole.
- The importance of the traditional fuel sector should be acknowledged as an industry in its own right, in terms of employment opportunities and income for a large number of people; within this, the valuable contribution of traditional fuel suppliers, especially women, in providing an important and affordable source of fuel for institutional, commercial and domestic consumers should be recognised.
- Vulnerability of fuel suppliers should be recognised and a commitment made towards improving their working and living conditions as part of current and future poverty reduction strategies.
- Impacts on livelihood should be systematically considered when addressing other social, economic or environmental objectives that may result in loss of employment for vulnerable members of society working in the infrastructure and service sector, including sector formalisation⁴; where significant losses of employment are likely, sustainable and gender-neutral re-employment or training programmes should be considered.
- New and existing policies and strategies must be developed for the rational and efficient production, transportation and marketing of biomass fuels, as well as for improved household energy efficiency.
- Long-term urban fuel strategies need to be developed that account for changes such as increase in demand, and progressive urbanisation.
- If regulatory measures are adopted, it is of fundamental importance that those are enforced in order to obtain the intended results.

⁴ Research has recently begun under DFID KaR 'Livelihood Substitution: Mainstreaming the poor in infrastructure and services development' Contract No. R8176

1 SUMMARY OF PROJECT OBJECTIVES

1.1 PROJECT BACKGROUND

Many sub Saharan countries recognise the importance of reducing the health impacts of traditional biomass fuel use in households and the environmental effects of fuel supply from rural areas. Governments have promoted a shift from traditional fuels for cooking to cleaner fuels such as kerosene, gas and electricity. However, such interventions can impact on the livelihoods of traditional biomass suppliers due to the decline in demand for wood based fuels. Often these suppliers and marketers are the urban poor and include a high proportion of women for whom there are few alternative employment options.

The new fuels tend to be marketed through much more formal channels, often organised by multinational companies. At the same time there are alternative options which can reduce the harmful effects of indoor air pollution and environmental degradation while supporting the use of indigenous natural resources; these include sustainable fuelwood production, improved stoves and use of chimneys and hoods.

This project aimed to quantify the impacts that fuel substitution has on poor people engaged in the fuel supply trade and look at the wider economic impacts in terms of import dependency and the local economy. An assessment matrix was developed to compare the impacts of different mitigation options on a range of key environmental, health, economic and social indicators.

1.2 PROJECT PURPOSE

The main objectives of this research is to:

- Determine all poverty impacts on traditional household fuel suppliers arising from fuel substitution of traditional biomass fuels by more modern fuels (LPG, kerosene, electricity, etc); and
- Inform policy makers of livelihood and poverty impacts of fuel substitution.

PROJECT OUTPUTS AND DELIVERABLES

Outputs of the project and deliverables supplied to DFID are outlined below:

- Detailed analysis of poverty impacts of fuel substitution on biomass fuel suppliers;
- Assessment of livelihood impacts of fuel substitution on urban households;
- Social, economic and environmental analysis and comparison of various options intended to mitigate health and environmental impacts of traditional biomass fuels;
- Recommendations to maximise household and national benefits from the mitigation of health and environmental impacts of traditional biomass energy use;
- Recommended actions for key international stakeholders.

Deliverables:

1. Country historical background reports - Ethiopia, Kenya, Uganda (Annex 1)
2. Urban biomass fuel suppliers profile (Annex 2)
3. Health related effects of traditional biomass fuels: the Ugandan case study (Annex 3)
4. Conceptual livelihoods framework: using the sustainable livelihoods approach to analyse poverty impacts (Annex 4)
5. Fuel substitution impacts: an assessment matrix analysis (Annex 5)
6. Final Technical Report (this document)

2 METHODOLOGY

The proposal for this project was built on the premise that the impacts of fuel substitution are likely to be negative for the many actors involved in the traditional fuel sector, particularly those employed in urban areas. One purpose of the fieldwork was to verify these assumptions by determining the impacts that fuel substitution measures have on biomass fuel suppliers. At the same time, the fieldwork was designed to better understand the vulnerability of those employed in this sector, so that the impacts on them can be considered when fuel substitution, or other measures designed to reduce the health and environmental impacts of traditional fuels, are initiated.

In addition to impacts of fuel substitution on suppliers, the project was also designed to investigate the impacts on consumers. This built upon earlier research carried out under a DFID project⁵ looking specifically at the impacts of improved stoves on consumers in the same three countries.

The research framework adopted by the project team comprised a combination of desk and field research methods, in order to obtain both secondary and primary data. Additional research was undertaken in order to examine current policies and legislation relating to fuel supply and energy policy in each country, and to identify key issues to be explored during the fieldwork.

The project team also applied the principles of the DFID Sustainable Livelihoods⁶ approach in the design of the research framework.

Cross-cutting Issues

The main purpose of this research was to assess the impacts of Fuel Substitution on traditional biomass fuel suppliers. Within this objective, it was important to ensure that a number of key issues were addressed.

- Health
- Gender
- Environment
- Economic Sustainability
- Social Equity

It can be difficult to find solutions that have equally positive impacts in all these areas. This was recognised by the project team and recommendations have been developed that seek to address all these issues.

2.1 SURVEY INSTRUMENTS AND RATIONALE

As far as possible, a consistent approach to the fieldwork was adopted in all three countries in order to ensure comparable results. To facilitate this, common research and analysis tools were provided centrally by ESD to all country partners. The samples for each survey varied slightly, but not substantially, according to the local circumstances. The main steps of the research include:

- **Historical analysis:** The first stage of research involved an analysis of the background to both the traditional and modern fuel sectors in each country, focusing on relevant policies, legislation and market changes for wood, charcoal kerosene, LPG, electricity etc. in each country. The purpose of this part of the research was to identify the timeline for key developments that took place in the energy sector, so that changes occurring at the macro-level could be considered alongside changes taking place at the micro-level.

⁵ Poverty Reduction Aspects of Successful Improved Stove Programmes (<http://povertystoves.energyprojects.net>) DFID KaR Contract No. R7368

⁶ 'Conceptual Livelihoods Framework: Using the Sustainable Livelihoods Approach to Analyse Poverty Impacts' Following a SL workshop, this paper was produced by the project team in order to strengthen the partners' understanding of the approach, and to ensure that the key areas of analysis were identified and addressed within the research.

- **Suppliers' survey:** this included the following instruments:
 - **Inflow tallies:** Tallies were conducted at key entry points into the cities, in order to identify all modes of traditional fuel transportation. The widest sample of fuel suppliers was obtained by conducting surveys throughout the day and, with the exception of Uganda, for parts of the night. This strategy was important, since the illegal nature of the business in two of the countries means that a high proportion of fuel transportation takes place after dark.
 - **Short survey:** For each category of supplier identified in the tallies, a short questionnaire was developed that could be carried out opportunistically, during the tallying exercise. The aim of this survey was to characterise the various categories of suppliers in terms of age, gender, types and quantities of fuel being transported, and to inform the next phase of more detailed questionnaires by identifying the most significant and most vulnerable types of fuel supplier.
 - **Detailed survey:** This survey constituted the largest element of the fieldwork. Interviews were conducted with a sample of around 45 respondents per supplier category (transporters and vendors) per country. Using detailed questionnaires as the survey instrument, the main purpose of this research was to characterise the livelihood status of the most significant actors involved in fuel supply. This questionnaire focused on both current levels of access to livelihood assets, and the vulnerability context in which these actors operate. A key aim of this questionnaire was also to establish changes that have occurred in the business and how these have affected fuel suppliers.
 - **Case studies:** In order to illustrate key examples of fuel suppliers and to explore the livelihood strategies of these groups in greater detail, case studies were carried out for each main category of supplier.
- **Consumers' survey:** this included the following instruments:
 - **Short questionnaires:** This survey was conducted with a small sample of consumers from various income groups. The purpose was to identify whether or not fuel substitution has resulted in any significant livelihood impacts. Questions relating directly to impacts of fuel substitution were asked at the very end of the questionnaire in order to avoid influencing the more open questions relating to the reasons for, and the impacts of, changes in household energy habits.
 - **Case Studies:** These were considered to be a more useful method of obtaining detailed information on changes in household fuel use, and provided an opportunity to better explore the reasons and impacts of households' changing fuel use habits.

2.2 SUSTAINABLE LIVELIHOODS FRAMEWORK

The project team applied the principles of the DFID Sustainable Livelihoods approach in the following way:

People-centred: By focusing the fieldwork on fuel suppliers themselves and obtaining primary data from this group, the research enabled the team to fully understand the extent of vulnerability within this sector, and provided people with the opportunity to offer their own ideas for improvements in the sector.

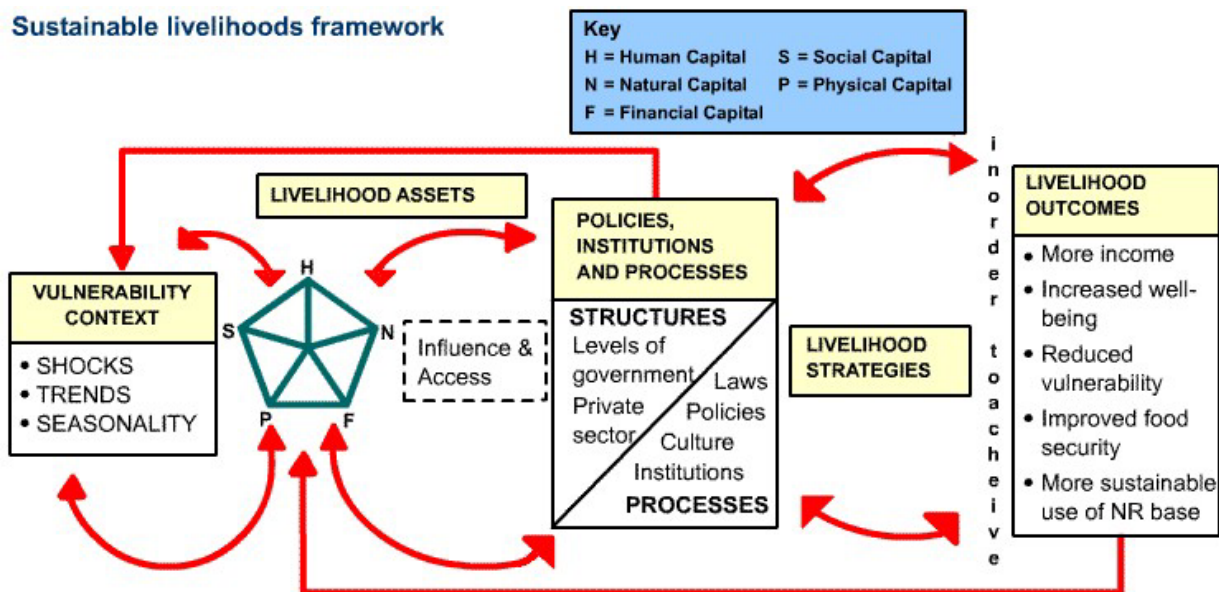
Builds on strengths: In analysing access to assets, the research sought to evaluate what existing assets fuel suppliers possess and how these can be developed alongside other measures in order to improve livelihoods.

Dynamic: The research analysed the historical background to fuel supply in each country and also investigated changes in livelihood over time.

Macro-micro: By examining local and national level policies, the project attempted to understand the way in which various institutions are influencing people's ability to secure their livelihoods in this sector. By involving local and national level stakeholders, it has been possible to make a connection between macro-level policies and the impacts on people at a micro-level.

Sustainability: The analysis of the impacts of fuel substitution focused on the three key sustainability indicators – economic, social and environmental. The recommendations developed are intended to strike a balance between these.

The key elements of the Sustainable Livelihoods Framework are depicted below; the inter-relatedness of each distinct aspect of the framework is indicated by the arrows.



A full interpretation of the Sustainable Livelihoods Framework in the context of the traditional fuel sector was developed by the team at an early stage in the project in order to develop an understanding of the framework (Annex 4). The project team found this framework to be a useful tool, both to provide the structure for the research and as a checklist to ensure that as many aspects of livelihood could be investigated, namely:

- **Vulnerability context:** external factors influencing fuel supply.
- **Livelihood assets:** existing levels of access to natural, social, human, physical, financial capital.
- **Policies, institutions and processes:** laws, regulations, social norms and the associated organisations and actors that influence the ability of fuel suppliers to secure their livelihoods from day-to-day.
- **Livelihood strategies:** the ways in which fuel suppliers carry out their activities, and adapt to the circumstances within the business.

3 INTRODUCTION: BIOMASS ENERGY USE IN THE REGION⁷

Biomass energy plays a vital role in the Eastern African region. For a large proportion of the population, biomass is the primary source of energy to meet cooking and heating needs. In rural areas, the dependence on biomass fuels can be as high as 95%.

On the other hand, in urban areas, where people have easier access to modern energy sources (such as electricity, LPG or kerosene) and end use appliances, dependence on biomass fuels can be proportionally lower, especially in the medium to high income classes.

This does not necessarily mean that volumes of biomass fuels consumed in urban areas are lower. The ever increasing number of the urban poor is, for the most part, solely reliant on firewood, crop residues and charcoal for their energy needs. People tend only to diversify and increase their energy use as their income increases. Although very different from one another in many ways, Kenya, Ethiopia and Uganda have common energy consumption patterns. The following paragraphs give an outline of biomass energy use in the three countries.

3.1 ETHIOPIA

Ethiopia has the lowest per capita average energy consumption in the world at 300 kgoe/y. Biomass fuels account for 94% of the total national energy consumption. Of the total biomass energy consumption, about 86% is derived from woody biomass. 93% of woody biomass is used for meeting household energy needs for cooking and heating (especially in Addis Ababa).

Charcoal is used for meeting part of the cooking and heating energy demands of households (97%), commercial establishments (1.5%) and cottage industries (1.5%). From 1995/96 national survey data, the total volume of charcoal consumed is estimated at 230,000 tons/year. Although over 85% of the total population lives in rural areas, urban households account for almost 70% of total charcoal consumption. This is due to the very large difference between average per capita consumption of charcoal: urban households consume about 17 kg per person per year, while rural households consume only about 1.8 kg per person per year.

Firewood, BLT, agricultural residues and cow dung are the other major biomass fuel sources used both at household and small enterprise levels.

The eucalyptus plantations in the mountainous areas located within some 30km North-East, North and North-West of Addis Ababa are the sole sources of firewood and BLT for the city. The major source of cow dung is the Sululta plains (behind Entoto) less than 30km from the centre of Addis Ababa. Charcoal is primarily produced in the central Rift Valley regions hundreds of kilometres from Addis Ababa. Considerable amounts of fuel residues, such as sawdust, cottonseed and coffee husks, are preferred fuels for commercial injera baking, and are being produced within the boundaries of Addis Ababa.

3.2 KENYA

Biomass fuels (mainly firewood and charcoal) provide 70% of Kenya's final national energy demand⁸. The household sector is the largest user of primary energy, accounting for 59% of

⁷ In the context of this research the terms woodfuel and fuelwood are used interchangeably to indicate all kinds of biomass fuel obtained by wood, namely charcoal, firewood, branches, leaves and twigs, sawdust etc.

the total energy demand. More than 93% of rural household energy needs are met by biomass. It is now estimated that 80% of wood fuel demand for urban households is met by charcoal. Increased urbanisation and increasing distance of wood resources have determined a rapid increase in the demand for charcoal. Data from the Ministry of Energy estimate that between 1995 and 2000 the annual consumption of fuel wood and charcoal grew at 4.5 and 7.4% respectively. The present shortfall in wood fuel availability that Kenya is facing is expected to bring about an increase in use of agricultural residues and animal dung for household energy use, especially in rural areas.

Prior to 1986, almost 70% of the total charcoal and firewood consumption in urban areas was produced in managed plantations and woodlots. According to the Ministry of Commerce and Industry, about 300,000 tons of charcoal per year is transported to Nairobi. The Forest Department (2000) estimates about 75% of charcoal comes from outside gazetted forests (farmlands and other sources) and less than 30% from natural forests. Most of Nairobi's wood fuel supply comes from North Eastern Province and the Rift Valley Province. Only a small proportion comes from the densely populated Central Province. The main users of charcoal are:

- households (all income categories, often in combination with other fuels);
- institutions;
- small and medium businesses (hotels, bakeries etc).

Charcoal briquettes obtained from charcoal dust are also available in relatively small quantities on the market in Nairobi and other urban areas. These products are usually sold at slightly lower prices than wood charcoal and are mainly suitable for heating purposes, hotels and institutions being the major purchasers. Pilot projects exist to produce charcoal briquettes from carbonised agro-residues such as sugar cane bagasse and coffee husks.

3.3 UGANDA

Biomass, mainly firewood, charcoal and crop residues, constitutes the most important energy source in Uganda, accounting for over 90% of total energy consumption in the country⁸. Wood fuels provide almost all the energy required to meet basic needs of cooking and water boiling for most rural and many urban households, institution and commercial buildings. Biomass is also the main source of energy for rural industries. Trading in biomass energy, especially charcoal, contributes significantly to the economy in terms of rural incomes, tax revenues and employment.¹⁰

Woody biomass is the main source of energy for cooking often used in the inefficient traditional three stones stove and for the provision of space heating. In Kampala the main consumers of fuelwood are:

- Low income households
- Institutions (schools, prisons, hospitals)
- Small and medium enterprises such as bakeries, commercial establishments (hotels, restaurants) etc.

⁸ Kenya Fact-book 2001.

⁹ MEMD (2002) "The Energy Policy for Uganda"

¹⁰ A Forest Department, EC-supported study in 1995 carried out field research in over half of Uganda's districts, in the most important biomass energy supply areas. This study showed that commercial wood fuels (charcoal and fuelwood) production and transportation accounted for over £50 million revenues collected locally from producers and transporters every year. EC-funded "Uganda: Commercial Woody Biomass Supply, 1995", Forest Department, Ministry of Natural Resources.

With regard to charcoal, about 70% of the total amount entering Kampala is produced by dedicated, itinerant charcoal sellers on an independent basis. Most charcoal is produced in the south and west of Uganda on non-government land in the districts of Masindi and Nakasongola. Charcoal producers generally enter into arrangements with landholders and pay them nominal fees or a proportion of the charcoal produced. Charcoal consumption increases at a rate close to that of urban population (6% per year).

4 FUEL SUBSTITUTION: AN HISTORICAL PERSPECTIVE¹¹

4.1 ETHIOPIA

Despite its important role in the overall socio-economic development of Ethiopia, the traditional biomass sector became the focus of government and donors' attention only in the early 1980s, after extensive studies highlighted that demand for traditional fuels exceeded sustainable supply limits and that household energy utilisation was characterised by enormous energy inefficiencies.

Despite this newly acquired awareness, interventions made by the government had a nature of 'crisis management' instead of systematic and planned approach to address the root causes of biomass fuel scarcity. As a result, the sector was guided by unwritten policies, which sometimes translated into directives intended to control, rather than regulate, activities and development initiatives in the energy sector. The government assumed almost exclusive responsibility for investments in the energy sector. Some of these policy related interventions of the eighties include the following:

- Imposition of a strict control and ban on trafficking of traditional fuels, especially on charcoal.
- Establishment of public enterprises to supply and market traditional fuels.
- Subsidisation of electricity and introduction of electric Mitads. The transition from biomass to electricity for injera baking was so rapid that ownership of electric injera Mitads grew from 13% of the households in Addis Ababa in 1985 to over 70% in 1995. In 1994 an electricity tariff revision was introduced bringing the average domestic tariff to more than double over a number of years. Although electricity is still subsidised for domestic consumers, a considerable number of people have reverted back to baking injera using traditional biomass fuels ever since 1998. Nonetheless, in Addis Ababa, urban electrification is close to 90% of all households, with over 70% of all households cooking at least part of their food using electricity.
- Subsidisation of kerosene and removal of import duties on kerosene stoves. Use of kerosene as a household cooking fuel was almost unknown until 1980. As a short term bridging strategy to buy time for peri-urban wood plantations to be established, the government removed all import barriers on kerosene stoves and embarked upon massive importation of stoves and a rapid increase in the importation of kerosene for urban domestic cooking.

Kerosene use for household cooking grew from less than 20% of Addis Ababa households in 1995 to over 90% of all households today. In 2001, sales of kerosene for lighting and cooking reached 221,000m³, compared to less than 25,000 in 1985m³.

¹¹ Country specific Status Reports on energy use and fuel substitution historical patterns can be found in Annex 1 of this report.

Penetration of LPG has never been significant and, in recent years, it has been decreasing due to high tariffs. In addition to the inter-fuel substitution measures mentioned above, the Ethiopian government also embarked on a set of demand side management strategies in order to make beneficial impacts on household energy utilisation pattern and end-use efficiency. To this end, improved stoves projects were launched in the 1990s, which resulted in incredible success stories, as illustrated in Table 1.

Table 1: Market penetration and characteristics of improved stoves in Ethiopia

Stove	Improvements
Lakech improved charcoal stove	Overall energy savings of about 25%. Introduced in 1991, the stoves were produced and sold commercially through existing marketing channels in a self-sustaining manner. Today, an estimated 50% to 60% of the urban households are using the stoves throughout the country.
Mirte biomass Injera stove	Overall energy savings of up to 50%. Work on this stove started in 1994, two years later close to 60,000 stoves were produced and marketed by the commercial private sector artisans. Estimated sales volume in the range of 50,000 units per year. A version for commercial applications and to burn any combustible biomass has been produced. It is estimated that tens of thousands commercial and institutional consumers are currently using it.

4.2 KENYA

Kenya still lacks a comprehensive and integrated policy approach to the environmental problems caused by the ever increasing household demand for biomass fuels and the consequent falling availability of forestry resources. A clear policy on energy production, distribution and use, recognising the importance of the role of biomass fuels, is yet to be drawn.

Nonetheless several scattered policy measures have been adopted by the government in the attempt to reduce the pressure of biomass energy on national forestry resources. In 1977, in reaction to a marked increase in charcoal production in several major national parks and reserves (primarily destined for the Arabian peninsula), charcoal was banned in Kenya, and has been officially banned ever since. This resulted in large producers (e.g., the East African Tanning Company, who sustainably produced over 40,000 tonnes of charcoal a year from black wattle – *Acacia mearnsii* – as a by-product of tannin extraction) and numerous small producers (primarily in the densely populated Central Province) ceasing production, and driving charcoal production and transport underground.

Another policy intervention was the banning of the *shamba* system of forest plantation establishment in 1986, together with the practice of felling indigenous trees.¹² At that time, wood-fuel accounted for 75% of Kenya's total energy use.

These bans had profound effects on fuel wood and charcoal production and transportation, causing charcoal and firewood prices to increase, especially in urban areas. The consequent deficit of fuel wood determined a steady increase in illegal deforestation as well as charcoal production activities and charcoal imports from neighbouring countries (e.g. Uganda and Tanzania).

¹² The shamba system permitted Forestry Department workers to grow crops in areas commercially cleared in forest reserves. It permitted these employees both to live and farm on these plots until the next cycle of tree planting (rotation) was carried out. The principle behind the shamba system was that forestry workers who lived on these plots would protect them and the forested areas around them as a means to protect their livelihoods. After a number of years, however, most observers and government concluded that rather than protect the forest, the workers in the shamba system were accelerating forest degradation. Hence, the system was abolished.

From a situation in which some 50% of all urban charcoal was produced and supplied to urban areas in 1977,¹³ it is now estimated that illegal, but politically tolerated land clearing activities for agricultural expansion and settlements provide up to 80% of the charcoal supplied in urban areas today¹⁴. Whilst in some cases this has alleviated charcoal and firewood shortages in the short-term, in the long term it is expected to further exacerbate the fuel wood crisis on account of massive forestry clearance.

Penetration of modern fuels and sources of energy in Kenya happened in several stages:

- Monopolisation of the electricity sector during the 1970s and 1980s, with the consequent government ownership of all retail sales of electricity in Kenya. Government policy since 1969 has explicitly halted any electrification of “non-official” settlements in urban areas (i.e. slums), where the percentage of urban population has grown from less than 30% in 1970 to more than 50% today, from less than 150,000 households in 1970 to more than 800,000 today. This has resulted in an absolute increase in the use of traditional fuels in urban areas
- Liberalisation of the petroleum sector in 1994 brought about competition and price liberalisation for LPG. Different oil companies market their own cylinders of different sizes and with different nozzles. LPG consumption has grown rapidly during 2001 due to power rationing and penetration is now estimated at 6% in urban areas, also thanks to the introduction of small size (3 and 4 Kg) cylinders. Nonetheless LPG is still expensive compared to other fuels and penetration is limited primarily to the upper and middle income classes, although penetration into lower income groups is accelerating quickly.
- Subsidisation of kerosene as a cooking fuel for urban areas and lighting fuel for rural areas. More than 94% of Kenya’s population use kerosene and demand has increased steadily over the years, until 2000 when volume sales declined by 5.7% due to price increases and government measures to limit the use of petroleum products, including kerosene. Penetration of kerosene is high in all classes of the population, mainly because appliances are relatively inexpensive and within means of most low-income consumers.
- In 1999 and 2000, drought for three consecutive seasons led the government to ration electricity countrywide. Use of electricity dropped by 9.9% while tariffs went up. Most consumers reverted to other fuels, such as LPG, kerosene and charcoal. Electricity is an expensive source of energy still out of reach for many urban low-income families and the majority of the rural population. Nonetheless, Kenya still has a large upper and middle class, relative to the rest of Africa, and household electricity consumption per capita in Kenya is significantly higher than in other countries in the region.

Table 2: Market penetration and characteristics of improved stoves in Kenya

Stove	Improvements
Kenya Ceramic Jiko (KCJ) – charcoal stove. Kuni Mbili and Upesi woodstoves	R&D began in 1982. By 1986 a total of 250,000 improved charcoal stoves had been produced and sold in urban areas. Commercialisation was very successful in urban centres because of increasing fuel prices, less so in rural areas where people tend to gather fuelwood. Penetration in the poorest parts of Nairobi (e.g. Kibera slum) was lower than expected.

¹³ Ministry of National Planning, and CIDA, “Land Use and Charcoal Production: A study of charcoal production in all districts of Kenya”, September 1989.

¹⁴ Schraum, (1987) “Managing urban/industrial woodfuel supply and demand in Africa”. Annuals of Regional Science, Vol II. pp 60 – 79.

4.3 UGANDA

Uganda's Energy Policy (September 2002) recognises the importance of the role of biomass as a source of energy, as well as the linkages between the energy sector and the economy, environment, forestry and health. Fuel substitution is viewed as a method to reduce impacts of energy in these other sectors¹⁵. The current energy policy is only the latest output of a set of policy actions and initiatives that commenced in the early 1960s trying to address environmental and forestry concerns linked to fuelwood use. These include:

- Charcoal production improvement strategy from early 1960s until 1972, targeting charcoal production technologies and fuelwood resources.
- Presidential ban on charcoal during 1987. The ban soon proved impossible to enforce and was lifted.
- Decentralisation of responsibility over charcoal production from the national Forestry Department to the local governments at district levels.

With regard to modern fuels, there has never been a targeted campaign to increase their market penetration to limit the environmental impacts of traditional biomass fuels. In broad terms the following applies:

- LPG distribution is very low in Uganda and the level of tax on this imported fuel is very high, making it accessible only to institutions and the upper income classes. Nonetheless, both the government and oil companies are taking an aggressive approach to increase its dissemination.
- Commercial penetration of kerosene began in 1965 with great success. The level of tax is still very low compared to other fuels. However, the trend in kerosene imports and consumption reversed during Uganda's civil conflicts from 1971 to 1986, and consumption has only been increasing steadily over the past decade.
- Electricity has been subsidised in order to reach the poorest, especially in urban areas. In the 1960s, the Government adopted a policy of "lifeline tariffs", whereby electricity prices were highly subsidised to ensure all income levels could afford it. Starting in 1993 the electricity tariffs were slowly adjusted to reflect the current economic cost of supply. However, with the 1999 Electricity Act, and the move to privatise the Uganda Electricity Board (the former monopoly electricity company), electricity tariffs have increased substantially over the past three years.
- A Rural Electrification Strategy Plan was adopted by Cabinet in 2001 to increase the electrification rate (grid access is only 5% for the whole country, and less than 2% in rural areas).

Although improved stoves dissemination is high in the Government's priorities to reduce impacts of biomass fuels on users' health and the environment, commercialisation of energy saving stoves has not been successful in Uganda so far¹⁶.

¹⁵ Par 1.3.1 of The Energy Policy for Uganda states that "...substitution in the use of fuelwood with LPG will reduce deforestation."

¹⁶ Results of "Poverty reduction aspects of successful improved households stoves programmes", KaR contract number 7368 attribute the failure of commercialisation to 1) poor quality and 2) wrong marketing approach.

5 URBAN FUEL SUPPLIERS PROFILE

Transporters and vendors were divided into dedicated and non-dedicated suppliers. The first are those who sell or transport only charcoal, firewood or BLT without trading in anything else. The non-dedicated suppliers are those who trade in other goods in addition to biomass fuels or engage in different activities as well as in biomass fuel trade. A more detailed profile of fuel suppliers is available in Annex 2¹⁷.

5.1 ETHIOPIA

The biomass fuel sector in Addis Ababa is characterised by a multitude of players at all stages of the supply chain (see charts in Figures 3 and 4) from production, processing and transportation through to marketing and delivery. In most cases, the definition of roles is very fluid, i.e. a woman who transports fuels could also sell it in a market stall making it difficult to group her with transporters or vendors due to her dual role. As a result of both this and the high informality and decentralisation of the business, it is very difficult to quantify the number of people involved in supplying traditional fuels in Addis Ababa. However, several thousands of suppliers are active as fuel market traders, kiosk vendors and wholesalers in the city, as are a comparable number of transporters, both motorised and non-motorised.

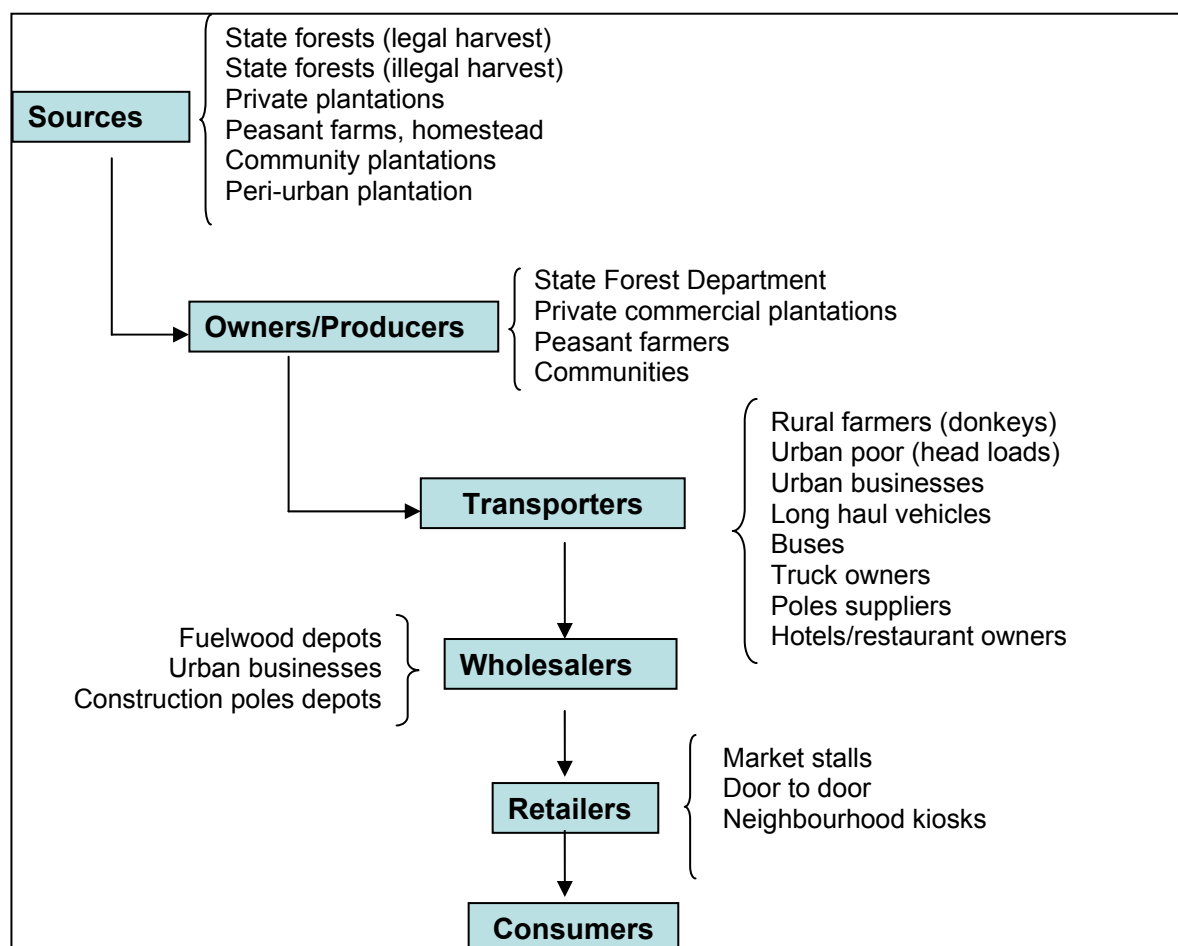


Figure 3: Ethiopia firewood supply chain

¹⁷ Biomass Fuel Suppliers Profile: Ethiopia, Kenya, Uganda

In Ethiopia, there is a clear distinction between the supply dynamics of fuel wood and charcoal, and BLT. Wood and charcoal are mainly produced by farmers upcountry and are transported from as far as 400 km. The distance travelled by transporters has increased in recent years as resources closer to the capital have been depleted. Addis-based traders have middlemen who organise supplies and transport in rural areas. Usually, the traders themselves collect their supplies and transport them to Addis Ababa. There is no organised delivery mechanism, particularly for charcoal.

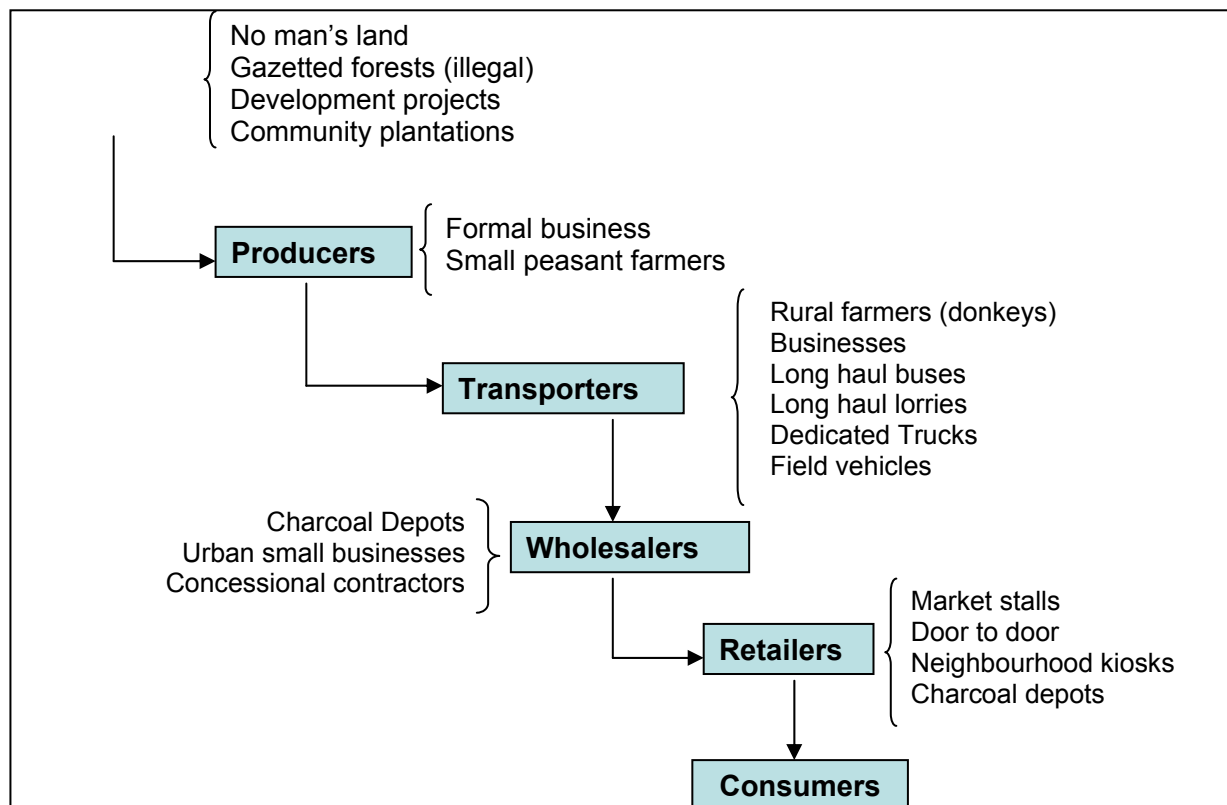


Figure 4: Ethiopia charcoal supply chain

On the other hand, BLT is produced in and supplied from peri-urban plantations within 30 to 40 km around Addis Ababa. A number of peri-urban plantations (all eucalyptus) developed in the mid 80s are the sole sources of BLT supplies to the city.¹⁸ Rural women and children collect BLT from state owned plantations free of charge (although bribes and favours are common to gain access) and transport it to either Addis Ababa itself or to the nearest small town where they sell it to local or Addis traders. In between 200 and 300 Addis-based merchants (almost all women) go to satellite towns on market days to collect their supplies. The traders rent open spaces in the satellite towns where they store and repack the BLT.

In recent years, new trends have developed in the traditional fuel supply business in Ethiopia:

- Increasing importance of motorised transport of fuels (mainly charcoal, and wood), especially through dedicated lorries and pickups. Transport of cow dung from the rural areas is still carried out mainly using donkeys.
- Wooden construction poles constitute the major sources of wood inflow into Addis Ababa.

¹⁸ Discussions made with farmers during the course of this assessment indicated that the peri-urban plantations have now become the major source of livelihood (accounting for 50% to 80% annual household income) for several thousand rural agricultural families around Addis Ababa.

- The access routes to town are becoming more and more specialised in terms of the majority of fuel transported. This is a direct effect of biomass availability in different geographical areas around Addis Ababa.

Transporters: Unique to Addis Ababa is the number of non-motorised transporters involved in transporting fuels to the city. Despite the fact that the role of motorised transport of biomass has been steadily growing in recent years due to the furthering of biomass sources,

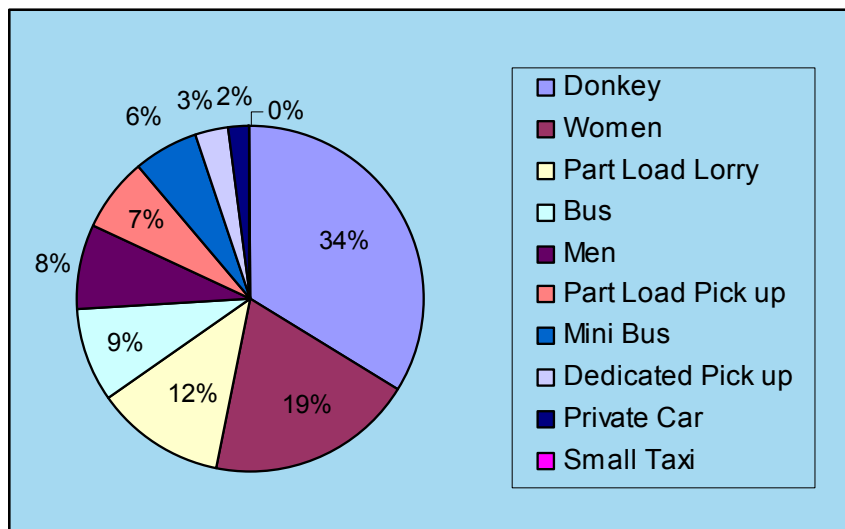


Figure 5: Ethiopian biomass fuel transporters by categories - head counts¹

several thousands of women, donkeys, children and to a lesser extent men still transport the bulk of firewood and cow dung to Addis Ababa on a daily basis. Around 61% of all the biomass inflow into Addis Ababa is carried by non-motorised means (see Figure 5). These include men, women and people-led donkeys.

Women represent over 70% of all human carriers into Addis and they mainly carry BLT. All motorised transportation is carried out by men. It is also worth noting that the vast majority of those transporting fuel by donkey are men.

Vendors: Traditional fuel vendors in Addis Ababa can be categorised into two main groups: large wholesalers/depots and retailers (see Figure 6 and 7).

- **Large Wholesalers/Depots:** Usually located in rented publicly owned spaces, they obtain their supplies both in small and large quantities from rural suppliers (small quantities by donkey and human loads) and urban-based middlemen using motorised means of transport. Depending on the types of products they deal in, wholesalers/depots can be sub-divided further into three categories. These are: (1) those who sell construction poles and traditional fuels (firewood and or charcoal), (2) those who deal in charcoal only, and (3) those who deal in firewood only.



Figure 6: Charcoal depot in Addis Ababa

- **Retailers:** This group consists of several sub groups that differ from one another in terms of size of business, sales volume, business location and levels of diversification. In terms of numbers this group is the second largest next to transporters in the supply chain. Traditionally women are more active than men in the retailing of traditional fuels (and other household consumption goods such as food items, spices and vegetables).

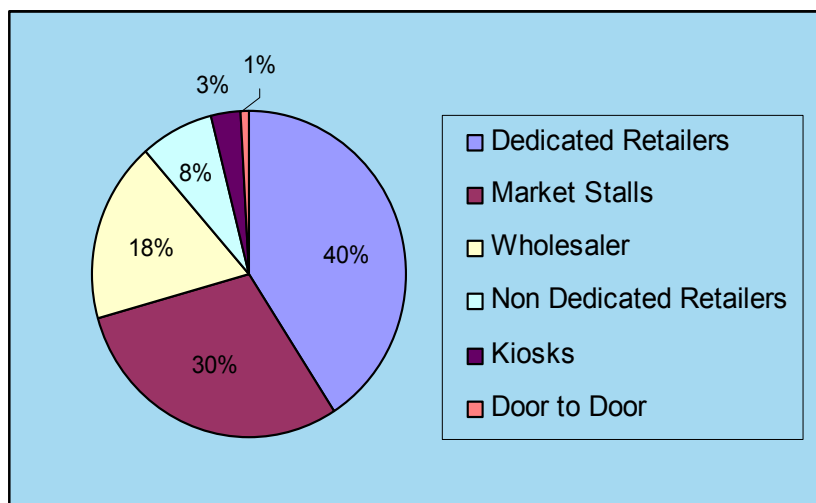


Figure 7: Ethiopian biomass fuel vendors by categories¹

The following are sub groups of retailers group ranked in terms of size of business:

- *Shops/Kiosks:* located in neighbourhoods, highly diversified including non-fuel consumer goods, almost always men, sometimes wholesale to smaller retailers and deliver to points of sale.
- *Market Stalls:* located in almost all small and medium neighbourhood markets (close to 1,000), some diversifying with non-fuel commodities. They have regular selling place, are usually urban women supported by their daughters.
- *Side of the road vendors:* usually sell self-collected fuels and have no regular selling place. They sell directly to household consumers.
- *Door to door vendors:* this category is decreasing in importance. They are mainly men selling usually charcoal packed in tiny plastic bags laden on donkeys.
- *Neighbourhood vendors:* in front of residences and small roadsides (footpaths) in slum areas. They sell very small units of BLT in bundles, or of charcoal in plastic bags. These vendors, mainly poor women, are generally not specialised in traditional fuels, but sell other products as well.

5.2 KENYA

Traditional biomass fuel trading in Nairobi is a very dynamic business that takes place in the whole of the Nairobi business district as well as in residential areas. The biomass supply chain is long and generally ramified (Figure 8). At times it is difficult to identify all the players and their roles, as they are often interchangeable.

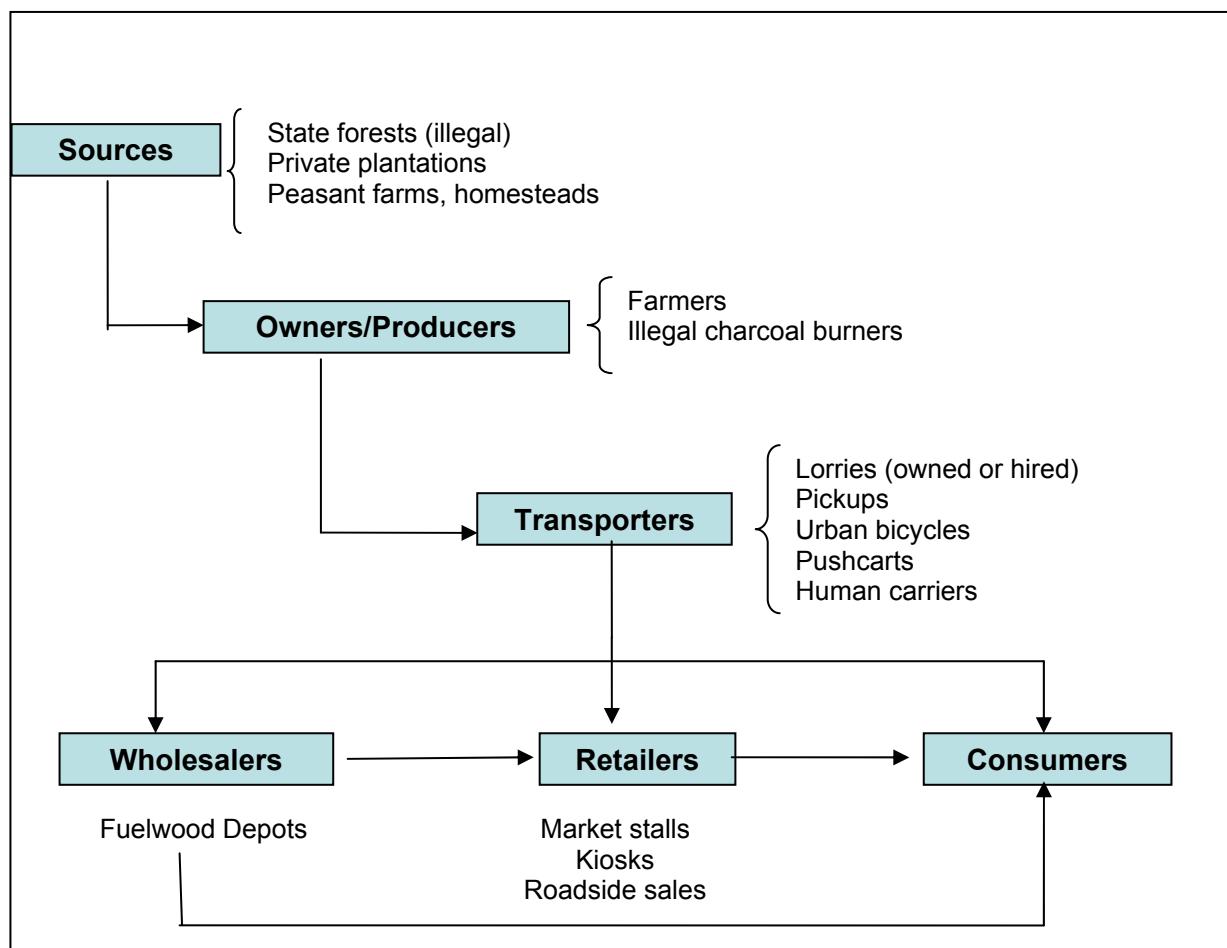


Figure 8: Kenya biomass supply chain

In most cases, charcoal and log producers are based in rural areas and are represented by agents in Nairobi, who generally operate motorised transportation, either lorries or pickup trucks in a fairly organised manner. Dedicated depot/wholesale operators, and non-dedicated kiosks, shops and roadside vendors are involved in selling traditional fuels both in the residential and business districts. Non-motorised transporters, using bicycles, pushcarts or just carrying fuelwood on the head, link up the various traders in the chain. The recipients of the traditional fuels from non-motorised transporters are mostly non-dedicated vendors such as retail shops and roadside vendors. They also supply their fuel to households, commercial enterprises or institutions. Although it is formally illegal to produce and transport charcoal, it remains the most important type of biomass fuel sold in Nairobi.

The most striking characteristic of the Kenyan traditional fuel business is the predominance of male vendors and transporters (representing around two thirds of all biomass fuel traders). This applies to all categories of transporters (with the exclusion of woodfuel head load carriers), and vendors, from wholesale and depot owners to door to door vendors.

Transporters: The category of motorised transporters in Kenya comprises lorry and pick-up drivers, who bring charcoal and woodfuel to Nairobi. Although transportation of biomass fuel is characterised by many risks, mainly due to the illegal status of charcoal trade and the poor transport infrastructure, it is an activity that allows for high profits, thanks to the large volumes of charcoal and woodfuel that are transported on a daily basis into Nairobi. Lorry charcoal transporters include:

- lorry owners who hire a driver to transport charcoal from production sites to Nairobi;
- business people or charcoal owners/dealers who hire trucks to transport their own charcoal.

These two categories of transporters collect the charcoal from production sites, mainly the Mount Kenya region and the Rift Valley, and transport it to major urban centres in the evenings and at night to avoid police and government officials. They then distribute charcoal to strategically positioned depot owners (wholesale retailers) early in the morning. Lorry charcoal loads always range from over 100 sacks to 350 sacks.



Figure 9: Women transporting firewood in the outskirts of Nairobi

Non-motorised transporters of biomass fuels include all those traders (the majority of them being men) who move charcoal or fuelwood across town using bicycles, pushcarts and wheelbarrows. Women carriers who collect firewood from Karura or Ngong forests and sell it by the roadside belong to this category as well (Figure 9). In most cases they transport biomass fuels for very short distances and link up vendors with household consumers. There are no clear cut lines between this category of transporters and door to door or roadside traders as they often collect or buy their own charcoal and sell it direct to households or by the roadside.

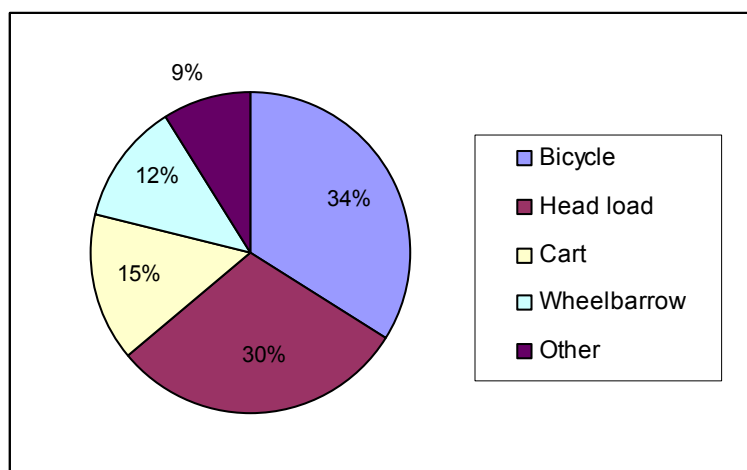


Figure 10: Kenyan non-motorised transporters by categories¹

Vendors: The category of vendors can be divided into several groups according to size of sales (Figure 11):

- **Large wholesalers/depots:** include both dedicated and non-dedicated depot owners. Dedicated vendors often own the premises where they work and have been in the business for a longer period of time than non-dedicated ones. Depot operators sell charcoal in large quantities, often in bags and generally operate large-scale wholesale stores, which can store more than 50 bags of charcoal at any given time. This category usually has a good network of suppliers to rely on, as well as an established number of preferential customers that buy in bulk, such as hotels and restaurants.

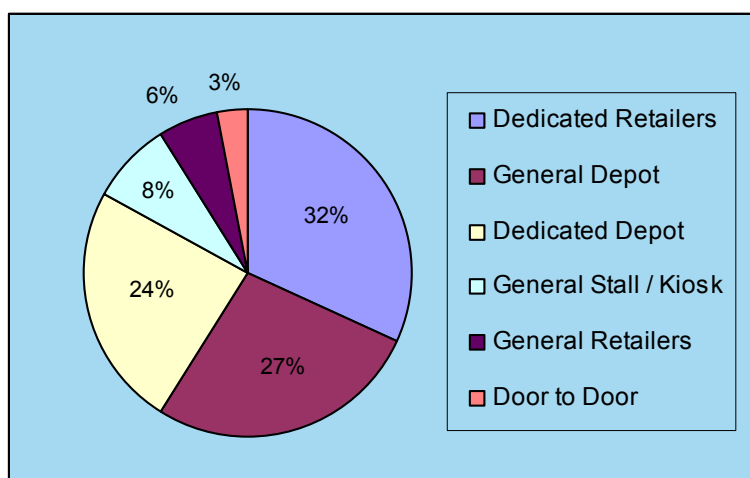


Figure 11: Kenyan biomass fuel vendors by categories¹

Retailers: The majority of retailers rent the space from where they sell woodfuel and charcoal. Those remaining either own the premises, or have occupied them illegally. Retailers usually have stayed in business long enough to establish strong relationship with both suppliers and customers.

5.3 UGANDA

In Kampala, charcoal is the preferred biomass fuel used by people with disposable income. Firewood, on the other hand, is mainly self-collected at no cost by the poorest living in swampy areas across town. Nonetheless there is a market for firewood in Kampala, mainly for heating purposes. The availability of small size lorries and pick-ups that can travel on small roads and muddy tracks deep into residential areas has determined a considerable change in the dynamics of biomass fuel supply in Kampala over the last few years, bringing about decentralisation of the business.



Fig 12: Non-dedicated roadside charcoal dealer in Kampala

The availability of small size lorries and pick-ups that can travel on small roads and muddy tracks deep into residential areas has determined a considerable change in the dynamics of biomass fuel supply in Kampala over the last few years, bringing about decentralisation of the business.

In the past, central market vendors and depots were the main sources of charcoal and

firewood, whereas nowadays, neighbourhood kiosks are the main points of sale for many customers. This has meant a decrease in the importance of wheelbarrows and bicycles as a means of transporting biomass fuels because people are able to reach a sale point within a few hundred metres of their households without requiring additional transport. The increased number of kiosks and roadside vendors also reflects the open nature of the traditional fuel business in Uganda and the economic growth in the sector.

Delivery of charcoal is guaranteed by charcoal dealers who either own or hire the lorries that collect the charcoal directly from producers in rural areas and sell it to various clients in town (market places, kiosks etc). It is very seldom that lorries sell directly to end users. Once the load is sold, the lorries make the trip back to the producer. It is not unusual for a wholesaler to do up to three trips upcountry per week. The majority of vendors visited by the charcoal transporters are kiosk vendors (62%) followed by market stall vendors (23%), the rest are wholesalers. Although in smaller numbers compared to kiosks and market stalls, the wholesalers/deport owners handle about 75% of the total charcoal income to Kampala. At times, kiosk and market stall owners will purchase only a single sack of charcoal from the transporters, whilst it is common to find a single wholesaler purchasing entire truckloads. Transporters usually exact a premium for having to travel long distances along poorly maintained roads to supply small stockists. This price increase is then passed on to the customers.

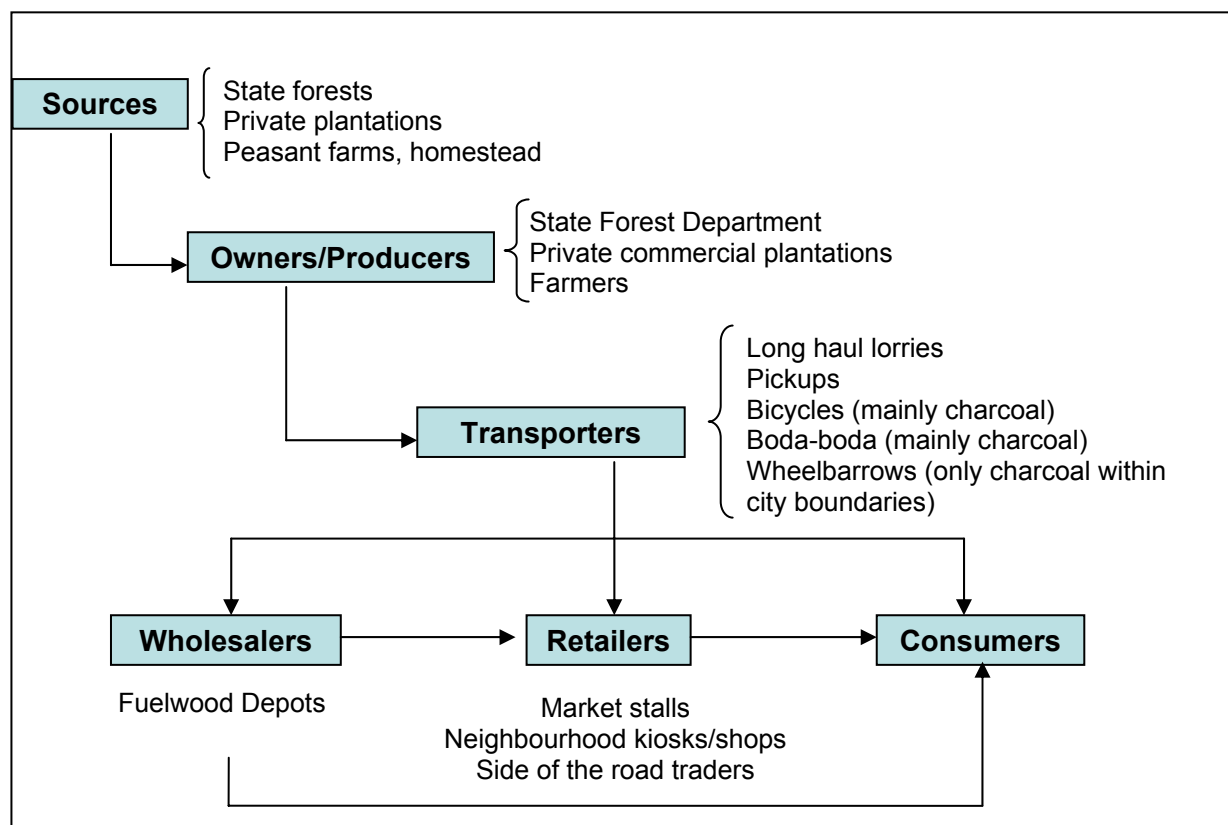


Figure 13: Uganda biomass supply chain

Transporters¹⁹: Lorries are the most important means of transporting both charcoal and firewood to Kampala and to mobilise the traditional fuel among vendors within the city. The vast majority of charcoal lorry drivers are employed by the lorry owner, with only 16% driving

¹⁹ Although boda-bodas are motorcycles, they are considered as non motorised means of transport given their limited loading capacity.

their own trucks²⁰. Most of the time, individual charcoal wholesalers hire the trucks, while the rest of the time it is a group of wholesalers that jointly hires a truck. Only 42% of the transporters are dedicated to transporting charcoal, while all the rest switch to other goods whenever the opportunity arises. About 16% of the transporters reportedly engage in other activities including small-scale farming. Non-dedicated lorries, pick-ups and bicycles contribute largely to ferrying firewood for personal use as opposed to commercial purposes.

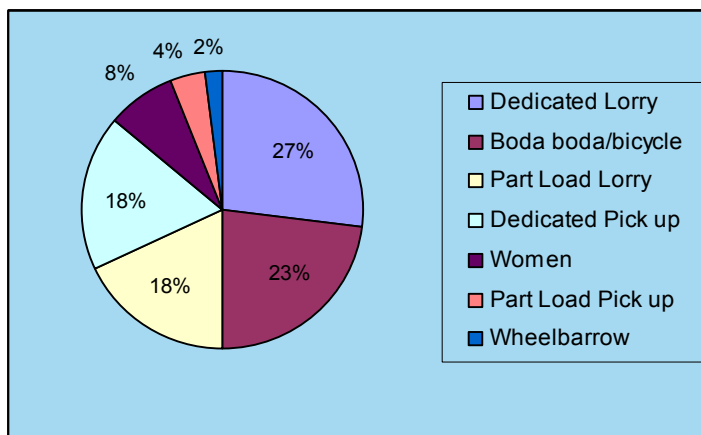


Figure 14: Ugandan biomass fuel transporters by categories¹

Among the non-motorised means of transport boda-bodas are becoming important, especially for charcoal from Masaka Road. The other forms of non-motorised transport, namely carts and wheelbarrows, are becoming less significant over the years due to the strong decentralisation of the business. Headload transportation of firewood is not significant in Kampala, unless it is for personal use.

Vendors: One of the main characteristics of the traditional fuel business in Kampala is the clear predominance of women (about 75%) over men. This is true across all categories of vendors, including wholesalers, and reflects the general perception that the charcoal trade is a “dirty” business that is an undignified activity for men. Another striking characteristic is the relatively short permanence in business for most vendors (less than 2 years), reflecting the high number of new entrants in the business determined by its growth. As mentioned above, the category of traditional fuel vendors comprises two main groups (see Figure 15 for relative proportions).

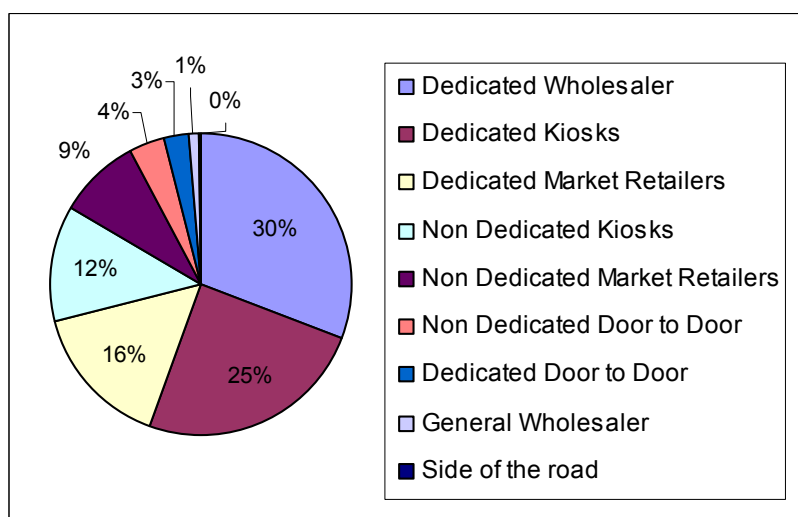


Figure 15: Ugandan biomass fuel vendors by categories¹

²⁰ Sample size of 64 lorry drivers serving all districts of Kampala.

- **Large Wholesalers/Depots:** Depot owners operate from central locations, from where they sell in bulk to institutions, hotels, restaurants and also retail to individuals. Their location in the marketplace is designated for charcoal vending.
- **Retailers:** In Kampala, the majority of charcoal vendors are dedicated, whereas the opposite is true for firewood dealers, who tend to sell other products as well, usually groceries and local food, such as *matooke*. Non-dedicated retailers are mostly located towards the poorest areas of town. In the majority of cases, market stalls and kiosks are supplied by wholesalers, although recently lorries are competing to supply as many retailers as possible (around 40% of retailers are supplied directly by transporters).

Retailers include:

- **Market vendors:** these are no longer the predominant retailers of traditional fuels, as neighbourhood kiosks have started to spread across all districts in Kampala, including residential areas. Despite this, they still represent a large proportion of charcoal and firewood traders. They sell to both other smaller retailers or to customers. They usually keep prices lower than kiosk vendors as they have better deals from transporters and wholesalers due to the fact that they buy large quantities of fuelwood at a time and are located in fairly central places.



Figure 16: Dedicated market charcoal vendors in Kampala

- **Neighbourhood kiosks:** typically kiosk vendors serve an average of 25 households, have a low capital base and therefore limited stock. Nevertheless, they have a solid and constant base of customers who purchase small quantities, even as little as 1 Kg or less, at one given time. 68% of kiosk vendors operate in rented facilities.
- **Roadside vendors:** The majority of these retailers are women who sell mostly firewood to either customers or other vendors. Roadside vendors are a relatively new phenomenon in Kampala as the majority entered the business recently (less than two years ago).

- *Door to door*: This category is numerically insignificant. The majority of door to door vendors sell directly to customers and deal mainly with charcoal only. The ratio between males and females is almost balanced.

5.4 SOME COMMON ISSUES

The traditional fuel business in the three countries has been growing steadily over the past few years due to increase in demand determined by population growth, especially in urban areas. The analysis of data collected during the project activities highlighted a few characteristics of the business common to the three countries in the study:

- **Extreme decentralisation and open access.** No particular skills are required to enter the business in any of the positions in the fuel supply chain. This is one of the main reasons why a great number of people involved in the business are among the poorest and with least alternative options in society. These include a high percentage of women, who are very often either divorced or widowed household heads.
- **Deregulation and a high degree of competitiveness.** These circumstances contribute to vulnerability, especially for those who do not own any premises from which to carry out their business.
- **Fluidity of roles** is another common aspect of the traditional fuel business in the three countries. This is particularly true for those people who self-collect the fuel, transport it and then sell it directly to customers in the various market places.
- General perception of the business is that of a **dirty and petty trade**, mostly suitable for women. This accounts for the high proportion of women engaged in the trade, mainly sales, while transportation happens generally in bulk and is the prerogative of men owning or renting motorised vehicles.
- **Illegality** of the charcoal business in Kenya and Ethiopia. For this reason, there are neither written rules nor regulations that govern the charcoal business, and people engaged in charcoal production and transportation have to do so in a semi-illegal environment.

6 LIVELIHOOD ANALYSIS OF FUEL SUPPLIERS

6.1 GENERAL CHARACTERISATION

As the previous section has shown, the urban biomass fuel supply sector comprises a wide number and range of activities – from production and processing through to transportation, marketing and delivery of wood, charcoal and other biomass products, such as BLT. Even when excluding the upstream activities of production and processing, there are still a wide range of actors involved in this sector – from wholesale vendors of wood in the form of poles to donkey and human transporters of wood, charcoal and BLT. Suppliers were, therefore, divided into transporters and vendors, so that distinctive areas of activity could be fully investigated. A summary of the types of actors that were the focus of the livelihood analysis is indicated below.

Table 3: Key Groups of Fuel Suppliers in Addis Ababa, Kampala and Nairobi

	Transporters		Vendors	
Addis Ababa	Motorised	Lorries	Wholesalers	Depot owners
	Non-motorised	Human carriers Donkeys	Retailers	Shops/kiosks Market stalls Roadside vendors Door-to-door vendors
Nairobi	Motorised	Lorries Trucks	Wholesalers	Depot owners
	Non-motorised	Human carriers Bicycles Carts Wheelbarrows	Retailers	Kiosks Market stalls Roadside vendors Door-to-door vendor Neighbourhood vendors
Kampala	Motorised	Lorries Pickups	Wholesalers	Depot owners
	Non-motorised	Bicycles Boda-Boda (motorbike taxi) Wheelbarrows and carts Human carriers	Retailers	Market stalls Roadside vendors Neighbourhood kiosks Door-to-door vendors

Despite the diversity of this sector across the three countries, some common characteristics prevail.

- **High proportions of women** are engaged in the fuel supplier sector. Although the proportion of women is higher in Ethiopia than in Kenya and Uganda, the distribution of employment is such that, in all three countries, women are predominantly engaged in the most arduous and low-paid activities, while the male-dominated activities are characterised by higher returns and greater potential to diversify in times of fuel shortage. Therefore, women constitute a significant proportion of the most vulnerable fuel suppliers.

- Women are concentrated in the **non-motorised** aspects of the business, especially transportation of fuel by head or backload.
- Very few women are engaged in the more profitable wholesale sector. Most of them are engaged in **small-scale** vending activities
- **There is a gender correlation** between the dominant **modes of transport** used in each city, and the actors engaged in fuel transportation. Whilst in Ethiopia, the concentration of female involvement in the transportation sector is dictated by the high level of non-motorised, and particularly backload transportation of fuel, Uganda's transportation sector is almost entirely the reserve of men, since vehicles are more commonly used for transporting fuels. In Kenya, human transportation of fuel is also less significant, but nonetheless dominated by women.
- A **gender bias** is also evident **among vendors**. In all countries, the large wholesalers are usually male. In Ethiopia in general, the retail of many different commodities is an activity more often pursued by women, which explains the concentration of women in this sector. In Kenya, the wholesale fuel sector is also dominated by men.
- In the fuel supply sector as a whole, **education levels** are generally very low. No specific skills are required to enter the business.
- The **age** of those involved in fuel supply range from children through to the elderly. In Uganda, the ages of the largest group in the sample were between 26 and 36; in Kenya the average age was 37 and the statistics are also similar for Ethiopia, where the majority of fuel suppliers are below the age of 40.

A more detailed profile of fuel suppliers is available in Annex 2²¹.

6.2 LIVELIHOOD CIRCUMSTANCES

One purpose of evaluating livelihood circumstances is to establish how vulnerable fuel suppliers actually are, and thus how susceptible they might be to changes in the market, such as those brought about by fuel substitution measures, or the 'shocks and trends' that are characteristic of the 'vulnerability context' in which traditional fuel suppliers operate, i.e. the conditions over which people have very little, or no control. By evaluating current levels of access to financial, physical and social assets, it is possible to consider how existing assets might be developed in order to buffer the negative impacts of shocks and trends, or how access to assets might be improved.

6.2.1 Transporters

Ethiopia: Access to financial assets is very limited for the fuel suppliers interviewed in this survey. For 73% of the sample, fuel transportation was their sole source of income, and this was particularly true for female transporters, of whom only 18% reported additional sources of income. The implications for loss of this income are, therefore, more serious for female transporters. When combined with income statistics, the vulnerability of their situation is even more evident.

On the basis of the World Bank's 1 dollar (equivalent to 8.78 ETB) per day poverty line, the average income for both men (11.98 ETB) and women (9.02 ETB) places transporters barely above the poverty line (see Table 4). The levels of effort involved in obtaining this income should also be considered, since non-motorised transporters carry biomass fuels from a distance that ranges up to 40km from the city of Addis Ababa.

²¹ Biomass Fuel Suppliers Profile: Ethiopia, Kenya, Uganda

Table 4: Daily income of fuel transporters by gender

Income (ETB)	Gender			
	Female	Male	Total	Percent
1 to 10	10	4	14	33%
11 to 20	4	1	5	12%
21 to 30	8	9	17	40%
31 to 40	3	2	5	12%
Total	26	16	42	100%
Average	9.02	11.54	11.98	

In the context of fuel supply, important sources of physical capital for transporters will include assets such as donkeys or vehicles. As mentioned previously, motorised transportation of fuel is relatively minor in Addis Ababa and access to lorries is only significant for men. With reference to donkeys, the second most important mode of fuel transportation, there is also a distinct gender variation. While only 25% of all female transporters used donkeys to transport fuel, 82% of all male transporters had access to this important domestic asset.

In Ethiopia, community-based organisations are very important, the most widespread of



Figure 17: Donkeys are an important livelihood asset in the Ethiopian fuel transportation business

which are known as Iddir and Iqqub²² - informal, self-help associations based on pre-existing social ties (e.g. residence, ethnic origin, shared workplace, etc.). Of the sample, 75% of female and 88% of male transporters reported membership in at least one of these organisations. This indicates that, although fuel transporters have very limited financial and physical resources, the support mechanisms they can draw upon provide some degree of security and livelihood enhancement.

Kenya: For 72% of the motorised transporters interviewed, transportation of fuel is their main source of income, whilst only 28% indicated that alternative activities were pursued when business was slow. This indicates that, for the majority, this is a very important source of livelihood. With reference to income, lorry transporters are able to make around 60,000 KES per trip, of which usually two are made per week. Some drivers even make three trips, making well over 200,000 KES if their lorry capacity is above 350 sacks. This is very good income and is comparable to what other transporters make when transporting other foodstuffs.

Vehicles are a major physical asset for fuel suppliers engaged in motorised transportation of fuel. Whilst only 20% of the motorised transporters actually owned the lorries they used, the remaining 80% either hired their vehicles or borrowed these from friends, relatives or business acquaintances. For this group, this asset means that, in times of shortage of fuel

²² A detailed description can be found in the Ethiopia Final Country Report available online at <http://fuelsubstitution.energyprojects.net>.

(e.g. during the rainy season), vehicles might be used to transport alternative products, thus reducing their vulnerability. The very fact that they are in a position to borrow vehicles also indicates that these people have strong social assets on which they can draw.

Handcart pushers, who make two trips transporting an average of 15 sacks of charcoal per trip, are paid KES 20.00 per sack. This brings the total to KES 600.00 per day which is shared between two to four people. Handcart pushers always operate in groups, indicating that social networks are a very important asset in this area of activity.

Transporters using bicycles make between one and five trips in a day and are paid about KES 30.00 per sack transported. Their average daily income ranges from KES 30.00 to KES 150.00. This group and the hand-cart pushers are hard hit during periods of scarcity and other external shocks.

The disparity of income between the various groups of transporters in Kenya is therefore very clear, with non-motorised transporters in a far more vulnerable position than the lorry drivers.

Uganda: Three quarters of the sample of transporters were engaged in fuel supply as their sole source of income, whilst the remainder of the sample pursue additional activities such as other kinds of transportation and farming, both to supplement the fuel business and to increase their quality of life. For those who are engaged in motorised fuel transportation, income is above that of a primary school teacher or police constable. The majority of motorised fuel transporters do not own, but rather hire the lorries or pick-ups used in fuel transportation.

Case Study 1 – A BLT Vendor in Addis

Mrs B, a 30 year old widow with two children, has seen the price of BLT increase, having an impact on her ability to secure sales, and she states that her daily income has decreased almost by half in the last four years. Her only reason for remaining in the business is the lack of an alternative.

One of the main problems expressed by Mrs B is the lack of a secure vending place. The main space she now occupies is on a roadside, although she vends in and around a designated market place. As a result, she is exposed to occasional harassment. During the rainy season she faces hardship and damage of her fuel supply, resulting from the lack of shelter.

Her accommodation, an informally sub-let single room in a family house, was affordable to begin with, but has been gradually increasing at the same time that her income has been decreasing. With two children to care for, and no other income to rely on, her situation illustrates extreme vulnerability in this sector (Figure 21).

In general, the survey results indicate that fuel transporters have a reasonably good level of access to financial and physical assets. Even among non-motorised transporters, few problems in affording accommodation were reported. Most bicycle transporters tend to travel into the city from their homesteads at which they produce the fuel, and members of this category tend to own their own homes. At the lower end of the scale, wheelbarrow transporters tend to live in temporary structures, such as shacks which, though undoubtedly inadequate forms of accommodation, are usually rent-free.

Again, a wide range of livelihood circumstances exist within the transportation sector, with motorised transporters faring much better than their non-motorised counterparts.

In terms of social assets, only 25% of transporters reported membership of any social or community-based organisations, these included transport associations, a development committee and savings/credit associations.

6.2.2 Vendors

Ethiopia: Of the sample interviewed, over 80% of fuel vendors consider this activity to be their main source of livelihood. With an average of only 5 ETB per day, fuel vending in Addis Ababa is a very low-paid occupation. Average daily income generated from sales of fuel is highest for wood (4.83 ETB), followed closely by charcoal (4.38 ETB), and only 2.6 ETB per day for sales of BLT. Incomes of male vendors are consistently higher than those of females.



Figure 18: BLT vendors in Addis Ababa

women who have been occupied in this sector for the longest time, indicating that this activity is an important source of livelihood. Judging by the meagre financial rewards and as illustrated by Case Study 1, it is likely that, for this group, there is little other option than to pursue this activity.

For vendors, access to physical resources is a key asset. This might include the space from which fuel is sold, the means of packaging the fuel, or the storage facilities available. Results of the detailed survey indicate that over three-quarters of the vendors were operating from premises occupied without permission. This means that a very low percentage has access to this important physical asset and, once again, this is the case for more women (86%) than men (74%). This is worsened by the fact that almost all roadside vendors were female. The visibility of a location at the side of the road means that women are at greater risk of being harassed by local health and environmental authorities.

Case Study 2 - The experience of an 80 year old charcoal vendor in Nairobi

Peter and his wife have been in the charcoal business for 7 years and have no intention to leave. Peter buys, on average, 20-30 bags of charcoal per week and ensures a constant stock of 15 bags per day. His fixed clients include hotel owners, small schools and kindergartens and meat roasters, who comprise around 20% of his customers. However, his main customer base is in the domestic sector, where he is beginning to get regular customers who seem to trust him because of his age.

One such customer said: "I like buying from him because he does not start with very high prices and sometimes he can give you charcoal on credit".

On average, Peter sells 3 bags per day, or as much as 5 on a good day, generating an income of KES 300-500 per day. At the end of the month, sales are particularly good.

Kenya: In the business of charcoal, the wholesale sector can be a lucrative livelihood option. Physical assets include the storage depots that provide security, and an important social

asset for this group comes from the relationships of trust that are developed with customers. These relationships facilitate a wider customer-base, since wholesalers are in a position to offer credit to trustworthy customers. For many retailers, charcoal sales can also generate good levels of income. Kiosk vendors earn significantly more than roadside vendors and both categories are able to meet their household expenses adequately. This is not surprising since their incomes compare favourably with occupations such as low ranking civil servants and primary school teachers. Most vendors have strong social networks, and two-thirds of the sample reported membership of either some kind of community or religious organisation.

Uganda: For fuel vendors in Kampala, the survey results indicate that there is a significant difference in the gross earnings of male and female vendors, with male earnings at a rate that is around 70% higher than that of their female counterparts.

As an indicator of livelihood, access to accommodation indicates that depot owners are among the least vulnerable fuel vendors, whilst market vendors are the most vulnerable category. Only 25% of all vendors own their own homes, and these are concentrated in the category of depot owners, only one-fifth live in rented accommodation. Close to 70% of kiosk and roadside vendors rent their houses, with the disadvantage that renting accommodation has an impact on their savings. Market vendors are the group who are least likely to own their own houses. Of these, 95% rent their homes and these are predominantly in the High Density Areas of Kampala that are characterised by poor sanitation and health risks.

In relation to social assets, an advantage that female vendors have is that they are far more likely to belong to community organisations. In the sample surveyed, only women were members of community groupings, which included the Uganda Women and Credit Trust Fund and the Disabled and Elderly Association.

6.2.3 Conclusions

- For the majority of suppliers, the traditional fuel business is a hard way to secure a livelihood. Very often incomes are extremely low, particularly for women. In all countries, there are significant differences between the income levels of motorised versus non-motorised transporters and wholesale versus retail vendors.
- Men seem to have greater success in using social assets to obtain credit, avoid harassment with authorities or access shared resources such as donkeys or other vehicles.
- In most cases, it is women for whom access to assets is particularly limited. It is only in terms of social assets that women seem to be able to compete with men and, even then, it has been observed that these tend to be when social networks involve grouping together with other women.
- Social assets (such as membership to associations) are very important. This is also true in terms of development of relationships of trust with customers.
- Vulnerability is not a factor for all fuel suppliers in the sense that:
 - The better off amongst suppliers have incomes that are comparable with those of mainstream employment, such as police constables and primary school teachers;
 - these groups, in order to secure a reasonable standard of living, are able to draw upon key assets, such as physical assets:
 - vehicles (high volumes of sales can be transported with minimal physical effort and, in times of shortage, vehicles can be used to transport alternatives to fuel), and

- location of vending premises, including the ability to store large volumes of fuel in a secure and weatherproof location is an important factor that can reduce vulnerability.
- The successful categories of suppliers constitute only a small proportion of actors engaged in fuel supply.

6.3 VULNERABILITY CONTEXT

'Vulnerability context' is the term used within the Sustainable Livelihood Framework to describe external shocks and trends, i.e. the external conditions that lie furthest from people's control. The vulnerability of the poor often means that they are least able to cope with the negative impacts of these conditions. Although some trends may be positive, such as technological changes, the poor are often not in a position to benefit from them. The purpose of highlighting these external factors is to draw attention to the fact that there are aspects of the fuel supply business that will inevitably create difficulties for those trying to operate within it. These conditions may also affect many other urban dwellers who are trying to secure a livelihood in similar streams of work.

Many of the conditions described in this section are common to all types of fuel suppliers, although the level of impact is likely to vary from one group to another. The summary below includes some general social and economic trends, and highlights their relevance to the fuel supply sector, with case studies illustrating how these have affected livelihoods in reality.

6.3.1 Economic shocks

Prices of both traditional and alternative fuels can have an impact on the fuel supply trade. These are influenced by the supply and demand dynamics characteristic to the fuel business, but also may depend on external factors such as oil price fluctuations, like those that occurred during the oil price shocks of the 1970s, or fuel subsidisation.

6.3.2 Population trends

Urbanisation is increasing at a significant rate in Africa. By 2025, the percentage of the total population living in urban areas in Africa is expected to rise from 37% to 54%²³. Although this will inevitably mean an increased market for fuel, it will also result in an increase in competition – both for a share in the market, for the limited biomass supplies and for vending and storage space. This is especially important for fuel suppliers, since the informality of this sector means that urbanisation is likely to bring many new entrants.

In Uganda, in particular, the issue of competition amongst all types of supplier is a key theme. For reasons of competitiveness, wholesalers are beginning to offer credit to vendors and, for vendors, securing the loyalty of customers is a key survival strategy. Even competition between transporters and vendors is becoming an issue, with transporters increasingly delivering fuel all the way to the point of sale.

6.3.3 Technological trends

Availability of new technologies may influence the traditional biomass fuel business dynamics. In Nairobi, for instance, LPG stoves are becoming an increasingly important household cooking appliance, even for less affluent members of society. This is partly due to changes in the marketing of LPG, which can now be bought in small size canisters (4 Kg) specifically commercialised to address the needs of the low income market.

²³ UNCHS (1996) *An Urbanising World*, Global Report on Human Settlements, Oxford University Press

Trends towards motorised transportation also have an impact on fuel suppliers. For example, in Uganda, imports of second hand lorries from Dubai have meant that vehicles are more widely available, thus increasing competition in the motorised transportation sector, and pushing non-motorised transporters further to the margins.

6.3.4 Seasonality

This is a key factor for fuel suppliers, since they must adapt to the seasonal changes in the market. These include both climatic conditions which affect the production of charcoal and the ability of suppliers to transport fuel, for example in the rainy season, but also festivals and other celebrations that cause fluctuations in demand. In all three countries, the conditions within the rainy season were considered to be a major obstacle within the fuel supply business.

Case Study 3 - Impacts of seasonal patterns on a large charcoal and wood depot owner in Kampala

For Mr Kibonge, a fuel supplier who left the business after 10 years, in 1994, the rainy seasons were the worst periods in the year. His regular suppliers had trouble accessing good charcoal from their usual sources and, when they did, these sources were not easily reached because of poor road conditions.

As a result, this would delay deliveries to his depot, sometimes for a couple of days. The price of charcoal would also increase during this time. A bag that he would usually buy at UGS 6,000 would increase to UGS 7,500. Although Mr Kibonge would pass the price increase onto his regular customers, the rainy seasons had a significant impact on earnings. See Figure 2.

Not only are roads impassable during the rainy season, presenting a serious problem for transporters, but also production of charcoal becomes more difficult, with the effect of inflating prices. For vendors, wet weather also presents a major hindrance to fuel supply activities, since supplies become wet, damaged and difficult to handle. In this condition, wood and charcoal are obviously more difficult to sell.

6.3.5 Conclusions

- Individuals do not have a direct impact on the external trends that affect their livelihoods as these are influenced by demographic, economic and environmental circumstances.
- Individuals can reduce the influence of the vulnerability context by drawing on a number of assets that can help them to adapt to these conditions and to minimise the effects on their livelihoods.

6.4 STRUCTURES AND PROCESSES

Structures and processes are distinct from the events of the vulnerability context because, unlike shocks and trends, they can be influenced by the participation of people. They include the organisations that operate in society (e.g. governments, legal institutions, local councils and developers) and the institutions that guide both organisations' and individuals' behaviour (e.g. laws, social and cultural norms). The processes are interpreted as both the outcomes of various combinations of organisations and institutions, and the changes that take place within these. In simpler terms, structures and processes may be described as the way in which the 'rules of the game' and the 'players of the game' can affect livelihoods.

Some structures and processes that are specific to the fuel supply sector are summarised below. These range from international conventions through to social and cultural norms,

and are based on the experiences described by transporters and vendors in the detailed survey, as well as the historical studies on policies and legislation.

The observations from the background research and fieldwork enable us to group the structures and processes that influence fuel supplier livelihoods around four key themes:

- Biomass regulation
- Fuel substitution
- Lack of sustainable forestry policy
- Social conventions

When considered alongside the previous section, this analysis enables a better understanding of the vulnerability of fuel suppliers. By placing them in the context of both socially-generated and inherent circumstances within the fuel supply sector, it has been possible to identify some of the reasons for the difficulty of securing an adequate livelihood in this business.

6.4.1 Biomass Regulation

International environment lobby: Since the 1980s, international concerns relating to deforestation and the global environment have increased. In 1981, during the global energy crisis, Kenya hosted the UN Conference on New and Renewable Energy, which resulted in a series of objectives, including the increased supply of biomass through afforestation; the encouragement of interfuel substitution; and the establishment of improved stove programmes. These concerns have influenced the energy policies and measures adopted in Ethiopia, Kenya and Uganda, a summary of which can be found in Section 4 of this report. In particular, the following policies have influenced the fuel supply sector.

Government responses: During the 1980s in Ethiopia, a ban on the trafficking of biomass fuel was imposed, and checkpoints established around Addis Ababa to control the influx of traditional fuels into the city, to curb deforestation. Since 1991, the strict regime has been reversed. In Kenya, despite the importance of biomass in the energy mix, the traditional fuel business is not recognised by the government. This has resulted in a series of presidential and ministerial decrees that have rendered the production and transportation of charcoal 'illegal'. In Uganda, the importance of biomass is now being recognised, and the wood fuel supply trade is regulated under both the Forestry Acts and the Local Governments Acts, 1997, which allow both to charge levies to suppliers.

Livelihood Impacts on Fuel Transporters and Vendors

Ethiopia: The ban on trafficking of biomass fuel in Ethiopia led to harassment, confiscation of supplies and even imprisonment for fuel suppliers in Addis Ababa, especially charcoal transporters. Since the ban has been relaxed, the situation for transporters has improved. However, with a lack of any clear policy to replace the ban, harassment continues, and transportation at night remains a necessity.

Many problems expressed by vendors are related to the lack of either recognition of the sector or support from local authorities. Because they often occupy business premises without permission, the premises are often inadequate, lacking storage space that could both increase security and reduce the drudgery involved in having to transport fuel to and from the source. This is a major disadvantage for this group of vendors. For roadside vendors, harassment is worse since they are in a more exposed position, and are more clearly visible to local health and environmental authorities.

Kenya: Access to supplies is reduced by the Government restrictions on charcoal production. Motorised transporters of charcoal are often subject to harassment by the local authority and government officials.

Restricted supplies and the lack of a coherent policy means the most successful suppliers are those who are capable of corrupting the system. Honest traders have been driven out of the business, and as the group who are less prone to corrupt practices, women are also less likely to survive in this sector. This will, perhaps, explain the changes that have occurred in this sector in Kenya. Contrary to earlier findings (Bess 1989), the representation of women is decreasing in the fuel supply business. As an underground business, the quality of charcoal is uncontrolled and sacks are often filled with dust or unburned wood. This was a common complaint from many vendors, since they pay normal prices for substandard charcoal, which they cannot sell on to the customer.

Uganda: New fees and levies relating to transportation of fuel in Kampala have recently been introduced, and these are accompanied by harassment of suppliers by the authorities who are responsible for collecting these levies.

Quality of charcoal is also uncontrolled and sacks are often filled with poorly carbonised charcoal and increasing charcoal fines. As in Ethiopia, the problem of inadequate premises and storage facilities is a common complaint, and supplies can easily become damaged in wet weather. By the nature of land tenure in Uganda, very little space is available and landlords and city authorities are very interested in what activities are taking place on their land, increasing the pressure on those occupying premises illegally.

6.4.2 Fuel Substitution

Government Policies: Alternatives to biomass fuel have been promoted in various ways in the last few decades in all three countries. Please refer to Chapter 4 for details.

Government and donor-led stove programmes: All three countries have introduced improved stove programmes, with varying levels of success. The effectiveness of these programmes has been researched in previous work but, in general, the take-up of improved stoves has been considerably more successful in Ethiopia and Kenya, than in Uganda²⁴.

Livelihood Impacts on Vendors and Transporters

It is very difficult to make any direct links between fuel substitution measures and traditional fuel supplier livelihoods. When asked about changes in the business over time, most suppliers did not consider such macro-level policies as having a direct impact on them, but referred rather to the changes in their day-to-day activities.

²⁴ Poverty Reduction Aspects of Successful Improved Stove Programmes (<http://povertystoves.energyprojects.net>)
DFID KaR Contract No. R7368

Case Study 4 - Quitting after 50 Years in the business

The case of this 70 year old Addis Ababa based fuel vendor provides an interesting example of the changes experienced in the business over time. On arriving in Addis Ababa from Southern Ethiopia 50 years ago, with no education, skills or capital, Mr S entered the fuel supply business as a last resort.

Unexpectedly, his business thrived: *“In those days, there was neither kerosene nor electric Mitads. Everyone, including the rich, used firewood for cooking”*. Until the mid-1980s, income from his business was enough to save money after meeting his family’s basic needs. Despite the success of his business, Mr S decided to change his activity to a more formal and secure activity, and he set up a shop selling ready-made cloth. As a new entrant in a competitive textiles sector, Mr S was, unfortunately, forced to quit and decided to return to the one business he knows.

According to him, unlike the old days, there is no longer free movement of traditional fuels. Since the mid-1980s, the Government has banned firewood and charcoal trade. Moreover, many consumers had the choice of using kerosene and electricity for cooking. The family’s income is now generated by renting part of his single room house to fuel traders as storage space.

Ethiopia: Case Study 4 illustrates a fuel supplier’s experience of the way in which the market has changed in Addis Ababa. With the massive introduction of kerosene, it is extremely likely that impacts on fuel sales have taken place.

Kenya: Successful charcoal vendors did not recognise any direct impacts on their business from the introduction of modern fuels. Most were of the opinion that their livelihoods are not significantly at risk, since households that can afford to use firewood and charcoal will not convert to these fuels exclusively. One case study illustrates: *“We know that foods like *githeri*, and other traditional foods and vegetables taste better when cooked with charcoal or firewood”*.

Uganda: Neighbourhood kiosk vendors are the only category of suppliers to confirm that they notice each time someone changes fuel, because they lose one of their clients, who they know personally. This is due to the extreme decentralisation of their business. On the other hand, economic impacts of fuel substitution did not feature strongly in transporters’ accounts of their day-to-day problems.

This may partly be due to the fact that, often, transporters do not engage in the trade directly, but deliver on behalf of the bulk dealers who bear the brunt of economic fluctuations.

6.4.3 Lack of sustainable forestry policies

As in countries worldwide, the natural forestry resource is under increasing pressure in Ethiopia, Kenya and Uganda. In these countries, where biomass is an important source of fuel, the lack of a clear policy to encourage sustainable forestry and charcoal production, in the long-term, puts these resources at serious risk. As reported in Chapter 4, among the three countries, Uganda seems to be at the forefront with regard to recognising the importance of biomass as a source of energy and the links between depletion of forestry resources and biomass collection. An attempt to set up and enforce policy measures that account for these links are under consideration.

Livelihood impacts on transporters and vendors

Ethiopia: As local resources are depleted, the distance from Addis Ababa to the sources of supply increases. One of the effects of this process is that the number of motorised transporters entering the market in Addis Ababa has been steadily increasing, since non-motorised modes of transportation are insufficient for bringing the fuel to Addis Ababa. As already mentioned, men dominate the motorised transport sector, which means that women are likely to be increasingly pushed out of the business.

Uganda: Many people have noticed a reduction in charcoal quality due to the fact that regions, other than the traditional charcoal producing districts of Masindi and Nakasongola, are becoming charcoal production areas. Trees other than the hardwood acacia are used to produce charcoal.

6.4.4 Social conventions

As mentioned earlier in this report, attitudes towards the traditional fuel sector are generally negative, partly due to its illegal nature, and also as a result of the nature of the work itself, since charcoal is not a clean commodity. In addition to this, more general gender inequalities mean that women tend to face a greater number of obstacles in their attempts to secure a livelihood in the fuel supply sector. The results indicate that women tend to have lower negotiating power, are excluded from the motorised transport sector, and are very rarely present in the wholesale supply of fuel.



Figure 19: Road side charcoal vendor in Nairobi

Livelihood Impacts on Transporters and Vendors

Ethiopia: As mentioned earlier, the social norms that operate within many family units mean that, when physical assets are available, priority of access to them is usually afforded to male household members. This can be seen in the case of transportation by donkey. For non-motorised transporters in Addis Ababa, 82% of males had access to donkeys, whilst only 25% of females were able to use donkeys for fuel transportation.

Kenya: A complaint expressed by women within the surveys was that they were less likely to be offered credit by depot owners. The gender-based power relations that reduce the bargaining power of women, when accompanied by their low representation in the sector as a whole, mean that women are in a weaker position in the fuel sector in Nairobi.

Uganda: The charcoal sector is considered a 'dirty business', a perception that results in the process of social exclusion for charcoal and market vendors in particular. Since women are predominantly engaged in the charcoal business, they are disproportionately affected by this negative attitude.

Exploitation in this sector is related to the low bargaining power of women. Transporters and suppliers, who are predominantly male, deliver woodfuel at very high prices, thereby reducing the profit margin for the vendors. There is little support from the marketing authorities who are more interested in obtaining their daily rental fees and fees for offloading fuel, rather than taking any regulatory role.

6.4.5 Conclusions

- Policies and legislations can have negative impacts on fuel suppliers. For instance the charcoal ban in Kenya and Ethiopia has created the conditions for corruption and institutional harassment to flourish, thus increasing the vulnerability of suppliers.
- The impacts of fuel substitution on suppliers' livelihoods are not considered to be significant by the majority of those interviewed. This may suggest two things: either that
 - livelihoods of traditional fuel suppliers are, so far, not at risk from the introduction of modern fuels such as kerosene, LPG and electricity; or
 - the measures adopted to reduce traditional biomass fuel consumption have been ineffective.
- The failure to address the issue of sustainability of the traditional fuel sector is a direct cause of problems affecting the suppliers, such as the necessity of having to access more distant sources of fuel, and the diminishing quality of charcoal.
- Social attitudes towards charcoal trade are largely influenced by the official attitude to charcoal production. Although these are difficult to alter, improvements are more likely to take place in an environment where the fuel sector is considered a legitimate means of securing a livelihood, and traditional biomass fuel is recognised to be an important source of household energy.
- Bargaining power of women is likely to be increased if women were formally represented within the sector, and if networks could be established to provide access to vehicles, shared storage areas or credit facilities.

6.5 LIVELIHOOD STRATEGIES

Transporters and vendors must find innovative ways of adapting to this environment, and must use whatever resources they can to get by. This section focuses on the personal experiences of fuel suppliers, with the purpose of understanding how assets are currently utilised. During the fieldwork, and particularly in the case studies, suppliers were asked to describe the strategies they employ to overcome the problems they face in their day-to-day activities.

6.5.1 Transporters

Ethiopia: Transporting fuel supplies at night is an important livelihood strategy for motorised transporters of fuel.

Kenya: In addition to travelling at night to avoid road blocks, transporters hide charcoal under other, more legitimate goods, such as vegetables.

Transporters tend to be in a relatively strong position of power, and often dictate both the price at which they purchase charcoal from producers, as well as that at which they sell it on to vendors. On average, a lorry transporter of charcoal makes between 150-250% of tax-free profit from sales.

As mentioned earlier, it is often difficult to differentiate between vendors and transporters. As a livelihood strategy, some transporters are also engaged in retail.

Uganda: Although most fuel transporters are solely engaged in this activity, some diversify by either transporting other goods, or by gaining employment in other sectors, for example in agriculture, the retail sector or in eating houses. In many cases, livelihoods from fuel transportation are supplemented with income generated by other household members.

Around 45% of transporters overcome the problems of harassment by bribing their way out of trouble with the traffic police, whilst the remaining percentage believed that operating within the law was morally correct.

Case Study 5 - Mr Mburu: Transporter and vendor

Mr Mburu owns a bicycle for local transportation of charcoal and sub-hires a lorry to transport charcoal from Narok. Half of the charcoal he transports belongs to the lorry owner because he cannot afford to buy a full load.

Some of the charcoal is delivered to other vendors whilst the remaining half is sold at his store.

By teaming up with the lorry owner, Mr Mburu is able to maximise his assets. He is also relieved of the responsibility of finding a permit to transport charcoal because the lorry is licensed to carry general merchandise.

6.5.2 Vendors

Ethiopia: Vendors, many of which are migrants from rural areas, have generally very few formal skills. In their effort to make a living, they draw heavily upon support from informal networks such as kin and friends. The case studies clearly indicated that no vendor had originally envisaged making a living from the traditional fuel business. Initially, most vendors are engaged in various informal activities such as casual labour, domestic service and petty trade. It is usually when there is has been no other alternative that they have turned to this sector. On entering the traditional fuel business, they either use their own small savings or, again, rely on informal networks to raise finance for their business. Support from informal networks continues throughout their operations.

As mentioned earlier, vendors usually occupy premises illegally, and often set up their makeshift shelters in strategic locations, such as marginal plots adjacent to a village market, or close to a concentration of consumers. By combining their living and working locations, they are able to minimise transportation costs and housing rent. The asset of location is, therefore, a key physical asset employed in the vending business.

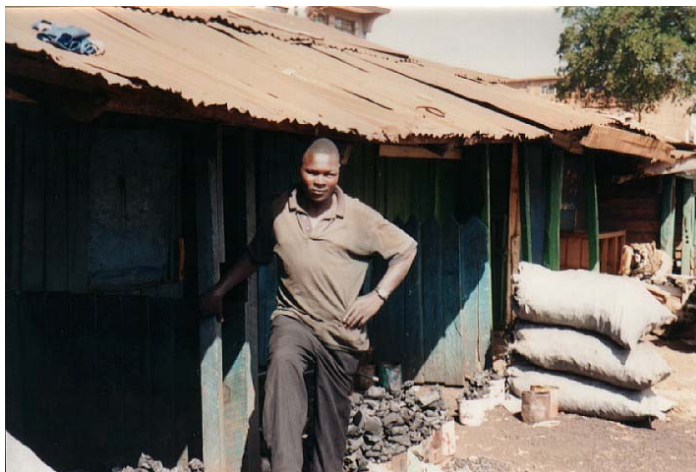


Figure 20: Dedicated charcoal dealer in Nairobi

Many vendors attempt to diversify their sources of livelihood. Where possible, they either use family labour to assist them in carrying out the business, or engage family members in other income generating activities.

In their effort to beat the competition, vendors are trying to get as close to the consumers as possible. They are beginning to

stretch their vending outlets to every single suburb (including roadsides) in all corners of Addis Ababa. Some vendors have adapted to the market by improving the convenience of purchasing charcoal. Rather than selling charcoal loose, it is pre-packed in plastic bags of various sizes as a 'take-away' with fixed prices.

Kenya: Vendors bypass the regulations that prohibit charcoal sales by purchasing general trade licences to operate a kiosk. However, this strategy is not always successful. When the local authorities discover vendors selling charcoal, they say that they do not have the correct licence. In order to avoid such harassment, most charcoal vendors pay the council staff KES 20 per week as *chai* to allow them to sell charcoal.

Uganda: In response to the general trend whereby transporters are increasingly delivering charcoal directly to neighbourhoods, an important strategy for vendors in Kampala has been to take their activities to residential areas. By conducting sales from the backyard of their homes, vendors are not eligible to pay fees. The disadvantage of this situation, however, is that transporters charge neighbourhood vendors higher prices for the charcoal delivered to balance the discomfort of travelling along difficult roads.

Wholesalers are in a more competitive market than vendors and a strategy employed by them is to offer credit to vendors in order to secure their client base. This has the dual advantage of providing vendors with modest amounts of credit purchases.

Creating and maintaining customer loyalty has to be a key livelihood strategy for all fuel vendors, in response to the large numbers of players who are entering the fuel supply business, and many suppliers rely on fixed customers. Twice as many male kiosk and market vendors have fixed customers. Considering that women are more highly represented in this sector, this indicates a significant gender difference.

6.5.3 Conclusions

- Fuel suppliers employ a wide range of strategies to overcome the challenges faced within the fuel supply sector.
- Non-financial resources can be deployed to adapt to difficult circumstances. In the absence of savings and physical assets, social assets are extremely important in setting up a fuel supply business, since vehicles can be borrowed and finances raised through informal networks.
- Trust is important in securing strong customer relationships, and providing suppliers with a competitive edge.
- Physical assets for retailers are maximised by combining accommodation with vending location, and strategies are increasingly focusing on reducing distance between customers and points of sales.
- When access to physical location is limited, particularly for small-scale and roadside vendors, strategies often include the bypassing of licensing regulations or permits through payment of bribes.

7 LIVELIHOOD ANALYSIS OF CONSUMERS

7.1 INTRODUCTION

Although this study focuses on the livelihoods of fuel suppliers, a brief study of consumers was also carried out in order to create a balance between the positive and negative impacts of fuel substitution measures on suppliers and on consumers. For example, whilst measures to reduce the consumption of traditional biomass fuels may result in loss of livelihood for fuel suppliers, they may have positive effects on the health and quality of life of consumers, and may therefore be justified on those grounds.

The purpose of the consumer survey was to qualitatively identify the reasons that lead to changes in cooking fuels across different income groups, and to investigate the positive and negative impacts of the changes in fuel use. It must be recognised, of course, that consumers' decisions to use different types of household fuel are influenced by a host of factors, including availability, price, convenience and status, among others. At the outset, therefore, the team recognised that there may be difficulty in linking consumer decisions to fuel substitution measures at the macro-level.

The brief survey was conducted in 30 households, representing three income groups (high, medium and low).

7.2 LIVELIHOOD ANALYSIS

Ethiopia: A key finding was that kerosene is the leading household cooking fuel that is used by all households irrespective of income levels. Charcoal, followed by electricity, wood and BLT are also important cooking fuels. However, there is some class differentiation in the use of these fuels, with electricity and charcoal being more commonly used in higher and middle income groups, and wood and BLT in low income households. LPG was the least important fuel, used only by the most affluent households. In general, a combination of fuels is used for different purposes and the higher the income, the wider the range of fuels used by the household. A conclusion from this is that, given the limited access to a range of fuels for poorer households, the chances of adaptation to unfavourable market changes are slim for low income groups.

With respect to changes in fuel use, it was only wealthier households that have tended to switch fuels, mainly from traditional to modern fuels. Despite this, however, when sudden price (electricity) and supply (LPG) changes have occurred, consumers have tended to revert back to traditional fuels. For example, as a result of supply scarcity and price hikes in recent years, the majority of consumers in Addis Ababa were forced to give up LPG since the mid-1990s.

There is no doubt that past policies, scarcity of supplies and government measures such as subsidies on kerosene and electricity have had far-reaching impacts on shaping consumers' behaviour. This can be seen in the transition in Addis Ababa's households from the non-existence of kerosene to almost complete penetration between 1980 and 1995. The same is true for electricity, and these changes coincide with the shortages in supply of traditional fuel and the promotion of kerosene and electricity by the government.

In general, positive and negative impacts relating to changes in fuel use were similar. Those who had switched from traditional to modern fuel use, did so in order to reduce household expenditures, but reported that they are experiencing smoke-related health problems. On the other hand, those who switched from traditional to modern fuels were happy about the

convenience and smoke-free cooking, but complained about increasing household expenditure.

In summary, the main factor influencing household fuel decisions is cost. Although electricity and LPG are the most preferred fuels, access to them is limited by affordability. It has mainly been wealthier households that have changed fuels in the past. For the highest income groups, this has usually been for the sake of convenience, whilst for others, economic reasons have dictated the choice of fuel. Lower income households using kerosene, wood, charcoal and BLT have tended not to switch fuels.

Kenya: For low-income households, choice of fuels is limited by their ability to invest in a variety of cooking devices. This group tends to live in crowded single rooms, with very poor ventilation where use of charcoal leads to indoor air pollution, fatigue, headaches and damage to clothing. Therefore, for the lower income group, kerosene is an important fuel, even more so than for the middle-income group. One factor influencing choice of kerosene over charcoal by low-income groups is the fact that it can be bought in smaller quantities than charcoal, and thus requires a smaller proportion of daily income being spent on fuel. The convenience of kerosene is also a considerable factor, including the ability to switch the heat on and off quickly, enable faster cooking and improve indoor air quality. This is particularly important, given the fact that households in this group often share a single room.

The middle-income group tended to use a variety of cooking devices and related fuels. Kerosene and charcoal are invariably the fuels of choice for long-cooking meals and for boiling water for drinking and/or bathing and for cooking *githeri*. LPG and, to a lesser extent, electricity are predominantly used for light and fast cooking tasks. Unlike the low-income group, middle-income households tend to achieve economies of scale by buying fuel in much larger quantities, thus paying much less per unit of charcoal than low-income groups. They are also able to bring large bags of cheaper and higher quality charcoal home from journeys up-country during their regular visits to their rural homes. However, the reasons why charcoal is more appealing to this group than to the low-income group are not solely economic. Middle-income groups use their charcoal stoves either in their well-ventilated and larger kitchens or outside in their private backyards. Thus, the problems of indoor air pollution are far less significant for this group.

Upper-income households tend to use the widest range of cooking devices and fuels. Virtually every household visited was using all the types of fuel available, e.g. wood, charcoal, kerosene, LPG and electricity. However, it was clear that LPG and electricity are mainly fuels for cooking purposes whereas wood and charcoal are for barbecuing and space heating. Kerosene, though used, was considered to be inconvenient compared to electricity and LPG. Similarities with the middle-income households included the excellent shelter conditions, negating the pollution problems of charcoal and the ability to purchase larger quantities of fuel.

Uganda: A typical household in Kampala would have access to multiple sources of energy. This stems from the fact that different kinds of meals call for different cooking devices. Convenience is also an important factor.

The results of the survey showed that the higher class households tended to limit themselves to fewer energy types than the middle and lower classes of society. This could be explained by the fact that the alternatives to electricity, i.e. kerosene, charcoal and firewood are not convenient in terms of cleanliness and storage. Furthermore, accommodation for higher-income groups does not usually offer convenient storage facilities. Despite this, however, more than 70% of the households interviewed have access to more than one source of energy. Each energy-type is used for a specific cooking or heating purpose.

The groups most likely to have changed their fuel type in the past were the upper and middle-income households, indicating the lack of choice in fuel-use for the poorer households. Where changes have taken place, this was mainly reported to be due to price, as well as convenience. Over the past couple of years, a tariff hike pushed many off the electricity market. More than three quarters of those that changed fuels did so in the recent past, and changes in fuel use occurred most amongst electricity users. Around 64% of the households that had switched fuel types had changed from electricity to another source of fuel.

Impacts associated with fuel-switching were predominantly economic. Only one household linked fuel-switching impacts to health, and others considered convenience factors, such as time of cooking, to be more important.

7.3 CONCLUSIONS

From this brief survey, it is possible to highlight several observations relating to fuel substitution measures and consumer livelihoods.

- In general, higher-income households tend to use a wider range of cooking devices and associated fuels, whilst poorer households are limited to the use of one or two types of fuel, predominantly traditional fuels or kerosene.
- For the lowest-income groups, limited access to fuels means that these groups are more vulnerable to the impacts of fuel substitution measures. Unlike middle and upper-income households, they are not able to diversify in response to price and availability trends.
- Drivers for changing household fuel types are predominantly economic, followed by convenience factors such as speed of cooking food and ability to switch appliances on and off quickly. Despite this, traditional fuels continue to be used by households at all income-levels.
- Indoor air pollution is most significant for the poorest households that do not have access to a separate kitchen.
- For poor households in Kenya, the smallest possible units of fuel are purchased, thus reducing daily expenditures but increasing the overall cost of fuel. For this reason, kerosene is preferred over charcoal by low-income households as kerosene can be purchased in quantities that are adequate for one meal only.
- There is a correlation between fuel substitution measures and changes in household fuel use, which explains the movement from the preferred fuel type, electricity, and LPG to less convenient fuels. In both Ethiopia and Uganda, these fuels were subject to tariff increases, or removal of subsidies that coincide with reported changes in fuel use habits.

8 FUEL SUBSTITUTION INTERVENTIONS

8.1 INTRODUCTION

During recent years and across many developing countries fuel substitution measures, including the introduction of subsidised modern fuels and the promotion of improved stoves and ventilation, have been promoted as a solution to a wide range of real or perceived problems arising from the use of biomass fuels. Most of these measures were introduced with the support of international organisations and lobbied for by national governments, but not always did they succeed in achieving the objectives they were aimed at.

As highlighted through the main part of this research, the impacts of these interventions extend, not only to the problems they are intended to solve, but to a number of other social and economic circumstances, such as the livelihood of traditional biomass fuel suppliers. For example, in some cases, an intervention may succeed in addressing environmental degradation, yet result in unforeseen problems in other areas of life. Indicators of these impacts were selected, including local employment, dependency on foreign imports, gender and other social indicators, health, economy and environment.

The impact assessment matrix presented in this chapter provides a tool that enables a first-cut analysis to be made of likely impacts from a range of interventions. This can facilitate policymakers to identify areas in which further attention is required before embarking on widespread or aggressive policy changes.

8.2 IMPACTS OF TRADITIONAL BIOMASS FUELS

Problems associated with the use of biomass fuels have been identified over the years in the areas of health, environment and social impacts, particularly gender. These are explained in greater detail below.

8.2.1 Health Impacts

There is consistent evidence that exposure to biomass smoke increases the risk of a range of serious diseases in both children and adults. Incomplete combustion of biomass fuels generates smoke containing many substances (Figure 21), amongst which particulate matters, carbon monoxide, nitrous oxide, formaldehyde and organic matters are the most common.



Figure 21: Girl lighting a fire for cooking in Kampala. Soot on the walls has accumulated from previous fires.

It is the increased exposure to PM_{10} emissions resulting from partial or inefficient burning of biomass fuels using traditional methods in poorly ventilated kitchens, that is responsible for the increased frequency of respiratory infections, including bronchitis, pneumonia and bronco-pneumonia, among women and men of all ages in developing countries. Asthma and tuberculosis are also believed to be exacerbated by biomass fuel smoke. People in developing countries are commonly exposed to very high levels of pollution for 4-7 hours daily over their lifetime. In mountainous areas and during

winter, where indoor heating is required, exposure may occur for even longer hours.

Other health hazards are also associated with cooking over open fires, such as severe burns to the person cooking, often a child. Exposure to smoke can also result in eye infections while low birth weight is thought to be associated to carbon monoxide exposure during pregnancy. In addition, collecting and handling biofuels can be a strenuous activity for women and girls who often end up carrying heavy loads for long distances.

8.2.2 Environmental Impacts

Biomass fuel for household energy use is often stated as a cause of environmental degradation. However, it is now recognised that the use of firewood for household energy is *not* among the major causes of forest clearance, since most of it is collected rather than cut. More important causes of forest degradation and forest clearance include:

- increasing needs for agricultural and pasture land, especially for cash crops and commercial livestock production;
- weak forestry resource management and supply policy formulation and enforcement;
- industrial use of timber for construction and other purposes;
- exploitation of mining resources;
- de-gazetting of state-owned forest land;
- unsustainable production of charcoal (for commercial and industrial purposes).

Nonetheless, it has been observed that collection of traditional fuels and charcoal production may have a considerable impact in certain locations. When sudden and uncontrolled concentrations of people occur, such as in refugee camps or slum areas around cities, the sudden rise in demand for fuel puts unsustainable pressure on the local environment. This also partly relates to the fact that, in recent years, social and economic changes associated with urbanisation have led to a significant shift from fuelwood use to charcoal. It is indeed important to remember that the transformation from firewood to charcoal is always connected with high energy losses, particularly if the carbonisation process takes place in traditional hearth kilns.

A further environmental impact is associated with the collection and use of animal dung as fuel which leads to the loss of important nutrients, and in turn causes the reduction of crop yields.

8.2.3 Social Impacts

Traditional fuel use has disproportionate effects on women, and contributes further to the social inequalities that are caused by an uneven distribution of fuel-collection, cooking, and childcare responsibilities between men and women within the household. In the context of household biomass energy use, women in developing countries suffer from:

- higher exposure to indoor air pollution, and other biomass-related cooking hazards than men;
- engagement in fuelwood and dung collection – for both personal use and for livelihood purposes. This has the dual effects of:
 - spending time that could otherwise be dedicated to other social or income-generating activities; and
 - greater likelihood to suffer from the muscular and skeletal problems associated with carrying heavy loads of wood.

8.3 MITIGATION OPTIONS OF THE IMPACTS OF BIOMASS FUELS

As highlighted in Chapter 3, concerns over environmental impacts of traditional fuels and fears of fuel shortage were the causes that initially brought about the considerable emphasis on fuel efficiency (particularly improved biomass stoves) in the late-1970s and throughout the 1980s. Donor and government led programmes focused on technological solutions for fuel savings, and hundreds of improved stove programmes were implemented in developing countries, with varying degrees of success.

Although indoor air pollution was a secondary concern, improved stoves proved to be effective in limiting the exposure to indoor smoke. The main beneficiaries of these measures were the end users of biomass fuels. However, no major improvement to the environment can really be claimed, the main reason being that people tend to take advantage of the fuel saving benefit and cook more food using the same amount of fuel.

Subsidised promotion of modern fuels, such as kerosene, LPG, electricity, and associated appliances are other examples of alternative options that have been introduced as part of energy and social policy programmes in many developing countries. As a general practice, traditional biomass fuels tend to coexist in combination with other fuels to serve different purposes. For example, where available, electricity is often used to boil water, whilst charcoal is used for slow cooking of food and kerosene or LPG for fast re-heating, etc.

Regulatory measures have also been adopted to reduce the pressure of charcoal making on the environment. Examples of regulatory measures are the ad hoc presidential bans in Kenya and Ethiopia that formally forbid the production of charcoal, but not the use of it. Rather than preventing or even reducing the use of charcoal, the bans, if not enforced, create the conditions for uncontrolled and unsustainable charcoal burning practices, thus worsening the impacts on the forestry resources that they were intended to preserve.

In considering some of the key measures that can alleviate the health, environmental and social negative impacts of traditional biofuels, a number of mitigating interventions were identified and classified under five categories as shown in Table 5:

Table 5: Potential interventions for reducing negative health and environmental impacts of traditional biomass fuels in developing countries

SETUP AND APPLIANCES	USER BEHAVIOUR	FUEL SUBSTITUTION	SUPPLY MANAGEMENT	REGULATORY
1. Improved ventilation 2. Chimneys and hoods 3. Outdoor cooking hut 4. Improved stoves 5. Improved stove with flue attached	1. Fuel drying & appliance maintenance	1. Briquettes and pellets ²⁵ 2. Kerosene 3. LPG 4. Biogas ²⁶ 5. Electricity	1. Sustainable forestry 2. Sustainable charcoal production ²⁷	1. Charcoal ban

²⁵ Briquettes obtained from charcoal dust, agricultural residues, sawdust etc.

²⁶ Locally produced and utilised

²⁷ Charcoal production using sustainably grown wood resources and efficient kilns (to improve carbonisation efficiency)

8.4 IMPACTS OF MITIGATION OPTION ON LIVELIHOOD AND DEVELOPMENT INDICATORS

The research, focussing on the dynamics of traditional fuel business has identified the costs and benefits of fuel substitution and other possible mitigation options on a selection of livelihood and development indicators. The focus was drawn on four cross-cutting themes:

1. health;
2. environment;
3. sustainable economy;
4. social equity.

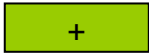

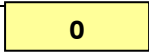
Gender has been incorporated in the “social equity” cross cutting theme. The indicators selected are outlined in Table 6.

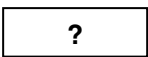
Table 6: Livelihood and development indicators

	INDICATORS	EXPLANATION
HEALTH	1. Respiratory impacts	1. Includes ARI, ALRI and other respiratory diseases
	2. Other health hazards	2. Includes accidental burns, fires, eye infections, accidental fuel ingestion etc.
	3. Transport related	3. Includes backache, bone fractures and other injuries deriving from transporting heavy loads
	4. Handling/vending related	4. Includes diseases due to charcoal dust exposure, dung handling infections, etc.
ENVIRONMENT	5. Forestry cover	5. Natural forest coverage in the country
	6. Soil quality	6. Includes soil characteristics such as fertility, nutrients leaching, erosion etc.
	7. Local air quality	7. Refers to presence of air pollutants in the local environment
	8. Water quality	8. Refers to presence of water pollutants, both organic and inorganic, including silt, BOD etc.
ECONOMY	9. Forex	9. Balance of foreign currency in country
	10. Official government revenues ²⁸	10. Refers to government revenues from sales of fuels
	11. Security of energy supply	11. Refers to availability of indigenous sources of energy, dependability from fossil fuel imports etc.
	12. Employment	12. Refers to number of people involved in providing the alternative intervention options
	13. Income generation	13. Refers to income generated at household level
SOCIAL	14. Gender equity	14. Refers to gender related issues of time availability, drudgery, role in the household, employment opportunities etc.
	15. Other livelihood benefits	15. Refers to availability of different options for lighting, cooking, livelihood enhancing solutions etc.

²⁸ Assessment of the impacts on this indicator is strictly country specific. The level of official government revenues is dependent on each country's taxation policy, subsidies etc.

Impacts are identified against the indicators within each one of the cross-cutting themes. The results of the analysis are graphically represented in a matrix that highlights how the alternatives to traditional biomass fuel use impact on the indicators. In order to evaluate this, the performance of alternative mitigation options are compared to a business as usual (BAU) scenario, which, in the context of the research, is the use of biomass fuels in a traditional manner, e.g. on a three stone fire. Impacts are then evaluated using a simple positive, negative and colour scale where:

	denotes a positive impact of the mitigation option compared to the BAU;
	denotes a negative impact of the mitigation option compared to the BAU;
	denotes no changes in impact compared to traditional fuel use.

Where uncertainty exists over the cost/benefit of an intervention with regard to one of the indicators, a question mark  was used.

Some intervention options may have different impacts on the same indicator according to the particular aspect and/or application considered. For example, the impact of LPG use on respiratory diseases is usually very positive, but if not well maintained, LPG stoves can release considerable amounts of carbon monoxide. Or the use of agro-residues for pellets can have a negative impact on soil quality as nutrients are taken away; but, on the other hand, reutilisation of charcoal dust can reduce deforestation and therefore improve the quality of soil. In such cases, the double impact is represented in the same cell.

While most of the impacts are comparable across the region, some are country related, such as the impacts of introducing certain modern fuels or the impacts of regulatory measures', which are not applicable to Uganda.

With reference to electricity it should be noted that, in order to assess impacts on the environment and the general economy the source/fuel used to generate power (fossil fuel or renewables) is crucial. In the same way, the impacts of fuel substitution on foreign currency expenditure depend on in-country availability of resources. For the three countries in the study, which do not have oil resources, all modern fuels impact negatively on the foreign exchange balance as they have to be imported.

A summary table of the impacts of mitigation options on the indicators can be found in Appendix 1. The last two rows of the matrix as seen in Figure 22 are used to exemplify how the combination of two mitigation measures can add up benefits in different sectors and end up becoming the best option available for policy makers to attempt mitigating the negative effects of traditional biomass fuels. Once again, this type of approach requires the joint effort of different governmental departments.

Fig 22: Impact assessment matrix

INTERVENTIONS	IMPACTS														
	HEALTH				ENVIRONMENT				SUSTAINABLE ECONOMY				SOCIAL		
	Respiratory impacts ⁵	Other health hazards ⁶	Transport related	Handling related	Forestry cover	Soil quality	Local air quality	Water quality	Forex	Official gov't revenues	Security of energy supply	Employment	Income generation	Gender equity ⁷	Other livelihood benefits
Setup/appliances															
Improved ventilation	+	+ 0	0	0	0	0	0	0	0	0	0	0	0	+	+
Chimneys and hoods ¹	+	+	0	0	0	0	0	0	0	0	0	+	?	+	+
Outdoor cooking hut	+ -	+ 0	0	0	0	0	0	0	0	0	0	0	0	+	+
Improved stove	+	+	0	0	+	0	+	0	0	0	+	+	+	+	+
Improved stove with flue attached	+	+	0	0	+	0	+	0	0	0	+	+	+	+	+
User behaviour															
Fuel drying & appliance maintenance	+	+ 0	0	0	?	0	+	0	0	0	0	+	0	0	0
Fuel															
Briquettes and pellets ²	0	0	+	+	+	+ -	+	0	+	0	+	+	+	+	0
Kerosene	+	?	0	0	+	+	?	+	-	-	?	-	?	+	?
LPG	+	+ -	0	0	+	+	+	+	-	-	?	-	?	+	?
Biogas ³	+	+ -	+	+	+	+ -	+	+	+	+	+	?	+	+	?
Electricity ⁴	+	+ -	+	+	+	?	+	?	?	+	?	-	+	+	?
Supply management															
Sustainable woodlot	0	0	0	0	+	+	0	+	+	+	+	+	?	0	0
Sustainable charcoal	0	0	0	0	+	+	0	+	+	+	+	+	?	0	0
Regulatory															
Charcoal production ban	?	?	0	?	?	?	0	0	-	-	-	-	-	0	?
Combined interventions															
Improved stove & sustainable woodlot	+	+	0	0	+	+	+	+	+	+	+	+	+	+	+

1 Built in the structure of the house
2 From charcoal dust or agro-residues
3 Locally produced

4 Includes all electricity sources (fossil fuels and renewables)
5 Includes ARI and ALRI
6 Includes burns, eye infections, accidental fuel ingestion etc.

7 Relative to time spent cooking and drudgery

9 CONCLUSIONS AND RECOMMENDATIONS

Evidence indicates that the use of biomass fuels is increasing, both in rural and urban areas and this trend is not set to change in the near future. Consumers of traditional fuels include households from almost all income levels as well as a wide number of institutional and commercial consumers.

Studies in all three cities, as well as many other African urban areas, show that traditional fuels represent a major means for **all** urban households to cope with ever-changing environmental, economic and political impacts on modern fuels. Traditional fuels enable households to reduce their risks of frequent energy supply shortages, whether induced by international factors (e.g., oil prices), national and international policies (e.g., increased electricity prices), or climate conditions (e.g., droughts that lead to reduced hydroelectricity supplies and increased tariffs). Traditional fuels offer urban households one of the greatest means to cope with these vagaries of the urban energy economy.

Project findings highlight that the entire sector is characterised by a high degree of vulnerability as suppliers can count on very limited resources that can buffer them from the impacts of seasonality, increasing competition as well as technological and economic changes. In the following sections, the final conclusions and recommendations stemming from the analysis of the traditional fuel sector are presented.

9.1 DEPENDENCY ON TRADITIONAL FUEL SUPPLY FOR LIVELIHOOD

- The sector in the three countries is highly decentralised, with many different transportation and vending opportunities and it is relatively easy to enter, requiring few formal skills and low initial financial outlay. For these reasons this sector has become a significant source of employment for many people in urban areas.
- For the majority of people engaged in the sector, fuel supply is the *only* livelihood option available. Many do not have other sources of income to support them financially, and do not engage in supplementary income-generating opportunities that they can pursue in times of low supply and demand. Indeed, if alternatives were available, the project's research shows that most suppliers would not choose to be engaged in their current activities. Dependency on this sector to secure a livelihood is a key indicator of vulnerability within the fuel supply business.

9.2 LIVELIHOOD IMPACTS OF FUEL SUBSTITUTION MEASURES

- This research has been unable to show conclusive evidence of negative livelihood impacts of fuel substitution policy on fuel suppliers. This indicates that so far, policies have been ineffective in significantly reducing the rate at which biomass is being consumed in urban areas. Whilst fuel substitution measures have led to displacement of traditional fuels, this is outweighed by an even larger increase in urban traditional fuel demand due to the high rate of population growth, particularly low income populations who cannot afford modern fuels.
- A further reason is related to the subjective views of suppliers themselves. Most suppliers relate observations about past changes in the business and current concerns to day-to-day activities, rather than changes brought about by macro-level interventions.
- However, given the current livelihood circumstances of most fuel suppliers, widespread and successful fuel substitution policies and measures are likely to result in loss of livelihood for many, and particularly the most vulnerable among the suppliers.

- The nature of modern fuel supply, and the fact that it is produced, marketed and distributed in more formalised channels, and often by multinational oil companies, indicates that it is extremely unlikely that most traditional fuel suppliers would be able to make a smooth transition from sales or transportation of fuelwood to sales or transportation of LPG or kerosene. The electricity business is even less open to the informal sector.
- In terms of health, poor household consumers experience positive impacts from fuel substitution thanks to improved access to modern fuels. The fact that cleaner fuels such as kerosene are also available to low income households indicates that some fuel substitution policies are resulting in positive livelihood benefits for the poor.
- The modern fuel supply sector and its supply dynamics are important areas to be investigated further to identify the potential to absorb traditional biomass fuel suppliers into the more formalised modern fuel business. On this aspect, the research of this project is expected to be developed further under a related research project that is investigating how to mainstream livelihood considerations into infrastructure and services improvements²⁹.

9.3 RECOMMENDATIONS FOR AVOIDING NEGATIVE IMPACTS

Given the potential for fuel substitution to adversely affect livelihoods in the traditional fuel sector, it is important that social considerations are taken into account, alongside environment and health, when introducing fuel substitution measures or other interventions designed to reduce consumption of biomass and improve health.

A combination of mitigation measures will minimise impacts on the range of social, economic and environmental factors that are relevant to the fuel supply sector, and will promote sustainability on all levels. Although this study recognises the desirability of promoting modern fuels so that households are able to climb the 'energy ladder' and increase their quality of life with the ability to access a wider range of fuels and appliances, some important issues should not be ignored.

1. Firstly, for the poorest among urban dwellers, traditional biomass fuel is and will likely continue to be the *only* affordable option in meeting household needs.
2. Secondly, even wealthier households will continue to use biomass fuels, through choice, since biomass represents a major fallback option should other modern energy supplies be reduced, or their prices significantly increased (as happens periodically in each of these urban areas). Furthermore, many traditional foods require the type of cooking afforded only by wood or charcoal, and these fuels are required in certain cultural practices.
3. Security of energy supply and the desire to decrease dependency on imported oil products are further reasons that biomass fuels will continue to be important for all classes of urban households, as indigenous sources of energy.

For these reasons, some initial **recommendations** to policymakers are listed below:

- Acknowledge the importance of the traditional fuel sector as an industry in its own right, in terms of employment opportunities and income for a large number of people.
- Recognise the valuable contribution of fuel suppliers, and especially women, in supplying an important and affordable source of fuel for institutional, commercial and domestic consumers.

²⁹ DFID KaR 'Livelihood Substitution: Mainstreaming the poor in Infrastructure and services development' Contract No. R8176

- Recognise the vulnerability of fuel suppliers and a commitment to improving their working and living conditions as part of the current and future poverty reduction strategies.
- Develop existing and new policies and strategies for the rational and efficient production, transportation and marketing of biomass fuels and household energy efficiency (e.g., improved stoves).
- Systematically consider impacts on livelihood when addressing other social, economic or environmental objectives that may result in loss of employment for vulnerable members of society working in the infrastructure and service sector.
- Ensure that, where significant losses of employment are likely, sustainable and gender-neutral re-employment or training programmes are pursued.
- Develop long term strategies that account for changes such as demand increase and progressive urbanisation.

9.4 IMPROVING LIVELIHOODS FOR FUEL SUPPLIERS

As indicated above, regardless of fuel substitution measures, biomass fuel is likely to continue to provide an important source of employment and income in urban areas in developing countries, and this is certainly true in the cities of Addis Ababa, Kampala and Nairobi, especially in the short-term. Based on the analysis of the vulnerability context of fuel suppliers, this research has identified some important areas of improvement within the sector in the hope that the impacts of some of the negative aspects of the fuel supply business might be reduced.

The project's recommendations to improve the suppliers' livelihood respond to the need to

1. improve assets, which are an important means of reducing vulnerability, and
2. change the institutional context of fuel suppliers.

Improved access to resources can empower people to address institutional barriers through a range of livelihood strategies, nonetheless action must also be taken at the macro-level, so that the conditions of the fuel supply sector can be improved, in order to meet the social, economic and environmental objectives of society as a whole.

Strengthen existing livelihood assets

Improvements that can be made within the sector are summarised in Table 7. Precise measures and interventions have not been given in this report, since the possibilities for improving these assets will depend on specific circumstances within each country. The ability of these to positively influence livelihoods of fuel suppliers will also depend on changes occurring in the institutional context.

Table 7: Recommendations for enhancing livelihood assets

Assets	Improvements	Vulnerability Impacts
<i>Financial</i>	<ul style="list-style-type: none"> ○ Ability to save ○ Access to credit ○ Increased income 	<p>Savings can support households in times of low supply & demand.</p> <p>Credit may allow purchase of labour-saving aids, e.g. vehicles and can improve sustainability of business.</p>
<i>Physical</i>	<ul style="list-style-type: none"> ○ Storage space ○ Designated selling areas ○ Adequate and sheltered premises 	<p>Less frequent journeys, security.</p> <p>Reduced scope for harassment.</p> <p>Reduced risk of damage to supplies from rain, etc.</p>

Social	<ul style="list-style-type: none"> ○ Business networks ○ Community groups ○ Supplier organisations 	<p>Collective bargaining power to influence prices and quality of wood and charcoal, especially for women.</p> <p>Improved security (collection, transportation in groups); better access to shared resources (e.g. vehicles), especially for women.</p>
Human	<ul style="list-style-type: none"> ○ Education ○ Training 	<p>Improvement of opportunities to pursue alternatives in times of low supply and demand, or in case of displacement as a result of fuel substitution.</p>
Natural	<ul style="list-style-type: none"> ○ Sustainable production 	<p>Security of supply; reduced scope for harassment; improvements to status of sector; reduction in necessity for motorised transportation.</p>

Address institutional barriers

Recognition of the traditional fuel supply sector is a key recommendation from this study.

It is clear that increased legitimacy in this field of activity has the potential to reduce the scope for official harassment and corruption and to improve general conditions, such as low productivity and low income, harsh competition and bad working conditions, lack of bargaining power and exploitation. Ideally, the formalisation of traditional fuel supply business may enable suppliers to access business premises, credit, business facilities, etc.

On the other hand, it should also be acknowledged that the informality of the sector has its own benefits, such as ease of entry, a certain degree of freedom and autonomy, invisibility and escape from government control.

The extent to which formalisation of this sector should occur is, therefore an issue for further investigation, and this should include an analysis of the likely impacts on the most vulnerable fuel suppliers

APPENDIX 1

SUMMARY OF IMPACTS OF MITIGATION OPTIONS ON A SELECTED SET OF INDICATORS

Table A: Impacts of mitigation options

MITIGATION OPTIONS	HEALTH	ENVIRONMENT	SUSTAINABLE ECONOMY	SOCIAL
SET UP AND APPLIANCES <ul style="list-style-type: none"> Improved ventilation Chimneys & hoods Improved stoves Outdoor cooking huts 	<p>Ventilation and chimneys can reduce the level of health-damaging pollutants, such as carbon monoxide, benzene, PM₁₀s and nitrogen oxides³⁰.</p> <p>Improved stoves have been designed to reduce pollution and burns.</p> <p>These interventions will not reduce the health and safety impacts resulting from transportation and handling of biomass fuels.</p>	<p>If used in conjunction with traditional biomass fuels, these measures will not have positive impacts on the environment.</p> <p>In the case of improved stoves, although they are more efficient, the effects on forests and air quality will not necessarily change. Households may continue to use similar amounts of fuel, but for a wider range of purposes, e.g. by cooking more food, or using excess fuel to boil water, etc.</p>	<p>At low national cost, improved stove production can boost the local economy, particularly in terms of employment.</p> <p>Ventilation and chimney initiatives may also provide job opportunities in terms of production and installation.</p>	<p>Households can benefit by using the same amount of fuel for additional purposes, thus improving quality of life at no extra costs.</p> <p>The health improvements have positive gender impacts, since women are usually responsible for cooking.</p> <p>There are also employment opportunities for women in the production of improved stoves, while employment in the biomass sector is not at risk.</p>
FUEL SUBSTITUTION <ul style="list-style-type: none"> LPG Kerosene Electricity 	<p>Although modern fuels result in reduced smoke and indoor air pollution, they are not without their own safety and health risks. These include accidental fuel ingestion, explosions, burns and high carbon monoxide levels, especially for LPG.</p>	<p>The use of LPG and kerosene can have positive impacts on forests and air quality, but there are risks to water and soil quality, associated with unsafe disposal. These risks, however, are mainly associated with bad practice.</p> <p>However, wider environmental impacts related to the use of fossil fuels need to be taken into</p>	<p>Import costs are high for modern fuels. Uganda, Ethiopia and Kenya spend approximately \$10m, \$20m and \$40m each year respectively on household kerosene alone. If subsidised, national costs are even greater. These fuels are supplied by multinational organisations, with formal distribution channels. Employment in</p>	<p>Wider access to modern fuels can improve quality of life for those who can afford them, and lighting from kerosene and electricity can improve opportunities for learning in the home.</p> <p>Gender impacts are likely to be positive for consumers, whilst for those employed in the traditional biomass fuel supply trade, the loss of livelihood may be significant, especially since most</p>

³⁰ Sparknet (2002) *Public Health and Household Energy* (www.sparknet.info)

		account (e.g. climate change, resource depletion etc). As for the environmental impacts of electricity, these are strictly dependent on how electricity was generated in the first place.	this sector is unlikely to favour the poor.	modern fuels are supplied and distributed by multinational organisations in the formal sector.
<p>USER BEHAVIOUR</p> <ul style="list-style-type: none"> Fuel drying and appliance maintenance 	<p>The use of green or damp firewood creates more smoke than the use of dry wood, and can also clog chimneys. This has clear implications on health.</p> <p>The same thing applies to the correct use and maintenance of appliances. Risk of burns, leakages and explosions are all minimised with improved maintenance.</p>	<p>As indicated above, unsafe disposal can have detrimental effects on water and soil quality.</p>	<p>Local employment in training and maintenance of appliances could have positive impacts on the local economy.</p>	<p>Health improvements from using dry fuel will have positive impacts on the main fuel users, women.</p> <p>Depending on the particular effects of ill-maintained appliances, women are also likely to benefit from improved practices.</p> <p>As an additional financial cost, maintenance is unlikely to be a priority for poorer households, and so this group may be excluded from the benefits of appliance maintenance services. However, if it might be possible for users to carry out simple maintenance themselves.</p>
<p>SUPPLY MANAGEMENT</p> <ul style="list-style-type: none"> Sustainable forestry Sustainable charcoal production 	<p>When used in a traditional way, biomass fuels will continue to result in ill-health. Unless used in conjunction with other measures, consumers and particularly women will continue to suffer from the adverse effects of biomass combustion.</p>	<p>Sustainable production of biomass will slow down the rapid and uncontrolled depletion of national forest resources, whilst ensuring a sustainable supply of indigenous resources for the future.</p>	<p>Both national and local governments have the potential to benefit from a sustainable biomass sector. Revenues may be accumulated through tax and licensing measures and local employment created.</p>	<p>The employment in the biomass sector will be less subject to outside risks. Gender impacts may continue to be negative unless the sector is organised in a more formal way. The removal of the legal barriers may reduce corruption and raise the social status of this business.</p>

<p>REGULATORY</p> <ul style="list-style-type: none"> • Charcoal production ban • Charcoal transportation ban 	<p>The charcoal ban, unless enforced, has no particular effects on health because experience shows that people keep buying it if available and use it in the usual appliances. To a certain extent it can also be argued that illegal charcoal burning practices stemming from the ban are directly linked to declining charcoal quality and the consequent worsened burning performances.</p>	<p>Charcoal ban, unless enforced, has clear negative impacts on the environment. Instead of preventing people from producing charcoal, the ban forces them to act illegally and to produce charcoal to meet demand using unsustainable and illegal practices, often in national or protected forests. Lack of long term vision also pushes people not to replant the trees cut down.</p>	<p>The impacts of charcoal ban can be very severe on the general economy of the country if the measure is not enforced. Charcoal trade is practiced despite the ban, resulting in loss of official tax revenues from production and commercialisation, loss of national income from charcoal export, loss of confidence in government's measures.</p>	<p>Charcoal ban has a clear negative impact on the livelihood and social status of those engaged in the business despite the ban. Police harassment, bribery, loss of income, wrong perception from the general public are some of the most obvious impacts on social welfare.</p>
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ANNEX 1

COUNTRY HISTORICAL BACKGROUND REPORTS

- **Ethiopia**
- **Kenya**
- **Uganda**

ANNEX 2

URBAN BIOMASS FUEL SUPPLIERS PROFILE

ANNEX 3

HEALTH RELATED EFFECTS OF TRADITIONAL BIOMASS FUELS: THE UGANDAN CASE STUDY

ANNEX 4

CONCEPTUAL LIVELIHOOD FRAMEWORK: USING THE SUSTAINABLE LIVELIHOOD APPROACH TO ANALYSE POVERTY IMPACTS

ANNEX 5

FUEL SUBSTITUTION IMPACTS: AN ASSESSMENT MATRIX ANALYSIS



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