

# **Energy Provision for the Urban Poor**

## **Kenya Country Case Study**

By Stephen Gitonga

### **IT Kenya Energy Programme**

P. O. Box 39493 Nairobi

Tel. 254 2 442108

Fax 254 2 445166

E-mail Gitonga @itdg.or.ke

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## Brief Summary of the Case study

The Kenya country study was conducted in several areas in Nairobi, which traditionally are inhabited by the urban poor. The case studies addressed the following two themes: energy for small-scale enterprise and cooking fuels and technologies.

Charcoal is the main fuel used by *small enterprises* in poor urban areas. It is used for smelting, welding, baking and casting and forging metals. Firewood is second in importance followed by kerosene. However, there is a tendency to use more efficient fuels when the income of small enterprises increases

With respect to energy provision, charcoal supply is fairly reliable except during the rainy season where prices are inflated. Charcoal production is low during the rainy season and the roads where it is transported are impassable. All these extra costs traders are passed on to the consumer. Fuelwood is obtained from the nearby forest and of-cuts from furniture workshops. Although electricity is mentioned as the preferred fuel for most of the people, it is not highly easily accessible to the small enterprises. The reasons are more legal than financial since the enterprises are very often located in informal settlements.

Although kerosene and welding gases, acetylene and oxygen, are available, energy supply is facing several constraints. A key constraint is the monopoly of the distribution by the company that supplies welding gases. One has to register with the company and pay a monthly fee even if cylinders are not filled-up, as is common practice in industrialised countries. These requirements increase dramatically the costs. Health problems associated with the utilisation of the various fuels are not listed as a priority although there is a concern about their impact. This might be due to the priority given to energy access at affordable prices.

Charcoal is the main cooking fuel used by *households* in urban poor areas. It is followed by kerosene and firewood. A notable aspect is the fact that every home that had a charcoal stove also possessed kerosene stove. Kerosene stoves are used mostly in the morning for preparing breakfast while charcoal stoves or open fire for firewood are used during the day for cooking or warming the food.

The utilisation electricity is almost non existent and gas is a very unpopular fuel for many poor urban dwellers apparently because of the damage that fire can cause to informal structures. However further analysis revealed that cost is the main reason for not using gas. Apart from the lack of income, which is in itself a hindrance to the provision of energy, the absence of property rights limits dramatically energy access for poor urban people. The fact that they live in the informal settlements makes it difficult for them to access to electricity or to use LPG safely as risk of fires is great.

Improving energy access to the urban poor implies action on these key constraints, particularly geared towards small enterprises who are currently the main source of employment for the urban poor. Innovative ways of providing credit to small enterprises could greatly improve their access to sustainable energy supplies. The formal recognition of small and medium enterprise (SME) by the utility (Kenya Power and Lighting) should facilitate their access to a better service. This

could be done by licensing them in groups in the areas where they are operating.

## **Method of data collection**

The study collected both secondary and primary data. The primary data was collect by visiting several organisations who are stakeholders in the energy sector. A list is provided in the appendices. Information was also collected from opinion leaders and development and community workers in the urban poor areas. The case study is based on the urban poor of Nairobi but the analysis includes the general urban poor situation in the country.

Primary data was also collected by conducting a questionnaire to 53 respondents of which 27 represented the small enterprises and the rest the households. The survey was conducted in the following areas of Nairobi:- Kawangware, Kangemi, Kibera, Gikomba, Buru burur NCKK, Korogocho, Dandora, Kayole, Shauri Moyo, and Kariobangi.

The people who were interviewed ranged from age 30 and below (46.2%) to above 40 (23.1%) the rest aged between 30 and 40 (30.1). The respondents included 64.2% females and 35.8% males.

The occupation of the respondents are: - carpenters (6.4%) housewives(6.4%), artisans (14.9 %) traders(25.5%) and other miscellaneous activities(46.8). The work involved carrying out a simple structured questionnaire in several households, institutions, small enterprises, interviews with several key stake holders and a review of existing literature.

The results were analysed by use of SPSS statistical package and the information provided here is just a part of larger volume of information that could be generated from the data if required.

# **1. CURRENT STATUS OF URBAN POVERTY AND ACCESS TO ENERGY IN KENYA.**

## **1.1 Urban Poverty in Kenya: An Overview**

Urbanisation in most African countries is not directly influenced by economic growth but by the search for better opportunities by impoverished individuals. Perhaps the most visible form of poverty in the urban areas in Africa is reflected by the low quality of housing. Poverty embraces all aspects of life and in urban areas the main aspects are: - poor food resources leading to low consumption, low quality energy sources leading to a myriad of other problems, lack of income leading to poor housing, very low social status, a combination of other aspects of life are affected including education, lawlessness, lack of services, and a level of hopelessness.

In Kenya, 47% of the population is below the poverty line. The urban population is expected to increase with the dwindling agricultural sector. The economic growth for the country has not hit the target for the last 10 years. The bulk of the urban poor are those who have come from the rural areas in search for employment. The distribution of wealth in Kenya is very uneven with the first 20 percent sharing 90% of the country's wealth while the rest share the ten percent. The extent of urban poverty is great and it is what can be called income poverty. Lack of sustained growth in the economic sector is identified by many studies as the main cause of income poverty in both the rural and the urban areas.

The country depends on agriculture for its economic growth. The country has about 40% of its land arable and only 20% high and medium and high potential. Rainfall therefore contributes a lot to improve agricultural production and thus influence the rural to urban migration. A new factor, however, has been introduced with the liberalisation of the agricultural sector. Importation of cereals and sugar has for example almost crippled the sugar and the maize subsector. All these factors combined enhance poverty.

The Government's Central Bureau of statistics estimates that urban poverty in Kenya is 29.29%. The population of Kenya in 1994 was estimated at 26.4 million and 11.5 million were absolutely poor. Of which 10.3 million lived in the rural areas and 1.2 million in urban areas. The extremely poor were 6.4 million and 430,000 in urban areas. In 1997, it was estimated that both urban and rural poor was 12.6 million in a population of 29.9 million. Urban poverty in Kenya is manifested in form of increasing street children, single parents with large families, poor households living in the slum areas and informal settlements, unemployed youth idling in urban areas, increased wave of crime and the mushrooming informal settlements and shelter.

The rate of urbanisation in Kenya is increasing while the rate of economic growth is decreasing. The state of affairs perpetuated by that process of urbanisation without growth is that more and more people in the urban areas constitute the urban poor. While population in the urban areas is increasing, the resources and opportunities needed to support the population is either stagnant or decreasing. The living conditions are increasingly deteriorating and crime rate is increasing. The provision and use of energy resources in the urban poor communities is substantially decreasing and traditional form of fuels are finding increased popularity in urban areas.

Urban poverty in Kenya has historical origins. Since Kenya attained independence the gross domestic product has had mixed success as shown in the following analysis.

< 1964 to 73, the growth rate was 6.6% ,



- < 1974 to 80 it fell to 5.2% and in
- < 1980 to 89 fell to 4.1
- < while it reached a low 2.5% between 1990 to 96.

This trend has continued and the country's growth of the gross domestic product has stagnated for the last one year. This general trend in the Kenya's economy has only made the situation of the urban poor greater and has caused general increase of the population that is highly affected by the problems associated with urban poverty. In Kenya, both absolute poverty and relative poverty are observed. In absolute poverty status, the communities lack income and consume inadequate calories. For the relative poverty situation, the communities are excluded from accessing the necessary skills, assets and resources. Both these situations are prevalent in the urban areas in Kenya.

Urban poverty has directly influenced access to energy for the majority of the urban population. Cost of energy in the urban setting has been going up for the last ten years. The main sources of energy for cooking and the small and micro enterprises in Kenya are:- Electricity, liquefied petroleum gas (LPG), charcoal, firewood, Kerosene, acetylene/oxygen and solar power. These sources of energy are all not readily accessible to the urban poor. Accessibility is affected by the housing structures, policy on sources of energy, level of disposable income, ownership of shelter, level and cost of technology used with the energy resource and distribution of the energy resources.

## **1.2 Kenya Energy Policy Objectives**

Broadly speaking, the Kenya energy sector policy objectives are to:-

- < guarantee security supply of both electricity and petroleum fuels to the domestic economy
- < enhance energy supply and delivery capacity to all sectors of the economy including domestic households at a pace consistent with the growing demand through technically efficient but cost effective systems
- < create an enabling environment for the private sector participation in the supply of energy including electricity
- < institutionalise and internalise environmental impact assessment and awareness of energy development and consumption, and develop an internal capacity for the impact assessment and mitigation of negative effects and,
- < promote energy conservation through use of technically efficient but cost effective supply and end-use technologies.

## **1.3 Stakeholders in the Kenya energy sector.**

Broadly, they can be categorised into three:-

- < Government Ministries and Institutions
- < Non Governmental organisations and community based groups
- < The private sector

### **1.3.2 Government Ministries and Institutions**

This includes the ministry of energy which is the manager and implementers of the energy policy

in Kenya, research institutions(including Universities), Kenya institute of Research and Development, Parastatals including the Kenya power and lighting Company Ltd., the Kenya Power Generating Company Ltd. Ministry of Finance, Ministry of environment, Ministry of Agriculture , Local authorities, Kenya pipeline Company Ltd. and the Kenya refineries.

### **1.3.3 Non Governmental organisations (NGO) and community based organisations (CBO)**

There are many NGOs and CBOs that deals with various aspects of energy. They include:- The Intermediate Technology Development Group in Kenya, Kenya Energy and Environmental Organisation, Resource Projects ( Formerly Bellerive Foundation), Foundation for Woodstove Dissemination/African Energy Policy Research Network, Solarnet, Help Self Help Centre and many others which are operating in different sectoral areas. The CBOs are many and dispersed in different parts of the country

### **1.3.4 The private sector**

There are several private sector companies that deals with energy services and products ranging from those who deal with solar energy, wind energy, consultancies, energy equipment manufactures and sellers, welding gas producers and sellers, acetylene and oxygen gas manufactures, petroleum companies, Independent power producers, engineers and contractors.

## 2. Case Examples Based on A Particular Energy Need

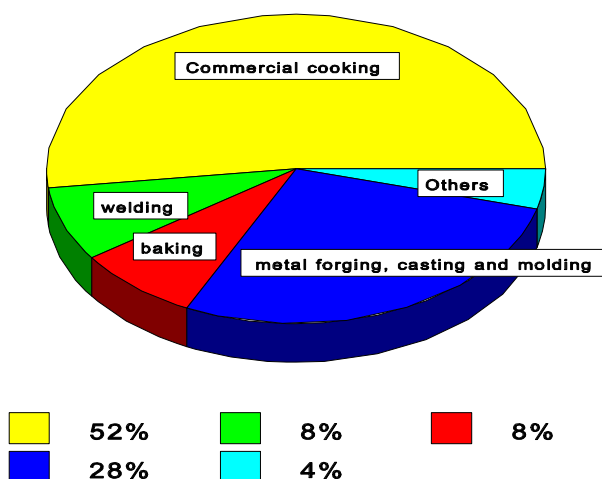
The case examples will be given in terms of energy need.

- < Energy for small scale enterprise with three examples in commercial cooking, baking and small scale metal works ( smelting, welding, casting, moulding and forging of metals by use of heat)
- < Cooking, heating and lighting for household energy needed for, and institutional energy needs ( in small public institutions, hospitals, schools etc.)

### 2.1 Energy for small scale enterprise

The study looked at three examples. These are, commercial cooking, baking, and small scale moulding, welding and casting). The interviews revealed that of the 25 enterprises visited, commercial cooking is practised by 52% of the respondent, welding 8% , baking 8% , metal forging, casting and forging is done by 28% of the respondents and other activities 4%.

## Activities carried out



The main fuel used by the urban poor small enterprises is charcoal. Charcoal is used for smelting, welding and baking. It is also used for casting of metals and forging metals. It is popular among the small enterprises because except for the rainy season it is readily available and affordable. Sale of charcoal is very flexible since the quantity of sale depend on the users request. For instance , it is sold in sacks of about 35kg, tin of about 9Kg or even smaller units according to the users requirements.

Technology/Device used/fuel	% of total interviewed
cooker/stove (Charcoal and firewood)	75.0
blower (Charcoal)	12.5
welding torch (Kerosene, electricity, acetylene gas)	8.3
others ( charcoal)	4.2

Total	100
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Fuel use is determined by the activities carried out in the small enterprises. The entrepreneurs who own kiosks (commercial cooking), use saw dust and firewood. They obtain it from carpentry workshops (left overs). The cooking is usually done in the open, with no structures for the kitchen for lack space and to reduce nuisance from smoke.

Energy for heating of metals (forging, casting, welding etc) usually comes form charcoal. A case was reported that coal is used reportedly obtained from the railway station workers/collected along the railway line. The coal is smuggled from the railway station. This was reported in the Shauri Moyo areas.

The analysis shows that charcoal is a very important fuel for the urban poor who depend on small enterprises . Firewood is second in importance, followed by kerosene. However, as the poor gets more resources and moves up the ladder in their enterprises, the situation changes. Fuels used change in importance for example, a 1998 study entitled “Improving access to energy for the development of the micro and small enterprise sector” listed the following as order of fuel use and requirement. Note the change in importance from charcoal to electricity as the poor gets more resources.

Activity	Energy Source(s)
Automotive, mechanics/welders	Electricity, petro, kerosene, gas(LPG), charcoal
Metal fabricators	Electricity, petroleum, LPG
Carpentry/Furniture makers	Electricity, petrol
Electricians	Electricity, charcoal
Shoemakers	Methylated spirit, electricity
Tailors	Electricity
Battery Manufactures	Electricity, gas, paraffin, charcoal
hairdressers	Electricity, charcoal, paraffin
Food processing	Electricity, charcoal, kerosene
Spray painters/panel beaters	Electricity, petrol

*Source:: Recssad Field survey; 1997*

In Kamukunji small enterprises, charcoal is predominantly used. For welding charcoal is used. No case was reported where the urban poor small scale welders were using acetylene and oxygen gas. This is possibly because of the initial costs for the equipment. Charcoal is used in the hardening of metals to make hammers for hammer mills. This is common in Dandora. Forging of metals is done by use of charcoal as fuel. Kerosene is used in one of the furnace for the manufacture of oven spare parts. Kerosene is also used for welding by use of a welding gun. The technologies used in the small enterprises range from charcoal stoves or heaters, blower supported fires (mainly fired using charcoal), kerosene welding gun and simple furnaces/ovens..

The bulk of the energy supplied to the small enterprises come from traders (83.3%) ,while 12.3% of the suppliers come form shops and only 4.2 of the supplies come directly from outside Nairobi.

<b>Fuel supplies</b>	<b>% of respondents</b>
traders	83.3
shops	12.5
outside Nairobi	4.2
<b>Total</b>	<b>100</b>

Bakeries use wood from the nearby forests. They use improved stoves for this. They are located in residential areas and electricity is very common in residential areas, though there is rationing. Rationing increases the preference for wood, although they would rather use electricity if there were no problems with rationing. Electricity cost is another factor that keeps them out of it.

### **2.1.1 Energy service provision**

The issue is addressed in relation to supplying energy needs and the services to maintain supply. Each fuel presents a different case and therefore energy provision for the urban poor is a complicated example. The energy services provided are full of informal strategies adopted by enterprise owners to cope with fuel supplies and costs.

#### *Charcoal and firewood*

Charcoal is usually supplied by traders who bring it from the rural areas to certain urban centres. From the centre, the retailers then take over the activities. The retailers sell to small buyers who buy charcoal in small quantities.

Charcoal supply is quite reliable, except during the rainy season. Charcoal prices are therefore inflated during the rainy season. Production of charcoal is low during the rainy season and the roads where it is transported are impassable. All these extra costs incurred by the traders are passed on to the consumer. One aspect of supply of charcoal is the extra transport cost an enterprise owner have to incur to transport it from the selling point to their premises.

The other aspect of use of charcoal is the cost of production brought about by the intensity of labour required to carry out the work. For example casting of metals requires a lot of energy and charcoal has to be kept burning to get the desired level of output and quality of product.

Firewood is obtained from the nearby forest, left overs form furniture workshops and from pruning obtained from fence production. It is usually used for commercial cooking.

The table shows the estimates of the daily fuel costs (fuel prices per purchase) for the enterprises visited. It is evident that the daily cost is at the order of 50Ksh to 200Ksh, depending on the enterprise and the fuel.

General Fuel prices per every purchase	% of total interviewed
10 to 20 Ksh	9.1
20 to 50 Ksh	9.1
50 Ksh to 200Ksh	68.2
over 200	13.6
<b>Total</b>	<b>100</b>

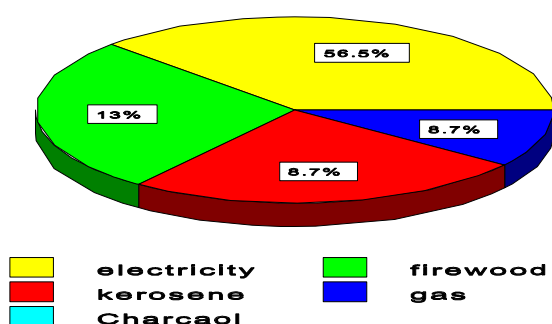
### Electricity

Although electricity is mentioned as the most preferred energy source for most of the people interviewed, it is not highly accessible to the small enterprises. The reasons for this are more legal than financial since the enterprises are located in informal settlements. There are many cases where the enterprises are located in formal centres but the account owners are the landlords thus control the use and cost of power. This problem makes it inaccessible to many small enterprises operated by the urban poor.

A few reasons were recorded during the interviews.

- < Landlords charges electricity exorbitantly ranging from 50Ksh to 300Ksh per month
- < In some areas hired 'quacks' have connected electricity illegally to small enterprises and at one time it was reported that somebody was electrocuted. This indicates the efforts some enterprises make to gain electricity connection.
- < Where the enterprises are located outside the residential houses, landlords restrict electricity use to lighting as they pay the bill and own the account.

### preferred fuel



< The general trend is haphazard establishment of enterprises therefore they cannot legally be connected to the grid. Operating from the residential areas especially for welders is very costly as residential areas have the single phase power supply while require three-phase power supply. Sometime there is conflict between the residents and the small enterprise owners whereby residents complain about low supply to their houses as a result of overuse

by the enterprises.

- < There is very high relationship between land ownership and accessibility to electricity. There is also very strong relationship between house type and use of gas or electricity. All this is because of the legal requirements in the connection of electricity and the risks if fire in relation to the use of gas. An enterprise has to get clearance from the urban councils to be connected with power, but most enterprise owners do not know about this

requirement so they start from the power company and this cause delays.

When those interviewed were asked to state why they do not use their best preference, 81.8 cited cost as the main hindrance, 9.5% cited lack of supply and 4.5% other reasons and lack of the fuel. These observation, made during the interviews, agree with similar studies done in other areas.

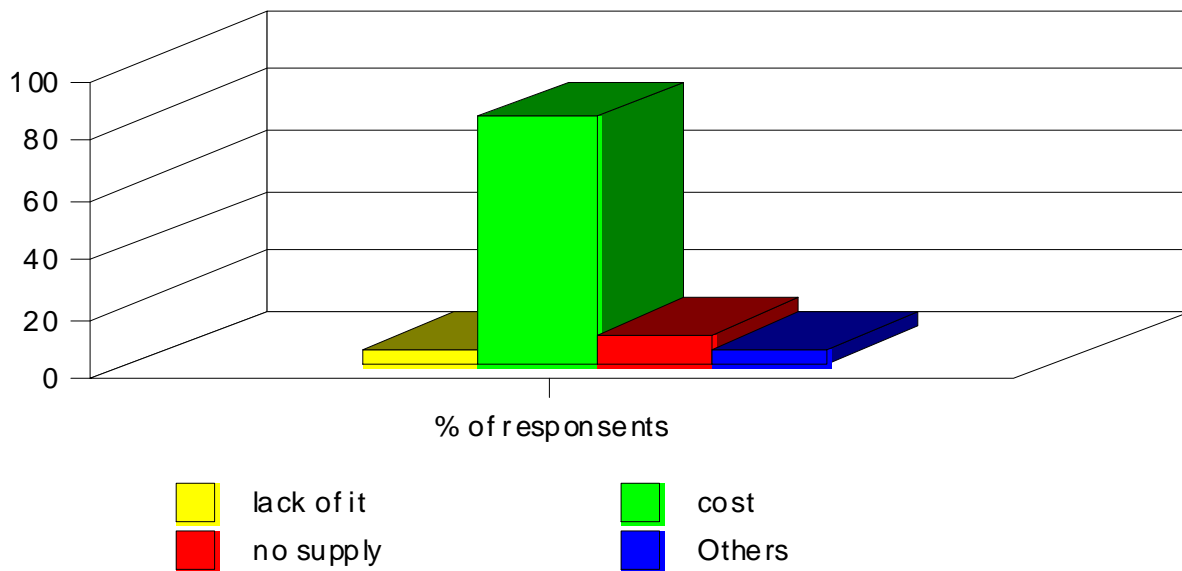
### **Petroleum products**

From the interviews with enterprises dealing with welding and metal fabrication, it was noted that although kerosene and the welding gases, acetylene and oxygen, are available, there are many problems that they face. One of the problem is the monopoly in the company that supplies welding gases. One has to register with the company and pay a monthly fee even if they did not fill-up the cylinders. The requirements makes the costs high and unaffordable. Petroleum products are usually supplied by Petrol stations and usually they are not located where the enterprises. The fuel has to be transported dangerously to the premises or operation areas . This applies to motor vehicle mechanics and paint sprayers who use petrol in their operations. Kerosene is the other fuel that fall in this group. It is cheaper than petrol and is usually used for welding.

### **How adequate is the supply?**

From the interviews conducted, the small enterprise owners believe that the supply is adequate with 75 percent of those interviewed asserting this. This is based on the fact that the suppliers are always there when needed. However, the buyers complain that although the supply is

## Reasons for not using the preferred fue



adequate, they do not get the fuel in the right quality. In most case the charcoal is so loose and damaged that it ends up being wasted as charcoal dust. Some innovative ladies in Kangemi and Kawangware have used it to make charcoal balls that they sell to hatcheries as mentioned elsewhere in this report. The general problem in the acquisition of energy for the small enterprises is lack of the fuel at the right time, at the right quality and the right price.

The supply of other fuels such as welding gas, LPG, electricity and kerosene is, however, erratic. Majority (54%) of those interviewed complained that they do not get the fuels in the right quality. Others complained that they do not get the fuel when it is required(40%). This is common with welding gas, and those affected are metal fabricators and welders.

The least problem listed is associated with health problems. The respondents believe that some of the energy sources pose risks to their health. They are concerned about smoke and smell of kerosene and fine dust of charcoal from charcoal, but they take no precautions. This could be attributed to ignorance and lack of knowledge of the side effects of use of various fuels.

## **2.2 Cooking fuels and technologies**

The study has looked at the household and institutional sector for the aspects of cooking fuels and technologies used by the urban poor. The location of the households studied are: - Kibera, Kangemi, Kawangware, Kamukunji, Dadora, Kariobangi and Kayole. The bulk of the interviewees came from Kibera.

The institutions that were visited are those involved in serving the poor communities in the selected locations. They include:- the redeemed church rehabilitation centre Korogocho, Imani rehabilitation centre, Kayole, among others.

### **2.2.1 Energy service provision**

The main energy used by households for cooking in the urban poor areas is charcoal, followed by kerosene, and then firewood. A look at the fuels used indicate that 73% of the individuals interviewed use charcoal for cooking while 13.5% use kerosene. Firewood is used by 8.1% of the respondents. One notable aspect is that every home that had a charcoal stove also possessed a kerosene stove. It is used occasionally depending on needs and the situation. Kerosene is used mostly in the morning for preparing breakfast while the charcoal stove or open fire for firewood is used during the day for cooking or warming the food. Charcoal and firewood are more popular for hard foods and foods that take long to cook.

Use of electricity is non-existent and gas is a very unpopular fuel for many poor urban dwellers mainly because they fear that it can cause fire to the informal structures found where they live. However after further analysis, it is revealed that cost is the main reason for not using the two energy sources. Theft of gas cylinders is the other problem cited.

Charcoal is obtained from vendors who are strategically placed in various places in the residential areas. It originates from the rural areas. Firewood is obtained from dealers who seem to have many sources such as trees cut during development and construction and from pruned fences and forests. Another source of wood is street boys who collect wood pieces which they later sell to willing buyers. There are many street boys in Nairobi.,

The transporters who bring firewood from the rural areas leave the charcoal in selected places.



It is then sold to retailers who are stationed more closer to the users. Charcoal residue is used in Kangemi to make charcoal balls which are then used for cooking. Residues of carpentry workshops are also used as fuel. There are established fuel vendors who sell firewood to consumers. They get their fuel from Jamhuri and Ngong forests.

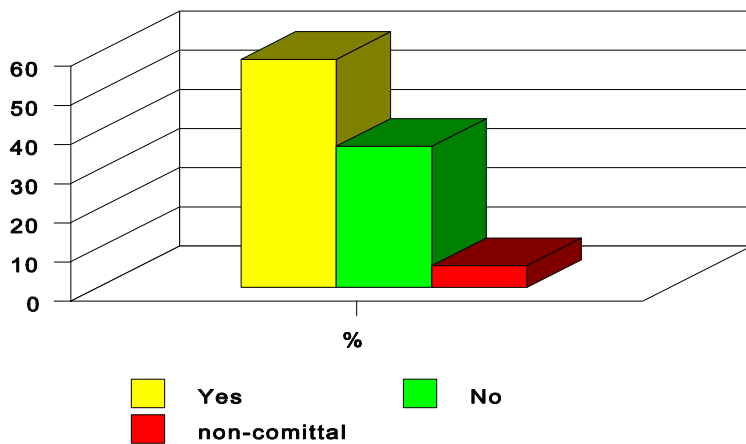
One notable thing in the energy use by the urban poor is that the more disposable resources they have the more choices they have for fuel. Most of the residents are casual labourers, in that case, they prefer to use kerosene for cooking but they still use charcoal. All the households use both charcoal and kerosene as they interchange their use according to fuel availability and finances. The landlords that were interviewed indicated that they use more charcoal than the casual labourers. Reasons range from space availability and cash. A few were found with electric cookers and table-top gas cookers.

Kerosene was considered by majority as cheap and abundant, quick to light and busy housewives found it best as compared to charcoal. This explains why almost everybody had both the charcoal and the kerosene stove.

Ceramic stoves are highly used for cooking with charcoal. Despite the low quality of the ceramic parts, repeated buying was reported showing the importance the residents attach to them.

Some tenants would like to use firewood to cook but due to the nature of their homes, they have no space. Lack of space mean the use of congested open spaces and in the process it causes nuisance to the neighbours. However it was noted that the older generation of the tenants used wood regardless of the situation.

### Is the supply adequate?



Wood is the preferred fuel in the institutional level. The institutions use improved wood stoves for cooking. They get their supplies from vendors and sometimes from urban trees when they are cut down for clearing for development and construction.

There are only two recorded cases of the use of other technologies such as the fireless cooker. One in Kibera and the other in Kawangware. One lady in Kangemi is making and using charcoal briquettes.

She has not started to sell it. Another in Kibera is selling to those who own hatcheries at a cost of Ksh 2 for every 35 briquettes (0.02 \$ for 35 briquettes).

When the respondents were asked to state why they prefer to use the fuels(charcoal and kerosene), 64.7% indicated that it is easy to use while 29.4% is because it is cheap. Only 5.9% use the fuels because they are available. Majority feels that the supply is adequate. The most important factor in the provision of energy to the urban poor is not only the supply but other factors such as

affordability.

The majority of the respondents(58.3%) believe that the supply for fuel is adequate while 36.1% indicated that it is not. The accessibility of energy to the urban poor has greatly influenced their eating habits and the frequency of cooking. 42.9% cook twice possibly because they are not in the house during the day but even for those who are in the house just warms the food. The rest cooks three times (37.1%) and only a couple of people cook only once. It has greatly affected the food they cook with majority eating fast cooking foods of stiff porridge and rice and very little of maize and beans.

The above trend has influence to the technologies used for cooking with majority eating stiff porridge and rice. These are fast cooking foods and the households prefer to use kerosene. They use firewood where maize is to be boiled.

Charcoal is used to fry and boil food and therefore a more flexible fuel for the urban poor. Seventy five (75%) of the respondents acknowledged the use of existing energy the fact that the choices that they have, have influenced their eating habits. When asked why the energy source has influenced them, 41.4% said it is because they cannot afford the fuel, 24.1% said that it is because it is not available and 17.2% because of the high costs of fuel. When probed further on how it has affected them, 75.9% said they eat less than they used to.

Further analysis indicate that they do not only eat less but the food choices are limited. Their method of cooking is dominated by boiling (54.1%) (water to cook stiff porridge) and frying (40.5%) ( for rice and vegetables ) as a result of the limited choice of foods cooked. This has some nutritional and financial implications. Nutritional because, the foods cooked are very similar over a long period and financial because, frying requires oil which is not cheap especially for the urban poor. The household size is 2 to 5 members for 69.4 % of the respondents and 5 to 10 for 30.6 percent. The low figures could be explained by the poverty levels and the inability to keep large numbers of individuals feeding under the same roof

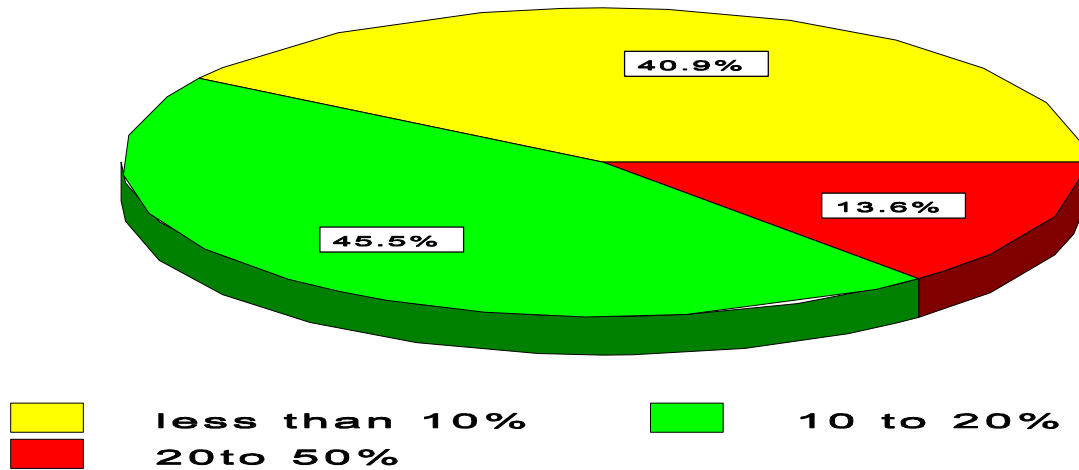
Gas cylinders are very popular with thieves and the urban poor do not like to use gas because of that among other reasons.

## **2.3 Income and urban energy**

### **2.3.1 Small enterprises**

The factors that control the use of urban energy by the poor are purely dependent on affordability and therefore the level of disposable income. An analysis of this aspects indicates that productivity is the most important in influencing the economic performance of the small enterprises, and the price/cost of energy is just one factor influencing this. For the small enterprises, the percentage of fuel costs in relation to the profits is an important factor.

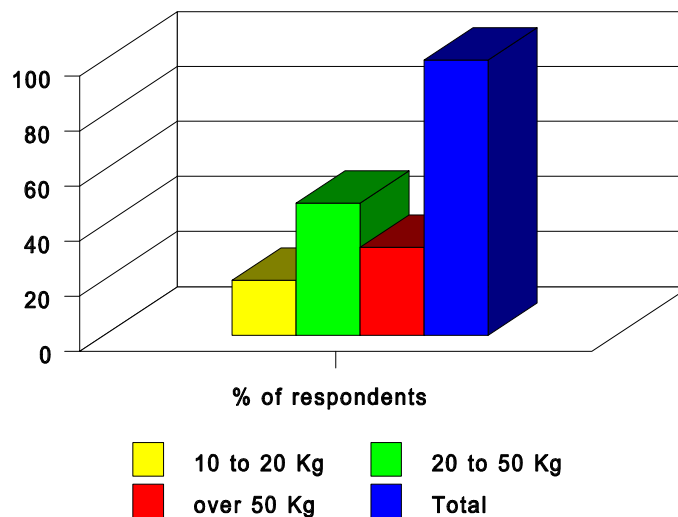
## % of fuel costs to Profits



However, other factors are more important in influencing the economic performance of the small enterprises. One important factor is initial cost of accessing energy or the equipment/devices that are needed to run with the energy source. Other factors include, access to energy, access to credit facilities, reliable market and competition, land/premise ownership or security of tenure among others. The economics of urban energy is therefore influenced by the nature the of the energy supply.

Cost of investment of the energy technologies forms a major portion of the upfront financial inputs required to start a small enterprise. For example, for a welder, cost of registration with BOC Company and the acquisition of the acetylene and oxygen gas cylinders form the major initial investment to start the business. The maintenance and fuelling of the gas is only problem number two and it is determined by the volume of work that the business owner has.

## Fuels used per day



An analysis of the source of the market of the products made by the small enterprises indicates that majority of their products are sold in Nairobi. The study shows that marketing of the products is very localised within the areas of operation. The incomes received from the operations of majority of those interviewed fall in the range of between Ksh 1000 to Ksh 5000.

<b>General Daily income</b>	<b>%of respondents</b>
1000 to 5000Ksh	76.0
5000 to 10,000Ksh	12.0
over 10,000Ksh	12.0
Total	100

Cost of fuel per day to most of the small enterprises interviewed ranged between Ksh 30 and Ksh 50. When the fuel used per day is estimated it is confirmed that rate of fuel use and cost of the fuel are less significant than access and supply.

### **2.3.2 Households**

In the households individuals can be divided into two categories:-

- < Labourers including mostly casual workers, bar attendants, vegetable vendors, domestic workers, drivers etc. The labourers have no security of income
- < Landlords (owners of the informal settlements). They have no titles to the land or the buildings. They have other sources of income and could get up to 12,000 a months from the rents and other such activities s as illicit brew production.

There are other few individuals in the periphery who have formal jobs i.e., owners of kiosks

The economics of energy use is therefore related to the above categories of the community. The labourers cannot afford expensive fuels so they depend on kerosene and charcoal, and some use firewood. The cost of fuel range from 1 to 20 Ksh per purchase. Fuel is purchased in small quantities. On average the daily consumption of fuel falls within the range of 1 to 2 Kg of fuel.

<b>cost</b>	<b>%</b>
1 to 10Ksh	21.6
10 to 20 Ksh	59.5
20 to 50 Ksh	10.8
over 50	8.1
Total	100

<b>Daily fuel use</b>	<b>% of respondents</b>
1kg	18.2
1to 2 kg	75.8

others	6.1
<b>Total</b>	<b>100</b>

The interviewees indicated that they use over 200Ksh monthly on fuel

<b>Monthly fuel cost</b>	<b>%</b>
less than 100Ksh	27.8
100 to 200Ksh	16.7
over 200Ksh	55.6
<b>Total</b>	<b>100</b>

An estimation of the prices of various fuels used by the poor indicates that over 60% of the respondents pay a range of 10 to 50Ksh per Kg of fuel. This high cost is because the buy in small quantities which are highly priced per unit of useful energy supplied.

<b>prices per kg</b>	<b>%</b>
1 to 10 Ksh	13.3
10 to 50 Ksh	60.0
50 to 100 Ksh	26.7
<b>Total</b>	<b>100</b>

The percentage of money used for energy in relation to the household income range is generally less than 20%.

<b>percentage of expenditure total income</b>	<b>%</b>
less than 20%	68.6
20 to 30%	31.4
<b>Total</b>	<b>100</b>

In summary, urban poor households purchase energy in small quantities determined by the daily requirements and daily income. If for example the daily income does not allow the individual to cook, then the option of eating outside the house e.g., in a kiosk, is often preferred.

One observation made during the study is that people living in the informal settlements have varied sources of income and not single of them can be considered sustainable.

## 2.4 Health and Environment

### 2.4.1 Small enterprises

Majority of the small enterprise owners and workers are not aware of the health impacts of their operation to their health or environment. They are aware of the bad smell from kerosene, effects of carbon monoxide in an unventilated area when using charcoal, effects of welding light to welders eyes etc. but take no precautions. It can be concluded from the interviews that there is general ignorance of occupational health and environmental hazards by the use of different fuels.

There is one potential health hazard noted in the survey. The commercial food cooks use firewood which sometimes originated from furniture workshops and the wood is contaminated paint and varnish. This may be harmful to the individuals in the long term. This applies to both small enterprises and households. There is only one report during the survey of health fears from bakery workers because of exposure to extreme heat when feeding the oven.

### 2.4.2 Households and institutions

The health problem in the use of energy by the energy poor is hidden being a myriad of problems that it are not recognised as one by the household. When asked whether there has been any health problems associated with fuel use 65.7% said there are none, despite an obvious evidence on this.

Health effects	%
yes	34.3
No	65.7
Total	100

Use of charcoal has direct and indirect impact on the environment and health of the users. Majority of the urban poor live in congested single rooms and the levels of carbon monoxide are significantly high. Charcoal dust in the storage places and in the homes is a nuisance. Kerosene fumes and smell is also a nuisance. Firewood is used outside the house but it was reported that neighbours have complained to its use because of smoke. Ventilation in the small rooms is not adequate and kerosene stoves produce fumes which are a nuisance. It is possible that the fuels used predisposes the households members to ailments such as itching eyes and running nose. The study concludes that as far as the technologies used by the urban poor are concerned, there is clear indication that environmental problems viewed as normal, and thus not identified as a problem by the urban poor communities. Open fire cooking exposes the food to dust. Some use cardboard to cover the food while others leave it open.

The charcoal stove is commonly used by the poor urban dwellers and therefore all environmental problems associated with it are experienced. Firewood is used in the institutions and therefore

smoke the main environment problem in both indoor and outdoor cases.

## **2.5 Problems and opportunities**

### **2.5.1 Small enterprises**

The problems the small enterprises operated by the poor sections of the urban society face are enormous . They range from lack of security of tenure in relation to the premises to legal problems associated with the place where the work is situated. Most of the activities are situated in the informal settlements where land ownership is a problem. The houses that they operate from are rented or they operate from makeshift premises. However, there are those that are located in areas designated by the council, church organisations or the government for their operation but they face the same problems as the ones in the other areas except for the scale of the problem. The main problems identified in the areas areas where the study was conducted( Gikomba, Shauri moyo, kariobangi light industries, Dandora, Buru Buru NCCCK and Kangemi) include:-

- < They are located in areas where accessing energy is a problem. For instance, in Shauri moyo and Kangemi areas, some are located in residential areas. In the NCCCK areas, the operators do not own the sites where they operate from so accessing electricity is a problem. Accessing other forms of energy is not a problem as that of accessing to electricity . In Kangemi, Dandora and Gikomba, the operators do not have permanent sites and in many cases they are not secure and they cannot legally be connected to electricity. However, they have arrangements with those connected which allows them to pay an agreed amount of money at an agreed rate. This makes the cost of operations high. Other small enterprises such as welding, motor vehicle repairs, paint spraying and casting of metals are located in areas with Temporary Occupation Licenses TOLs that requires the council to write a no objection letter before they are connected with power.
- < Most of the small enterprises do not have enough money to install three- phase electric output. It is reported by another study that it costs from Ksh 70,000 to Ksh 90,000 to install a three phase electric transformer. This is beyond what most small scale enterprises can afford
- < In some areas, the small scale enterprises are unable to connect to power because the existing transformer is overloaded

### **2.5.2 Households and institutions**

There are obvious problems facing the urban poor in the use of energy which is mainly related to the type of shelter that the households have. They affect the possibility of moving up from one fuel source to the other. They affect the freedom of choice and the households are forced by the circumstance to use what is suited to the type of shelter that they have rather than sometimes the money. For instance, although use of Liquefied Petroleum Gas (LPG) could solve many of the problems they are facing, and despite the fact that it is costly to acquire the system, fire hazards apparently plays a significant role in determining the adoption of such a technology in those areas. The households cannot have access to electricity because the houses they live in are not legally allowed to have electricity because of ownership and land issues.

The institutions that serve the urban poor also face a serious problem as they cannot afford to upgrade from use of firewood to gas or electricity as most of them are voluntary organisations and they depend on charity.

Almost all (97.3%) fuel supplies are purchased in Nairobi, except for 2.7% which is supplied from outside. It should be pointed out that the origins of charcoal is entirely away from Nairobi. This manifested on the time taken in the search of energy. Most of the respondents(88.2%) indicated that they take less than 30 minutes to get their fuel. Only 11.8% take more than one hour to get their charcoal, kerosene, firewood from the selling points.

## **2.6 Some general aspects in the provision of energy to the urban poor**

The case study has shown that there are unique aspects in the provision of energy to the urban poor. One important aspect is the fact that poverty itself if a hindrance to the provision. There is strong indication that other aspects could be addressed to achieve significant impacts. They include: -

- < Technical aspects
- < Legal aspects
- < Environmental aspects
- < Socio-economical aspects
- < Ownership and management in the supply chain
- < Community participation in energy supply.

### **2.6.1 Technical Aspects**

The technical aspects in the provision of energy to the urban poor seems to be crucial in determine the uptake and use of the available technologies. For instance, the technologies/devise used for productive end-use purposes are very costly to the urban poor. The reason lies in the development of the technologies. The poor are not seen as a major contributor to the market of the products so they are not for them they are made for those who are able to afford. What this has done is to stifle the entrance of the poor members of the society to the ranks of the non-poor. Take for example the acetylene gas case, if only the technology is made affordable, the poor will be able to eke a living and move up the ladder from poverty to a humble life. If the electric welder was affordable, the welders who only uses charcoal would move to metal fabrication and thus get more income. The problem lies in the fact that technologies are not developed for them but for the market.

### **2.6.2 Legal aspects**

There are crucial legal aspects in the provision of sustainable energy to the urban poor. The very obvious legal problem facing the poor is the location of their premises. Poor location of small scale enterprises and lack of property rights are other problems facing the sector=s access to sustainable energy.

The fact that they live in the informal settlements makes it difficult for them to access to electricity. The cannot use LPG safely as risk of fires is great. The licensing of business is very much dependent on ownership of land or premises and particularly important is the security of tenure of the premises. All these factors are not in the favour of the urban poor in Kenya and present a very unique problem which needs very innovative concepts in accessing to them.



Ignorance on procedure, existing options, available technologies etc. are the other constraints which sometimes translate to legal aspects when procedures are flouted through ignorance.

#### **2.6.4 Environmental aspects of Urban energy in Kenya**

The environmental aspects of the provision of energy to the urban poor is the most controversial in the sense that the poor are not very familiar with environmental concerns although they are aware of some of the side effects of the use of fuel. The study revealed that they do not take environmental aspects as a problem and what is more important is living at that point of time.

Most of the fuels used in the informal sector which is dominated by the small enterprises have one or more environmental aspects. For instance, charcoal if operated in unventilated areas could cause injury as a result of carbon dioxide. Firewood produces high levels of smoke which is an environmental concern. Kerosene produces unpleasant smell. The urban poor operates without any precautionary measures. Charcoal dust is dangerous to the lungs .

The general environmental problems caused by use of energy by the urban poor is manifested elsewhere in the rural areas as most of the energy that they use originates from there. Deforestation and the cutting of trees has a major environmental impact. Charcoal and firewood are the main culprits in the destruction of vegetation second only from development of agricultural lands.

Petroleum industry in Kenya contributes substantially to the environmental problem. Oil spillage especially at the coast where it is refined. Diesel fired power generating plants produces sulphur dioxide in the atmosphere. Deposition of sludge from the oil industry in Kenya has environmental dimensions.

Most of the electricity used in Kenya is from hydro power plants. The damage to the vegetation where the dams are constructed and the concentration of minerals in the water in the dams are some of the noted environmental problems that energy generation in Kenya has caused. Most of the rivers come from the agricultural areas and chemicals from fertilisers and insecticides and herbicides find their way to the dams. The chemical content of water is quite high. Geothermal plants in Olkaria in Kenya generates substantial brine which could have serious problems to the vegetation. Fortunately for Kenya , its geothermal sites produces only insignificant proportion of hydrogen sulphide which is an environmental concern in high concentrations.

#### **2.6. 5 Socio-economic aspects**

The urban poor face many social economic complications. Most of them are casual labourers and earn a living by the day. It is difficult for them to plan ahead except when they are self employed in their small enterprises. Their decision making process is determined by what is available at that point in time. This explains why most of those found with charcoal stoves also possess the kerosene stove. It is a coping strategy so that when there is no enough money to purchase charcoal kerosene can be used and vice-versa.

The reality of the urban poor=s socio-economic status could be easily turned into an opportunity. They are a hard working lot and they take any opportunity that comes by fast and with

enthusiasm. What is required are guidance and provision of the tools for production. Energy is the surest tool coupled with credit instruments that are friendly to the poor and an energy supply concept that could operate in such situation as exhibited by the urban poor.

### **2.6.6 Different types of ownership and management in the supply chain**

Different energy sources have a different ownership and management in the supply chain. One similar aspect of all the ownership and management is that the private sector is the main player while the Government provides the policy guidelines for the operations of the energy supply sector.

#### ***Electricity sector***

The ownership of the production of electricity is under the Kenya electricity generating company and some licensed Independent power producers. The electricity producers sell the power to the Kenya Power and lighting company which is in charge of the distribution of the power to the consumers.

The Local Authorities play a significant role in the supply chain as they are recognised in the provision of the no-objection letters to the power distributor before power is connected to the consumers. There is another player though informal in the supply of electricity, the landlord. Once landlords are connected with power, they take control of its use by the urban poor and therefore plays a significant role in the supply chain. They are however, not legally bound in their role.

#### ***Petroleum sector***

The ownership and supply of power from the sector is in the hands of the international oil companies that operate the whole sale distribution of the products. They have licensed dealers who operate the filling stations and other outlets of their products. The licensed dealers sell the products to the consumers. The Government plays the part of policy guidelines and in the payment of tariffs which in most cases determines the pricing of petroleum products.

The other players in the ownership and management of the petroleum sector are, the Kenya Pipeline Company which is in charge of the management of the oil pipeline which feeds the wholesale distributors at designated points. The other player is the Kenya Petroleum refineries limited. The company is in charge of refining the crude products. The last in the chain of ownership and distribution are the small operators of kerosene and cooking gas. These are the most important to the urban poor. They buy the fuel and stock in small stores and sell to the poor in small quantities that they are able to afford. The prices are however, high compared with average prices from the filling stations.

#### ***Acetylene and oxygen gas for welding***

The ownership and management of this sector is controlled by one company the BOC Kenya limited. It is monopoly at this period as there is no other company operating this business. It registers the users of its products and the upfront costs of having the cylinders and the gases is extremely high for the small enterprises. The Government plays the role of guidance to the operations of this important sector.

### ***Woodfuel sector***

The sector's ownership and management is in the hands of traders who buy charcoal or firewood from the source usually from the rural areas and transports it to urban areas. Once the fuel reaches the urban areas, it is sold to whole salers who stores the fuel at various points. The whole salers then sell to smaller distributor. The most important player to the urban poor is the small seller. The poor buy charcoal or firewood in small quantities from the retailers. The many players involved means that the price keep on increasing from one to the other.

### ***New and renewable energy sector***

This sector is dominated by the private enterprises who manufacture, distributes and sells the products to the consumers both rural and urban. In the solar energy sector, several companies are involved in the manufacture, importation and sale of the units. They use designated depots in the country and a network of outlets in the urban areas for selling their products. In the battery industry, the same arrangement is in place. The biogas industry not well developed and its ownership and management is confined to individual operators.

### **2.6.7 Community participation in energy supply projects**

The community is not highly involved in many energy supply projects unless the project is developed for the community. The main reasons are that the energy industry in Kenya is almost fully controlled by the private sector and the market forces determines which direction it is heading. There are however, a few community energy projects but only involves limited community members in the urban set up. Action Aid an international NGO had one project in Nairobi, Help self Help Centre had a paper briquetting project, and the Undugu society a charcoal briquetting project. These are just but some of the notable energy projects. It seem that this has contributed to the low recognition of the problem faced by the urban poor and how the energy sector can be used to spur the development of the small and micro enterprises.

### 3. Conclusions And Recommendations Drawn From The Case Study Experiences

This case study has revealed very important attributes of the use of energy by the urban poor. Poverty is the limiting factor in the use of sustainable energy by the urban poor, rather than the availability of resources. One interesting revelation from this study is that the urban poor have not benefited significantly from any of the energy policies in Kenya. The policies that control the petroleum industry are more in favour of the transport sector and therefore kerosene although cheaper than petrol and diesel is still costly in relation to the incomes of the poor.

Wood fuel prices are determined by the market. The charcoal market is complex, as charcoal is used by both the rich and the poor, so there is no specific policy that has been formulated to target the poor. Electricity is inaccessible because of many reasons. The main ones are legal in nature as result of the informal nature of the places where the urban poor live. LPG is expensive as the cost of the cylinder and the cooker are beyond what the poor can afford.

However, there are many opportunities that can be exploited to reach the energy requirements of the urban poor. They include:-

- < Perhaps the most sure way of getting high value and sustainable energy to the poor is to make it reach to the small enterprises, as they have recorded the highest level of employment of the urban poor. This has two advantages, it will help them uplift their level of income which will make them shift to higher grade fuels as a natural response. It will create employment thus mitigating increase of new entrance in the poverty circle. This could be regarded as a way of enabling the poor participate in primary production where the poor households would produce and earn more in order for them to be able to feed for themselves on a sustainable basis.
- < The best way in the short term of improving access to sustainable energy in the small enterprises is by locating the enterprises in areas where they are easily accessible to electricity. This may be difficult initially but local Authorities could be encouraged to collaborate with the Kenya power and lighting company to provide *metered electricity booths* for use by small enterprise. This a new concept of power provision and may require to be tested before it is applied on a wider. One way of doing it is by grouping the small enterprise operators from the poor section of the community together, formalise the group, and identify an appropriate space for their operations with the help of the local authorities. The next phase is to invite the power provider to erect a power booth that could be used by the group. The power booth will be metered according to the structure and management of the group. It envisaged that such a move would greatly boost the productivity of the sector. Electricity cannot be provided to temporary occupants of space, an illegally owned plot or house. It is important that the small enterprises are formalised to enable them have access electric power.
- < For the small enterprises to be recognised by the Kenya power and lighting, they are supposed to be re-organised in a formal manner. This could be facilitated by licensing them in groups by areas where they are operating. The task lies with the local authorities.
- < Competition in the availability of acetylene gas and oxygen which today is owned by a monopoly should be encouraged. The Government through the ministry of energy could look at ways of reducing tariffs of imported acetylene or encourage production of acetylene gas in the country.
- < Projects geared to the provision of energy to small enterprises should be developed as

the small enterprises have peculiar problems ranging from the technologies that they use to accessing energy in its usable form.

- < There are opportunities of using the urban poor sanitation problem for commercial production of gas for sale using the current technologies. This will require an investment on the side of technology . The urban poor could be involved (with the local Authorities) in the manufacture of biogas from raw sewage from the informal settlements which is currently a health hazard for bottling using special cylinders designed for that purpose. The gas could be sold to willing buyers in the open market. The funds generated from the sale could be used to benefit the poor. That could form the bases for an integrated urban energy and sanitation system.
- < Innovative ways of providing credit for energy to small enterprises could greatly improve the access to sustainable energy to the urban poor. This would require an audit to be done to explore the intricate areas that needs special attention before this could happen.
- < Identification of investments that would encourage access to energy for the small enterprises

### **Appendix one: Institutions visited**

- 1) Kianda Health Centre (MSF), kibera.
- 2) USAID, Environmental Dept.
- 3) Ministry of Energy
- 4) World Bank
- 5) Undugu Society
- 6) Action Aid
- 7) Kabiro Solar Jikos
- 8) Redeemed Church , Korogocho
- 9) Imani Rehabilitation centre, Kayole
- 10) Kianda Health Clinic(MSF), Kibera

### **Extra sources of information**

Central Bureau of Statistics CBS

Opinion leaders in Kibera

Undugu Social workers

others

Charcoal dealers, Firewood traders

## **Appendix Two: General Background From the Terms of Reference**

The bulk of energy consumption in developing countries occurs in urban areas. Urbanisation is increasing pressures on the infrastructure and resources of the rapidly expanding cities of the South. Access to energy resources for cooking, heating, mechanical power and lighting, which are basic requirements of life, impacts significantly on poor urban communities and their environment. The choice and consumption of fuels for household energy in urban areas are complex matters, affecting household income, family health, social structure, local and national environment and technology choice. Agencies are putting increased effort into addressing these questions and there is now a need to share their experiences and ideas to promote a more sustainable and acceptable solution to problems of energy provision in urban areas.

### ***Response***

Consequently, the UK Department for International Development (DFID) have identified energy area as a future priority for its projects on urban poverty. DFID has commissioned Intermediate Technology (IT) to identify the options for increasing access for the urban poor to higher grade and more sustainable forms of energy. The outputs will be dissemination in an issue paper to assist DFID to include energy in its urban poverty programme. The outputs will also be disseminated more widely through publication in journals and reputable conferences.

### ***Scope***

The project commissioned case studies from India, Kenya, South Africa, Peru and Mali on the following themes:

- ! Access to energy (especially non-technical barriers)
- ! Low cost electrification options
- ! Energy for small enterprise
- ! Cooking fuels and technologies
- ! Energy service provision (supplying energy needs)
- ! Economics of energy for the urban poor
- ! Health and environment

Each country case is focusing on selected topic. There are three topics that are cross cutting issues for all case studies.

## **THE KENYA COUNTRY CASE STUDY TERMS OF REFERENCE**

### **Main objective of the study**

To identify key issues which have to be addressed in order for the poor urban communities to access higher grades and more sustainable forms of energy.

### **Outputs from the study**

The output from this project is a report which will cover:

- ! A description of the current status of urban poverty and access to energy in Kenya.
- ! Between 3 and 10 detailed case examples of actual cases

! Conclusions and recommendations drawn from the case study experiences

### **Case Study requirements**

This consultancy is to produce detailed case examples which will inform the bigger project, so that the project recommendations are based on real case examples. The case studies from Kenya should concentrate on the following two themes:

- ! Energy for small scale enterprise
- ! Cooking fuels and technologies .

Cross cutting themes which should be considered in all case studies are:

- ! Energy service provision (supplying energy needs and the services to maintain supply)
- ! Economics of urban energy
- ! Health and Environment

It is intended that these case studies cover problems and opportunities for each of the case studies, in particular with respect to *the technical, socio-economic, legal and environmental aspects*. The examples will illustrate success or failure of a particular initiative. They should *identify the key stakeholders and their role* in the energy scheme. In some cases the interface with rural areas may also be addressed.

The case studies for Kenya are based around a particular energy need in specific location where the urban poor are found. The study based its discussions on the existing energy policy objectives and looked and commented about the different types of ownership and management in the supply chain and community participation in energy supply projects



## **Appendix three: Guidelines to the issues and questions**

### **General information**

Questionnaire No.

- 1) Name of interviewee
- 2) Name of interviewer
- 3) Day of interview
- 4) Location/Place

### **Personal Details**

- 6) Approximate age of interview
- 7) Male or female
- 8) Daily occupation/activities

### **Cooking fuels and technologies**

- 9) What fuels are used (all) in order of use and preference
- 10) How much is spent on each
- 11) where they are purchased/origins if not purchased
- 12) Are the supplies adequate?
- 13) How much they use on per day or week or month basis
- 14) How much it costs
- 15) What foods are cooked normally
- 16) How many times are foods cooked or eaten or re-heated?
- 17) Number of people eating with you in the house.
- 18) What devices( stoves, heater, burners, cookers, lamps, lanterns, etc) are used for lighting or cooking
- 19) Do you always get the fuel when you need it? In the right qualities? Would you prefer another system of supply? What you prefer another fuel than the one you usually use? Give reasons.
- 20) What are the prices of the various fuels that you use?

### **Energy for small scale enterprise**

- 21) Type of enterprise?
- 22) What are the activities in the enterprise?
- 23) What technology /device is used in each activity
- 24) Where are the supplies got from?
- 25) what are the prices of the fuels
- 26) are the fuels adequately supplied?
- 27) What are the problems faced in acquisition of the fuels or technologies or marketing or what are the problems associated with the fuel
- 28) What market do they serve?
- 29) is use of the fuel a nuisance?
- 30) what percentage of the profits goes to fuel
- 31) What are the approximate income from the enterprise on daily basis on a busy day? How much fuel do you use in such a day? How much does it cost?
- 32) What other alternatives can you use? Why don't you use it?

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