Fuel Substitution – Poverty Impacts on Biomass Fuel Suppliers

DfID KaR project no R8019

Country Status Report

Ethiopia

1. **Historical Perspective**

    1.1. Background: Earlier Days
    1.2. The Two Oil Shocks (1970s)

2. **Household Energy 'Crisis' and Government Responses (1970s to 1980s)**
    2.1. The 'Crisis' in Focus
    2.2. Supply Enhancement Interventions
    2.3. Demand Management Interventions
    2.4. Inter-fuel Substitution Measures

3. **Current Household Energy Status Impacts of Interventions**

(to be written up)

    3.1. Traditional Fuels
    3.2. Modern Fuels

1. Historical Perspective

1.1 Background [1880s to 1970s]

Historically, traditional fuels are the sole source of energy in Ethiopia. Owing to various socio-economic and technological reasons, traditional fuels continued to dominate the energy landscape of the country to this date. Available literature indicates that establishment of the capital, Addis Ababa, (1880s) is closely linked with availability of trees for construction and energy purposes. Owing to fuel wood and construction poles shortage he faced, Emperor Menelik II (1862 to 1907) abandoned Addis Ababa and moved the capital to Addis Alem (45 kms West of Addis). It was later on when eucalyptus trees were introduced and the Emperor was convinced that the new fast growing trees could alleviate the problem that the capital was moved back to its present location. It is the footprints of those days that one can see eucalyptus vegetation on the Entoto hills (North and North-west of Addis) today.

Fuel wood shortages in the capital during those days, however, do not represent the situation nationwide. It is rather confined to Addis Ababa and associated with urbanization and presence of massive military and administrative personnel around the Emperor in the capital. Although the statistics are conflicting and inconclusive, some sources indicate that the country's forest cover was by far better (16% in the 50's) than what it looks today (below 3%). In fact, Ethiopia was a net exporter of tree products including charcoal to neighboring Djibouti and the Middle East as recently as 1960s.

1.2 The Oil Shocks of the 70s as a Landmark

Like many other developing countries, the two oil shocks of the 70s were the most significant landmarks in the energy sector of Ethiopia. Prior to the oil shocks efforts and interventions were very much limited and geared towards modernizing the then booming economy through rapid electrification and introduction of 'modern' (improved stoves as a component of community or integrated rural development effort) cooking techniques. With exception of electricity, energy as an issue came to the attention of the government only after the oil crises that hit the economy hard. In fact, there is a popular belief that the oil crises of those days, through its adverse economic impacts, had played a pivotal role in bringing an end to the Imperial regime of Emperor Haile-Selassie. Market prices of petroleum products and fuel wood, like those of many other commodities, hiked resulting in spontaneous civil unrest, which culminated in the outbreak of the 1974 popular revolution.

One of the most significant achievements of the 1974 revolution is the abolition of the feudal system of land ownership in Ethiopia. Both urban land and rural agricultural land was confiscated from feudal landlords and made public property. Since then, rural farmers have the right to use the land and pass it onto their children by way of inheritance. But, they cannot sell or mortgage it –major constraint. There is a popular belief that the fact that farmers have usufruct rights is serving as a disincentive for proper land development and conservation of natural resources, including trees, on their land. It is also believed that such 'public good' nature of land and tree resources, which leads to unsustainable management and utilization, is the main cause for rapid depletion of forests and consequent adverse environmental impacts in Ethiopia.

Institutionally, the Ethiopian National Energy Committee (ENEC), comprising representatives from relevant sectoral ministries and a secretariat under the auspices of Ministry of Mines and Energy, was established in 1975 in order to respond to the crises that shook the economy badly. The rest of this paper will discuss, in relation to fuel switching, major events and inter-temporal changes that took place, major interventions undertaken and impacts made, and developments and outcomes achieved since the global energy crises of the 70s.

II. The Household Energy 'Crisis' and Interventions of the 80s

2.1 The Crisis in Focus

Despite its immense role for the overall socio-economic development of the nation, the traditional energy sector of Ethiopia was almost unknown until early 1980s. In the past, energy (and associated environmental problems), except electricity and petroleum products, was not given the kind of attention it deserves. It was only after extensive studies made in the sector and their alarming findings and recommendations in the early 80s that traditional fuels started to attract the attention of the government and donors. Findings and key recommendations of the energy sector studies of the early 80s can be summarized as follows:

- *traditional fuels are the major source of energy meeting over 94% of the demand nationally,*
- *the household sector is the major consumer of energy (90%) and this demand is being met by traditional fuels almost entirely,*
- *since demand for traditional fuels exceeded sustainable supply limits, environmental and economic (agricultural productivity) consequences of further extraction of tree resources without interventions are far-reaching,*
- *supply scarcity of traditional fuels made prices unaffordable for urban consumers and costly (in terms of time and effort) for rural households. Consequently, household consumers are forced to use less desirable residue fuels such as cow dung, agricultural residue and factory waste,*
- *household energy utilization was characterized by enormous energy inefficiencies suggesting that there is considerable room for improvement,*
- *coherent policies and strategies were lacking to guide projects and programmes in the energy sector,*
- *as a result of all of the above, there is a perceived household energy 'crisis' in Ethiopia, and this needs to be addressed immediately and coherently to alleviate the problem.*

Based on their 'conclusive' findings, the studies also recommended three types of intervention strategies that the government should pursue to address the household energy problem and related environmental concerns. These were **(a) supply augmentation, (b) demand management, and (c) inter-fuel substitution.** Details of these three interventions are discussed below.

2.2. **Enhancing Supply of Traditional Fuels:** GoE in collaboration with international donors embarked upon state-owned large-scale afforestation programmes in many parts of the country. This included major peri-urban fuel

wood plantation projects such as Addis-Bah, Nazreth, Dessie and Gondar. Farmers were also encouraged to plant trees on wastelands around their communities. Despite some ownership and management problems, these plantations are still running under state ownership. Since the change of government in 1991, however, there has been a downturn in afforestation efforts.

2.3. **Demand Management:** A number of demand management interventions aimed at improving both conversion and end-use efficiencies of traditional fuels (firewood and charcoal) were carried out between 1985 and 1995. Among these were **Charcoal Production Pilot Project and Cooking Efficiency Improvement and New Fuels Marketing Project** both of which fall under the DANIDA and World Bank funded Energy I Project. The Energy I Project embraced about eight sub-projects all of which were designed to contribute to alleviation of the household energy problem through introduction of improved stoves, conversion efficiencies and marketing of new biomass fuels such as briquettes. Furthermore, the projects were expected to generate information for policy makers and institutional capacity building through training within the sector. The array of sub-projects under the Energy I included the following:

1. *Cooking Efficiency Improvement and New Fuels Marketing Project,*
2. *Woody Biomass Inventory and Strategic Planning Project,*
3. *Biomass Fuels Supply and Marketing Review Project,*
4. *Energy Planning and Training Project,*
5. *Charcoal Production Pilot Project,*
6. *Crop Residue Briquette Project*
7. *Monitoring and Evaluation of Crop Residue Briquette Project, and*
8. *Industrial Energy Auditing Project*

On the demand management side, in terms of making beneficial impacts on household energy utilization pattern, end-use efficiency improvement and domestic energy mix, improved stoves project, which was conceived in mid 80s and implemented in the first half of the 90s, has achieved stunning success.

The Lakech improved charcoal stoves with an overall energy savings of about 25% in actual cooking conditions was 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.

Another improved stove that was commercialized successfully was the ‘Mirte’ biomass Injera stove. Work on this stove was started in 1994 and two years later close to 60,000 stoves were produced and marketed independently by the commercial private sector artisans. With an overall energy savings of up to 50% and estimated sales volume of about 50,000 units per year, impacts of the stove in terms of affecting the urban household energy landscape is believed to be simply enormous.

Furthermore, the fact that the stove was modified for commercial application (where the stoves are used everyday for several hours) and burn any combustible biomass meant that tens of thousands of commercial and

institutional consumers are using it, which means thousands of tones of woody biomass is saved each year. Although it was documented that these stoves had had considerable beneficial livelihood impacts on household and commercial consumers through savings on their energy expenditure, several biomass suppliers might have been displaced and or lost their jobs due to less demand for their supplies. Therefore, such undesirable, but often inevitable impacts need to be investigated thoroughly under the current project to determine the livelihood impacts of possible reduction of demand for biomass fuels on traditional fuels suppliers.

2.4 **Inter-fuel Substitution:** Despite acute fuel wood shortages and political will and responsiveness to address domestic energy problems using every possible means, in the past, there were no well articulated set of policies and strategies that systematically guide efforts and interventions in the energy sector. Interventions made by the government had a nature of 'crisis management' instead of systematic and planned approach to address the problem and provide lasting solutions. As a result, the sector was guided by a long wish list of unwritten policies, which sometimes were translated into directives intended to control, rather than regulate, activities and development initiatives in the energy sector. Between mid 1970s and early 1990s, government (through donor support) assumed almost exclusive responsibility for investment and programme interventions in the energy sector. Some of these policy related interventions made in the 80s include the following:

a. ***imposing strict control and ban on trafficking of traditional fuels****: Five checkpoints were established around Addis to control trafficking of traditional fuels in to the city. For most parts of the 80s, biomass fuels suppliers were harassed, confiscated and even thrown to jail for transporting fuel from surrounding plantations owned mostly by the state. The ban was much more strict on charcoal than other fuels. However, this did not stop people from bringing in these badly needed commodities to the city. Either by bribing the guards at the checkpoints or by avoiding the checkpoints and using neighborhood roads, or traveling at night to avoid detection by the guards, rural farmers and urban poor, mainly women, continued to supply the city with traditional fuels throughout the period.*

b. ***establishing public enterprises to supply and market traditional fuels:*** *As part of its attempt to curb fuel shortage; and mainly as part of its socialist ideologue of 'protecting the poor from sabotages of businessmen', the government established a public enterprise Charcoal and Fuel wood Production, Processing and Marketing Enterprise (CFPPME) around 1986. Several traditional fuels depots were established in Addis and other major urban centers. Firewood and charcoal was supplied (at subsidized prices) to households with ration cards. At the peak of its operation the enterprise managed to cover about 17% of supply to Addis in 1988. The enterprise died a lingering death soon after the collapse of the socialist regime in early 1990s.*

c. ***subsidizing electricity and introducing electric Injera Mtads****: Due to economic hardship during the repressive communist regime, the economy was not strong and active enough to consume whatever little amount of electricity was generated. Hence, electricity tariff remained very low and the domestic tariff*

subsidized. Besides, the utility as part of its demand creation strategy, embarked upon production and marketing of electric Injera Mtads at very low prices compared to the private sector. In addition to improving sales volume for the utility, the purpose of this venture was to encourage consumers to shift from biomass to electricity for Injera baking. Transition from biomass to electricity for Injera baking was so rapid that ownership of electric Injera Mitads made a big leap from 13% in mid 80s to over 70% in mid 90s in Addis Ababa. With a modest liberalization of the economy after a new government took power 1991 demand for electricity increased considerably leading to a "rethink" about the then existing low tariff. Electricity tariff revision was introduced in 1994 where the old regressive tariff gave way to more progressive one using phased approach over a number of years. However, although average domestic tariff has more than doubled, electricity is still subsidized for domestic consumers. As part of inter-temporal change that resulted due to the increased tariff, considerable number of domestic consumers had abandoned their electric Injera bakers and reverted back to traditional fuels over the past few years.

d. ***subsidizing kerosene and removing import barriers on kerosene stoves****: Use of kerosene as a household cooking fuel was almost unknown in 1980. As a short term bridging strategy to buy time for peri urban plantations to be established, the government removed all import barriers on kerosene stoves and embarked upon massive importation of the stoves, which reached over 600,00 between 1983 and 1987. With over 90% of the Addis households owning kerosene stoves currently, Ethiopia had completed its transition from no kerosene (1980) to full-scale penetration in mid 1990s.*

III. Current Status of Household Energy and Impacts of Interventions

3.1 Traditional Fuels:

3.1.1 General

Policy directions pursued and resultant programme interventions (see II above) carried out throughout 1980s, and onwards, have changed the household energy landscape considerably. Among others, in Addis Ababa for instance, transition from "no use" of kerosene as a cooking fuel in the 80s was almost completed (95%) in mid 1990s. Ban on movement and trade of traditional fuels was lifted allowing for more people to enter (exit from) the market. With massive penetration of electric *Mitads*, electricity became the major source of energy for *Injera* baking among all strata (over 70%) of households. Improved stoves that were almost unknown in the 80s made major in-roads in all major urban areas; and energy efficiency improvement efforts are being pursued consistently since then. The following section will discuss current household energy situation as a result of policy and programme interventions pursued in the past.

3.1.2 Fuel wood

Fuel wood Suppliers, intermediaries and Consumers:

- Liberalization of the macro-economy resulted in free movement and trade of fuel wood. Furthermore, liberalization is also believed to have brought about more commercial food catering establishments such as commercial Injera bakers that use primarily fuel wood for their cooking needs.
- Perhaps due to lifting of the ban and increased distance of sources of supply, motorized transport assumed greater importance.
- Market prices of firewood have shown remarkable downturn trends over the past several years, which might have attracted more consumers.
- Sizes of bundles have shrunk consistently over the years.
- Numbers and volumes of private fuel wood depots increased by many folds mainly due to integration of fuel wood trade with that of construction poles by depot owners.
- The boom in construction industry in recent years has also contributed to increased supply of fuel wood through sale of poles used for scaffolding.
- Although it is hard to determine the volume of supply without proper inflow survey and measurement, it is evident that numbers of market locations, intermediaries and retailers have increased considerably implying likely expansion of the sector.
- Owing to convenience and fuel economy of improved biomass *Injera* stoves in the face of increasingly growing electricity tariff, more households and commercial establishments are using fuel wood for their cooking needs.

3.1.3 Charcoal

- Despite some official discouragement of the charcoal trade mainly at points of production, the charcoal market has expanded over the years and it is easily available.
- Sources of supply are primarily pockets of natural acacia woodlands in the central Rift Valley region up to 500 kms South and East of Addis.
- Production techniques are traditional earth kilns with very low conversion efficiencies.
- Due to illicit nature of the trade, medium trucks bring in supplies after mid night.
- Despite consistently shrinking volumes of sacks and changes in packaging that is meant to make detection of poor charcoal quality difficult, retail prices have not changed much over the years.
- Charcoal is used almost by all categories of households for the more important Ethiopian coffee ceremony over improved (Lakech) and traditional charcoal stoves. Its use for other domestic cooking is limited. Use of charcoal for commercial cooking is rather insignificant.
- Currently, there are efforts to introduce efficient charring techniques and non-acacia tree species for charcoal making.

3.1.4 Other Traditional Fuels: BLT, Cow Dung and Others

- Use of BLT, which was started during the 'household energy crisis' of the 80s, has continued to this date claiming considerable share in domestic energy mix.

- BLT is used almost exclusively for *Injera* baking, which requires steady and widespread flames under the plate.
- Volume of supply of cow dung for cooking seems to have gone down in recent years.
- Cow dung is used primarily for baking special homemade bread during festivities.
- Other residue fuels that are produced within the city such as saw dust; cottonseed and coffee husk are being used for *Injera* baking increasingly.
- The advent of improved biomass *Injera* stoves, which burn any biomass well and do not require separate kitchen (ownership of private kitchen in Addis is below 20%) seems to have encouraged many consumers to use these residue fuels.

3.1.4 Improved Biomass Burning Stoves

'Lakech' Charcoal Stoves:

- Addis Ababa 70% of the households,
- Other major urban areas 50%
- Other small urban areas 20% to 30%
- It is purely private sector commercial operation
- Product quality problems that had existed few years back resolved
- Estimated energy savings 25% over traditional charcoal stoves
- Prices range between Etb 10 and Etb 30 depending on quality
- There are no other ongoing improved charcoal stove programmes currently.

'Mirt' Improved Biomass *Injera* Stoves:

- It is designed exclusively for *Injera* baking with an overall thermal efficiency of over 20% over three stone fire,
- Currently, an estimated 200,000 stoves are distributed through existing marketing channels,
- The majority of consumers are Addis households and food catering commercial establishments,
- Currently, the GTZ supported HHE project is promoting the domestic version of the 'Mirt' in several urban areas of Ethiopia.

(to be continued from here)

3.2 Modern Fuels

3.2.1 General situation

Description of general country situation and the most recent developments. This should be quite specific about:

- Percentage market shares of different fuel supplies and end uses
- In country availability of main resources for the different modern fuels (e.g.: oil, hydro etc.)
- Relevant ongoing energy programmes

3.2.2 Electricity

Electricity Suppliers
Brief description of the type, size, key locations, and status of producers, including recent changes (e.g. sector expansion rate, electrification, etc)

Electricity Consumers
Brief description of the type and status of urban consumers.
Indicate drivers for switching of this source, including current price levels
Describe technologies used in energy conversion

3.2.2 LPG

LPG Distributors
Brief description of the type, size, key locations, and status of distributors, including recent changes (e.g. sector expansion rate, etc.)

LPG Consumers
Brief description of the type and status of urban consumers.
Indicate drivers for switching of this fuel, including current price levels
Describe technologies used in energy conversion (e.g.: LPG bottles, lamps etc.)

3.2.3 Kerosene

(Describe as per LPG section)

3.2.4 Other Fuels

(Describe as per LPG section)