FUEL SUBSITITUTION – POVERTY IMPACTS ON BIOMASS FUEL SUPPLIES

COUNTRY STATUS

UGANDA

JANUARY 2002

1.0 TRADITIONAL FUELS

1.1 GENERAL SITUATION

Biomass, principally fuel wood and charcoal, is in quantity terms the most important energy source in Uganda. Wood fuel (firewood and charcoal) on both non-commercial and commercial basis constitutes 88% of energy consumed in the country. Basically any dry material can be used as a source of wood fuel. Sources of these dry materials are mainly trees and bushes, which occur in all types of land cover use e.g. forests, woodlands, bush lands, agricultural farms etc.

Table 1: Woody Biomass Availability

Land Cover (use)	Gross	Protected	Available	Total Biomass	Protected	Available
	Area (km^2)	Area (km^2)	Area (km^2)	(, 000t, Air dry)	(, 000 t, Air dry)	(, 000 t, Air dry)
Broadleaved Plantations Total	188. 9	66. 7	122.2	1,431. 2	1505. 65	925. 55
Bushlands Total	14,221. 9	8,626. 7	5,595. 2	14,961. 3	8,102. 34	6,858. 96
Grasslands Total	50,721. 1	23,163. 4	27,557. 7	58,560. 8	27,522. 52	31,038. 28
Impediments Total	37. 4	11. 4	26. 0	0.0	0.00	0.00
Large scale Farmlands Total	684. 5	22. 6	662. 0	0. 6	0. 00	0. 60
Softwood Plantations Total	163. 9	156. 9	7. 0	2,456. 5	2,353. 50	103. 00
Subsistence farmlands Total	84,007. 1	4,985. 7	79,021. 4	104,534. 3	4,346. 80	100,187. 50
Tropical High forests Total	6,511. 1	4,763. 4	1,747. 7	145,847. 8	106,700. 83	39,146. 97
Tropical High Forest (degraded)	2,730. 6	971. 5	1,759. 1	30,855. 5	10, 978. 29	19,877. 21
Water Total	36,895. 6	270. 5	36,625. 1	0.0	0.00	0.00
Wetlands Total	4,840. 3	535. 8	4, 304. 5	0.0	0.00	0.00
Woodlands Total	39,744. 6	13,726. 5	26, 018. 1	118, 474. 2	40, 728. 35	77,745. 85
Built up areas Total	365.8	26.0	339.9	47.4	3.72	43.68
Grand Total	**241,112. 8**	**57,327. 0**	**183,785. 8**	**477,169.6**	**201,242. 00**	**275,927. 60**

Source: MEMD

Table 2: Estimated Annual Sustainable Supply of Traditional Fuels, in 1993

	Million Air dry tons	Percentage
Wood Biomass	21.0	72..0
Residues	5.4	18.5
Animal Dung	2.8	9.5
Total Supply	29.2	100

Source: Uganda Energy Assessment Report – 1995

Of the estimated total annual supply woody biomass such as bush lands provide 30% and woodlands 20%. Agricultural areas provide the balance, half coming form fallow land and the other from arable lands, mainly small farms.

Wood fuels provide the energy for cooking and water boiling for most rural and many urban homes. They are also important for rural industry, especially for the production of building materials, such as bricks, tobacco curing, tea processing, fish drying and commercial enterprises in urban areas, such as restaurants and bakeries.

Wood fuel will continue to be the dominant source of energy in Uganda for the foreseeable future. Even if the entire hydroelectric potential in Uganda were fully utilized (about 2000MW) wood would supply more than 75% of the total energy consumption in year 2015.

The National Energy Policy recognizes the role energy supply improvement in rural areas is likely to play thus the need to include biomass in the realms of national energy planning. It also recognizes that wood fuel harvesting contributes to degradation of forests as wood reserves are depleted at a rapid rate in many regions, the impact on the environment, health of the end-users and the burden of collecting firewood on women and children.

The scarcity of wood fuels in some parts of the country can be addressed through demand side (households, institutions, industry and commerce, transport and agriculture) management, which includes the use of energy efficient devices and alternative sources. In this respect, the use of improved stoves is high on the Government's agenda for promotion. The use of petroleum based products, e.g. LPG and Kerosene for cooking is limited, but is being encouraged.

1.1.1 Forestry/environmental/land use policy in place affecting production of charcoal/fuel wood

Uganda's forests and woodlands are viewed as the mainstay in the three pillars of sustainable development: economics, society and environment. The forest policy recognises that Uganda's forest resources provide energy, supplying 93% of national energy demand. Gazetted forest reserves, which cover about 40% of the total forest area in the country, are not the major source of biomass energy for current and future demand. About 35 million cubic metres of firewood are consumed annually way above the total annual allowable cut of 350,000cubic metres for all reserved forests. Since these forests still have growing stock it implies that bulk of biomass used for energy is mainly obtained from areas outside forest reserves.

1.1.2 Relevant ongoing energy programmes

- ***Ministry of Energy and Mineral Development***

The MEMD is implementing the Sustainable Energy Use in Households AND Industry (SEUHI), a three-year project supported by the Netherlands Government. The objective of this project was to improve efficiency in energy conversion and use in the households and small-scale industry. The project addresses rural and urban household stoves in Kampala, Soroti, Adjumani, Kabale and Tororo; charcoal production in Luwero, Nakasongola and Masindi; lime production in Kasese, Kisoro and Tororo.

- ***Rwenzori highlands Tea Company***

The company consists of 6 tea estates namely; Bugambe, Kisalu, Muzizi, Mwenge, Kiko and Ankole Tea Estate.

The Biomass initiative started in 1994 emphasises production and utilization of fuelwood. Three estates (Mwenge, Kiko, and Ankole) have planted 465.6 ha of Eucalyptus (excludes area planting before 1994) managed at a rotation of 6 to 8 years. Over mature eucalyptus fuel wood produced 480 kg of made tea/m3 of fuel wood as compared to 320 kg of made tea/m3 of fuel wood from 6-year-old crop. RHTC has introduced efficient wood fired steam boilers in two estates (Mwenge and Ankole). The new boilers improved fuel wood consumption from 220kg of made tea/m3 of fuel wood to 320- 480 kg of made tea/m3 of fuel wood, a 31% to 54% reduction in fuel wood consumption. The company also uses efficient wood burning cook stoves to prepare food for factory workers.

- ***British American Tobacco/Universal Leaf Tobacco***

Substantial amount of energy is required to cure tobacco. The curing process is a crucial step in the ultimate quality of tobacco. Subsistence farmers do 95% of the growing and curing of tobacco. BAT supplies growers with agro inputs, which includes transportation of fuel wood and distribution of tree seedlings. Over 15 million seedlings were distributed in 1999 and 2000. However since there is limited monitoring of tree planting, the number of trees surviving on farmland may be far less. BAT has introduced an energy efficient tobacco-curing barn, which use 10 m3 of fuel wood per 1,000 kg of cured tobacco as compared to the traditional method, which uses 20 m3 of fuel wood.

- ***Joint Energy and Environment Project (JEEP)***

Since 1983, JEEP has been involved in energy and environment issues. JEEP concentrates on training and creating awareness on energy, environment and sustainable agriculture. JEEP has a membership of over 500 members and 30 groups of youth, women and farmers.

Currently JEEP' s thrust is in training of, trainers in among other topics; energy conservation and alternative fuels, construction of fuel saving cook stoves, other energy saving household technologies and tree planting.

In order to generate income to offset their overheads, JEEP plans to step up marketing of institutional stoves and improved charcoal stoves. JEEP has also acquired land where it plans to establish a training and demonstration center. Improved stoves, tree planting and biogas will be some of the key activities at the center.

- ***Integrated Rural Development Initiatives (IRDI)***

Integrated Rural Development Initiatives was conceived in February 1994 by a group of people with experience and interest in environment conservation; and, rural and peri-urban development. The majority of the population resides in the rural and peri-urban areas where they depend on agriculture for their survival. Coupled with this rural people depend on biomass energy for their cooking and heating needs. IRDI therefore aims to reduce environmental degradation, promote sustainable utilization of natural resources and improve the social economic status of the communities especially the marginalized groups. IRDI promotes the use of renewable energy technologies with emphasis on training trainers in mud stove construction and use, use of a hay basket and construction of biogas plants. IRDI currently operates in Kampala, Mpigi, Mukono, Rakai, Mbale and Kamuli. The Cross Border Biodiversity Project, Ministry of Water, Lands and Environment support the work in Rakai.

- *Makerere University*

With support from NORAD, Nyabyeya Forestry College established a Biomass Energy Resource and Training Centre, for training forestry technicians and graduate foresters. They also plan refresher courses for older technicians and short courses for extension workers. This aims at training target groups in production of different biomass technologies -particularly improved stoves. The college has established a training and demonstration unit with a wide range of technologies on display. Training of college staff and technicians in different aspects of biomass energy and stove production has been conducted. The college plans to begin training artisans, and staff of CBO's and NGO's (short courses) and forestry technicians (module in forestry training).
[The Faculty of Technology, Makerere University has established demonstration/training units for different technologies including biogas, improved cook stoves and is planning to install a gasifier.

- ***National Environment Management Authority***

The National Environment Management Authority supports CBO's and NGO's involved in environment related activities in Mbarara, Kabale, Kasese, Arua, Tororo, Busia and Mbale Districts. Support is provided at sub-county level.

1.2 FUELWOOD

1.21 Suppliers and intermediaries.

- Sources of fuelwood:
  - Agricultural Lands
  - Wood Plantations
  - Unprotected bushlands
  - Gazetted forests

Fuelwood used by households in the rural areas is collected by the users themselves from their agricultural lands and bushlands. Most of the fuelwood used in the urban areas, is produced from clearing for agricultural development and on-farm plantations on islands and main land near the towns. It is then transported to the urban areas by road (Lorries, pick-ups) or boat. Trucks are usually owned by registered transporters. Pick-up owners are not necessarily registered transporters

Wood transporters tend to be more closely tied to promoters, although many transporters also search for their suppliers and move round a catchment area on average of between 50 – 100km. Most transporters hire out their vehicles.

Kampala Fuel wood inflows by carrier type (tonnes per annum, based on February 1995 inflow survey)

Carrier	Weight	%Total
Dedicated Lorry	111,756	76.9
Dedicated Pickup	17,136	11.8%
Dedicated Boat	6,666	4.6%
Bicycle	3,005	2.1%
All Others	6,780	4.7%
Total	145,342	100%

Wood Fuel Inflows into Kampala by Inflow points

Inflow pt	Weight	%Total
Naganjo	35,374	17.1%
Busega	31,818	14.7%
Kireka	24,650	17.0%
Kyengera	17,393	8.8%
All othes	36,107	42.4%
Total	145,342	100.0%

Nearly a third of Kampala's fuel wood comes from Luwero and northern Mpigi within 100 – 150 km radius from Kampala. However considerable amounts also come from the east and lake Victoria Islands within 50 – 75 km radius.

As with Kampala and else where wood fuel sources tend to be much closer to points consumption, given the weight and high mass of wood.

1.22 Consumers

Woody biomass, fuel wood, is the main source of energy for cooking often used in the inefficient traditional three stones stove and for the provision of space heating.

- Rural Consumers
  - Used in households for cooking and water heating
  - Institutions 9schools, health centers)
  - Rural Industries ie. Tobacco curing, tea processing fish smoking, lime burning, sugar jaggeries, brick and tile making.
- Urban Consumers
  - Low Income Households
  - Institutions (schools, prisons, hospitals)
  - Small and medium enterprises eg. Bakeries, commercial establishments (hotels, restaurants))

Overall Proportional Estimates of Wood Fuel Consumption

Category	% Household Use
Wood Rural	97.3%
Wood Other Urban	45.1%
Wood Kampala	11.6%
Wood Jinja	16.0%
Wood Entebbe	14.0%

Source: Final Report - A Study of Woody Biomass derived Energy Supplies in Uganda

1.23 Price Levels

In virtually all rural households, fuelwood is corrected and used as free good. Where it is fuelwood prices are more variable, given the wide range of measurements for wood fuel. Bundles differ in weight from 2.5kg to 6kg per bundle and prices by weight vary between Ushs. 100 and Ushs. 300 per kg in the market place Each bundle contains 4 to 6 pieces. A ten tonne lorry of fuelwood delivered in Kampala can sell for between Ushs. 200,000 to 350,000, depending upon the supplier, the source of supply, the time of the year and the buyer.

The reliance on fuelwood is expected to continue for the next couple of years given the relatively high cost of alternatives like petroleum fuels and electricity and an un developed market for LPG.

The key issues in the biomass sub-sector are basically two, namely;

- supply of biomass - ensuring a sustainable supply of wood.
- Rational use of biomass - management of demand through the use of improved efficiency devices like improved cookstoves, kilns, and improved efficiency charcoal production etc.

1.3 CHARCOAL

1.31`Charcoal Suppliers and intermediaries

Most Charcoal (70%) is produced by dedicated, itinerant charcoalers on an independent basis. More than 60% of the producers come from areas outside the districts in which they are producing charcoal. Most charcoal is produced from south and west of Uganda. All producers produce charcoal on non-government land. They enter into arrangements with landholders and generally pay them very norminal fees.

Nearly 80% of all producers engage in charcoal production as their sole or major economic activity.

Producers almost always produce charcoal for an agreed negotiated fee, either paid incahs or as a proportion of the charcoal.

Luweero, Nakasongola and Masindi districts produce a bulk of charcoal for Kampala market (this represents over half of Uganda's charcoal demand) with lesser amounts from Mpigi and Mukono districts.

1.32 Charcoal consumers

Most of the charcoal produced is consumed by the urban population (Kampala, Jinja and Entebbe). It is used in households for cooking, heating water and ironing.

Markets for ten sites of charcoal production

Item	Production Site	Markets in Uganda	Other Markets
1.	Buvuma Island	Kampala/Jinia	
2.	Mpigi	Kampala/Entebbe	
3.	Mukono/Baale	Kampala/Entebbe/Jinja	
4.	Nakasongola/Lwampaga	Kampala/Entebbe	
5.	Luweero	Kampala/Entebbe	
6.	Kamuli	Kampala/Jinja/Tororor	
7.	Iganga	Kampala/Jinja/Tororor	Kenya Kisumu
8.	Tororo	Tororo	Kenya (Busia)
9.	Kiboga	Kampala	
10.	Mubende	Kampala/Entebbe	

Source: Final Report - A Study of Woody Biomass derived Energy Supplies in Uganda

Households Using Charcoal

Category	%Households use
Charcoal Rural	2.7%
Charcoal Overall urban	54.9%
Charcoal Kampala	88.4%
Charcoal Jinja	84.0%
Charcoal Entebbe	86.0%

Source: Final Report - A Study of Woody Biomass derived Energy Supplies in Uganda

85% of the households in urban areas with populations greater than 30,000 use charcoal as their primary fuel and 40% of households with population between 4500 and 30,000 use charcoal as their primary fuel. While 10% of households with population less than 4,500 use charcoal as their primary fuel.

1.33 Price Levels

The weight of the Bags vary between 40kg and 60 kg and market prices in Kampala range between Ushs.7,500 – 10,000. In Jinja and Entebbe market prices range between Ushs. 5,500 – 7,000. Market prices for charcoal in smaller urban areas vary more considerably from Ushs.3000 to Ushs. 5,500.

1.34 Improved stoves

Improved cookstoves can be categories as follows:

- Rural Stoves
- Urban stoves
- Institutional stoves

There are various organisation in Uganda promoting the use of improved cookstoves.

Below is a table showing various types of stoves and the promoting organisations.

ITEM	NAME	TYPE	PROMOTING ORGANISATION
1.	USIKA STOVE	Household	USIKA CRAFTS
2.	Black Power	Household/Institutional	Black Power Ltd
3.	RAC Stove	Household/Institutional	Rwashana and Associates
4.	Y-Stove	Household	YMCA
5.	LORENA	Household	MEMD, IRDI
6.	UNICEF	Household	Several NGOs
7.	All ceramic stoves	Household	Several sectors

2.0 MODERN FUELS

2.1 GENERAL SITUATION

Uganda's Modern Fuel supply and consumption is composed of Petroleum products 6.1% and electricity 1.1% Table 1 in Annex 1 shows the Energy Balance for the year 2000.

2.1.1 EXISTING ENERGY RESOURCES IN UGANDA

Uganda is endowed with abundant renewable energy resources. These include plentiful biomass supplies, extensive hydrological resources, favourable solar conditions and large quantities of biomass residues from agricultural production, among others. With the exception of biomass, Uganda utilises only a small fraction of its renewable energy resource potential.

There are efforts to explore for oil in the Western Rift Valley, in the 'Albertine Graben' region. However, all the petroleum products used in the country are imported currently.

- **Hydropower Resources**

Uganda has a comparative advantage in hydropower resources within the region. These are concentrated on the White Nile River and are estimated at at-least 2000MW potential. There are also numerous small streams with a potential for mini and micro hydropower development. Table 2 below shows the existing hydropower potential sites both on the White Nile River and the small rivers and streams.

Table 2 Hydropower Sites

2(a) Sites on River Nile

SITE	LOCATION/ DISTRICT	CURRENT INSTALLED CAPACITY (MW)	MAXIMUM POTENTIAL (MW)	PROJECT/ PROPOSED INSTALLED CAPACITY (MW)	STATUS	COMMISSIONING DATE
Nalubale (Owen Falls)	Jinja/Mukono	180	-	-	In Operation	1954
Kiira (Owen Falls Extension)	Jinja	-	-	200	Partly Commissioned. (80MW from 2 units).	2000
Bujagali	Jinja/Mukono	-	320	250	AES Nilepower licensed to develop site	2005
Kalagala	Jinja/Mukono	-	450	350	Feasibility study completed	N/A
Kamdini(Karuma)	Masindi/Apac	-	180	150	Feasibility studies completed, NORPAK Power Ltd has interest to develop site	N/A
Ayago South	Gulu/Masindi	-	234	N/A	Preliminary studies available	N/A
Ayago North	Gulu/Masindi	-	304	N/A	Preliminary studies available	N/A
Murchison	Gulu/Masindi	-	642	N/A	Preliminary studies available (has adverse environmental effects)	N/A

Source : MEMD

2 (b) Non-Nile Sites - *Source: MEMD*

SITE	DISTRICT	INSTALLED CAPACITY (MW)	POTENTIAL (ESTIMATED) (MW)	STATUS
Maziba	Kabale	1.0	-	In operation
Kuluva	Moyo	0.12	-	In operation
Kagando	Kasese	0.06	-	In operation
Kisizi	Rukungiri	0.06	-	In operation
Mobuku 1	Kasese	5.0	-	In operation
Mobuku 3	Kasese	10	-	Operated by Kasese Cobalt Co.
Mobuku 2	Kasese	-	11.1	Pre-feasibility studies complete
Muzizi	Kibale/Kabalore	-	4-10	Estimate
Paidha	Nebbi	-	5.1	Feasibility study completed and ready for development
Rwizi	Mbarara	-	0.5	Pre-investment studies carries out
Kakaka	Kabarole	-	3.0	Estimate
Nsongezi	Mbarara	-	2.0	Estimate
Nyamabuye	Kisoro	-	2.2	Pre-investment studies carried out
Siti	Kapchorwa	-	1.0	Full feasibility studies to commence soon.
Sipi	Kapchorwa	-	5.4	Pre-investment studies carried out.
Anyau/Olewa	Arua	-	1.5	Feasibility study complete
Haisesero	Kabale	-	1.0	Estimate
Kitumba	Kabale	-	0.2	Estimate
Mpanga	Kabarole	-	0.4	Estimate
Nyakibale	Rukungiri	-	0.1	Estimate
Leya	Moyo	-	0.12	Estimate
Amua	Moyo	-	0.18	Estimate
Narwodo	Nebbi	-	0.4	Estimate
Mvepi	Arua	-	2.4	Estimate
Esia	Moyo	-	0.24	Estimate
Ala	Arua	-	1.5	Estimate
Agoi	Arua	-	0.35	Estimate
Nkussi	Mbarara	-	0.9	Estimate
Mitano	Kabale	-	2.0	Estimate
Kikagati	Mbarara	-	-	Abandoned
Sezibwa	Mukono	-	0.5	Estimate
Tokwe	Bundibugyo	-	0.2	Estimate
Mgiita	Bundibugyo	-	0.15	Estimate
Miria Adua	Arua	-	0.1	Estimate
Soghai	Kabarole	-	2.0	Estimate
Ishasha	Rukungiri	-	4.0	Feasibility studies completed
Buseruka	Hoima	-	15.3	Pre-feasibility studies completed
Nengo Bridge	Rukungiri	-	7.7	Pre-feasibility studies completed

- **Petroleum Sector**

Petroleum Exploration

Though production has not been established in Uganda, the hydrocarbon generating capacity of its rift basins is very evident. The first serious contribution to the evaluation of Uganda's hydrocarbon potential was by the Government geologist E.J. Wayland who documented numerous hydrocarbon occurrences (Wayland,1925).

The principal potentially productive area is the Albertine Graben which, as defined in its broadest sense, stretches from the border with Sudan in the north to Lake Edward in the south a distance of 570 km. Although of variable width, the basin is commonly 45 km wide.

Geological and geophysical work todate has indicated that source rocks and maturity are guaranteed in the Albertine Graben. Hydrocarbons have been generated as proved by substantial oil seeps or occurrences within the graben. Surface mapping has demonstrated typical rift basin block faulting and sequences of reservoir quality exposed within the graben.

The graben is divided into five exploration areas.

- **Renewable Energy Resources**

With the exception of biomass, Uganda's renewable energy resources are minimally tapped. Exploitation of these abundant resources including will provide a window in the badly needed energy supply for the country.

Solar Energy

The private sector is the major actor in the development of solar resources in Uganda. Several local companies organised themselves into the Uganda Renewable Energy Association (UREA) and are actively participating in the solar industry.

To-date, about ten thousand solar home systems have been installed in the country, through the private sector, donor support (especially to health units and institutions) and by organisations which require isolated stations.

Factors affecting the popularisation of solar energy include the following:

- The high upfront costs out of reach for most consumers especially in rural areas;
- The lack of technical capacity to design, install and maintain the systems;
- The lack of local capacity to manufacture some of the solar systems' components locally;

- Limited awareness about the existence of the renewable energy technologies;
- Poor marketing skills on the part of the vendors; and
- Inability of solar vendors to exploit the benefits of economies of scale; each vendor imports in limited quantities.

Geothermal Energy

Uganda's geothermal resources, located in the Rift Valley region, are estimated at 450 MW. Three sites have been identified (Katwe field in the south, Buranga field near the Rwenzori Mountains and the Kibira field near Lake Albert). The Katwe field is considered the most promising due to the presence of subsurface steam at 230^{o}C and its location 35 km from a 132 KV transmission line at Kasese.

Wind Energy

Although Uganda has not done a comprehensive wind mapping, available data from the meteorological department show that the wind regime is not conducive for electric power generation. However, the available winds can be utilised for water pumping and grain milling. Windmills have been successfully used in the Karamoja region. There are just a few isolated cases of wind generators installed in the country.

Biogas

This technology was introduced in Uganda over 20 years ago. There has also been a number of projects targeting the dissemination of this technology the most recent one being the support obtained from China to construct 20 demonstration biogas digesters and also to train a number of technicians.

There are a number of individuals who have constructed biogas digesters especially those who keep cows on a zero grazing basis.

The difficulty with this technology, like many other renewable technologies, is the initial capital to construct the digester. This is out of reach of most rural poor. There is also a need to perfect the designs so that the design of high integrity is popularised.

Industrial Biomass Residues

Extensive use of biomass residues has been in co-generation in sugar mills. The three sugar mills, Kakira Sugar Works Ltd., Sugar Corporation of Uganda and Kinyara Sugar Works co-generate power using bagasse. Kakira Sugar works is planning to expand their co-generation capacity from the present 2.5 MW to about 15 MW in phase 1, with the objective of selling excess power to the grid.

Some biomass residues are also used to provide process heat in building material production. However, there is a lot of crop residues, which are left to waste but would otherwise be used to produce electricity-employing technologies like the gasifier technology.

2.1.2 RELEVANT ONGOING ENERGY DEVELOPMENT PROGRAMMES

- **Uganda Photovoltaic Pilot Project for Rural Electrification**

With the support of UNDP/ GEF the Government of Uganda is implementing a pilot solar project called the Uganda Photovoltaic Pilot Project for Rural Electrification, UPPPRE, to address the problems identified above. This project has made efforts to involve financial institutions in providing loans to both consumers and vendors of solar PV systems. There has also been an extensive awareness campaign, which has led to an increase in sales of systems by the private sector. Several technicians including members of UREA have been trained in the design and installation of systems.

Under the Energy for Rural Transformation program, a rural electrification program being developed by Government, there will be a big solar component, building on the lessons of the pilot project.

- **Power Sector Restructuring and Privatisation**

In 1997 the Government of Uganda formulated a comprehensive and detailed Strategic Plan for transforming the Uganda power sector into a financially viable electricity industry, in order to make its full contribution to the economic and social development of Uganda.

This plan was revised into a new Strategic Plan in June 1999.

The New Strategic Plan places particular emphasis on the role of competition in promoting efficiency within the power sector and on private sector participation as being a key driver to enhance the power sector's performance.

The key elements of the reform are:

- Increasing the scope of competition in the provision of new generating capacity and in the running of existing generation assets. New generating capacity to be competitively provided by the private sector through independent power projects (IPPs);

- A separate Transmission Company, which in the medium term will remain in public hands, to be responsible for network maintenance, system operation and dispatch, and bulk purchase and supply of electricity. New transmission

capacity will as far as possible be developed, financed, constructed, operated and owned by the private sector ; and

- A financially viable distribution system let out to the private sector under a concession.

In all these cases the existing assets will remain in public hands and in the case of the existing generation and distribution, the running of the business will be privatised.

A new Act, the Electricity Act, 1999 gave a legal backing to those reforms and opened up the electricity industry to the private sector, removing the monopoly by the state utility, Uganda Electricity Board (UEB).

Independent Power Producers (IPPs) have started entering the sector. Already one IPP, AES Nile Power has been licensed to develop the 250 MW Bujagali Project which is located some 8 Km downstream of the existing Nalubale (formerly Owen Falls) power station. Work on this project is expected to be completed by the end of 2005 or early 2006. Another developer has shown interest to develop the 150 MW Karuma Project and has already conducted feasibility studies.

Other developers have shown interest in developing the small hydropower sites. A study was conducted recently, to evaluate small hydropower sites in the 0.5 - 50 MW range. Nine sites, namely; Nyamabuye, Nengo Bridge, Bugoye, Kakaka, Sogahi, Rwizi, Buseruka, Siti and Sipi were considered under this study.

Two small hydro power plants, the 5.1 MW Paidha Project and the 1.5 MW Olewa Project are due for development to supply the fast growing West Nile region. These two projects will be developed by the private sector under the Government rural electrification programme called 'Energy for Rural Transformation' ERT. This is likely to be the first Proto-type Carbon Fund, PCF, project in Africa whereby the World Bank PCF will purchase certified emission reduction, CERs, certificates from this project.

2.1.3 Petroleum Supplies

A new Downstream Petroleum Legislation and Regulations has been drafted with the objective of ensuring competition within the industry, monitoring of quality and carrying out institutional framework reforms.

2.2 ELECTRICITY

2.2.1 Electricity Suppliers

To-date, only a small fraction of the hydro resources are exploited, explaining the low level electrification in the country, standing at about 5% connection to the main national grid with about the same percentage providing self generation using petroleum generators and installation of solar panels.

Total installed hydro-power capacity currently stands at about 280 MW;

- Nalubaale Power Station - 180 MW
- Kiira Power Station - 80 MW
- Small hydropower plants ≈ 20 MW

There is on going work at the Kiira Power Station (formerly Owen Falls Extension) to install the remaining 120 MW. This is expected to be achieved by 2003.

The Nalubaale and Kiira Hydropower stations in Jinja are operated by the Uganda Electricity Generation Company established on April 01, 2001 following the unbundling of the former Uganda Electricity Board into three successor companies and one statutory corporation. The three successor companies are: Uganda Electricity Generation Company, Uganda Electricity Transmission Company and Uganda Electricity Distribution Company.

The Uganda Electricity Distribution Company owns and operates the grid connected electricity supply infrastructure operating at 33kV and below. It is responsible for the electricity retail business including metering and billing of customers and customer connections. UEDCL'S operations are spread countrywide with offices in the following Districts:

Kampala Area:

Banda, Kabalagala, Kitintale, Najjanankumbi, Natete, Entebbe, Central (Metropolitan) Mpigi, Nakulabye and Wndegeya

Upcountry Districts:

Bombo, Mubende, Lugazi, Jinja, Soroti, Tororo, Mbale, Kitgum, Hoima, Adjuman, Moyo, Moroto, Kasese, Masaka, Kisoro, Bushenyi, Mityanan, Mukono, Kayunga, Iganga, Kamuli, Kapchorwa, Gulu, Masindi, Lira, Arua, Nebbi, Fort Portal, Rukungiri, Kabale and Mbarara.

The operations of UEDCL are regulated by the Electricity Regulatory Authority (ERA) in accordance with the 1999 Electricity Act.

Electricity Consumers

Only 5% of Uganda's population is supplied with grid electricity, and 70% of these customers reside in the three major towns of Kampala, Entebbe and Jinja. Approximately 20% of the country's urban population is connected to the national grid, while about 1% of all rural dwellers are connected to the grid. Official records show that there are about 170,000 grid electricity users. The national average per capita consumption is about 44 kWh per year for all users, a figure that can be compared with

an average of 170 kWh for the Kampala – Entebbe district, and less than 10 kWh in most outlying districts.

The map shown in Annex 3 shows the existing electricity grid in the country.

2.3 LIQUIFIED PETROLEUM GAS

2.3.1 Distributors

In Uganda only four Oil marketing companies are trading in LPG. There are Shell, Caltex, Total Ltd and Gapco. LPG is imported. It is sold in form of cylinders. Other equipment include stoves, regulators and rubber hosts and their prices vary according to sizes.

These oil-marketing companies use their stations as distribution channels for small consumers. As for large consumers they are supplied directly to their host gas tank.

2.3.2 Consumers

Most of the consumers of LPG are hotels, schools, hospitals and a few "urban elite" middle income-earning families.

Taxes

Taxes on LPG are as follows:

1. Import duty	7%
2. VAT	17%
3. Import licence commission	2%

2.3.3 Prices

Prices vary according to sizes e.g. for a 15Kg cylinder prices will be as follows:-

Facility	**price in U Shs**
cylinder	65,000
stove	40,000-60,000
regulator	12,000
rubber hose	7,000-8,000
product	32,000

Source : MEMD

2.4 Kerosene

Kerosene commonly known as BIK is a common product in the oil insustry. Almost all the 16 oil marketing companies operating in the Ugandan market do trade in Kerosene. BIK attaracts the least government tax of shs 200 per litre as compared to shs 370 and shs 580 for AGO and PMS respectively.

The distribution for BIK is through the normal retail network of the oil marketing companies. According to the data available the national consumption is shown in the table below

2001 SALES

PRODUCT/MONTH	Jan-01	Feb-01	Mar-01	Apr-01	May-01	Jun-01	Jul-01	Aug-01	Sep-01	Oct-01
Kerosene	4,375	3,812	4,127	4,355	4,769	4,399	4,688	4,489	7,991	4,205

Year	000'litres Kerosene
1965	30,524
1966	37,009
1967	34,352
1968	42,572
1969	43,260
1970	49,515
1971	45,524
1972	44,268
1973	49,756
1974	50,686
1975	56,721
1976	68,280
1977	68,070
1978	53,906
1979	48,501
1980	58,336
1981	28,165
1982	35,258
1983	39,100
1984	39,100
1985	43,600
1986	43,189
1987	41,022
1988	43,544
1989	47,220
1990	42,360
1991	34,562

1992	29,409
1993	29,463
1994	33,453
1995	43,068
1996	46,361
1997	48,576
1998	59,508
1999	60,684
2000	47,342

The Base Case and High Case scenarios are summarized I Table 3 below

Demand Projections for Kerosene and LPG: 1994 – 2010 (million litres)

	Kerosene	LPG	TOTAL
Base Case			
1994	33	1.3	34.3
2010	46	6	52
% growth rate p.a.	2.1%	9.8%	6.0%
High Case			
1994	33	1.4	34.4
2010	46	10	56
% growth rate p.a.	2.1%	13%	7.55%

Source ESMAP: Uganda Energy Assessment Report No. 193/96

3.0 HISTORICAL PERSPECTIVE

3.1 TARIFF REVIEW

- Tariff Review 1993

The 1993 UEB Tariff was arrived at following a detailed study by Consultants Price Waterhouse in association with British Electricity International Ltd. And Community Management Services of Kampala working with UEB officials as counterparts. The study was done and completed in 1990.

- The tariff came into effect on 1st July 1993. The tariff levels were worked out in terms of United States Dollars

- The tariff Policy at that time was to meet on going commitments of the board as required by the statute, i.e. to

    - Finance new developments
    - Rehabilitate existing infrastructure

- Price increases of 80% on average

An analysis of daily demand pattern on the UEB system indicated that domestic customers were primary responsible for the system peak (between 1800hrs and 2300hrs). They were therefore assigned the responsibility for capacity costs by setting energy rate equal to the long run marginal cost at the distribution.

However the board developed a lifeline rate for small (poor) domestic customers by instituting a multi-block system.

The domestic tariff for the first 30 kWh per month was set far below the long run marginal cost rate at Ushs. 20/= per kWh. Consumption between 31 and 200 units per month was set near the LMRC at Ushs. 70/= per kWh; whilst consumption above 200 units was set above LRMC at Ushs. 100/= per kWh to subsidise poor customers. Subsidy was therefore within the same class and not across classes.

- Even with the subsidy created for the low income consumers, the rise in the tariff was felt with more people in urban and rural areas moving to traditional fuels for cooking and water heating.

		A verage Price per kWh Sold		
Code	**Group**	**New Tariff Ushs**	**Old Tariff Ushs**	**Percentage Increase %**
1.	Domestic	82.4	52.0	58.5
2.	Commercial	124.7	55.0	126.8
3.	Industrial-High Voltage	106.4	50.1	112.1
3 (a)	Industrial – High Voltage Combined with off-peak	91.4	45.1	102.6
4	General	125.6	58.0	116.5
4 (a)	General Combined with off-peak	117.8	N/A	N/A
5	Street Lighting	125.3	55.0	127.8
	TOTAL	94.0	52.0	80.0

52/= = 4.00 US Cents
94/= = 7.2 US Cents

(ii) Tariff Review 2001

- The overall goal of the power sector is to create a sustainable electricity industry with increased energy supply to meet demand for social and economic development. In order to meet this goal a wide range of policy instruments including a tariff adjustment are being implemented by Government.
- The Electricity Regulatory Authority revised the tariff basing on the recommendation made by UEDCL with effect from 1st June 2001.
- There was need to adjust the tariff to make it cost reflective i.e. to:

    - Correct for inflation and currency exchange
    - Support new capital investments in the sector
    - Attract private sector investment in the sector
    - Remove cross subsidies to reflect the cost of supply for each customer category
    - Cover operation and maintenance costs.

- The new investments in the power sector and improvement in the power supply will result into positive socio-economic impacts i.e. with industrial development in urban and rural areas, modernization of agriculture and large commercial investments jobs are created.

3.2 PRIVATISATION

- The Government of Uganda formulated a comprehensive and detailed strategic plan for transforming the Uganda power sector into a financially viable electricity industry.

- The process towards privatization started with the development of the power sector strategic plan between 1996 and 1999.

- The objective of the reform programme is meeting the energy needs of the Uganda population and of the economic and social sectors through a diverse range of strategies aimed at supporting the goals of social equity, rural and industrial development and environmental sustainability on a long-term basis.

  The Power Sector Strategic Plan places particular emphasis on the role of competition in promoting efficiency within the power sector and on private sector participation as a key driver to enhance the power sector's performance.

  The new generating capacity will be provided competitively by the private sector through independent power projects

- Helped bring in private sector
  Resulted into the need for full cost recovery for services

3.3 RURAL ELECTRIFICATION

Rural electrification forms an integral part of the Government's wider rural transformation and poverty eradication agenda. Apart from the traditional approach of grid extension, Government has made tow major interventions.

(i) Uganda Photovoltaic Pilot Project for Rural Electrification (UPPPRE)

- UPPPRE is one of the programmes being implemented by government to increase rural access to electricity.

- UPPPRE is a three year programme started in 1998.

- The aim of UPPPRE is to create the necessary conditions for accelerating access to electricity using solar technology by isolated and dispersed rural areas projected not to have access to grid-based electricity in the near future and which have both ability and willingness to pay the unsubsidized cost of the systems.

- Impacts of the programme on macrolevel:

    - Prices of solar equipment have gone down by 30%
    - there has been growth in sales of 20% per year
    - more people are accessing solar systems with the intervation of village banks
    - impacts of programme on fuel switching:

    - more people in the rual areas are switching from Kerosene to solar lighting

(ii) Energy for Rural Transformation (ERT)

- The Ministry of Energy and Mineral Development in consultation with the Ministry of Finance, Planning and Economic Development, the Ministry of Local Government and other stakeholders in the private and public sector prepared a Rural Electrification Strategy and Plan covering the period 2001 to 2010 which has been approved by Cabinet.
- Under this Plan, a programme known as Energy for Rural Transformation (ERT) is being developed, under this programme, Government together with the private sector and our development partners is planning to undertake a massive rural electrification programme covering all regions of Uganda.

- The primary objective of the RE Strategy is to reduce inequalities in access to electricity and the associated opportunities for increased social welfare, education, health and income generating opportunities.

- The Government's Rural Electrification (RE) Strategy aims to achieve for the year 2010 a rural electrification rate of 10%, meaning that 480,000 rural consumers, a net increase of 400,000 over the year 2000 figure are to be serviced. It is estimated that 15% of the increase in serviced households will come from higher connections to the existing grid outside the urban triangle, 40% from extension of the interconnected grid, 25% from isolated grids and 20% from photovoltaic solar systems.

  Since this programme is yet to start its impacts cannot be assessed right now.

3.4 NATIONAL BIOMASS STUDY

- The study commenced in May 1989

- To compile an inventory of woody biomass and agricultural residues in nine peri-urban areas in which there was believed to be woodfuel shortages.

- The project has provided tangible benefits to other institutions(e.g. primary biomass results and the various data layers both in Map and digital form) and has

helped stimulate interest in cooperation and collaboration in use of environmental information.

The study has organized training sessions and assisted other organistions and individuals in exploring the possible uses of GIS technology

3.5. Efficiency in the use of Biomass Energy

- The Ministry of Energy is implementing the Sustainable Energy Use in the Household and Industries project funded by the Royal Netherlands Government.

- It is a three-year project. It started in July 1998.

- It is intended to increase efficiency in energy production and use in households and industries to promote national socio-economic development with minimum negative environmental impacts caused by energy exploitation.

  The immediate objectives of the project include:

  - Improve household cookstoves efficiency and popularize usage of fuel efficient cookstoves
  - Improve efficiency of charcoal production and charcoal stove performance efficiency
  - Improve fuel efficiency in lime kilns
  - Improve the environment through afforestation and tree protection bye-law

- Impacts

  People in the districts of Kabale, Tororo, Soroti, and Adjuman are abandoning the traditional three stone fire place and resorting to the improved cookstoves which are mare efficient, use less fire wood and are smoke free. People from the neighbouring districts too are requesting for the programme to be taken to their areas

  People are now using better methods of charcoal production and they are better organized.

  MEMD in collaboration with ACORD planted over 500,000 seedlings in Adjumani district.

3.6 NATURAL RESOURCE FORESTRY POLICY

- Revision of Forestry Policy

- Begun in 1998, has been approved by cabinet and is yet to be passed by parliament.
- The forest policy recognizes that Uganda's forest resources provide energy, supplying 93% of energy demand. It views farm forestry as major strategy in ensuring adequate supply of biomass energy. The policy plans to take advantage of government commitment to promote and develop farm forestry through the Plan for Modernisation of Agriculture.
- Once in place the policy will play a vital role in the collaboration among various sectors (land use, water, wildlife, industry and energy) as Forests and woodlands are viewed as the mainstay in the three pillars of sustainable development,: economics, society and the environment.

3.7 ENERGY POLICY

- Integrating existing sub-sectorial policies
- The present draft was prepared in April 2001
- The reason being that in the past Uganda's Energy Sector has been driven by annual ministerial policy statements on the budget. Yet the importance of the energy sector in the economy requires that a long-term planning approach for energy development be adopted. In particular, the liberalization of the energy sector , in line with the overall macro-economic policies, require that clear , long-term policy guidelines be in place to encourage project development and harmonise sector activities.
- The main policy goal is to meet the energy needs of the Ugandan population for social and economic development on an environmentally sustainable way.
- To ensure that energy plays a central role in the economic development of the country and in the region. Government will adopt the following strategies:
    - Encourage competition within the energy markets to achieve efficiency.
    - Encourage competition within the energy markets to achieve efficiency
    - Attract investments in energy services provision by providing appropriate incentives.
    - Ensure energy supply security and reliability
    - Promote energy trade within the region.

Government will ensure that environmental considerations are given priority by energy suppliers and users to protect the environment and put in place a monitoring mechanism to evaluate compliance with established environmental protection guidelines.

3.8 ENVIRONMENT POLICY

- The National Environment Statute, 1995

- Was enacted in 1995 and came into operation on the 19th May 1995

- The Statute is to promote sustainable development intergrating environmental requirements into all planning and production processes and ensuring that renewable resources are optimally used through reduces waste, use of appropriate technology and finding of alternatives to present use of resources

- Some of the principles of environment management are:
    - To ensure all people living in Uganda the fundamental right to an environment suitable for their health and well-being;
    - To conserve and use the environment and natural resources equitably, taking into account the productivity of the available resources;
    - To ensure that the direct costs of environmental pollution are borne by the polluter and;
    - To require environmental assessments of proposed projects which significantly affect the environment or use of natural resources.

NEMA is responsible for ensuring that these principles are observed. The right to clean and healthy environment is a constitutional right which Government must protect and each person has a duty to maintain and enhance the environment**.**

ANNEX 1 UGANDA ENERGY BALANCE, 2000

ANNEX 2 MEMBERS OF UGANDA RENEWABLE ENERGY ASSOCIATION (UREA)

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Key:	**Areas of UREA member companies specialization:**
*	**PV solar systems sales and installations**
^	**Manufacture of solar thermal water heaters and dryers**
+	**Electronics manufacturing**
@	**Renewable energy/environmentalists consultants**
$	**Biomass /power generation engineers and consultants**
#	**Telecommunications**