

Country Report

# Kenya's Energy status

By

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### *1.1.2. Administration and Governance*

With her capital city being Nairobi, Kenya still has two more cities, Mombasa and Kisumu with the former being a port city and the latter, a lake city. Nakuru is one other major commercial town which might acquire city status in the near future. However, the country is administratively divided into eight (8) regions (provinces) which are further subdivided into Districts, then Divisions, locations and finally, sub-locations. A sub-location is basically an administrative unit comprising two to three villages. Ideally, resource distribution need mimic the same structure but this leaves a lot to be desired practically.

Kenya is both a central government and presidential system republic. This is currently a very volatile issue which is yet to be addressed by the supposedly new constitution. The multiparty democracy was adopted in the year 1992 due to pressures from the international community. The president and the members of parliament representing regions equivalent to 'Divisions' (Constituencies), are elected by the people after every five (5) years.

### *1.1.3. History*

The history of Kenya features and is responsible for what Kenya is as a country today. The 40 distinct tribes are said to have stemmed from three (3) main linguistic families, the Cushites said to have entered Kenya from South Ethiopian highlands in the year 2000BC; The Nilotes from the West and the Bantus from the South between 500BC to A.D. 500. In about A.D. 100, the Arabs are said to have traded with Bantus along the coast and their intermarriage led to the language, Swahili.

The Portuguese in 1498, in the name of trade, took charge of the coastline until 1600 when the Arabs reclaimed control. In Mid 19th century, the British influence superseded Arabs' and as opposed to the former traders, the British were more interested in venturing into the interior. This led to more explorers coming in and settling in the more fertile lands in the heart of the country. The Berlin conference of 1885 saw the Europeans partition East Africa into small spheres of influence which today form the individual Sovereign states. In the year 1920, Kenya was declared a British colony and white settlers took over vast fertile lands whereas the local people were restricted from cash crop farming and instead subjected to forced labour. The development of the Railway network and the main towns is linked to the productivity of the targeted regions during that period.

Between the years 1952–1956, the African Protests peaked under the umbrella of 'Mau Mau' Emergency, a Kikuyu-led uprising. Kenya was put under state of emergency until 1959 and most of leaders were imprisoned, families shattered and innocent people killed. In 1963 Kenya gained her independence led by the late 'Mzee Jomo Kenyatta' who became Kenya's first President. Mzee Jomo Kenyatta was president until 1978 when he passed on and a new president, Daniel Arap Moi was ushered in to rule Kenya as second president. President Moi's reign came to an end in the year 2002 when his supposedly predecessor lost to the opposition

leader and Kenya's third president, president Mwai Kibaki who is currently serving his second term in office.

All along, the unresolved pre-historic issues concerning land, tribal indifferences, resource distribution seem to have dominated the political arena to-date. Differences in political ideologies among emergent political powerhouses barely focus on real development issues but are rather driven by events of the pre-historic Kenya. Of course this does not leave energy related issues unaffected. Some energy investments are biased towards regional im-/balances than resource potential itself.

#### ***1.1.4. Climate***

Kenya's climate can generally be categorised into four regional climates;

- Lake Victoria basin
- Rift Valley and Highlands
- North, North-East and Eastern Highlands (Nyika plateau)
- Kenya's coast

However in general, the climate varies from tropical along the lake and the coast to arid in the interior. Less than 15 percent of the country receives reliable rainfall of 760 millimetres or more per year. Most of the country experiences two wet and two dry seasons. The driest month is August, with 24 millimetres average rainfall, and the wettest is April (long rains period) with 266 millimetres. The hottest month is February (*Library of congress - 2007*).

## **1.2. The people**

### ***1.2.1. Demography, education and Health***

As of the year 2008, Kenya's population was estimated at 37.9 million (*Global Edge -2008*). Her population growth rate is also estimated at 2.7% with life expectancy standing at 47-55 years. Kenya's education system on the other hand is of the American model, eight (8) years primary school, four (4) years secondary school and four (4) years of University education. She also records a literacy level of 75-85 %. So far, *Malaria, TB & HIV/AIDS* are Kenya's main health challenges as a country.

### ***1.2.2. Communication and religion***

Swahili is the National language in Kenya while English is the official language of business. However, Kenya also boasts of her strong language and cultural diversity embodied in the over 40 native languages. Majority of Kenyans are believers of some faith. About 75% are Christians, 20% Muslim and 5% are Buddhists, Sikhs or believers of some Traditional teachings.

### 1.3. Economy

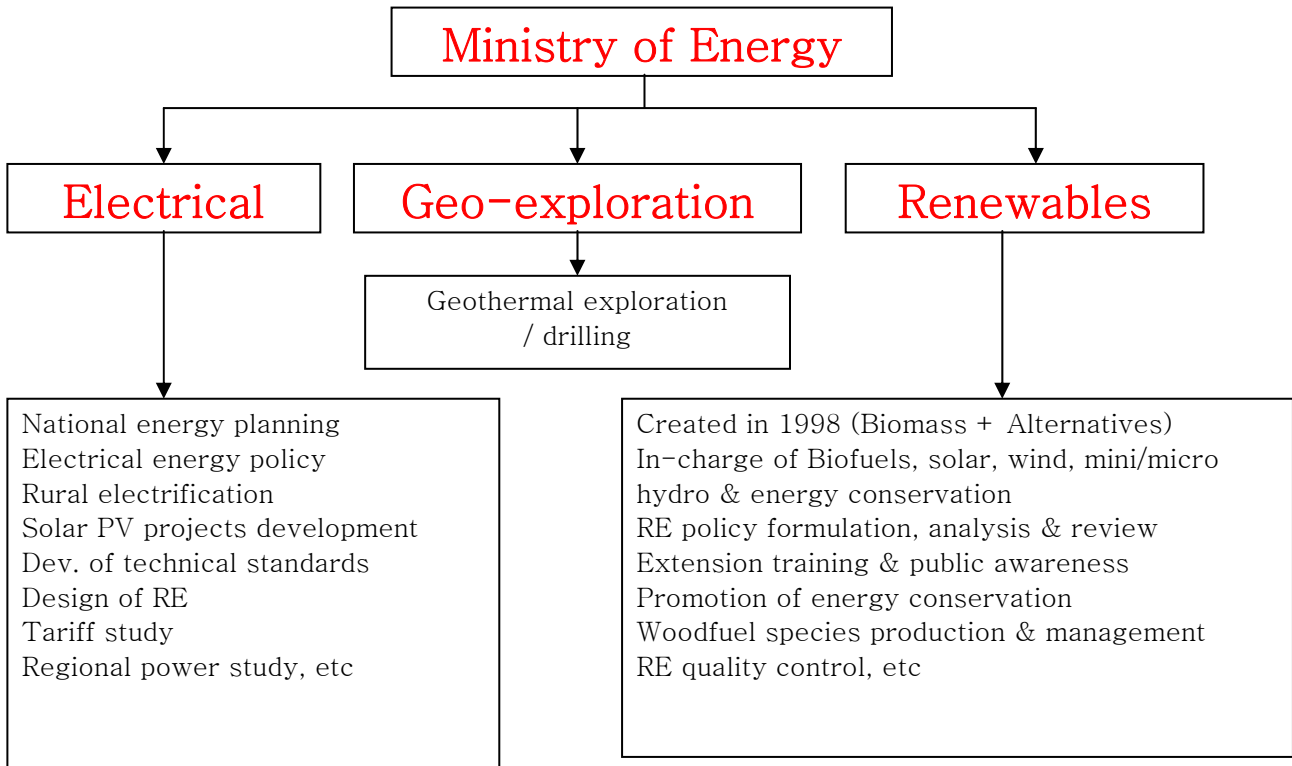
The Kenya shilling (KShs.) is the currency and unit of exchange: - (1€ = KShs.104, 1US\$ = KShs.78). However still, at very low levels of business informal butter trade still exists. The economy is reliant mainly on Agriculture which supports about 45% of rural population. However, only 7-8% of Kenya's land is arable. Tourism is the second largest supporter of her economy. The rich wildlife, the natural physiography, the warm coast and the relatively favourable temperature ranges all year round are the main drivers of tourism. The main exports are tea (28.4%), horticultural products (16.3%), petroleum products (10.2%) and coffee (6.1%) - (*International Marketing Research Reports - IMRR 2003*). Other products of export include but not limited to; sisal, soda ash, leather, pyrethrum extract, iron and steel, hides and skins, oils, insecticides, polishing and cleaning preparations, cement, fish and fish products, meat and meat products, honey, dairy products.

The main trading partners/blocks are East African Community (*EAC*) where Kenya exports both raw and manufactured products; Common Markets for East and South Africa (*COMESA*) - manufactured products; European Union (*EU*) & United Kingdom (*UK*) taking in tea, coffee and cut-flowers; African Growth and Opportunity (*AGOA*), a United States focussed trading block taking in a big chunk of textiles and apparel and finally the new South African Development Community (*SADC*). On the other hand, the main exporters to Kenya are United Kingdom, United Arabs Emirates, Japan, India, China and South Africa, exporting mainly machinery and electronic goods.

By 2006, Kenya's gross domestic product (GDP) was estimated at US\$17.39b  $\approx$  €12.92b and a per capita GDP of US\$1,200  $\approx$  €891 (Purchasing Power Parity - PPP adjusted) was recorded.

## 2.0. Ministry of Energy

The ministry of Energy plays a very crucial role in shaping the future of a country in matters relating to energy and development in general. It is in-charge of planning and designing national energy systems that keep the country alive. Addressing energy issues without a mention of the same is therefore inappropriate. Kenya's Energy Ministry is made up of three (3) divisions or departments playing distinct roles. Some of the responsibilities are highlighted in the schematic diagram below.



*Adopted from the Min. Energy website*

On a very close scrutiny of the Electrical and the Renewable energy departments, one may not actually draw a very clear line between the two with reference to the renewable energy sources.

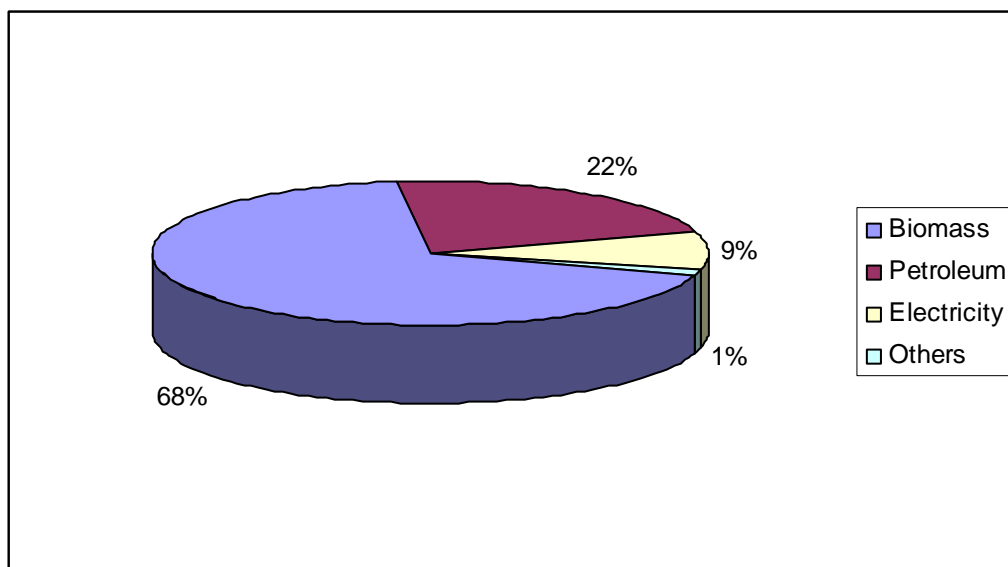
On the other hand, the Ministry on the 1st of April 2008 introduced, through a press release, feed-in-Tariffs for wind, biomass and small hydro power energy. This was followed a month later by a feed-in-Tariff Guide for Investors. This is very good news for Renewable energy irrespective of whether the rates are practically viable or not. Most surprising though was the fact that solar energy was not considered in the list. The rates and definitions are schematically shown below.

Renewable Energy source	Capacity (MW)	Firm power (€/kWh)	Non-firm power (€/kWh)
Biomass	0 - 40	0.045	0.029
Wind	0 - 50	0.058	0.058
Small Hydropower	0.5 - 0.99	0.077	0.064
	1 - 5	0.064	0.052
	5.1 - 10	0.052	0.039
(Big Hydro)	For comparison - 0.0175€/kWh		

Adopted from the April 1<sup>st</sup> 2008 press release

### 3.0. Energy sources

The energy supply in Kenya is mainly from three primary sources. *Biomass* forms the largest share providing about 68% of the total energy demand. 22% is then covered by *petroleum*, 9% by *electricity* and other sources provide about 1%.



### 3.1. Biomass

According to the Renewable energy Department of the Ministry of Energy, the biomass demand stood at 34.3 million tonnes in 2000 compared to an estimated sustainable supply of 15 million, thereby indicating a deficit of over 56 per cent. The deficit could currently be over 60 per cent. The demand was estimated to be growing at 2.7 % per year while the sustainable supply was growing at a slower rate of 0.6 % per year.



The principal drivers of biomass energy demand were cited as, population growth, lack of access to biomass energy substitutes and the rising levels of poverty among Kenyans. The supply and demand imbalance is said to exert considerable pressure on the remaining forest cover and vegetation stocks, thereby accelerating the processes of land degradation. In addition, the continued exploitation of biomass-derived energy poses a threat to competing land use systems such as agriculture, forestry and human settlements, among others.

On a positive note, the efforts from the Forestry Department, Ministry of Energy, UNEP, GTZ, Green Belt Movement, local NGOs and other organizations in promoting tree biotechnology research, tree planting, woodlots establishment and energy-saving stoves can not be ignored.

#### *A. Firewood*

A larger majority of rural population depend on firewood for their overall energy demand. Over 20,000 Institutions also depend on firewood for both catering and water heating. In the year 2000, firewood consumption was estimated at 3,394 kg (rural) and 2,701 kg (urban) per household per annum. Per capita consumption was 741 and 691 kg respectively (*RE Dept. Ministry of Energy*).

#### *B. Charcoal*

Charcoal forms an important fuel source for urban dwellers. It is also said to be one of the main causes of increased deforestation as it is a source of income for the many unemployed rural. Per capita consumption in 2000 was 156 kg (rural) and 152 kg (urban). Worthy noting is that 83 % of both medium and high income groups in urban set-up also use charcoal. Therefore, its demand can not be underestimated.

#### *C. Briquettes*

The Kenya Planters Cooperative Union (KPCU), for decades produced briquettes 'Kahawa Coal' from coffee husks. The briquettes were however highly priced and could not penetrate the market. Of late, attempts to revive the plant could not take-off due to lack of enough feedstock as many other coffee millers have emerged affecting the supply of coffee.

In 2003, a private Enterprise, Chardust Ltd Kenya was started and in conjunction with a sugar company, Chemelil is now producing 5 tonnes of 'Canecoal' per day from bagasse.



*Courtesy: Elsen Karstad-2003*

#### *D. Biogas*

Biogas technology has been actively promoted in Kenya since early 1980s. About 1,390 family biogas plants (Average 10m<sup>3</sup>) have been installed in the country. A considerable potential exists in small scale farmers' dairy industry in the agricultural productive regions. However, the adoption is greatly hampered by the high capital costs and low level of awareness. Biogas has not yet been tapped on a commercial scale although there is a potential from slaughter houses and bio-wastes in many municipalities, the food industry and other large scale dairy farms. This could now fit in well with the introduction of feed-in-tariffs for renewables.

The continued promotion of biogas technology is basically being pioneered by several organizations which include and not limited to;

- Ministry of Energy through the energy centers all over the country.
- Ministry of Agriculture, GTZ and Association of Biogas Constructors (ABC-K) through the PSDA programme are promoting fixed dome digesters.
- Pioneer Technologies and Land 'O' Lakes are promoting low cost bag (tube) digesters.
- Local Universities, JKUAT and Egerton in particular, are focusing more on research and technology dissemination.
- The Government of Kenya and local NGOs through the Athi Water Services Board in year 2008 funded about 20 Human excretes digesters in a number of city slums. (*DNA-6/3/2008*)
- Local entrepreneurs are also joining the band wagon and the new Chinese model, the Puxin domes are getting entry into the market.

#### *E. Co-generation*

This is an emerging practice mostly in the sugar industry in Kenya. There are seven (7) sugar companies producing an average of 1.8 million tonnes of bagasse. One sugar company, Mumias has an installed capacity of 35 MW out of which 26MW is sold to the national grid. New projects are in the pipeline and are expected to boost the energy mix. There is a big potential for duplication in other sugar, saw milling, paper and rice industries.

#### *F. Biofuels*

Kenya's potential for Biofuels is in her vast arid and semi arid lands. Despite the fact that the issue of biofuels is threatening the very scarce resource, land, needed for food production, research is more focused on non-food feedstock. However on the ground, the issue of biofuels is not yet well understood and both local and foreign interested parties are sending mixed signals on plantation establishments. The Government's hand is expected to move a bit more swiftly to cap probable conflicts in the near future. Commercial establishments for *Jatropha Corcus* and Castor oil are currently peaking up. Other non-food plants on Research are Cotton, Yellow Oleander and *Croton Megalocarpus*. Food based feedstock include Sunflower and Coconuts.



*Tractor running on Biodiesel Courtesy: Prof. J. M. Keriko-JKUAT*

### *G. Ethanol*

Kenya's quest for alternative energy sources started way back in 1970s. In 1978, a power alcohol factory was established in Kisumu reason being that most of the sugar companies were situated near the town and hence there was a surplus of molasses. The Government could however not operate the plant for several years. In the year 2003, the state owned firm was sold to Spectre International Inc, a company co-owned by a multinational firm, Energem Resources Inc (55%) and a local investor (40%). Currently, the company produces potable alcohol and industrial methanol for beverage, medical and industrial applications. The production potential is around 120,000 litres per day but only 60,000 litres per day is presently produced.

The plant is however being positioned to supply fuel ethanol to Kenya, Uganda and other neighbouring countries in the near future. The company is in the course of exploring use of sweet sorghum as alternative feedstock.

From the above highlights, the statement; "Biomass is a sleeping giant" could not only be right for other cases but also Kenya. The potential is enormous yet sustainable and efficient technologies to exploit it are still lacking or not brought to focus.

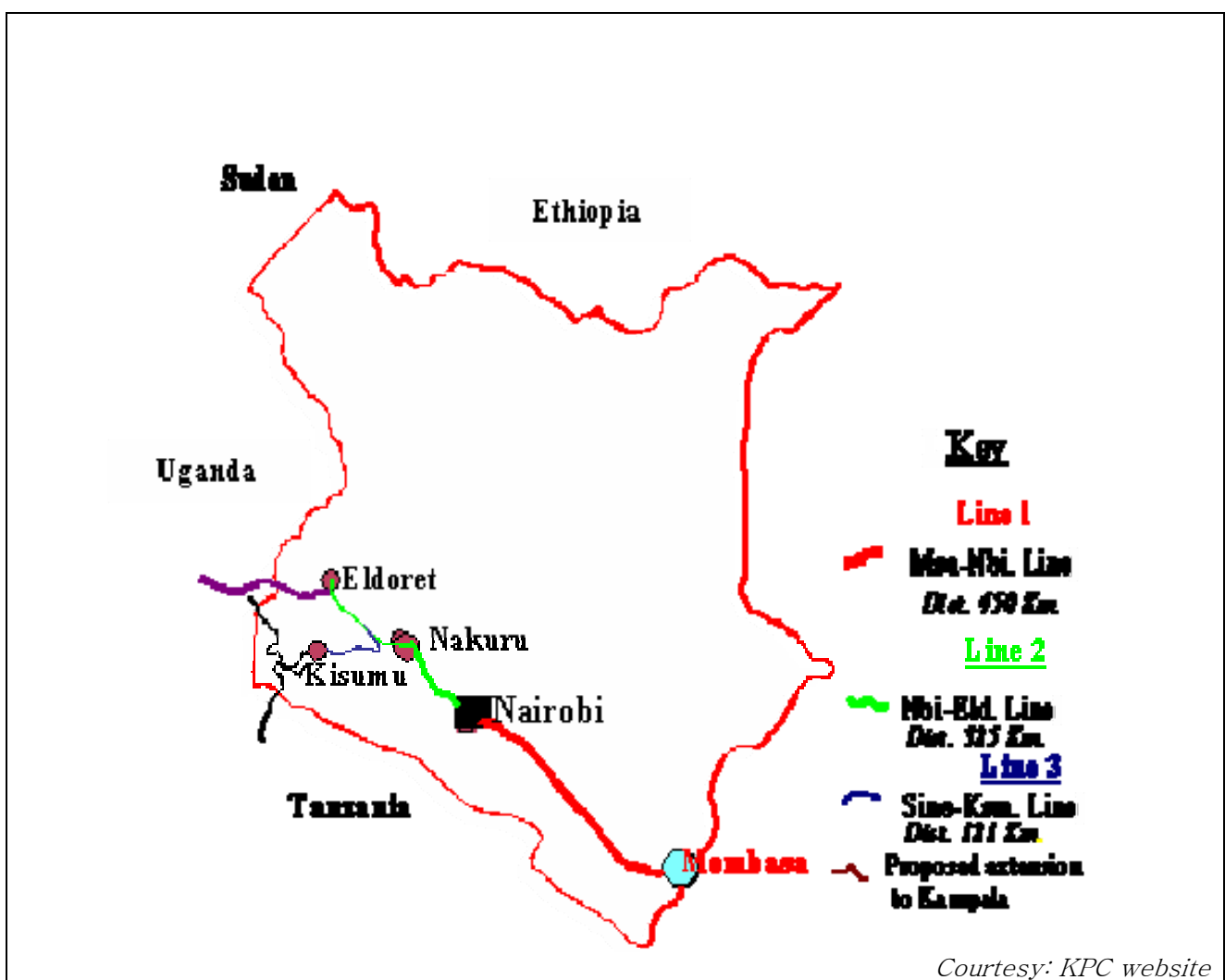
### **3.2. Petroleum**

Petroleum, as highlighted earlier provides 22% of Kenya's primary energy demand. Kenya of the other hand does not have any oil reserves. Therefore, all the

petroleum needed in the country is imported. The supply currently stands at over 3.2 million tonnes (Crude + refined products).

The Kenya Petroleum Refinery Limited (KPRL) which is co-owned by Government and local oil companies is in-charge of one and the only oil refinery in the country located in Mombasa, the port city. The refined petroleum and other products are distributed to the interior through a pipeline, by rail and tankers. The Kenya Pipeline Company (KPC) which is wholly owned by the Government and under the Ministry of Energy was commissioned in 1978 and is in-charge of the oil pipeline. The petroleum industry is however dominated by both multinational and local oil companies.

The pipeline, from Mombasa connects to Nairobi, Nakuru, Eldoret and Kisumu as shown below.



The pipeline transports five different grades of refined products which include; Motor Spirit Premium (MSP), Motor Spirit Regular (MSR), Automobile Gas Oil (AGO), Jet A-1 and Illuminating Kerosene (IK), on behalf of oil companies. Main companies retailing in the country are; Shell, BP (Kenya) Ltd., Caltex Oil (Kenya), Fuelex, Jovenna, Kenol/Kobil, Mobil, National Oil Corporation of Kenya (NOCK), Total Kenya, Gapco, Engen, Mafuta Products and Petrol.

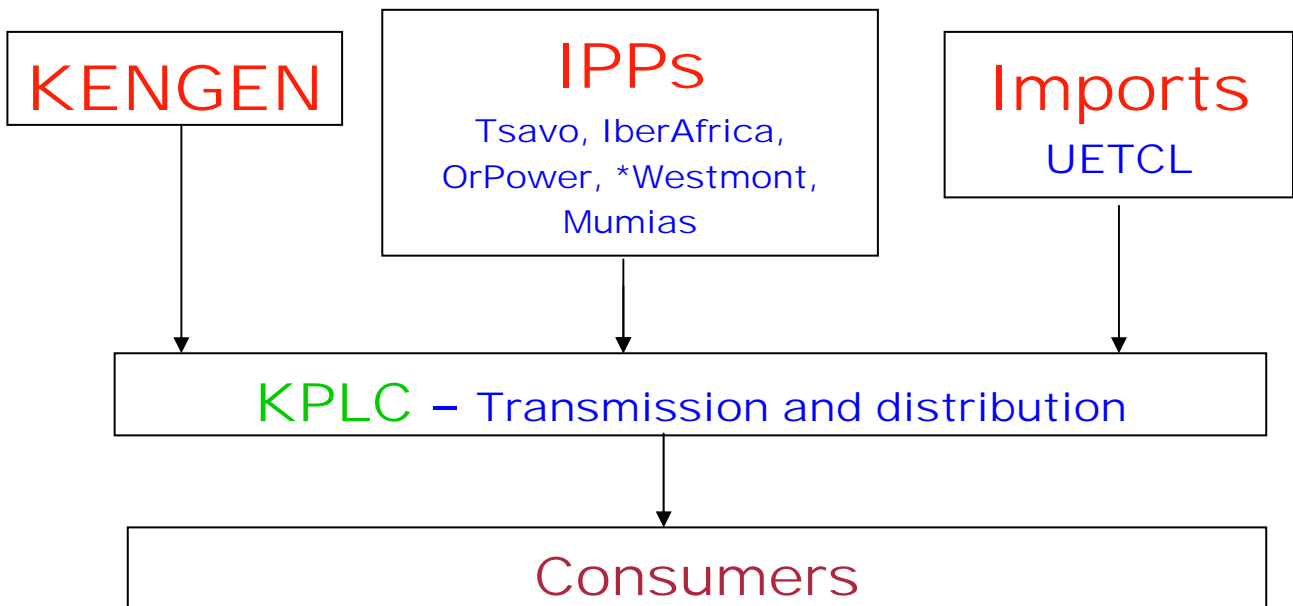
### 3.3. Electricity

#### *Background*

Whenever people mention the word energy, the first thing that crosses their minds is electricity. This is probably because it is one of the most versatile forms of final energy and hence the most user-friendly form of energy. In Kenya, electricity contributes only 9% of the total energy demand yet it has undergone several milestones in terms of infrastructure development and promotion. It may not be possible to bring out the big picture under this framework but a short background highlighting the sector development is as below;

- 1954 – Kenya Power Company (KPC) was born and was under the management of Kenya Power and Lighting Company (KPLC) to which it sold power in bulk.
- Virtually all Power investments, even to-date are funded by Multilateral and Bilateral agencies.
- In 1990s, changing donor trends and corruption almost crippled the sector.
- In 1996, the sector was liberalised and this saw the joining of the sector by Independent Power Producers (IPPs).
- The State utility in 1997 was unbundled into Kenya Power Company (KPC) to be in-charge of generation and Kenya Power & Lighting Company (KPLC) which was to take over transmission and distribution.
- KPC wholly remained in the hands of the Government (100%) while KPLC was 51% owned by the state.
- In the same year, 1997, Electric Power Act (Electricity Bill '97) led to the birth of Electricity Regulatory Board (ERB) mandated to look into electricity generation issues in terms of negotiating power tariffs and protecting shareholders.
- Still in 1997 the first IPP received a 'Build Own Operate (BOO)' contract for 7 years.
- In 1998, Kenya Power Company was renamed, Kenya Electricity Generating Company (KENGEN).
- In 2002/3, there was a public outcry over increased power prices citing corruption through the shoddy deals between the electricity distributing company and the IPPs.
- Key IPP players to have signed contracts to-date are, Westmont\*, IberAfrica, OrPower 4, Tsavo and Mumias.
- In 2006, the Government relinquished 30% of its shares in KENGEN to the public through initial public offer in the stock market.
- In 2007, a new Energy Act-2006 was enacted and the Electricity Regulatory Board (ERB) was renamed Energy Regulatory Commission (ERC)
- In 2008, the Ministry of Energy introduces Feed-in-Tariffs for Renewable Energies.

*Supply structure*



*Retailing price*

Customers Below 1500 kWh	Fixed (€)	0 – 50 units (€/kWh)	51 – 1500 units (€/kWh)	Above 1500 units (€/kWh)	Fuel costs (€)
Domestic	1.19	0.012	0.08	0.18	?
Small Commerce	1.19	0.089			?
Industrial	7.94 + 5.95*	0.057			?
? – f (fuel costs, units produced/purchased ...by producers)					
* – Demand charge per kVA					

The rates vary depending on the category of the customers. The table above is just an illustration of how the pricing is structured. The factor on the last column, fuel cost, is dependent on the type of fuel used to generate power. Therefore, when fuel costs go up, the customer has to bear the costs. This implies that the supplied power is heavily dependent on fuel type and this to some extent either engenders/endangers the investments options.

With the introduction of Feed-in tariffs for renewables, it is not clear whether the attractive rates will still be pushed over to the clients, otherwise this will impact negatively and the Government must be ready to somehow subsidized for this.

### *Electricity generation by source*

Electricity in Kenya is mainly generated from Hydro, Geothermal and Thermal power plants. Installed electricity capacity in Kenya stands at over 1,300 MW (Approximated). Peak demand stands at 987MW against effective supply of 1,172MW (*KPLC Report 2007/08*). The national access rate is about 15%, with the rural access being only 4% and 51% in the urban areas. Per capita consumption was estimated at 125 kWh by the year 2007 (*Ministry of Information and Communication – 2007*)

### *Hydropower plants*

All hydropower plants in Kenya are run by KENGEN. Currently, the installed capacity stands at 737.28 MW. Kenya also imports about 20MW of electricity from Uganda. The table below shows the established hydropower plants and their installed capacities.

SN	Station	Installed capacity (MW)
1	Gogo	2
2	Gitaru	225
3	Kamburu	94.2
4	Kindaruma	40
5	Kiambere	144
6	Masinga	40
7	Mesco	0.38
8	Ndula	2
9	Sagana	1.5
10	Tana	14.4
11	Turkwel	106
12	Wanjii	7.4
13	Sosiani	0.4
14	Sondu Miriu	60
	<b>Total</b>	<b>737.28</b>

### *Geothermal power plants*

Geothermal resources are mainly located in the Rift Valley approximately in a field of about 70 km<sup>2</sup>. Exploration first started in 1956, but interests increased in the 1970's but initial production started in 1981. Estimated potential of geothermal energy in Kenya is more than 2,000 Megawatt equivalents. Currently there are two geothermal power stations, Olkaria I (45MW), Olkaria II (70 MW) both operated by KENGEN and an IPP (OrPower 4 Inc) produces 12MW at Olkaria III. The two, KENGEN and the IPP produce a total of 127 MW of geothermal energy.

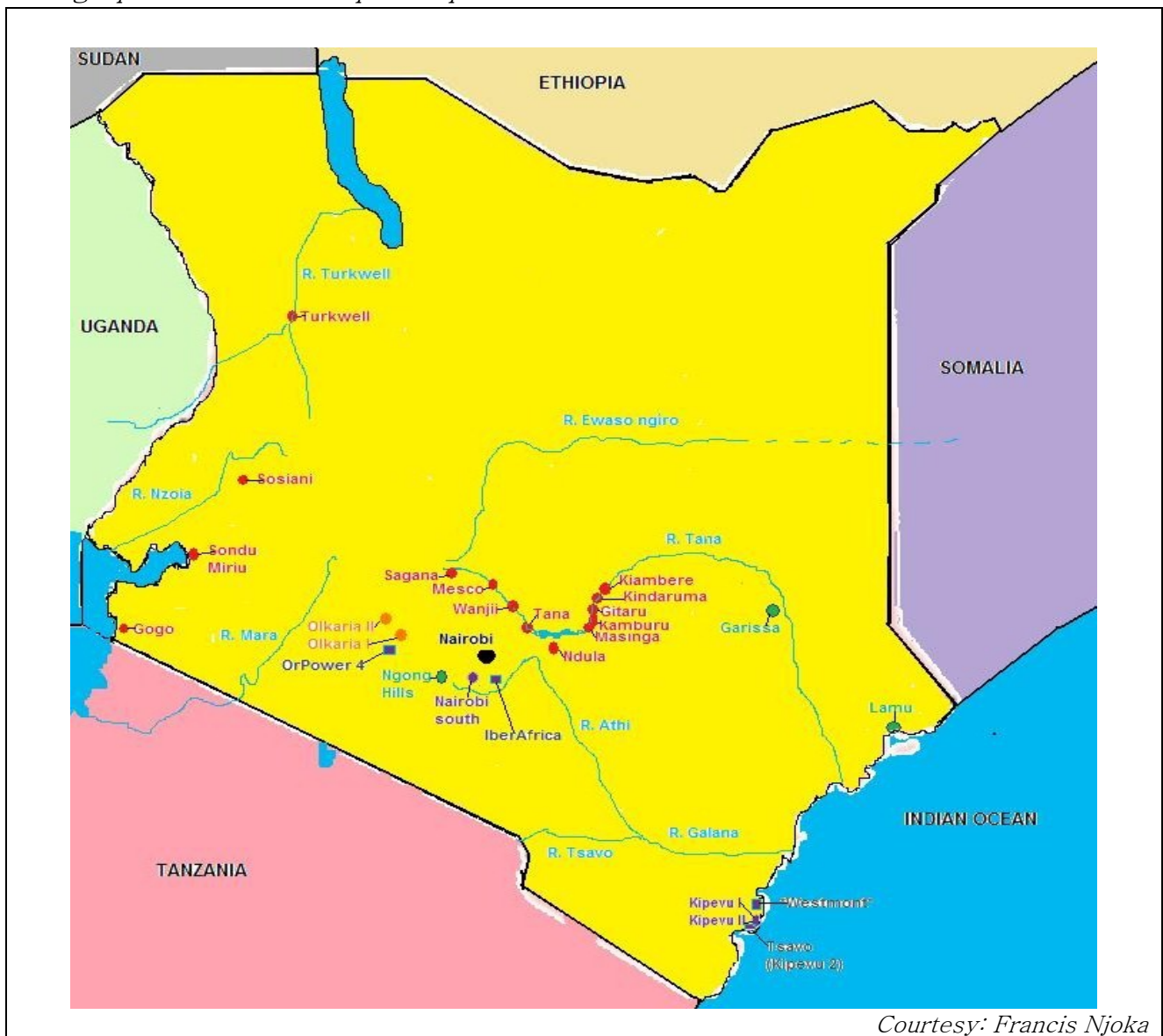
### *Thermal power plants*

KENGEN also runs several thermal power plants which include Kipevu I (60 MW gas turbine), Kipevu II (75 MW diesel run generators) and Nairobi South Gas turbine (11.5 MW) in total producing about 146.5MW. About 174 MW is generated by IPPs' (Tsavo and IberAfrica) thermal installations. Two emergency thermal power plants situated in Embakasi & Eldoret also do exist.

### *Other sources of electricity*

- About 0.4MW is generated from 0.55MW wind generators installed at Ngong hills.
- KENGEN also runs isolated diesel plants producing about 5.8MW (Lamu -2.4 MW, Garissa - 3.4 MW).

### *Geographical location of power plants*





### *Upcoming projects*

<i>Capacity</i>	<i>Station</i>	<i>Type</i>	<i>Implementer</i>
50MW	Tana, Kiambere & Kindaruma	Hydro	KENGEN
21.2MW	Sangoro downstream Sundu Miriu	Hydro	KENGEN
35MW & 2.5MW	Olkaria & Eburru	Geothermal	KENGEN
35MW	Olkaria	Geothermal	IPP
50MW	Nairobi	Diesel	IPP
90MW	Rabai (Mombasa)	Diesel	IPP
60MW	Kipevu	Gas	KENGEN
30MW	N- Eastern	Wind	L. Turkana Wind Power
38MW		Bagasse Cogeneration	Mumias/TARDA
11 off-grids	N-Eastern	Diesel	KENGEN
And several Regional interconnections with Uganda and Tanzania.			

### 3.4. Others sources of energy

#### *Solar Energy*

Kenya receives an irradiation of about 4-6 kWh per m<sup>2</sup> per day. The solar industry may not be quoted as successful despite the many players in the field. Over 15 Solar companies and 'stockists' are in private solar business. There also exists a solar energy networking entity, Solarnet, which attempts to bring together all players in the renewable energy field and create awareness. It is estimated that over 220,000 solar PV units under SHS scheme are currently in use in Kenya and about 7,000 solar thermosyphon kits are in use for water heating and drying. Recently, through the Government's rural electrification programme about 16 schools in North Eastern province (Garissa, Wajir & Mandera areas) were supplied with solar electricity.

#### *Micro Hydro power*

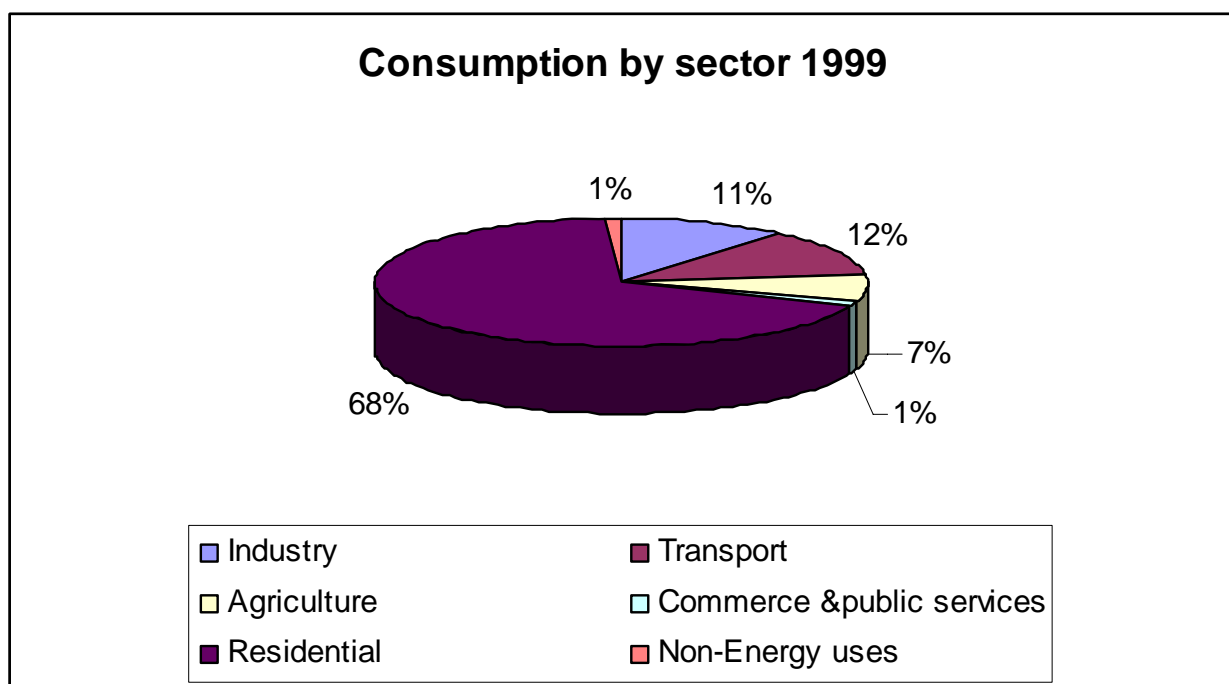
Kenya has quite significant endowment sites suitable for community mini grid systems. The current known potential for isolated mini and micro hydro power is estimated to be 300 MW. However, less than 1MW is currently exploited. Micro hydro projects offer potential solutions to rural electrification though this may not be long-term. A good example is the Tungu Kabiri 20kW unit (Meru south district), a project implemented by UNDP and Practical action. Other commendable projects include, the European Commission co-funded Kathamba (1.1kW) and Thima (2.2kW) projects both in Kirinyaga district.

## Wind mills



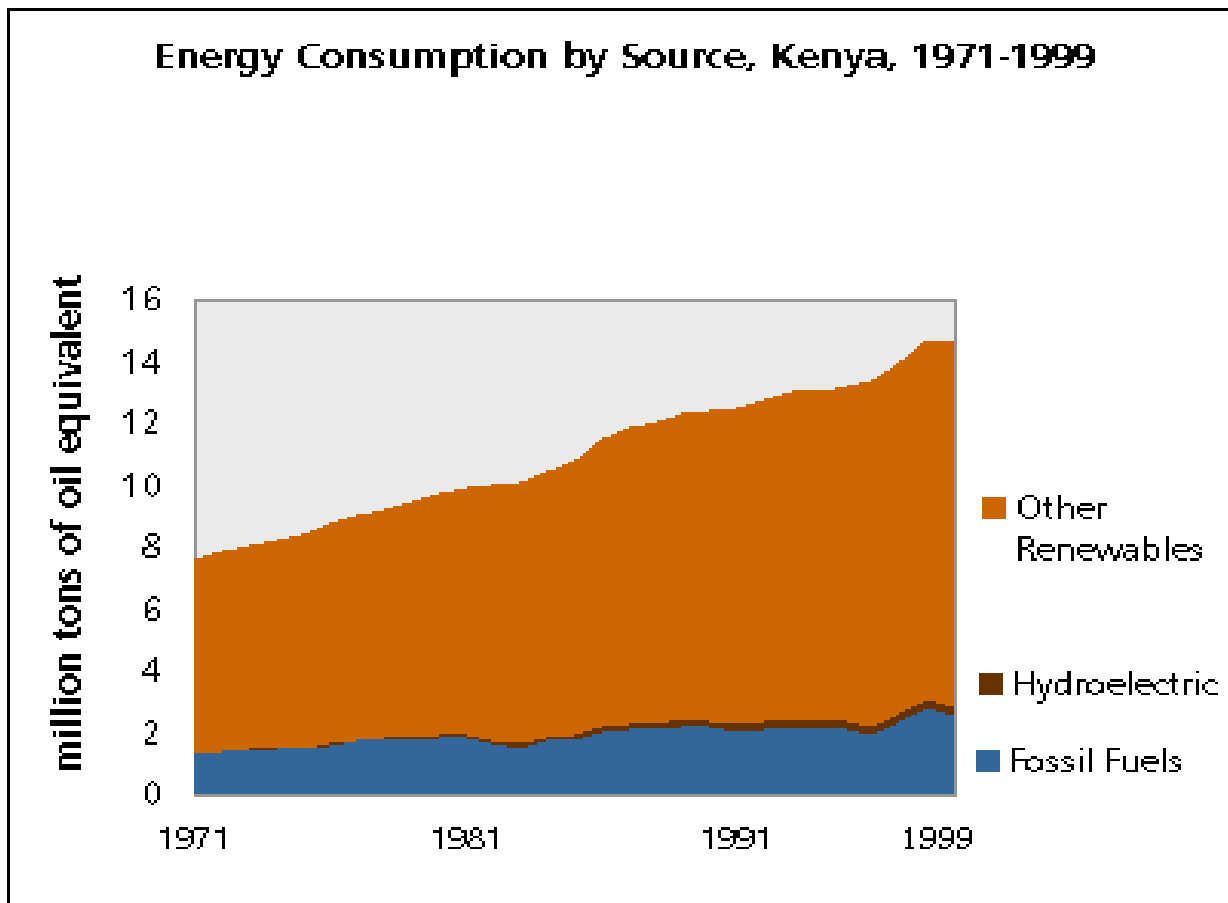
Kenya is also home to the famous multi-bladed Kijito wind pumps. The pumps are manufactured by a private company located in Thika and owned by Bob Harries Engineering Ltd (BHEL), since 1979. The pumps are mostly installed in arid and semi-arid areas (ASALs) to pump water from boreholes. The company has installed over 400 wind pumps with about 75% of them being within Kenya.

### 4.0. Consumption by sector & trends



The above chart shows that most of Kenya's energy is consumed by the residential sector. Despite the fact that the above data is somewhat outdated, the trend may not have changed much. This is supported or can be deduced from the fact that biomass use has not changed much within the last decade.

The chart below also shows that the consumption of renewable sources continues to increase tremendously whereas fossil fuel increments are minimal.



## 5.0. Barriers to RE – Policy

In as much as the Government’s role in matters of energy is critical, its stake in the energy sector as a provider compromises its ability, through the Ministry of Energy and ERC to clear and objective policy decisions. On the other hand, there is the problem of non-cohesive and coordinated research and/or initiatives within the general energy regime. The level of awareness among key stakeholders and the general public is still wanting. A good understanding of the global energy trends is necessary for informed decisions/guidelines. Kenya is also deficient of trained manpower in the energy sector.

## 6.0. Conclusion

The Ministry of Energy's introduction of feed-in-Tariffs is a step in the right direction and it is hoped more investors venture into RE though favourable incentives for solar PV are needed as well. The future sources of energy are definitely going to be renewables. The Ministry also needs to unite and strengthen the already existing groups of renewable energy players and all players must on the other hand look at each other as partners and not competitors.

For the Government to play a dual role, a lot of sobriety and objectivity must be practiced at all levels of its administration. The Government also needs to coordinate Biofuel establishments to mitigate probable food/fuel/land crisis.

As the rest of the world focus on independent, sustainable, clean and efficient energy systems, Kenya also needs to work on its energy infrastructure. The starting point is training of personnel especially in Renewable energy. For instance, the unsustainable use of biomass (which is a function of population increase, high levels of poverty), global warming trends and environmental degradation trends are all reflecting negatively on big hydropower plants for example. Therefore, only focusing on the quantitative production projections and failing to build on alternatives through training and research, investing or incentives will lead to adhoc remedial actions.

## 7.0. References

- The Energy Act 2006
- [www.energy.go.ke](http://www.energy.go.ke) – 29/12/2008
- [www.communication.go.ke](http://www.communication.go.ke) – 30/12/2008
- [www.kengen.co.ke](http://www.kengen.co.ke) 05/2008, 29/12/008
- [www.kplc.co.ke](http://www.kplc.co.ke) – 05/2008, 30/12/2008
- [www.kpc.co.ke](http://www.kpc.co.ke) – 05/2008
- Approval for schedule of tariffs of supply by KPLC – Gazette notice No.12 of 2006 (ERC)
- Feed-in-Tariffs guide for investors – Min. of Energy 01/05/2008
- The Kenya IPP experience – A. Eberhard & K. Gratwick (2005)
- Country profile: Kenya, June 2007 – Library congress (FRD)
- Energy privatisation and reform in East Africa (2008)– David Hall (PSIRU)
- Kenya country commercial guide FY2003: Investment climate – Cynthia Griffin (IMRR)
- <http://www.kijitowindpower.com/> – 07/01/2009
- [http://www.energem.com/energem\\_biofuels.asp](http://www.energem.com/energem_biofuels.asp) – 07/01/2009
- <http://globaledge.msu.edu/countryInsights/economy>. – 07/01/2009
- <http://gasifiers.bioenergylists.org/stovesdoc/Karstad/canecoal/vpnchemelil.html> –11/01/2009
- Status & Prospects of Biofuels in Eastern and Southern Africa –Stephen Karekezi, John Kimani, Waeni Kithyoma and Kennedy Muzee AFREPREN/FWD