

Energy sector offers major opportunities

China partners with Kenya to help bridge the energy gap

Kenya's energy sector will be a key enabler for Vision 2030, with opportunities in petroleum, Liquefied Petroleum Gas (LPG), the electricity sub-sector, coal, and renewable energies, including geothermal and hydropower.

Currently, the country depends on biomass (68 percent), hydrocarbons (22 percent), electricity (9 percent), solar, and other forms of energy (1 percent) for its energy needs, with petroleum and electricity dominating the commercial sector. Energy Minister Kiraitu Murungi and the Kibaki government are keen to reach out to Chinese investors to help bring the sector up to its full potential.

Hampered by under-developed infrastructure, the electric power supply in Kenya is far below demand. With an installed electricity generation capacity of 1,359 mW under average hydrological conditions, peak consumption demand stands at 1,200 mW, leaving a reserve mar-

gin of 13 percent that is being rapidly reduced by the country's expanding industrial activities. Urgent measures are, therefore, needed to generate additional capacity to meet the current and future energy demand.

Dry geological conditions experienced due to a drought between August and October 2009 meant capacity was reduced to 900 mW, and the government contracted an emergency power producer to fill the gap by generating 290 mW. Minister Murungi hopes Chinese cooperation will see the gap close further.

"I have visited China many times since 2004," he said. "The relationship between our two countries has always been of mutual benefit to our people. The greatest bottleneck we have had to develop in both Kenya, and Africa as a whole, is our infrastructure network, and we have realized that Chinese cooperation is really opening up the continent."

More than 80 percent of Kenyans



Kiraitu Murungi,
Kenya's
Minister
of Energy

live without electricity, and by 2012, analysts have predicted a peak electricity demand of 1,454 mW against an effective generation capacity of 1,923 mW. As challenging as this demand is, the Energy Minister remains confident that it represents an unmissable business opportunity.

"We are focusing on electricity generation," he said. "We are trying to upgrade our ageing transmission and distribution network, as well as expand it. We have a chronic shortage of power, which is a result of decades of neglect and underinvestment in the sector."

"Vision 2030 is an ambitious plan to transform Kenya from a backward, agriculture-based economy, to a medium-industrialized economy similar to say Malaysia or South

Korea. The challenge is to ensure we provide an affordable, adequate, and reliable power supply as the engine for development whilst taking care of our environment."

Customer connections

Demand is expected to grow 7 percent year-on-year over the next 10 years, fueled by an accelerated consumer connection policy that aims to connect at least a million customers over the next five years, at a cost of \$1.08 billion and the expected economic growth performance. Despite the bleak "80 percent without" statistic, customer connections rose rapidly between 2006 and 2008.

The projected growth rate will require corresponding increases in capital outlay to provide the needed incremental generation capacity and the associated supply and distribution infrastructure: the government connection charges will require 60,000 transformers, with another 2,000 requiring annual repairs. There is also high potential for the manufacturing of other related equipment, such as switchgears, insulators, and electricity meters.

A factory has been proposed to make the transformers, which will benefit from both the East Africa Community and the Common Market of Eastern and Southern Africa (COMESA).

Oil drilling

Other strategies to be deployed to increase energy supply in the country include the intensification of the ongoing exploration for oil, gas and coal in Mandera, Lamu, Nyanza and Mui Basins. The sector will also enhance the ongoing geothermal power exploration and development in collaboration with the private sector while LPG handling, storage, and bottling facilities will be constructed in Mombasa and Nairobi.

The Energy Minister believes the private sector will play a key role in providing the required capital either on its own or through public private partnerships. "We have a unique

local resource in geothermal energy which can produce around 7,000 mW, that will meet the country's needs for now, and we are trying to invite investors to this sector."

"We are very happy to have an enthusiastic partner in the form of the Great Wall Drilling Company from China. We also have interests in green energy; specifically wind energy as Kenya has very good velocity, and we are calling upon investors to assist in this area also."

Investments still exist in the exploration of hydrocarbons and petroleum, and Kenya is currently working with China's CNOOC Ltd over plans to sink the deepest oil exploration well in the country, which will be 5,000 meters.

We are exploring for coal in Eastern Province and will soon be tendering for that. We are looking for experienced coal companies that can apply clean coal mechanisms."

KIRAITU MURUNGI
KENYA'S MINISTER OF
ENERGY

"We are very excited about the initiative and happy with the commitment CNOOC Ltd has shown," Minister Murungi said, "We are also happy with the fact our oil storage and transport system is expanding. We are working with Chinese consultants and contractors to build a pipeline from Nairobi to Eldoret, which is about 300 km."

"We are also working with them to expand our transmission networks. We have just completed two high voltage projects: the Kamburu in Meru and the Kisi Chemosit line,

and are working on a new line from Mombasa to Lamu.

"As you can see, we are working with the Chinese in both the petroleum and renewable energy sectors and would like to strengthen this relationship," Murungi said.

Discussions are also ongoing with the government of Tanzania and the World Bank regarding the possibility of setting up a liquefied natural gas terminal in Mombasa that will use natural gas from Tanzania for electricity generation. If this is found to be feasible, the Ministry will invite private sector investment.

Coal exploration is another potentially lucrative investment opportunity. Mombasa Harbor was recently identified as the site for a 300 mW coal power plant, due to the availability of space and minimal amount of coal handling between ship and plant. The government hopes similar power plants can be built in the vicinity in the future, tapping into the coal unloading and grid connection facilities.

"We are exploring for coal in Eastern province and will soon be tendering for that," Murungi said, "We are looking for experienced coal companies that can apply clean coal mechanisms to help us generate energy from this resource."

The energy sector takes cognizance of the lack of strategic reserves, both electricity and petroleum, which cause disruptions in supply and prices. The sector has to mobilize enough financial resources to invest in the planned programs and projects that include renewable energy resources and petroleum to meet the target demand by 2012 as well as create the requisite reserves.

In view of this, the sector plans to undertake massive investments in the exploration, generation, transmission and distribution of energy over the plan period at an estimated cost of \$8.3 billion.

A major project to connect Kenya to the Southern Africa power pool through Tanzania at a cost of \$110 million is also planned.



Lake Bogoria Geysers

Geothermal and hydro development fuel growth

Capital and expertise from China aid clean fuel advance

Kenya is endowed with significant amounts of renewable energy resources, such as wind, solar, geothermal, small hydro and biomass. However, few renewable energy resources in the country have been fully assessed, mapped and appraised for their technical and economic viability.

If harnessed these resources could play a significant role in the country's energy supply mix, so the government is keen to get up to speed in the coming years.

As the most widely used form of energy in Kenya, biomass energy resources are derived from forest formations such as closed forests, woodlands, bush lands, farmlands, plantations and agricultural industrial residues. These resources include wood-fuels and agricultural residues.

Although biomass fuels are the most important sources of primary energy in Kenya, with wood fuel consumption accounting for over 68 percent of the total primary energy consumption, the development of these resources cuts across various sectors and requires a multi-sectoral approach.

With electricity demand expected to reach 15,000 mW by 2030, time is of the essence, so the government has identified Kenya's untapped geothermal potential (currently estimated at between 7,000 and 10,000) as the most suitable indigenous source of electricity generation. It is embarking on an ambitious program to realize 4,000-5,000 mW of power by 2030.

To accelerate this, the government formed the Geothermal Development Company (GDC) to undertake a comprehensive geothermal resources assessment. GDC, which is charged with exploration, drilling, assessment and development of geothermal resources, will sell steam to Kenya Electricity Generating Company (KGENGEN) and interested private investors to develop power plants and the generation of electricity.

Endowed with vast geothermal resources, the Rift Valley province has an estimated potential of between 7,000 and 10,000 mW. Out of this, only 202 mW has so far been developed.

Appraisal drilling is currently in progress in the Olkaria geothermal field for the development of 280 mW electric power plants. Twenty-five wells with an output of over 170 have already been drilled. At least 40 wells will be required for the power plants to reach their full capacity at a cost of \$231 million.

The People's Republic of China recently extended a loan agreement of \$90 million for the drilling of 26 wells attached to this project, which have the potential of producing an additional 140 mW.

"Using local resources and the help of development partners, such as the Great Wall Drilling Company, we have embarked on an ambitious drilling program", Energy Minister Kiraitu Murungi said.

"We hope to be able to generate at least the minimum 4,000 mW from geothermal resources. It is a major investment and we are appealing to other investors to join hands with us."

Opportunities for investment exist in various geothermal plants, which will produce between 50 mW and 140 mW in different sites around the Rift Valley within the next five years. Over the next eight years, the country plans to install additional geothermal capacity in excess of 720 mW, with GDC carrying out detailed surface exploration is Silali, Korosi, Barrier and Emuruangogolak. It will drill 566 wells, with a total amount of steam generation of 2,400 mW.

Minister Murungi, who oversees the GDC, said: "Total capital requirement for the project will be \$2,567 million. Capital costs will be met from a government budget of \$448 million, GDC net revenue from the sale of steam will be \$520 million while support from development partners will be to the tune of \$599 million."

Although hydropower plants have not been considered economical in the past, recent oil price increases now make them attractive for investment. The government has earmarked significant sites for small hydros, including stand-alone systems suitable to rural energy demand patterns.

The current known potential for mini and micro hydro is estimated to be 3,000 mW. Feasibility studies have been conducted and the Ministry of Energy has identified over 300 sites with a total potential of 600 mW. Private investors are being encouraged to aggregate several sites for joint ventures.



Wind farms will provide much-needed electricity in Kenya, which has abundant high-speed winds.

Renewable energies boost the grid

The Ministry of Energy has made significant strides in the promotion, development and utilization of renewable energy resources, resulting in an increase in the proportion of its contribution in meeting the country's energy demand. This has significant socioeconomic benefits, such as poverty alleviation and the improvement of the welfare of Kenyans and the country at large through income generation and employment and wealth creation.

Renewable energy technologies that have contributed in making a positive impact include solar, wind, micro hydro and modern biomass (co-generation and improved stoves).

As is fitting for a country so close to the Equator, solar energy is abundant in Kenya and offers a unique opportunity for a vibrant solar energy market that provides cheap electricity to homes and institutions, particularly those that are far from the national grid, in the Arid and Semi Arid Land (ASAL) areas. Although not yet fully exploited because of the initial capital outlay required to harness it, the private sector has done much to promote and install solar electricity (photovoltaic or PV) generators in the country, although data on installed capacity is as yet unavailable.

Important strides have been made

in implementing a solar electricity program in schools, health centers and dispensaries in remote areas far from the grid. This PV program was initiated in 2005 and to date has benefited 134 boarding secondary and primary schools, health centers and dispensaries in 20 ASAL districts at a cost of \$6 million.

Leading by example, the government will also introduce mandatory solar water heating in designated residential and commercial buildings within Kenya's municipalities, to enforce the usage of solar water heating and natural ventilation in all new buildings where technically feasible. As well as providing relief to the grid, solar water heating will reduce the oil import bill, develop the local solar industry and create employment. Water heating regulations have been developed and all formalities regarding by-laws approved.

The wind factor

A national Wind Atlas was prepared in 2001 with indicative wind regimes based on synoptic weather stations data. This was updated in 2005 using satellite data provided by several agencies including National Aeronautical and Space Administration (NASA) and ground validation. Since then the Ministry of Energy has installed 20 wind masts

and data loggers to enable collection of more wind data to augment the wind atlas.

A new project which aims to acquire more data at reasonable heights (40 m) that will be used to update the wind atlas to provide a more realistic wind map to guide investors to sites with good potential for wind power development started in 2009. Under this project, masts and data loggers will be installed at 33 sites across the country to generate wind regime data to enable private investors to make informed decisions on wind power generation. This will be extended in the coming years.

"We have just signed a contract with the Lake Turkana Wind Consortium for 300 mW in Northern Kenya, and there is enormous potential for tidal generation," said Energy Minister, Kiraitu Murungi. "We already have a proposal from an Israeli investor to generate electricity from the sea waves near Malindi, and invite more investors to come on board."

"To encourage accelerated investment in renewable energies, the Ministry has formulated new feed-in tariffs on wind, geothermal, biomass, and small hydropower systems. Under this policy Kenya Power and Lighting Company Ltd. is required to sign long-term Power Purchase Agreements with investors," Murungi concludes.