Lake Turkana Wind Power Project - Summary

Technical characteristics of the project

The Lake Turkana Wind Power project envisions the construction of a 310 Megawatt (MW) wind power plant in Loyiangalani, Laisami District, Northeastern province of Kenya. The wind farm will consist of 365 turbines each with a capacity of 850 kilowatts (kW). Each turbine will be mounted on a tower and powered by a three-bladed rotor.

The plant will add approximately 25% to the current existing capacity of Kenya and will supply up to 1,500 GWh of electricity per year. The electricity generated will be purchased by the Kenya Power & Lighting Company (KPLC) and distributed to consumers in Kenya.

The project concession area covers approximately 150 square km (66,000 ha), which has been leased from the Marsabit County Council for 33 years, twice renewable. The project area has unique geographical conditions in which daily temperature fluctuations generate strong predictable wind streams. Wind speeds have been measured during a full year at a 43, 62, 81 and 83 meter high. The average monthly wind speed is 11 m/sec.

The project will be connected to the national grid near Longonot. Hereto, the project will construct a 400 kV transmission line of approximately 428km in length.

As the turbines have to be transported from Mombasa to Loiyangalani a number of road adjustments, upgrades and constructions will be needed for the safe passage of the wind power units.

Economics

The total project cost (including transmission line and road construction) is estimated at 780 million USD. The project will be financed through equity and commercial loans. No ODA or grants are involved.

The project will benefit from carbon revenue by replacing electricity generated by fossil fuel fired power plants connected to the national grid. It is expected that the project will generate average emission reductions of 919,060 tCO_2 per year which at current market prices amounts to roughly 12 million euro per year.

Difficulties

Apart from the rather general barriers (financing and approval processes) which every infrastructure project experiences, there are a few specific barriers that had

to/have to be overcome by the project. These include:
Data Availability and site selection:

Wind potential assessments are site specific and time consuming. This means that wind energy developments require a large initial investment for careful wind prospecting which can take up to two years. Good equipment and quality work is needed, which is expensive.

Negotiating a good tariff

Key to the success of any grid-connected energy project is the retail tariff. According to a survey carried out by the World Bank, the retail tariff level is reported by leading investors as the most important reason why a power sector investment in developing countries succeeded with 66 percent of investors surveyed reporting that this is critically important for the success of an investment. The same survey also provides an insight into reasons why a power sector investment fails. An inadequate tariff level tops the list followed by a lack of government responsiveness and weak contract enforcement. (Source: Brandtzaeg, B. and S. Hansen (2005) *Barrier to Investment in the Power Sector in Developing Countries.* ECON Analysis/Nordic Consulting Group).

Currently, the Kenya Power and Lighting Company (KPLC) is the only licensed public electricity distributor in Kenya. The industry structure in place is therefore of the single buyer model, with KPLC undertaking transmission, dispatch, distribution and supply. KPLC buys the electricity from a power producer based on a Power Purchasing Agreement. Fifty-one percent of the shares of KPLC are government-owned.

In 2008, the Ministry of Energy adopted a *Feed-in Tariffs Policy on Wind, Biomass and Small Hydro Resource Generated Electricity*. Even though, the Feed-in Tariffs Policy is considered an important step towards attracting more investment in renewable energy projects, many project developers consider them to be too low for the policy to serve its purpose. In terms of wind energy, the Feed-in Tariffs Policy only provides a tariff for wind projects of 50MW and lower. Because of the lack of a guaranteed tariff for wind projects larger than 50MW, the project activity had to negotiate its own tariffs with KPLC.

Key barrier in negotiating an attractive tariff with KPLC is the fact that the country has historically relied a lot on hydropower, which is a relatively cheap form of energy (4 USD cent/kWh). Because of the increased occurrence of droughts in the region, hydropower has become less reliable and countries have realized the need for diversification. Nevertheless, the mindset is still very much focused on the 4 USD cent/kWh which is highly insufficient for a wind energy project.

As one of the elements of negotiating an attractive tariff with KPLC, the project has agreed with KPLC to transfer part of the carbon credit revenue to KPLC.

Transmission line

The location of the project area has been selected because of its exceptional wind conditions. The main disadvantage of the area, however, is that there is no transmission infrastructure in place that can easily connect the project activity to the national grid. In fact, lack of transmission infrastructure is increasingly seen as a major barrier to the implementation of renewable energy projects like wind and solar.

To overcome this barrier, the project activity has to establish a 428km transmission line connecting the project to the national grid. The construction of the transmission line is adding a separate set of barriers to the already existing barriers for the project.

Lack of understanding of technology

Wind energy is a relatively new form of energy in the region. Only on 21 August 2009, the first 5.1 MW of wind generated electricity was commissioned in Kenya. Because of the newness of the technology, there is still a general lack of understanding about the technology. People tend to be skeptical about the potential of wind energy as a reliable source of energy.

The lack of familiarity with the technology has meant that the negotiations and approval processes have been taking relatively longer and external support was needed to facilitate parts of the discussions.

Potential

The topography specifics (channelling and hill effects due to the presence of the Rift Valley and various mountain and highland areas) have endowed Kenya with some excellent wind regime areas.The North West of the country (Marsabit and Turkana districts) and the edges of the Rift Valley are the two large windiest areas (average wind speeds above 9m/s at 50 m high). The coast is also a place of interest though the wind resource is expected to be lower (about 5-7 m/s at 50 m high). Many other local mountain spots offer good wind conditions. Due to monsoon influence, some seasonal variations on wind resource are expected (low winds between May and August in Southern Kenya). It is expected that about 25% of the country is compatible with current wind technology.

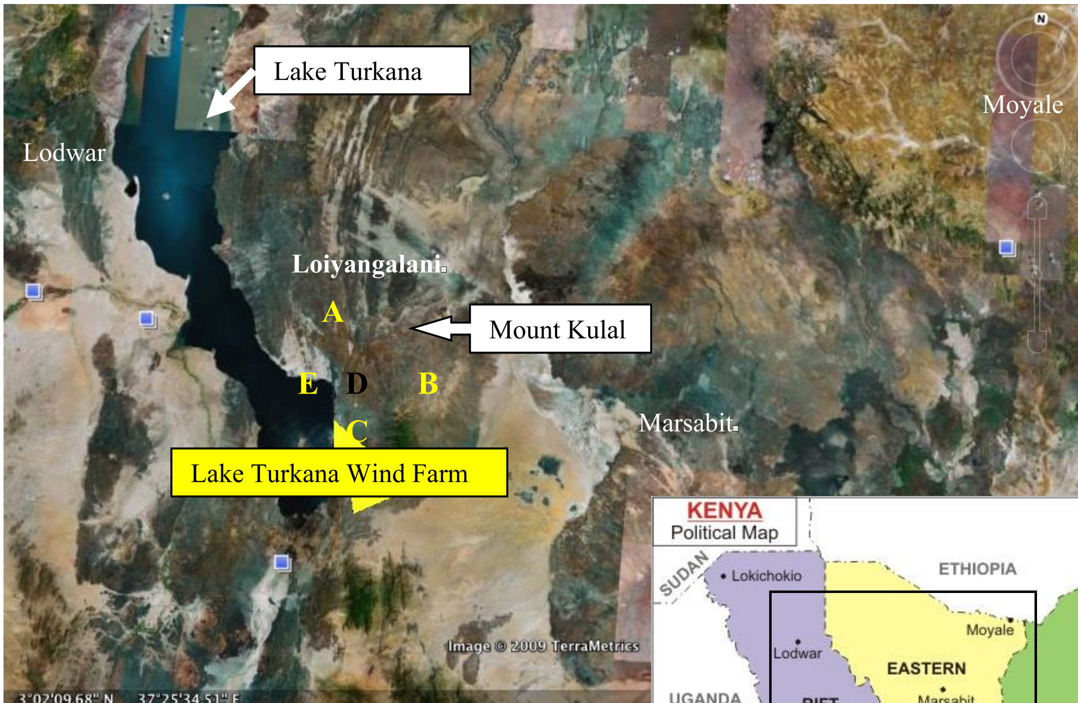
Currently there are already a number of other large-scale wind projects under consideration in Kenya including in Malindi, Kinangop, Ngong and Marsabit. The pioneering work done by the Lake Turkana Wind Power project will greatly facilitate the further development of those projects and increase confidence of investors and financers. The potential is certainly there but until the deal is closed, all eyes will be on the Lake Turkana Wind Project.

Co-benefits

The implementation of the Lake Turkana Wind Power Project is expected to contribute to the sustainable development of Kenya in various ways:

- The introduction of Lake Turkana Wind Power Project will provide a reliable source of energy to Kenya's growing economy
- The project will open ways for the further expansion of wind power projects in Kenya and the region
- The project will generate local employment opportunities during the construction and operation phase
- The project will upgrade the road system in the project area
- The project will contribute to Kenya's fiscal revenues through the payment of taxes.
- The project will improve the hydrocarbon trade balance through reduction of oil imports used for electricity generation.
- The project will reduce the consumer price of electricity which is currently very high due to high fuel costs

Figure 1: Project location and coordinates



Geographical Coordinates of the Project Area		
	North (N)	East (E)
A	2º 45’ 53”	36º 42’ 20”
B	2º 32’ 22”	36º 59’ 22”
C	2º 25’ 11”	36º 47’ 44”
D	2º 30’ 57”	36º 45’ 29”
E	2º 30’ 43”	36º 42’ 01”

Table 1: Currently installed power generating capacity in Kenya

Name	Type	Owner	Year	Capacity (MW)
Mumias	Biomass	Mumias	2005	2
Total Biomas				***2***
Olkaria II	Geothermal	KenGen	2003	64
Orpower 4	Geothermal	IPP	2000	13

Olkaria I	Geothermal	KenGen	1985	45
Total Geothermal				***122***
Sondu Miriu	Hydro	KenGen	2007	60
Gitaru	Hydro	KenGen	1999	225
Turkwel	Hydro	KenGen	1991	106
Kiambere	Hydro	KenGen	1988	144
Masinga	Hydro	KenGen	1981	40
Kamburu	Hydro	KenGen	1976	94.2
Kindaruma	Hydro	KenGen	1968	40
Gogo	Hydro	KenGen	1958	2
Sagana	Hydro	KenGen	1955	1.5
Sosiani	Hydro	KenGen	1955	0.4
Tana	Hydro	KenGen	1955	14.4
Wanji	Hydro	KenGen	1954	7.4
Mesco	Hydro	KenGen	1933	0.38
Ndula	Hydro	KenGen	1925	2
Total Hydro				***737.28***
Aggreko I	Thermal	Aggreko	2006	110
Aggreko II	Thermal	Aggreko	2006	40
Tsavo Diesel	Thermal	Tsavo	2001	74
Kipevu Diesel	Thermal	KenGen	1999	73.5
Kipevu GT2	Thermal	KenGen	1999	30
Iberafrica	Thermal	Iberafrica	1997	56
Kipevu GT1	Thermal	KenGen	1987	30
Nairobi South Fiat	Thermal	KenGen	1973	13.5
Total Thermal				***427***
Ngong wind	Wind	KenGen	1993	0.35
Total Wind				***0.35***
Grand Total				**1,289**

Figure 2: Vestas V52 Wind Turbines (Ngong Hills, Kenya)

Figure 3: Lake Turkana

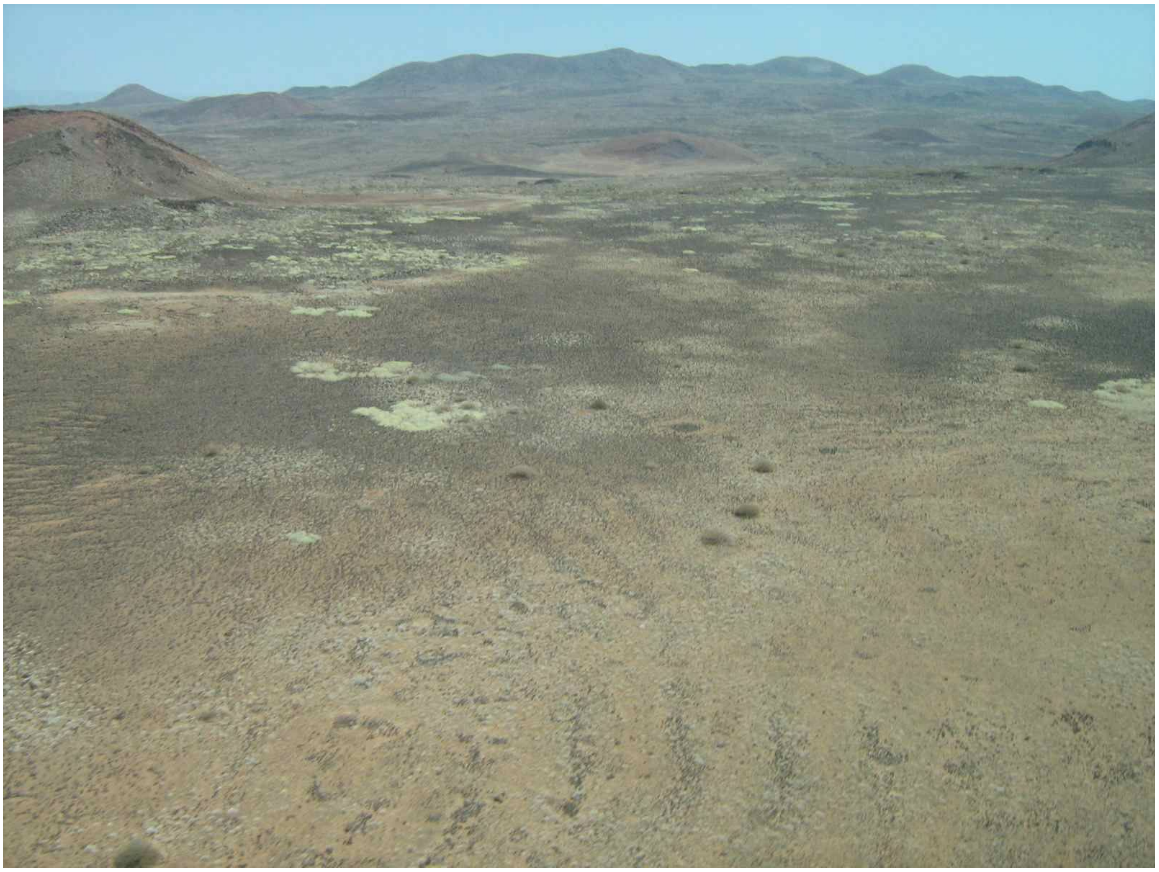


Figure 4: Project area