ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

SUMMARY

Lake Turkana Wind Power Project

Kenya

Project Number: P-KE-FZ0-001
Department: OPSM.3
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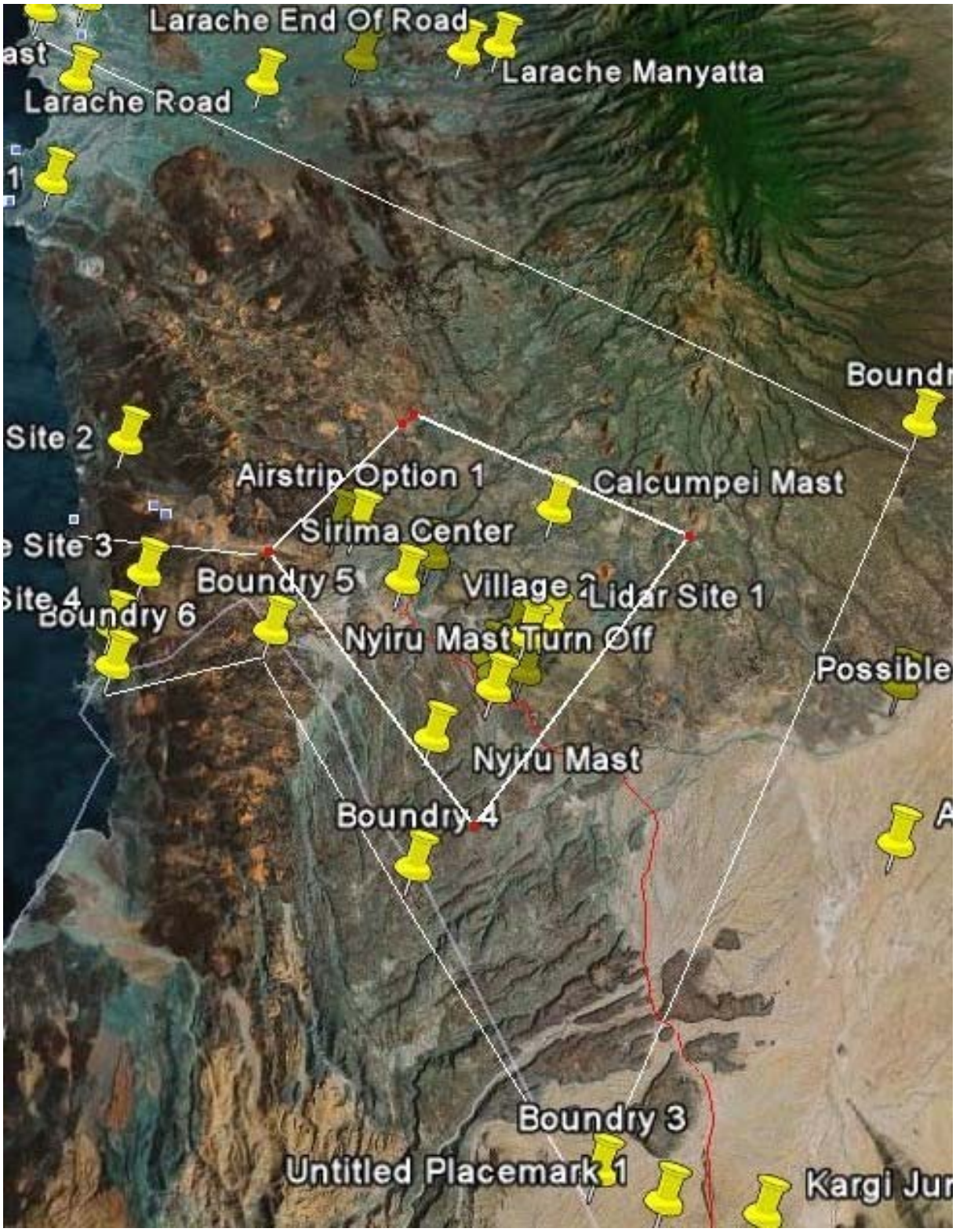
Map 1. Map of the location of the Lake Turkana Wind Power Project (within Marsabit District)



1. Introduction

This report is the Executive Summary of the Environmental and Social Impact Assessment (ESIA) Study prepared by a team of consultants, including Professor Francis M. Muthuri, Environmentalist/Team leader, Ms. Pauline Ikumi, Sociologist and Mr. Frank Msafiri, Natural Resource Assessment Expert/Botanist for Lake Turkana Wind Power (hereafter the Project) on behalf of the Lake Turkana Power Ltd. (hereafter the Sponsor) in the context of the Feasibility Study of the Lake Turkana Wind Power (LTWP) Project.

The objectives of the Environmental and Social Impact Assessment (ESIA) Study are to identify and evaluate the environmental and social (with a gender disaggregated analysis) effects, which could arise from the proposed construction and operation of project's activities, liaise with Government authorities, District Officers, Village Development Committees, and all organizations and interest groups involved directly and indirectly with the proposed project in order to seek their views, identify and describe procedures and propose enhancement and mitigation measures in an Environmental and Social Management/Monitoring Plan (ESMP), including institutional strengthening and capacity-building measures to ensure an efficient, effective and timely implementation of the ESMP.

The methodology underlying the preparation of the ESIA Study included a multi-stage approach, namely the preparation of a biophysical and social scoping review, including consultative meetings with National Environment Management Authority (NEMA), government departments (e.g. Livestock, Fisheries, Gender), para-statal organizations (Kenya Wildlife Service, National Museum of Kenya, etc.), provincial administration and local community leaders in Loiyangalani Division (e.g. including the Yammo Manyatta Community (Turkana), Nakuame Kwi Manyatta (Turkana), Kiwanja Ndege Manyatta (Samburu and Rendille) and El Molo Community (originally from Komote Laiyeni Village) as well as gender and youth-based groups, including the Mosaretu Women Group, Kifaru Women Group and Nayori Environmental Conservation Rehabilitation Youth Group, and, finally, NGOs. An exhaustive list of people and organizations invited and consulted during the ESIA Study as well as the minutes are found in Annex 9 and 10a) and 10b) of the ESIA Study. A field trip at the project location and in Loiyangalani from November 15 to 25th, 2007 was also undertaken as well as additional biophysical (plant specimens, water quality) and social surveys and an exhaustive literature review. Public disclosure of the draft ESIA report in Loiyangalani for a period of three weeks from March 31st, 2008 to invite written comments followed by a well represented Stakeholders Workshop (53 participants) on April 21st and 22nd, 2008 at the Palm Shade Lodge to present the ESMP completed the ESIA process.

2. Project Description and Justification

The Lake Turkana Wind Power Project involves the construction and operation of a 300 MW wind power plant in Marsabit District, near Lake Turkana in the Great Rift Valley, in the north-western part of Kenya. The wind farm will comprise 367 turbines of 850KW

capacity each to maximize the very high wind speed in the Turkana corridor low jet stream corridor.
In 2005, LTWP contracted DEWI - a leading international wind energy consulting firm - to carry out extensive wind tests using a dedicated wind measuring station situated in the envisaged wind farm. Wind speed measurements were recorded every ten minutes at heights of 43, 62, 81, and 83 meters above the ground. The average wind speed was set at an impressive 11 m/s (as compared with a high average in Europe of 7 m/s). LTWP subsequently submitted a proposal to the Kenyan Authorities who welcomed the project, granting LTWP the exclusive rights to survey the project site and to study the wind resources on 27 April 2006, and subsequently signing an MOU between the KPLC and the Company on 10 April 2008.
The clean power output generated will supply energy to Kenya's national grid to contribute up to 25% of the existing national installed power and will be connected at Suswa, near Naivasha. Average electricity production is estimated at 1,440 GWh per year. The project will be the biggest energy project involving exploitation of wind resource for generation of electric power in Kenya and the whole of the Africa Continent.
The project site is located at the South-Eastern end of Lake Turkana (between two high ranging mountains) in an uninhabited, rocky, desert area that has annual average rainfall of less than 300 mm. The closest deep-sea port is Mombasa, which is about 1200 km from the site. Administratively, the project will be situated in the Loiyangalani Division of the Marsabit District in Eastern Province of Kenya. The project will be developed and operated by the Lake Turkana Wind Power Ltd (LTWP), a consortium of foreign and local entrepreneurs. Kenya Power and Lighting Company (KPLC) will buy this capacity at rates which will be favorable to the domestic consumer.

The project will be constructed in one phase in accordance to the following schedule:

Installation of 1 turbine per day for a year period, starting July 1st, 2011. Completion date would be July 1st, 2012. Full connection to the Kenyan grid should start by completion of the 15th turbine, meaning July 15th, 2011.

Project lifespan of the proposed wind mills is expected to be 25 years.

Project rationale and justification. Currently the electricity sector in Kenya only reaches an estimated 14 percent of the population. Further electricity generation is therefore necessary in order to reach a greater percentage of the population and support economic growth. The situation is aggravated by the over reliance (approximately 50%) on hydropower which has been often unreliable especially in the dry seasons. The 1999 -2002 drought in the region is an example of periods where lack of water supply greatly affected the power production of the hydroelectric dams which had a crippling effect on the economy. As such, the project will increase the resilience of the Kenya power generation vis-à-vis potential climate risk variations in Kenya.
This experience underscores the need to increase power production and to diversify power sources. The entry of the Lake Turkana Wind Power Project into the Kenya power scenario will help the country to address power shortage and enhance further economic growth. Towards this objective, the implementation of the proposed Lake

Turkana Wind Power Project will provide the country with 300 MW of a relatively cheap source of energy.
In accordance with Kenya Vision 2030, energy is one of the infrastructural enablers of the three (3) developments pillars, namely the economic, social and political aspects. In addition, the current energy policy objectives in Kenya emphasize the need for energy availability and accessibility at cost effective prices. The policy also supports sustainable socio-economic development while protecting and conserving the environment. Finally, LTWP plans to develop this renewable energy resource to serve Kenyan consumers in accordance with the Government's "Least Cost Power Development Plan (2009—2029)". The Plan aims to encourage the diversification of Kenya's energy sources[1], enhance national energy security, reduce dependence on imports, and overcome the unpredictability of petroleum fuel costs. There is therefore a compelling need to improve the national generation capacity through such an investment.

The main sources of energy in Kenya are electricity, wood fuel, petroleum and renewable energy. Of the total energy requirements in the country, the bulk (68%) of the country's primary energy consumption comes from wood fuel and other biomass sources which has resulted in one of the highest deforestation rate on the whole Africa continent. This is followed by petroleum at 22%, electricity at 9% and other sources at 1%.

Of the above main sources of energy in Kenya, electricity is crucial for the economic development of the nation. The provision of inexpensive and reliable supply of electricity is the lifeblood of the Kenyan economy. However, today Kenya's electricity supplies are unreliable and expensive. The entry of the Lake Turkana Wind Power Project into the Kenya power mix will help the country to address power shortage and enhance further economic growth.

However, the development of large scale production of power as projected in the Lake Turkana Wind Power Project is likely to have site-specific and limited impacts on the bio-physical and social environment of the project area. As a result, an Environmental and Social Impact Assessment (ESIA) Study for the proposed project was carried out in accordance to the Kenya's Environmental Management and Coordination Act (EMCA, 1999).

3. Policy, Legal and Administrative Framework

In accordance with the 2nd Schedule of the Environmental (Impact Assessment and Audit) Regulations of 2003, contained in Kenya Gazette Supplement No. 56, Legal Notice 101, the project requires an Environmental Impact Assessment Study. The 2003 regulations have been used to guide the methodology and provide the framework for

[1] Kenya has traditionally relied on hydropower generation, which accounts for 50% of the national capacity. Reliance on a single power source has contributed to the existing energy crisis, which is further fueled by increasingly erratic climate changes and a higher incidence of drought.

the Environmental Impact Assessment (EIA) of the proposed Lake Turkana Wind Power Project.

This EIA report has been prepared in accordance to the outline contained in Part IV, Section 18 (1) of the above regulations stating:

- The proposed location of the project;
- A concise description of the national environmental legislative and regulatory framework, baseline information, and any other relevant information related to the project;
- The objectives of the project;
- The technology, procedures and processes to be used, in the implementation of the project;
- The materials to be used in the construction and implementation of the project;
- The products, by-products and wastes generated by the project;
- A description of the potentially affected environment;
- The environment effects of the project including the social and cultural effects and the direct, indirect, cumulative, irreversible, short-term and long-term effects anticipated;
- Alternative technologies and processes available and reasons for preferring the chosen technology and processes;
- Analysis of alternatives including project site, design and technologies and reasons for preferring the proposed site, design and technologies.
- An Environmental and Social Management/Monitoring Plan (ESMP) proposing the measures for eliminating, minimizing or mitigating adverse impacts on the environment; including the cost, time frame and responsibility to implement the measures;
- Provision of an Action Plan for the prevention and management of foreseeable accidents and hazardous activities in the cause of carrying out activities or major industrial and other development activities;
- The measures to prevent health hazards and to ensure security in the working environment for the employees and for the management of emergencies;
- An identification of gaps in knowledge and uncertainties which were encountered in compiling the information;
- An economic and social analysis of the project;
- An indication of whether the environment of any other state is likely to be affected and the available alternatives and mitigating measures; and
- Such other matters as NEMA may require.

While the Environmental Management and Coordination Act (EMCA) supersedes all other environmental legislation, numerous other laws and regulations has influenced the various aspects and activities of the proposed Lake Turkana Wind Power Project. The most important legislation that will guide the development and implementation of this Project is the Electric Power Act (1998). Other relevant legislation with regard to this project includes: Workmen's Compensation Act (rev. 1988); Geothermal Resources Act (1982) and Regulations (1990); Public Health Act (rev 1972); Physical Planning Act

(1996); Water Act (2002); Wildlife (Conservation and Management) Act (1985) ; Building Code (1997); Local Government Act (rev. 1998); Local Government Regulations (1963); Factories Act (rev. 1972); and Lakes and Rivers Act (rev. 1983) among other pieces of legislation.

Environmental and social requirements of Development Financial Institutions (DFIs), such as the African Development Bank policies (environment, gender, HIV/AIDS, poverty, public participation and public disclosure) and procedures (e.g. Environmental and Social Assessment Procedures) and the International Finance Corporation's Performance Standards (PS 1: Environmental Impact Assessment and Management System, PS 2: Labour and Working Conditions, PS 3: Pollution Prevention and Abatement, PS 4: Community Health, Safety and Security, PS 6: Biodiversity and Natural Resources Management) and IFC's Environmental, Health and Safety (EHS) Guidelines for Wind Energy (April 30th, 2007) were also relevant as baseline requirements to this study[2]. Finally, compliance with the Equator Principles has also been taken into account within the ESIA process and is reflected in one specific chapter of the final ESIA report.

Several international conventions and agreements are relevant to this study, including, among others, the Convention on Biological Diversity (CBD); the Convention on the wetlands of international importance (RAMSAR); the Convention on the conservation of migratory species of wildlife animals; and the African convention on the conservation of nature and natural resources.

Pursuant to the EMCA, its Second schedule and the Environmental (Impact Assessment and Audit) Regulations 31 and 35, NEMA reviewed and approved the ToRs of the ESIA Study on September 20, 2007.

4. Description of the Project Environment

The project area for the Lake Turkana Wind power Project is situated in the Loiyangalani / Mt. Kulal locations of Loiyangalani Division in Marsabit District of the Eastern Province of Kenya. On a closer view, the project area is located between the foot slopes of Mt Kulal and the south-eastern end of Lake Turkana in Loiyangalani Location. The project site covers an area of 150 km^2 (15km by 10km) while the wind farm will cover an area of 40km^2 distributed over three ridges with a distance of 70 meters between each turbine. The project area has been leased from the Government of Kenya (GoK) for a period of 99 years. The leased land runs south east from the south eastern shores of Lake Turkana and passes between Mts. Kulal and Nyiru. The area has unique geographical conditions in which daily temperature fluctuations generate strong predictable wind streams between the Lake Turkana (with relatively constant

[2] It is worth indicating that this project would have been normally classified as Category 2 under the African Development Bank's Environmental and Social Assessment Procedures (or under Category B under IFC's Environmental Policy). In the spirit of the Paris Declaration, and alignment of Bank's procedures toward country's EIA process, the Bank's Private Sector Department has agreed that the project be assigned a Category 1 and thus requires a site-specific ESIA Study, including the preparation of a detailed ESMP.

temperature) and the desert hinterland (with steep temperature fluctuations). The project area covers a valley between Mt Kulal and Mt. Nyiru that effectively acts as a funnel in which the wind streams are accelerated to high speeds.

Climate. The climatic conditions prevailing in the project area and other areas of the Marsabit District are summarized in Table 1. The climate of the project area is hot and very dry. The whole of the project area belongs to what is referred to as Agro Climatic Zone VII. This zone is characterized by very low rainfall and very high evapotranspiration as seen in Table 1.

Table 1. Main Features of the Agro Climatic Zones in Marsabit District

Zone	r/Eo (%)	r (mm)	Eo (mm)	Climatic designation
III	50-55	900 - 960	1750 - 1800	Semi-humid
IV	40 - 50	750 - 900	1800 - 2095	Semi-humid to semi-arid
V	25 - 40	525 - 750	11890 - 2095	Semi-arid
VI	15 - 25	320 - 525	2095 - 2150	Arid
VII	<15	170 - 320	2150 - 2280	Very arid

Source: A.J. van Kekem: Soils of the Mt. Kulal Marsabit Area

Legend:

r – Average annual rainfall (mm)

Eo – Average annual potential evaporation (mm)

Rainfall. The general patterns of rainfall in several areas in Marsabit District are characterized by a distinct bimodal distribution pattern. Based on the rainfall characteristic of the Agro Climatic Zone VII as recorded in the North Horr Meteorological Station, the project area rainfall is also very low, with a mean annual rainfall of less than 300mm. It is noted that there are no operational meteorological stations in the project area (covering the Agro Climatic Zone VII). For comparison, the nearest station with long-term records is North Horr which shares the same Agro Climatic zone (VII) with the project area and where rainfall records have been collected since 1959. The main wet season normally starts in March/April and lasts until May. The short rains start in October/November and last until December. An important characteristic of the rainfall in the project area is the high variability

Temperature. Generally, temperatures of the project area are high. The temperature patterns usually follow the general trends in the tropics where diurnal changes are greater than annual temperatures. The mean monthly temperatures of the project area are in the range of 27- 29^{o}C, the mean minimal lie around 13 – 20^{o}C and the mean maxima are 26– 35^{o}C. The coolest months are July and August while February, March and October are the hottest months.

Wind. Wind is an important factor with regard to the development of this project. Compared to the rest of Kenya, winds in the project area are very strong. The winds are generated by a low level jet called the Turkana Channel jet. The jet stream (discovered in 1981 by J. Kinuthia of the Kenyan Meteorological Department), is caused by the much larger East African low level jet. The Turkana Channel jet blows all year round from the South East through the valley between the East African and the Ethiopian

Highlands stretching from the Ocean to the deserts in Sudan. The wind is accelerated locally between Mt. Kulal (2300m asl) and the Mt Nyiru Range (2750m asl). Due to thermal effects, the wind slows down during mid-day and is at full force during the night.

Lake Turkana Wind Power Project has been measuring wind speeds and frequency in the project area for the last 30 months at 40, 60 and 80 meters altitude. The average wind speed in the project area has been recorded to be 11 meters per second. These are among the highest wind speed averages recorded in the world.

Topography. The project area lies between 450 metres at the shore of Lake Turkana to 2,300metres above sea level (masl) on the foot slopes of Mt. Kulal. The topographical features of the project area are quite variable. The common features of the project area include plains, foot slopes, plateaus, hills and minor scarps and foot ridges.

Hydrology. Occurrence of surface water is very rare in the project area. Only after heavy rains, shallow pools and seasonal water courses may be filled with water probably up to a maximum of a few weeks. The drainage ways in the project area are dry river beds, referred to as laggas. These drainage ways have bouldery and stony riverbeds. Many laggas in the project area seem to be too wide for the existing climatic conditions. They have wide beds with braided characteristics and changing stream channels. Sometimes, once in every 5 to 10 years, the laggas are filled up completely. The Lagga Yammo and Lagga Sirima are important drainage ways in the project area.

There are a variety of sources of water for the population and livestock in the project area. They consist of permanent springs, boreholes and waterholes dug in the riverbeds. An important source of permanent water is Loiyangalani Spring that provides water for the community around this area. Permanent surface water is found on the top of Mt. Kulal but this source of water is outside the project area.

Lake Turkana (6,750 km^2) is the largest body of water in the project area. This lake has been in existence since at least early Miocene but has varied in size since then. For example it was greatly expanded between 9000 and 7500 B.C. when it covered the Lotikipi Plains to the west and drained to the Nile. It was this temporary connection that permitted the ingress of a nilotic fauna to the lake. The lake is fed by 12 principal rivers of which the largest affluent is the Omo River. This river originates from the Ethiopian highlands, flows south down the Rift Valley and enters the northern extremity of the lake through a large and swampy delta. The Omo River contributes more than 90% of the total riverine inflow. The Kerio and Turkwell Rivers, although perennial in the upper reach, discharge into the lake for only a few months each year.

It is noted that the salinity of the Lake Turkana water is at a level critical to various fauna. This lake is interesting in the fact that it is the most saline lake in East Africa containing a normal fish fauna. In addition, the lake is at the extinction limit for mollusks and at higher salinities, dwarfism of fish would occur.

Water quality. In the project area where water scarcity is very high, the importance of the quality of available water supplies can not be overstated. Biological, chemical and physical analyses of several parameters of water have been sampled from various sources. Even of greater significance is the fact that the lake water is used by a section of local community for domestic purposes and for watering of livestock. Indeed the El Molo and the Turkana already attribute some of their health problems to the use of water from Lake Turkana. Lake Turkana water has high concentrations of total dissolved solids (2381Mg/l) and high pH values (9.56). Although moderately soft, it is saline and requires demineralization and pH adjustment before being used for domestic consumption. Water from the Loiyangalani Springs (both the tap water and surface flowing water) is chemically suitable for domestic purposes. However, samples carried out during field investigations have demonstrated that both the tap water and the flowing surface water are contaminated with coliforms. Therefore, it requires disinfection/boiling in order to render it suitable for drinking.

Results of water analysis also show that many sources of water in the project area and surroundings have higher levels (1.7– 3.8 mg / l) of fluoride than maximum values (1.5mg / l) recommended for drinking water by the World Health Organization (WHO). Other water constituents that exceed guidelines recommended for drinking water are hardness for Nguruset (476 mg/l) and sodium levels for Muliko Springs (2600 mg/l) and Loiyangalani Beach (807 - 1300 mg/l). There is therefore a need to conduct regular chemical, physical and biological water analysis of the available water sources and advice the local community on suitability for human consumption.

Biophysical environment. The project area has undergone tremendous natural degradation in form of erosion. Erosional processes, including gully, rill and stream bank erosion are common in the project area. In addition, erosional processes by strong winds are rampant. Although the erosional processes are basically neutral, the inhabitants of the project area and their livestock have enhanced the degradation in this area. The cutting of trees and shrubs by the pastoralists for construction of houses and for fuel is a major cause of degradation. In addition, overstocking of the fragile area causes unbalanced use of vegetation by livestock thus causing overgrazing and degradation of the environment of the project area. Increased insecurity brought about by conflicts among certain ethnic groups in the area and subsequent increased settlements close to Loiyangalani where adequate security is available also contributes to the degradation of the area. This trend is currently causing high demand for fuel wood and building materials.

Biodiversity. The most prominent biodiversity components of the project area are the terrestrial flora and fauna and the fish of Lake Turkana. Lake Turkana to the west of the project area harbours a great variety of aquatic animals, including crocodiles, hippos, fish and birds. It is also an important water bird site. Eight four bird species, including 34 Paleartic migrants, have been recorded in and around the shores of Lake Turkana. Twenty three (23) aquatic bird species, including Goliath Heron and African Skimmer breed on the shores of the lake.

Flora. There are large areas of barren land where vegetation is very scarce in the project area. However, most of the project area is covered by deciduous dwarf shrubs, such as *Indigofera spinosa, Duosperma eremophilum, Sericocomopsis hildebrandtii, Acacia reficiens, Acacia mellifera* and *Commiphora Africana.* The most prominent trees of the project area are *Acacia tortilis* and *Delonix alata* which are found along the laggas. Annual grasses that are common during the rainy season include *Aristida mutabilis*, *Aristida adscensionis* and the species of *Eneopogon* and *Cencrus*. Along and close to Lake Turkana, the salt tolerant grass *Sporobolus spicatus* is common.

Although the vegetation is scarce and under great pressure of exploitation by livestock, plants play an important role in the life of pastoralists of the project area. They provide firewood, materials for the construction of the houses and livestock enclosures and feed for livestock including camels, sheep and goats. The plants found in this area are also valued for edible and medicinal products and as a valuable source of fiber for rope making and gum. Uses of some common plants in the project area are outlined below as follows:

- *Acacia reficiens* is relatively unpalatable but is the main source wood for pastoralist communities;
- The foliage of *Acacia tortilis* and *Acacia mellifera* is browsed by camels and goats while the fallen leaves and flowers are eaten by sheep;
- The fruits of *Acacia tortilis* are eaten by all livestock species;
- *Salvadora persica*, *Cordia sinensis*, *Sericocomopsis hildebrandtii, Indigofera spinosa* and *Acacia senegal* provide browse for livestock;
- Thorny trees, such as *Acacia* and some *Commiphora* are lopped to provide boma materials;
- Soft-timber trees, such as *Delonix*, *Commiphora* and E*rythrina* are used for making milk pots, bowls, stools and drinking troughs.

Fauna. The project area suffers from paucity of wildlife. This is mainly due to increasing population with subsequent increase in poaching activities, especially for the big game. For example, elephants *(Loxodonta africana)* and black rhinoceroses *(Diceros bicornis)* were once plentiful on the lower slopes of Mt. Kulal until 1976 but have now been exterminated by poaching. Other wildlife species including Greater kudu *(Tragelaphus strepsiceros)* Oryx *(Oryx beisa), G*erenuk *(Litocranius walleri),* Grant's gazelle *(Gazella granti), G*iraffe *(Giraffa camelopardalis) and* Grevy's zebra *(Equus grevyi)* occurred on the middle and upper slopes of Mt. Kulal but are now locally extinct. The last buffaloes *(Syncerus caffer),* which lived in the higher levels of the montane forest, were seen in 1976 and the species is apparently extinct on Mt. Kulal now. The exceptionally low densities of wildlife, especially the megafauna within the project area, are attributed to poaching and intense competition between the wildlife and livestock. The project area, however has many species of reptiles, including venomous snakes, such as saw scaled viper, night and puff adder and cobra and lizards. The scorpions and other invertebrate fauna are also common in the project area. Outside the project area in other parts of Marsabit District, there is a variety of animal species protected in Marsabit National Park and Reserve, Sibiloi National Park, Central Island and South Island National Parks.

Socio-Economic Environment. The project area is located in a rather remote part of the country where services (like all other areas in Marsabit District) are poor. Most of the available basic services are concentrated in Loiyangalani Town situated to the west of the project area. There are no tarmac roads in the project area and Loiyangalani is connected to other areas through dry weather roads connecting Loiyangalani to North Horr, Loiyangalani to Baraga (to the south), Loiyangalani to Gatab and the Loiyangalani to Marsabit via Kargi. In many areas, these roads are prone to seasonal floods, which make them impassable during heavy rains. Loiyangalani is served by an air strip which is used for non scheduled air services by light aircraft. The project area does not have electric power connection. However, electricity is generated by diesel powered generators in several institutions, including schools, missionary stations, hospitals, tourist facilities and in some private households.

Population. The project area which falls in Loiyangalani Location of Loiyangalani Division in Marsabit District is inhabited by four main ethnic groups, including the Turkana, Samburu, Rendille and El Molo. According to population census of 1999, population in the Loiyangalani Division was 16,965 people with a density of 1.1 people per km^2, the lowest population density in Marsabit District. The population is now estimated to be in the tune of 20,000 people with a density of a 1.32 persons per km^2. The low population density in the project area is attributed to harsh climatic conditions and insecurity prevailing in the area.

From a **poverty standpoint**, Loiyangalani is a poverty stricken area. It is one of the poorest divisions in Marsabit District which itself is one of the poorest districts in Kenya. Acute poverty prevailing in the project area creates a situation where individuals or households cannot afford basic food and non-food items as well as their basic needs, such as food, shelter, clothing, health and education for their children. Local communities in the project area highly depend on relief food distribution which has significant social implications for the future of the communities. From an **education perspective**, there are two schools (Loiyangalani Primary and Secondary) and analysis by gender shows that there has been a consistent trend of having fewer girls enrolled due to socio-cultural factors, pastoralist's livelihoods and long distance to schools. From an **epidemiological profile**, the three most common diseases of the project area are upper respiratory diseases, malaria and diarrhea. It should be pointed out that the Loiyangalani Health Centre does not record incidences of HIV/AIDS, a disease/condition that is currently affecting a large section of community in Kenya. The situation of the poor health conditions of the project area is aggravated by the poor nutritional status prevalent in the project area.

Community livelihoods. The project area being a rangeland, the nomadic pastoralism is the main occupation of the local residents (e.g. livestock rearing of the camels, goats and sheep). Donkeys are mainly used for carrying water and other transport purposes. Fisheries are an alternative occupation of the inhabitants of the project area and surroundings, especially among the El Molo and the Turkana communities. The fisheries are confined to Lake Turkana which lies to the west of the project area. This lake has vast fishing potential but currently it is poorly exploited. According to the

Marsabit District Development Plan (1997-2001), the lake has potential of producing 170 tons of fish annually. However, fish production is impeded mainly by inadequate fishing boats, local unavailability of nets and hooks, poor handling methods, lack of cold storage and the poor conditions of the roads to the lake town of Loiyangalani. This situation discourages potential investors. Hence the fish resources of the lake are under utilized.

The local trees, especially the *Acacias*, found in the project area are exploited to meet the energy requirements of the local population. Firewood collected in the area is utilized mainly for domestic use although some firewood is sold in Loiyangalani market. Charcoal produced in the project area is mainly for income generation as the charcoal burners usually do not use firewood in their homes. The charcoal burners who are mainly Turkana women use a very inefficient mode of burning charcoal.

The absence of financial institutions (banks, credit institutions) at Loiyangalani and in the project area drastically limits commercial activities. The project area, however, has a fisherman's co-operative society, the Loiyangalani Fisheries Cooperative Society although its management and operations are suboptimal. In accordance with the District Development Plan (2002-2008), priority areas for development include fisheries, environment conservation and development of natural resources and cooperatives.

5. Project Alternatives

Electric Power Alternatives. The generation of adequate and affordable electricity is a very crucial factor for the economic development of Kenya. Indeed the current energy policy puts emphasize on the need for energy availability and accessibility at cost effective prices. Currently, there are several alternatives for generation of electric power including, hydro, geothermal, thermal, solar energy, bio gas, and wind and power alcohol. The bulk (60%) of the electric power capacity in Kenya is, however, based on hydropower while geothermal and thermal powers virtually supply the rest of the power requirements. Faced with the current situation where Kenya’s electricity supplies are unreliable and expensive, the installation of Lake Turkana Project will play a significant role in the stabilization of power situation in the country. More importantly, the introduction of 300 MW in the Kenyan grid will alleviate power outages, especially during the dry seasons, and help to reduce the country heavy reliance on the power production from the oil and diesel power generators.

Project siting. A quick look at the National Wind Resource Atlas as compiled by the Ministry of Energy (MoE) shows that, as a whole, Marsabit District is well endowed with potential extractable wind power to the tune of 450 – 750 Watts m^{-2}. Based on this information, several sites in Marsabit District were explored for suitability of wind power generation. The present site in Loiyangalani location was selected due to several suitable attributes, including the strength and stability of the winds prevailing in the area, security of the area, fresh water availability and road accessibility among other suitable characteristics. In addition, in order to avoid impacts of birds’ collisions with turbines, the Project developer have adopted strict mechanisms for a careful design and siting of the

wind park. The wind park design has allowed for wide corridors between a cluster of turbines. In addition, the wind park is being sited away at least 8km from the shore of Lake Turkana and at least 1km away from the nearest canyon.

Choice of the technology. The choice of the wind turbines to be used in the Lake Turkana wind park takes into account the latest technology in the market. The choice is based on the following criteria:

- Technology that is widely utilized and has proven reliability in practice under the most difficult circumstances;
- Technology that is able to operate under the prevailing extreme conditions of dust, high temperature and high wind speeds;
- Low maintenance; and
- Technology with reliable supplier with local servicing possibilities, excellent track record and able to secure maintenance continuity.

The Vestas V 52 turbine with a capacity of 850KW was first launched in Sweden in 2001. The novelty of the Vestas V 52 turbine is its transmission technology which has been improved significantly. The main shaft of the turbine is better supported over a longer length and less torsion occurs in the shaft. Occurring forces on the shaft are also better absorbed over the length. The Vestas V 52 uses new and better materials. Finally, the aerodynamics attributes have been improved, resulting in a decreased total weight.

6. Potential Impacts and Mitigation/Enhancement Measures

The implementation of the Lake Turkana Wind Power Project in the project area will lead to a variety of socio-economic benefits. At the national level, the project benefits will include:

- Stabilization of electricity access and reduction of power outage in Kenya: at its completion, the project is expected to add an extra 300 MW into the country's national grid. This will bolster Kenya's plan to expedite rural electrification programs in different parts of the country. The end result is an attendant multiplier effect on the socio-economic parameters of the whole country and stable power supply network;
- Reduction of the cost of the power: the power generated from the project will cost far less than from any other existing sources on the long-term as its production cost will not increase thereafter. In effect, this implies that the project has the potential to usher the country into a low-power tariff regime in the long run. This has not only a positive effect on the cost of the energy production but will also lead to economic gains through improved competitiveness;
- Diversification of power sources: implementation of the project presents Kenya with an opportunity to rely less on the expensive diesel-powered alternatives;
- Promotion of renewable energy and reduction of 16,000,000 tons of CO_2 equivalent: the proposed project will further promote renewable energy and will achieve CO_2 emission reduction by replacing electricity which would have been otherwise generated by fossil fuel power plant;
- Contribution to the Kenya's rural Electrification Program;

- Contribution to the Government revenue.

Due to the remoteness of the project site especially in an area of high poverty levels, the project will have significant positive economic and social impacts for the marginalized communities in the project area. Namely, the project will enhance the quality of life through the following:

- Employment opportunities for the local community during the construction and operation phases of the project (e.g. masons, carpenters, cooks and indirect spins-off, such as livestock and fish trade, ecotourism, etc.);
- Rehabilitation of existing road networks in order to facilitate the transportation of livestock and fish products to external markets;
- Installation of two sub-stations in Loiyangalani and Maralal in order to distribute, on a cost-recovery basis, electricity to the surrounding communities and the governmental institutions, including schools, hospitals, hotels;
- Assistance in acquisition of cold storage facilities for the fish caught in Lake Turkana. This will facilitate better storage for the fish, eliminate the need for sun drying of fish and increase the returns from the fisheries sector;
- Since some sections of the local community use the lake water for domestic purposes, the project will ensure that the marginalized communities have access to good quality water for domestic use; and
- The project will provide human and financial assistance in the development of health and education facilities in order to improve health conditions and literacy of local community, especially the marginalized groups, the women and the youth.

Distribution of the above mentioned benefits will be implemented through the Lake Turkana Wind Power Foundation.

Against the significant positive benefits brought about by the project, there will be some negative impacts emanating from both the construction and operation activities of the proposed project. From a **socio-economic perspective**, the project will significantly increase the number of people in the project area (during the peak construction phase: 600 workers; average is expected to be 300 workers; operational phase is expected to be 150 employees) following the commissioning of the project. This will lead to a number of negative socio-economic impacts, including cultural contamination from influx of construction employees, increased exploitation of natural resources, increased insecurity and community conflicts, increased incidences of diseases, visual intrusion, potential challenges and impacts of labor force management, and increased accidents and occupational hazards (e.g. machine/equipment injury risk, occupational noise and vibration, fire risk, risk of exposure to electro-magnetic radiation, risk of electrical shock, etc.). There is no expected resettlement envisioned within the scope of this project. Finally, no visible archeological remains, with scientific, cultural, public, economic, ethnic and historic significance, have been observed in the project area.

The project activities are likely to cause minor and site-specific negative impacts on the **bio-physical environment** of the project area including increased pressure and/or loss of habitat and resources (especially fuel wood), destruction of floral and faunal

communities (having in mind that the footprint of the 367 turbine foundations will cover only a total of 0.5 ha), disturbance to livestock, increased soil erosion and potential siltation of aquatic/lacustrine habitats, pollution from liquid and waste effluents, ponding conditions from borrow pits and quarries and increase noise level. More specifically, the projects' activities are likely to cause the following impacts:

- **Increased soil erosion:** Increased soil erosion is likely to occur in the project area during the road rehabilitation, operations of borrow pits and quarries, construction of the wind park and buildings and installation of turbines. The presence of loose earth (resulting from the above activities) coupled with prevailing strong winds and occasional rains could lead to acute and chronic soil erosion problems in the project area;
- **Increased siltation of the lacustrine habitats:** Some of the excavated sediments from the project site and the construction spoils emanating from excess excavated material and construction debris are likely to impart negatively on the environment of the project area and any nearby aquatic habitat associated with Lake Turkana. Subsequently increased siltation of the lake water will have some limited ecological implications on the aquatic habitat. However, this will depend on the closeness of the impacted area to Lake Turkana;
- **Ponding;** The road rehabilitation, wind park construction and other project activities may lead to creation of stagnant water bodies in quarries, borrow pits and depressions created during the construction works. The resultant stagnant water bodies are likely to be suitable habitats for the breeding of mosquitoes and snails that are disease vectors for malaria and bilharzias respectively;
- **Loss of habitat**: The presence of wind turbines may indirectly affect local fauna and bird populations by decreasing the area of habitat available to breeding, feeding, nesting, resting etc. This will mainly be brought about by land taken for the construction of infrastructure including staff houses, access roads, turbine bases and substations;
- **Destruction of floral communities:** Although this is an arid area, the existing vegetation plays an important role in maintenance of life in the project area and its surroundings. Indeed it is the resource upon which the pastoralist and their livestock populations depend on for their survival. Project activities are likely to destroy some vegetation with subsequent loss of some trees, shrubs and grasses from the area of operation albeit on a small scale;
- **Impact on terrestrial fauna:** This project will not have any significant impact on the terrestrial fauna of the project area due to the general paucity of fauna in the area;
- **Impacts on avifauna**: The project has the potential to affect the avifauna of the project area. This is mainly through ecological disturbance leading to displacement or exclusion of birds; and collisions of birds with wind turbines. However, the wind turbines will be located at least 8km from the shore of Lake Turkana on the plateau behind the Ongipi massif. Since migrating and over wintering birds are normally associated with Lake Turkana shoreline and aquatic habitats, collision risk of birds is expected to be very low;

- **Impacts on protected areas:** The protected areas (Mt. Kulal Biosphere Reserve and the South Island National Park) are situated away to the east and west of the project area respectively and project activities will have minimal impacts on them;
- **Potential disturbance in livestock activities:** The livestock activities are likely to be disturbed by both construction, presence of wind turbines and operations of project activities. The project may indirectly affect livestock by decreasing the grazing area due to land taken for the construction of infrastructure including access roads, turbine bases, staff houses and substations. Livestock movements especially towards the watering points are likely to be affected by fencing of the project area. Since the project area will not be fenced, the impact on the livestock is likely to be minimal;
- **Increased noise levels:** Noise levels are likely to increase in the project area both during the construction and operation phases of the proposed project. High levels of noise will prevail in the project area due to the use of heavy machinery in road construction activities and operations at the quarries, borrow pits and crushing plants. However, it should be noted that modern Vestas turbines are associated with low noise levels;
- **Air emissions:** Pollution through air emissions in the project area will emanate from road construction activities especially from exhaust pipes for vehicles and machinery used and the activities associated with the operation of the power plant;
- **Dust pollution:** Road rehabilitation activities and to some extent the wind park construction activities have the potential to generate high levels of dust in the project area especially where construction is taking place, and in both quarries and borrow pits sites. The crushing plant also has great potential to generate high quantities of dust thus creating a hostile environment and a health hazard to the workers;
- **Potential increase in pollution from solid wastes and effluent discharge:** The labor campsites are expected to produce considerable quantities of domestic effluents and solid wastes containing a wide range of substances which have high potential to pollute the environment if not properly disposed of.

Perhaps the most serious negative impact the project is likely to have on the project area is the potential for birds' mortality through collisions with the turbines. However, as mentioned previously, the project is not likely to interfere with migration of birds. The project area is more than 8km to Lake Turkana which is an important bird area in Kenya. Eight four (84) water bird species including thirty four (34) Paleartic migrants have been recorded around Lake Turkana (Bennun and Njoroge, 1999). According to Rose and Scott (1997), over 100,000 Little Stints (representing more than 10% of entire East African / South East Asia population may winter here. Lake Turkana also supports many wintering Palaearctic migrants and is a key stopover site for birds on passage. Since migrating and over wintering birds are normally associated with Lake Turkana shoreline and aquatic habitats, collision risk of birds is expected to be very low.

Social cumulative impacts encompass the likely increase in incidences of HIV/AIDS and increased cultural contamination among the local communities in the project area. Cumulative impacts of the wind farm installations may be considerable if bird movements are consequently displaced leading to the disruption of ecological links

between feeding, breeding and roosting areas. However, the type of design for the proposed wind park and its siting are highly unlikely to cause any significant cumulative and long-term impacts in the project area.

The ESIA study has proposed several measures to reduce negative impacts, including amelioration of social and health negative impacts, noise abatement, waste management, reduction of visual intrusion, restoration of habitat and biodiversity, reduction of soil erosion and siltation and prevention of accidents and health hazards. In addition, measures have been proposed with regard to the siting of the wind park in order to reduce collision of birds with turbines. A summary of the affected key environmental and social variables and the intensity of impacts is found in the following Environmental and Social Impact Matrix:

Environmental Parameters	**Intensity of Impact**
Stabilization of electricity sector	+3
Promotion of economic growth	+3
Contribution to the Government revenue	+3
Increased employment	+2
Improved communication	+2
Visual intrusion	-1
Cultural contamination	-1
Increased incidence of diseases	-1
Labour force management challenges	-1
Increased risk of accidents	-1
Loss of habitat	-1
Destruction of flora and fauna	-1
Disturbance to livestock	-1
Soil erosion and siltation	-1
Pollution	-1
Ponding conditions (in the quarries and borrow pits)	-1
Increase in noise levels	-1
Birds' mortality through collisions	-2

Interpretation :

+3 Highly Positive Impact – Impact with national or international benefits
+2 Moderately Positive Impact – Likely to impact on quality of life within the region / project area
+1 Light Positive impact – Minor impact but of significant local benefit
0 No Impact
-1 Light Negative Impact – Minor negative impact at the local level
-2 Moderate Negative Impact – A negative impact likely to adversely affect the environment or quality of life in the region / project area if not mitigated
-3 Severe negative impact with national or international implications

7. Environmental Hazard Management

Implementation of the project will definitely increase volume of human and motor traffic in this remote area. The increase in human and motor traffic will be aggravated by the transportation of construction materials and plant accessories and other equipment required to install the wind park. This is likely to result in a higher risk of accidents occurring in the area of operation during the road rehabilitation, wind park construction and operation phases, and during the construction of the transmission lines. Safety measures and emergency plans to contain accidents risk associated with project activities including vehicular transport, operation of machinery, equipment and other related activities will be developed and implemented through the training of the construction workers, provision of Personal Protective Equipments (PPE), and inclusion of specific Environmental, Health and Safety (EHS) clauses into contractors contracts (e.g. spill mitigation equipment, water spraying of roads, etc.).

8. Environmental and Social Management/Monitoring Plan

Environmental and Social Management Plan (ESMP), including monitoring plan, has been identified as an important process in the protection of environment of the project area. This will reveal changes and trends brought about by the presence and operations of the installed wind park facility. The basic attributes for the monitoring program will involve the following: a) collection and analysis of appropriate environmental data; b) preparation of periodic reports, including an annual environmental and social performance report to AfDB and liaison with other relevant bodies (e.g. NEMA); c) identification of unexpected environmental impacts; and d) formulation of mitigation measures for the unexpected negative impacts.

Key environmental and social variables include changes in biodiversity, avifauna mortality, changes in livestock's activities, changes in water quality, soil erosion and siltation, noise levels, increase incidence of STDs and changes in socio-economic status of affected communities among other varibales. In addition, an exhaustive one-year field baseline study will be undertaken to determine the use of the wind park by birds and to identify, if any, birds species that may be adversely affected.

The total cost for the implementation of the ESMP and other socio-economic activities is estimated at KSh.20,250,000 (€202,500) for the first year project operation. Cost estimates for subsequent years will be determined by the recruited Environment Management and Social Development Officer as well as the entry into force of the Lake Turkana Wind Power's Corporate Social Responsibility Program. The break down of the cost estimates is presented in the Table below:

Cost Estimates for the Environmental and Social Management Plan/Monitoring Program

Project Activity		**Cost Estimate (KSh)**
1	Remuneration for the Environment and Social Development Officer to implement the ESMP and the Grievance Mechanism	2,500,000

2	Purchase of a vehicle and other transportation requirements for the Environmental and Social Development Officer	4,500,000
3	Support for on-going community awareness throughout project implementation and sensitization program on cultural impacts from population influx during the construction and operational phases (including of security guards)	1,500,000
4	Lake Turkana Wind Power Project's Foundation for the implementation of the Corporate Social Responsibility (CSR) Program. Priorities programs include the support for education, health, potable water and sanitation. Maximizing SMEs opportunities (e.g. fisheries, afforestation, provision of energy efficient stoves, etc.) will also be considered and supported	4,000,000**
5	Cost of monitoring activities including a one-year baseline field study on impacts of the wind park on birds.	1,500,000
6	Sample water analysis (chemical and biological, and other samples)	100,000
7	Purchase of consumables (computer, sampling apparatus, field equipment, Protective Personal Equipments for employees, etc.)	300,000
8	Purchase of stationery, documentation and report writing	100,000
9	General landscaping works, including construction of silt traps, terracing and landscaping (rehabilitation of quarries & borrow pits), planting of binding grasses on slopes and trees (acacia)	1,500,000
10	Liquid and solid waste management activities, including septic tanks and pit latrines installation at labor camps, purchase of an incinerator for non-degradable domestic wastes,	2,000,000
11	Preparation of the requested independent annual environmental audit (ref. EMCA Regulations and Guidelines), certification under ISO 14001 (Environmental Management System) and OHSAS 18001 certification (Occupational Health and Safety)	250,000
12	Contingencies (10% of the total cost of the proposed Environmental and Social Management Plan)	2,000,000
Total Estimated Cost for the Environmental and Social Management Plan		**KSh 20,250,000**

* In accordance with the recently gazetted EIA fees of NEMA, which appeared on 11th February, 2009 in Kenya Gazette Supplement No. 14, the EIA license fee is 0.05% of the total cost of the project to a minimum of KSh 10,000 and a maximum of KSh 1,000,000. The above fees are paid as follows: a) 50% of the 0.05% being the processing fee is payable upon submission of an EIA Report and b) 50% of the 0.05% being license fee payable upon collection of the EIA license. Changes take effect immediately. NEMA payment of 50% of 0.05% of the total project cost was paid to NEMA upon submission of the final draft EIA Report on March 13, 2009. The Client is currently waiting for the NEMA review of the EIA Report and approval. Expected delivery of the environmental license is expected by May-June, 2009;

**The establishment of this Foundation has been officially approved by the Board of Directors of the Lake Turkana Power Project and will aim to support three key developmental sectors/priorities in the project area, namely 1) education through the construction and operation of schools and vocational training centers, 2) health through the construction and operational costs of medical clinics, focusing especially toward maternal and infant health; 3) potable water distribution and sanitation for human consumption. Water points for livestock are also envisioned. The Foundation will try, to the extent possible, to maximize SMEs opportunities in order to help local communities in moving out the "relief dependency syndrome". Financial resources allocated to the Foundation's program will be a percentage of profit generated by the Project (an estimated 1.0-1.5 million Euros per year for 25 years). The Foundation will be staffed by a Director and two project managers. It will operate under the guidance of the LTWP's Board of Directors. An identification mission is planned in May 2009 in order to better circumscribe the Foundation's program priorities and management system.

The overall responsibility for the implementation of the ESMP lies with the Sponsor. Implementation of the ESMP and of the Grievance Mechanism will be ensured through the recruitment of an Environmental and Social Development Officer to be stationed at Loiyangalani. The proposed environmental and social development officer will put in place mechanisms to initiate and operationalize the proposed mitigation and monitoring measures. As indicated above, the Project contractors under supervision from LTWP Ltd.'s agents (project engineer, architect and consultant environmentalist) is expected to implement relevant environmental mitigation measures, including rehabilitation of quarries and borrow pits, landscaping (grassing and planting of trees) among other relevant activities. The Contractor should ensure that all the installations are functional at least for a period of one year after the completion of construction activities.

9. Public Consultations and Public Disclosure

Public consultation was viewed as an important activity of this study in order to help the ESIA team to get the stakeholders' views on the perceived environmental and social effects of the project on the project area and their ideas on how the negative impacts can be mitigated. Following the completion of field study and drafting of the EIA study report, copies of the draft report were distributed to a wide cross section of stakeholders to review and communicate their comments to the Team Leader within a period of three weeks. A stakeholders' meeting was subsequently held in Loiyangalani between 21 and 22nd April 2008 and attended by fifty three (53) participants.

Generally speaking, the local population is very positive about the project and they welcome its installation in the project area. Indeed the people feel that the project is an event that will solve their many challenging problems, including their "relief dependency syndrome". The project, however, is likely to create very high expectations among the local community in the project area and surroundings. Peoples' expectations will especially be related to 1) employment opportunities for the local community during the construction and operation phases of the project; 2) rehabilitation of existing poor roads in the area – thus facilitating the local community to access external markets for their livestock and fish products; 3) assistance in acquisition of cold storage facilities for the fish caught in Lake Turkana in order to facilitate better storage for the fish, eliminate the need for sun drying fish and increase the returns from the fisheries sector; 4) provision of good quality water for the marginalized community since some sections of the local people use the lake water for domestic purposes; 5) assistance in the development of health facilities in order to improve health conditions of local community, especially the marginalized groups.

During the stakeholders'' workshop, several issues touching on the proposed project, including the project negative impacts on livestock, fisheries of Lake Turkana, the siting of the wind farm, job opportunities and other benefits to the community among other issues, were exhaustively discussed. Minutes of the Stakeholders meeting are found in Appendix 11 of the ESIA Study. As a direct result of the Stakeholder meeting, it was decided by the Sponsor to establish a Grievance Mechanism for the construction and operation phase of the project.

10. Complementary Initiatives

In addition to the construction and operation of the wind farm situated in Marsabit, there are additional and necessary infrastructures which will be require for the implementation of the Lake Turkana Power Project. Namely,

- *Roads Rehabilitation*. The site of the wind farm is located in Loiyangalani which is approximately 1,200km from the sea port of Mombasa from where the wind farm equipment will be transported by road to site. The last stretch, consisting of approximately 196km and starting in Laisamus require realignment, rehabilitation and repair works to enable the mast and blades of the wind mills to be transported without damage and for the roads to handle an 8 ton axle load. The scope of these works will entail building culverts, vertical realignment, filling, grading, leveling and general repairs. It is estimated that the civil works will cost approximately US$ 20M and will, in addition to providing transport access for the cargo to the wind farm, also provide an access road for communities living in the area and potentially increase economic development. There is no expected resettlement involved in this rehabilitation since the road concession is within an existing right-of-way;
- *Transmission Line*. The Project is unique in that the wind farm is located in an area that is presently not serviced by any transmission line network. In order for the Project to be able to supply power to the national grid through Kenya Power & Lighting Company Ltd (KPLC) - with which LTWP has entered into a 25-Year "take-or-pay" Power Purchase Agreement (PPA), it is necessary for the simultaneous development of a transmission line from Loiyangalani to Suswa where the wind farm will interconnect to the national high voltage network. A *Power Integration and Economics Study* was undertaken by Schicon to evaluate the most optimal routing of the transmission line for integration into the existing grid network. Of six options studied, the most favorable was the construction of a new double-circuit 400 kV line from the Turkana wind farm in Loyangalani via Baragoi, Maralal, Rumuruti, Nyahururu, Gilgil, and Naivasha to Suswa. This option has the benefit of providing a transmission network that maximizes the potential for future interconnection of planned geothermal plants, including Barrier, Namarunu, Emuruangogolak, Silali and Korosi. It also uses existing 'rights-of-way' from the existing KPLC line from Maralal to Olkaria. Under the terms of an Agreement with the Ministry of Energy and the Kenya Power & Lighting Company Ltd, LTWP has been authorized to seek financing for the transmission network on their behalf and to develop the transmission network under a Build, Own, Operate & Transfer (BOOT) scheme.

Carbon potential. The proposed project will achieve CO2 emission reduction by replacing electricity generated by fossil fuel fired power plant connected to the national grid. The carbon credit potential of the project ranges between 565,920 and 1,264,320 CO2 tons equivalents (or carbon credits) per year. Assuming a 10-year crediting period, this will result in a total of 5,659,200 to 12,643,200 carbon credits over the course of the project. In 2007, the average price for a Certified Emission Reduction (CER) was around €10. Based on this price estimate, the carbon credit value of the project could be in the range of €56,592,000 to €126,432,000 for the entire project. The carbon credit

earned by the project will be transferred to KPLC in order to reduce the end-consumer tariff.

Resilience to climate variations risks. As previously indicated, existing energy power production in Kenya over relies on hydropower (approximately 50%) which is negatively affected by increasingly erratic climate changes, including higher incidence of drought. As such, the project will increase the resilience of the Kenya power generation vis-à-vis potential climate risk variations in Kenya.

Impact of the dam construction (GIBE Project) on Lake Turkana. The Gilgel Gibe III (Gibe) Project, situated at 700 km upstream, will involve the construction of hydro dam across the Omo River in the southern end of Ethiopia mainly for the generation of electricity, a large share of which is expected to be sold in Kenya. The Omo River is the most important river of Lake Turkana water. Based on the full ESIA report of this project of April 2009 which is available on the Ethiopian Electric Power Company's website (http://www.eepco.gov.et/), it is expected that the dam will regulate the downstream hydrological flow while maintaining environmental conservation through on-going environmental flow which is designed to mimic natural flow regime.

11. Conclusion

The findings of the Environmental and Social Impact Assessment (ESIA) Study indicate that the socio-economic benefits of the Lake Turkana Wind Power Project far outweigh the limited and site-specific social and environmental costs, when enhancements/mitigation measures are effectively and timely undertaken. Most of the impacts are easily mitigable with conventional industry best practices.

In addition, the local population is very positive about the project and they welcome its installation in the project area. Indeed the people feel that the project is an event that will solve their many problems, including relief dependency syndrome. With explicit and tangible commitment of the LTWP Ltd. in the establishment of the Lake Turkana Wind Power Project's Foundation for the implementation of a comprehensive Corporate Social Responsibility (CSR) Program and the carrying out of the one-year baseline study on avifauna impact, it is felt that this project is environmentally sound and socially acceptable.

Approval of the ESIA Study for the wind farm by NEMA and delivery of the Environmental License will be a condition of first loan disbursement by the Bank. In addition, review and approval of the ESIA Studies (and Resettlement Action Plan, if applicable) for the transmission line and the road rehabilitation projects will be also a loan condition for Bank's first disbursement for the wind farm. The ESIA Studies will have to comply with Kenya's Environmental Management and Coordination Act and the Environmental (Impact Assessment and Audit) Regulations of 2003, AfDB's cross-cutting policies and procedures and, finally, IFC's Performance Standards and EHS Guidelines.

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Contacts:

African Development Bank,
Private Sector Department (OPSM.3)
Youssef Arfaoui
Energy Expert & Senior Investment Officer
P.O. Box 323, 1002 Tunis Belvedere, Tunisia
Phone : (216) 71 10 23 08 ; Fax: (216) 71 10 37 10 ; E-mail: y.arfaoui@afdb.org

African Development Bank,
Private Sector Department (OPSM.3)
Obiora Collins Okoye
Investment Officer
P.O. Box 323, 1002 Tunis Belvedere, Tunisia
Phone : (216) 71 10 38 16 ; Fax: (216) 71 10 37 10 ; E-mail: o.okoye@afdb.org

African Development Bank,
Private Sector Department (OPSM.0)
Louis-Philippe Mousseau
Principal Environment & Social Development Specialist
P.O. Box 323, 1002 Tunis Belvedere, Tunisia
Phone: (216) 71 10 35 40 ; Fax: (216) 71 10 37 10 ; E-mail: l.mousseau@afdb.org

Lake Turkana Wind Power Ltd.
M. Chris Staubo, Directeur.
P.O. Box 63716, Nairobi – 00619, Kenya
Tél : (254) (20) 2726868/2726901 ; email : africa@ansetintl.com
Web site : www.laketurkanawindpower.com

Francis M. Muthuri,
Environmentalist/Team leader,
P.O. Box 1285 – 00606, Sarit Centre, Nairobi –
Telephone : 0725 768758; E-mail : muthurifrancis@yahoo.com