

# UPDATED ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT SUMMARY



## Lake Turkana Wind Power Project

Kenya

November 2011

## **1. Introduction**

The Lake Turkana Wind Power project is of significant strategic benefit to Kenya, and one of the largest private investments in Kenya's history. It aims to provide 300MW of reliable, low cost wind energy to the national grid, equivalent to over 20% of the current installed electricity generating capacity. The wind farm site is located in Marsabit District in northern Kenya, approximately 50km north of South Horr Township and 8km east of Lake Turkana (see Annex 1 for location map). The 'Project' will comprise a wind farm, associated overhead electric grid collection system and a high voltage switchyard. The Project also includes rehabilitation of the existing road from Laisamis to the wind farm site, a distance of approximately 200km, as well as plant and equipment lay-down areas, and access road network in and around the site for construction, operations and maintenance purposes.

The Project proponent is the Lake Turkana Wind Power Consortium (LTWP), comprising of Sponsors Aldwych International, Industrial Development Corporation, IFU, KP&P Africa B.V, Norfund and Wind Power Invest A.S. LTWP is responsible for the financing, construction and operation of the wind farm.

This report is an update of the Executive Summary of the 2009 Environmental and Social Impact Assessment (ESIA) study of the wind farm development; since then, no significant baseline changes have occurred. This Executive Summary seeks to summarise the Project development undertaken, with respect to environmental and social aspects, since the issuance of the report in 2009. The additional information discussed in this updated Executive Summary includes the following:

- ESIA methodology to expand upon the public consultation and disclosure process;
- Local communities;
- Project water resources;
- Ornithology survey;
- Road rehabilitation; and
- Associated transmission line.

## **2. Project Description**

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 11m/s. LTWP submitted a proposal to the Kenyan Authorities to survey the site. LTWP was granted exclusive rights to survey the proposed wind farm site and to study the wind resources in April 2006, and subsequently signing a Memorandum of Understanding (MOU) between the utility, Kenya Power, and LTWP in April 2008.

The proposed wind farm will include 365 V52 turbines, with a hub height of 44m. The turbines will evacuate the power produced via overhead medium voltage (33kV) electricity collector grid system and associated step-up transformers (33/400kV) located in the switchyard. From the switchyard, power will be evacuated through a double circuit high voltage busbar and associated circuit breaker system to the proposed 400kV transmission line. Each turbine has a capacity of 0.850MW giving an installed capacity of 310MW. A concession area of 150,000 acres has been leased from the Government of Kenya for a 99 year term. The footprint of the wind farm will comprise 40,000 acres (approximately 162km<sup>2</sup>), with the remaining area acting as

a buffer around the wind farm site. The 365 wind turbines will occupy 23 acres, the switchyard will occupy 39.5 acres and the village including workshop will occupy 25 acres amounting to a physical land take not including internal roads of only 87.5 acres. Construction of the wind farm will take, in total, 32 months. Project lifespan of the proposed wind turbines is expected to be 25 years.

The generated power will be transmitted via a proposed 400kV transmission line that will run from the wind farm site to a new switchyard at Suswa, a distance of approximately 428km. The construction of the transmission line is the responsibility of the Kenyan Government through the state owned Kenya Electricity Transmission Company (KETRACO). KETRACO will own the transmission line and have a tolling arrangement with Kenya Power. The proposed transmission line will be primarily funded by the Spanish Government and constructed by a Spanish contractor, Isolux Corsan S.A., overseen by KETRACO. This transmission line development is considered an 'associated facility' i.e. the wind farm requires the construction of the transmission line in order to evacuate the power produced from the wind turbines onto the national grid. The development of the transmission line is a separate infrastructure project to LTWP's wind farm project and is discussed further in Section 10.

The proposed wind farm site is located approximately 1,200km from the seaport of Mombasa, from where the equipment will be transported to site by road. The majority of this road already exists; however, a distance of approximately 200km of existing rural road between Laisamis – Illaut – Kargi Junction (D371) and Kargi Junction – Loyangalani Road (C77) to the wind farm site requires rehabilitation works including strengthening identified weak sections, realignment, levelling and grading, construction of culverts and general repairs. The road will be 6m wide with a 5m road reserve to each side. Following consultation with stakeholders and their concerns regarding potential negative transport impacts, two route diversions were progressed in order to avoid existing settlements at Ngurunit, South Horr and Kurungu (see map in Annex 2). The actual construction of the 200km road is expected to take approximately 15 months.

### **3. Project Rationale & Justification**

The main sources of energy in Kenya are electricity, wood fuel, petroleum and renewable resources. Of the total energy requirements in Kenya, the majority (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 (22%), electricity (9%) and other sources (1%). Of the above main sources of energy in Kenya, electricity is crucial for the economic development of the nation. The provision of an affordable and reliable supply of electricity is the lifeblood of the Kenyan economy.

It is estimated that 14% of the population have access to electricity. Additional generation with associated transmission and distribution is 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 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 that had a crippling effect on the economy. This experience underscores the need to increase power production and associated facilities in order to diversify power sources.

In accordance with Kenya Vision 2030, energy is one of the infrastructural enablers of the three developments pillars, namely the economic, social and political aspects. In addition, the current

energy policy objectives in Kenya emphasise 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. Through the auspices of the Ministry of Energy, the Electricity Regulatory Commission, KenGen, KETRACO and Kenya Power the Least Cost Power Development Plan 2009 – 2029 (LCPDP) sets out the strategic capacity development for the energy sector.

The LTWP wind farm project is cited as the next least cost Project to be developed. According to the LCPDP, the wind farm will generate the lowest cost power available to Kenya, which is 60% less expensive than the emergency thermal power plants.

The entry of the Lake Turkana Wind Power Project into the Kenya power scenario will contribute to the power diversification, without resorting to fossil fuels (thereby effectively reducing associated carbon levels). In addition, the clean power output generated by the Project will supply energy to Kenya's national grid contributing up to 20% of the existing national installed power, thereby helping address the power deficit and enhance further growth. Average electricity production is estimated at 1,440 GWh per year. The Project will be the largest generation of electric power utilising wind in Kenya and Sub-Saharan Africa.

The development, construction and operation of the Lake Turkana Wind Power project will have site-specific, but limited, impacts on the bio-physical and social environment of the Project area which the ESIA studies undertaken has confirmed.

#### **4. Policy, Legal & Administrative Framework**

ESIAs for the wind farm development and road rehabilitation have been carried out in line with national standards. LTWP has produced a gap analysis report and is developing the Project to meet the World Bank Group/ African Development Bank (AfDB) including those standards of the Project Lenders.

The objectives of the ESIAs were to identify and evaluate the environmental and social (with a gender disaggregated analysis) effects, which could arise from the proposed construction and operation of the Project's activities; liaise with all stakeholders 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).

In accordance with the 2<sup>nd</sup> 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 the Project ESIAs. The ESIA reports have been prepared in accordance with the outline contained in Part IV, Section 18 (1) of the above regulations. These include:

- Proposed location of the project;
- Description of the national environmental legislative and regulatory framework, baseline information, and any other relevant information related to the project;
- Objectives of the project;
- Technology, procedures and processes to be used in the implementation of the project;
- Materials to be used in the construction and implementation of the project;
- Products, by-products and wastes generated by the project;

- Description of the potentially affected environment;
- Environmental 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;
- ESMP proposing the measures for eliminating, minimising 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 caused by carrying out activities or major industrial and other development activities;
- Measures to prevent health hazards and to ensure security in the working environment for the employees and for the management of emergencies;
- Identification of gaps in knowledge and uncertainties which were encountered in compiling the information;
- Economic and social analysis of the project;
- Indication of whether the environment of any other state is likely to be affected and the available alternatives and mitigating measures; and
- Other such matters as the National Environment Management Authority (NEMA) may require.

Whilst the Environmental Management and Coordination Act (EMCA) supersede all national environmental legislation, numerous other laws and regulations have influenced the various aspects and activities of the proposed Project. These include the Electric Power Act (1998), 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).

International environmental and social requirements of the Project Lenders and other financing institutions have also been taken into account. These include the African Development Bank policies (environment, gender, HIV/AIDS, poverty, public participation and public disclosure) and procedures (e.g. Environmental and Social Assessment Procedures); World Bank's Operational Policies; International Finance Corporation's (IFC) Performance Standards (PS1: Assessment and Management of Social & Environmental Risks and Impacts, PS2: Labour and Working Conditions, PS3: Pollution Prevention and Abatement, PS4: Community Health, Safety and Security, PS5: Land Acquisition and Involuntary Resettlement, PS6: Biodiversity Conservation and Sustainable Natural Resource Management, PS7: Indigenous Peoples, PS8: Cultural Heritage) and Environmental, Health and Safety Guidelines for Wind Energy<sup>1</sup>; and compliance with the Equator Principles.

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<sup>1</sup> This wind farm development would have been normally classified as Category 2 under the AfDB's Environmental and Social Assessment Procedures (or Category B under IFC's Environmental Policy). In the spirit of the Paris Declaration, and alignment of Bank's procedures toward country's ESIA 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.

Several international conventions and agreements are considered for these studies, including, convention on biological diversity; convention on wetlands of international importance (RAMSAR); convention on conservation of migratory species of wildlife animals; and African convention on conservation of nature and natural resources.

## **5. ESIA Methodology**

The methodology underlying the preparation of the ESIA for the wind farm included a multi-stage approach, namely the preparation of a biophysical and social scoping review, including consultative meetings with NEMA; government departments (e.g. Livestock, Fisheries, Gender); parastatal organisations (Kenya Wildlife Service (KWS), National Museum of Kenya, etc.); provincial administration and local community leaders in Loyangalani Division (e.g. representatives from the Turkana, Samburu, Rendille and El Molo communities); gender and youth-based groups; and non-governmental organisations. A field trip at the wind farm location and Loyangalani was undertaken as well as additional biophysical and social surveys and literature review. Public disclosure of the draft ESIA report for the wind farm development took place in Loyangalani for a period of three weeks from 31 March 2008 to invite written comments; this was followed by a Stakeholders Workshop on 21 and 22 April to present the proposed ESMP. The wind power project Environmental and Social Impact Statement was submitted to NEMA and duly approved; the EIA Licence was issued in July 2009 and has since been renewed.

LTWP has also been granted permission by the Ministry of Roads to strengthen identified weak sections of the 200km road leading to the wind farm site. According to the existing road classification and the new institutional arrangement in the road sector, the 160km Laisamis – Kargi junction (D371) section falls under the jurisdiction of the Kenya Rural Roads Authority while the 52km Kargi Junction - Loyangalani section falls under the Kenya National Highway Authority. The required ESIA for the proposed road construction was carried out in close collaboration with these statutory bodies, in addition to the Ministry of Roads. The key stakeholders identified and consulted for the road rehabilitation ESIA included the area sub chief, chief, District Officers and District Commissioners; Kenya Forest Service; KWS; Marsabit County Council; Kenya Rural Roads Authority; Kenya National Highway Authority; District Water Office; and neighbouring communities to the road re-alignment. The approach adopted was participatory and included public meetings, focus group discussions, administration of questionnaires and discussions with the key stakeholders in April 2010 and May 2011. The Licence was issued in January 2011 and has since been updated (re-issued in September 2011) to reflect the design modification.

Regular engagement continues with the communities in the Project vicinity. Of late, LTWP has developed a Community Engagement Plan (CEP) and information disclosure programme. Stakeholder disclosure pamphlets have been translated and distributed within the footprint of the Project area (and along the associated transmission line route). These pamphlets are also available from the LTWP office in Nairobi and on the LTWP website.

## **6. Description of Project Environment**

The wind farm site is located at the south eastern end of Lake Turkana in a largely uninhabited, rocky, arid desert area. The footprint runs south easterly direction from the south eastern shores of Lake Turkana and passes between two mountain ranges (Mts. Kulal and Nyiru). The area has unique geographical conditions in which daily temperature fluctuations generate strong predictable wind streams between Lake Turkana (with relatively constant temperature) and the

desert hinterland (with steep temperature fluctuations). The Project area between Mt Kulal and Mt. Nyiru effectively acts as a funnel whereby the wind streams are accelerated to speeds up to 15m/s.

**Climate.** The climatic conditions prevailing in the Project area and other areas of the Marsabit District are summarised in Table 1. The climate of the Project area is hot and very dry and is referred to as the Agro Climatic Zone VII. This zone is characterised by very low rainfall and very high evaporation.

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

Key: r – Average annual rainfall (mm); Eo – Average annual potential evaporation (mm)

**Table 1. Main Features of the Agro Climatic Zones in Marsabit District (Source: A.J. van Kekem - Soils of the Mt. Kulal Marsabit Area)**

**Rainfall.** The general patterns of rainfall in several areas in Marsabit District are characterised 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. 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 are in the range of 27–29°C, the mean minimal lie around 13–20°C and the mean maxima are 26–35°C. The coolest months are July and August while February, March and October are the hottest.

**Wind.** Compared to the rest of Kenya, winds in the proposed wind farm 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 (2,300m asl) and the Mt Nyiru Range (2,750m asl). Due to thermal effects, the wind slows down during midday 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 over six years. The average wind speed in the Project area has been recorded to be 11m/s (as compared with a high average in Europe of 7m/s).

**Topography.** The Project area lies between 450m at the shore of Lake Turkana to 2,300m above sea level (masl) on the foot slopes of Mt. Kulal. The topographical features of the Project area are quite variable; common features 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 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 stony riverbeds and have wide beds with braided characteristics and changing stream channels. Sometimes, once in every five to ten 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 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 Loyangalani 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.

**Water Quality & Sustainability.** In the Project area where water scarcity is very high, the importance of the quality of available water supplies cannot be overstated. Biological, chemical and physical analyses of several parameters of water have been sampled from various sources. Lake Turkana is located approximately 10km from the wind farm site; it is the largest body of water (6,750 km<sup>2</sup>) near the Project area. Lake Turkana water has high concentrations of total dissolved solids and high pH values. Although moderately soft, it is saline and requires demineralisation and pH adjustment before being used for domestic consumption. Given the poor quality noted above it is highly unlikely that LTWP will be able to utilise this resource.

Water from the Loyangalani Springs (both the tap water and surface flowing water) is chemically suitable for domestic purposes. Sampling carried out during field investigations have demonstrated that both the tap water and the flowing surface water are contaminated with coliform bacteria and requires disinfection/boiling in order to render it suitable for drinking. Results of water analysis show that many sources of water in the Project and surrounding area have higher levels of sodium, hardness and fluoride than maximum values recommended for drinking water by the World Health Organisation.

LTWP commissioned Rural Focus, to undertake groundwater water investigations as to the adequacy of sufficient water resources for construction and operations of the wind farm project. Water for construction is calculated to peak at 250m<sup>3</sup> per day with demand declining after the first year. Water for the construction of the village will have a daily peak demand of 280 m<sup>3</sup> per day. Demand is expected to decline over the second year until all site works are complete; at this stage, demand is calculated as 30m<sup>3</sup> per day, which is equivalent to the long-term water demand of the wind farm during its operational phase. Three boreholes have recently been drilled on site. The findings confirm that the quality is good and that the peak daily demand can be met from this aquifer. The peak abstraction period during construction is short, and following construction the aquifer is more than capable of meeting 30m<sup>3</sup> per day.

The amount of water required for construction of the 200km of road from Laisamis to site is calculated at 450m<sup>3</sup> per day. This requirement also includes potable and sanitation provisions for the construction workers. Water requirement for road construction is a contractual obligation for the contractor, Civicon. A number of options have been investigated by Civicon in conjunction with the Northern Water Services Board and Water Resource Management Authority and the local communities. The surveys have identified a number of potential borehole sites and drilling authorisation permits have been issued. Civicon will produce a Water Management Plan as part of their ESMP.



**Biophysical Environment.** The Project area has undergone tremendous natural degradation in form of erosion. The cutting of trees and shrubs by pastoralists for construction of building materials/ fuel, and the overstocking of the fragile area promotes unbalanced use of vegetation by livestock, thus causing overgrazing and degradation of the environment. Increased insecurity brought about by conflicts among certain ethnic groups in the area and subsequent increased settlements close to Loyangalani where adequate security is available also contributes to the degradation. This trend is currently causing high demand for fuel wood and building materials.

**Fauna.** The Project area suffers from paucity of wildlife; this is mainly due to increasing population and subsequent increase in poaching activities, especially for big game. The Project area has a number of species of reptiles, including venomous snakes. 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.

The site is located 8km from the edge of Lake Turkana, which harbours a variety of aquatic animals, including crocodiles, hippos, fish and birds. It is also internationally recognised as an Important Bird Area, known in particular for its water birds. In addition, the Great Rift Valley is a known bird migratory route. Consequently, in October 2010, LTWP commissioned a one year ornithology survey; the draft final report confirms it is unlikely that there will be a significant impact to migrating birds through collision with the turbines. A small collision risk remains during the autumn migration, to a few species of birds of prey and to some resident species such as eagles, kestrel and vultures; however no risk to water birds associated with Lake Turkana has been identified. In addition, a one-off bat survey was also undertaken; activity was found to be low on the ridges where the turbines are to be located. Recommendations from the report are incorporated into the Project ESMP.

**Flora.** There are large areas of barren land where vegetation is very scarce in the Project area. Much of the site is covered by deciduous dwarf shrubs, and any trees tend to be located along the laggas, along with some annual grasses during the rainy season.

Vegetation is scarce and under great pressure of exploitation by livestock, plants still play an important role in the life of pastoralists of the Project area. Plants provide firewood, materials for the construction of the houses and livestock enclosures and feed for livestock including camels and goats. The plants found in this area are also valued for edible and medicinal products and as a valuable source of fibre for rope making and gum.

**Population.** According to population census of 1999, population in the Loyangalani Division was 16,965 people with a density of 1.1 people per km<sup>2</sup>, 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<sup>2</sup>. The low population density in the Project area is attributed to harsh climatic conditions and insecurity prevailing in the area.

**Local Community.** The greater Marsabit District is inhabited by four main ethnic groups: including the Turkana, Samburu, Rendille and El Molo. The only people to be directly affected by the wind farm footprint are members of the Turkana tribe. The Turkana tribe is thought to be the ninth largest tribe in Kenya and tends to inhabit land within the operational footprint and to the west of the wind farm site; the Samburu tribe inhabit the land to the south-east of the site; and the Rendille tribe tend to populate land to the east of the site. The wind farm site

concession boundary borders the pastoral area of these three tribes. The El Molo tribe is located approximately 70km north of the Project site concession area along the shore of Lake Turkana; and the Gabbra tribe are located to the north-east of the site. The World Bank is considering triggering its Operational Policy on Indigenous Peoples (OP 4.10) as a precautionary measure for the Project but no indigenous people have been identified.

**Community Livelihoods.** Apart from the El Molo, who traditionally are fishermen relying on fish from the Lake for their subsistence, these nomadic ethnic groups travel around their tribal land boundary areas along traditional routes to the various pastures grazing their livestock. It is customary for the tribes to break into groups comprising of circa ten families setting up temporary encampments or revisiting previous camps where they remain for five to ten weeks depending on water and grazing land before moving on to new pastures. The migratory pattern of these tribes is cyclical and is dependent upon availability of pastures and water. Where water or pastures are readily available transhumance pastoralism exists. Headsmen with their livestock move between summer and winter pastures, especially in mountainous areas, returning to their semi-permanent settlements. The Sirima encampment located within the Project footprint are typical of Turkana transhumance pastoralists. Traditionally the adult men care for the grazing animals which in most of these ethnic groups are the major source of livelihood. Women are in charge of shelter either maintaining their portable, or repairing the existing, Manyattas at the various settlement locations where they migrate to on their travels; domestic chores include milking livestock, obtaining water and gathering firewood. Their Manyattas often consist of plastered mud and dung or hide with grass mats stretched over a frame of wooden poles. Duties of male and female children are clearly delineated; girls fetch water and help the women with the cooking, whilst boys herd cattle, goats and camels and learn to hunt and fight defending the herds. Animal rustling is common within the district and usually results in tribal fights over livestock and/or water rights.

**Wider Socio-Economic Environment.** Loyangalani is one of the poorest divisions in the Marsabit District which itself is the poorest district in Kenya. Most of the available basic services are concentrated in Loyangalani Town situated to the north-west of the project area (approximately 40km by road). There are no tarmac roads in the project area and Loyangalani town is connected to other areas through dry weather roads connecting Loyangalani to North Horr, Baraga (to the south), Gatab and Marsabit via Kargi. In many areas, these roads are prone to seasonal floods, which make them impassable during heavy rains. Loyangalani town 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.

From a poverty standpoint, Loyangalani 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 prevails with individuals or households highly dependent on charitable/welfare relief food provided by national and religious organisations for their basic needs. From an education perspective, there are two schools (Loyangalani 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. Poor health conditions are prevalent in the Project area aggravated by the poor nutritional status that prevails. The three most common diseases of the project area are upper respiratory diseases, malaria and diarrhoea. Incidents of HIV/AIDS are not recorded at Loyangalani Health Centre.

Loyangalani town is the epicentre for basic services in the area, with a health centre and a primary and secondary school; however the absence of financial institutions drastically limits commercial activities. The town, located nearby the shore of Lake Turkana, also hosts the main market and fish trading centre for the area. Lake Turkana has vast fishing potential but is poorly exploited and impeded mainly by inadequate fishing boats, unavailability of nets and hooks, poor handling methods, lack of cold storage and the poor condition of the roads. The area has a local fisheries cooperative but this is inefficiently managed. This situation discourages potential investors and fish resources are underutilised.

## 7. Project Alternatives

**Electric Power Alternatives.** The generation of adequate and affordable electricity is a very crucial factor for the economic development of Kenya. The current energy policy puts emphasis 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, 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 stabilisation of power situation in the country. More importantly, the introduction of 300MW 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, as discussed in Section 3.

**Project Siting Alternatives.** According to the National Wind Resource Atlas, as compiled by the Ministry of Energy, the Marsabit District is generally gifted with exceptional wind resource. Based on this information, several sites in the Marsabit District were explored for suitability of wind power generation. The proposed site was selected following extensive studies taking cognisance of each of the various site attributes namely environmental, social and sustainability, technology and commercial consideration, including the remoteness of the area, the strength and stability of the winds prevailing in the area, proven technology, benign environmental setting, low population density, security of the area, fresh water availability and road accessibility. In addition, in order to avoid impacts of birds' collisions with turbines, the proposed wind farm is sited at least 8km from the shore of Lake Turkana.

**Technology Alternatives.** Various turbine manufacturers and specifications were explored before deciding on the V52 model. The original wind farm ESIA (from 2008) was based on 100 V90 turbines; the V52 model, similar to those tried and tested by Kenya Power at Ngong Hills in Nairobi, was assessed to be more optimal due to its smaller size for transportation, simpler construction process and procedures, as well as more robust with higher capacity availability and lower maintenance costs, resulting in a lower tariff to the consumer.

## 8. Potential Impacts & Mitigation/Enhancement Measures

**Economic Impacts.** The implementation of the Lake Turkana Wind Power Project will lead to a variety of socio-economic benefits at a national level, these include:

- **Power:** Once in operation, the 300MW plant will provide low cost power (as per LCPDP). It represents a diversification of power source thus contributing to stabilising the electricity

sector. In addition, installation of an on-site sub-station could in the future distribute, on a cost-recovery basis, electricity to the surrounding area/communities.

- **Economy:** The Project will provide a stimulus to local businesses, especially trading centres along the road upgrade route. Rehabilitation of existing road networks will also have the effect of facilitating the transportation of local livestock and fish products to external markets. During operations, a portion of the revenue created by the selling of carbon credits will be provided to the Government of Kenya. The portion of carbon credit revenue given to the Government will be used to fund community benefits in the wind farm area and along the associated KETRACO transmission line. In addition, the proposed Project will further promote renewable energy and will achieve CO<sub>2</sub> emission reduction by replacing electricity which would have been otherwise generated by fossil fuel power plant. Furthermore, Kenya will save on foreign exchange imports (heavy fuel oil) for emergency power up to Euro 100 million per annum, thereby strengthening Kenya's Current Account and helping stabilise the Kenya currency.
- **Tax Income:** Euro 22.7 million payable in taxes to the Kenyan Government per annum during operations.
- **Employment:** Employment opportunities for the local community during the construction and operation phases of the Project e.g. security, masons, carpenters, cooks and indirect spin-off, such as livestock and fish trade, ecotourism, etc. On the wind farm site, during the peak construction phase: 600 workers, average is expected to be 300 workers; operational phase is expected to be 150 employees. On the road rehabilitation route: anticipated 300 jobs at any one time. Although creation of large scale employment will be temporary, there will be increased jobs in nearby towns and throughout the country from expanding economy.
- **Land Take:** LTWP is leasing the wind farm site. Due to safety hazards, grazing during construction will be discouraged in construction areas of activity. Once in operations, the 365 turbines have a small footprint i.e. the foundations footprints will cover a total of 23 acres. In addition the switchyard footprint will occupy 39.5 acres and the village including workshop will occupy 25 acres, amounting to a physical land take not including internal roads of 87.5 acres. The wind farm site will not be fenced so that the nomadic people may pass through the site. Along the road rehabilitation route, road wayleaves are already in place. However the acquisition of borrow pits located on private land may result in temporary loss of land. This may also be caused by temporary traffic diversions on private land where the road reserve is not adequate.
- **Communication & Tourism:** Once the road is rehabilitated it will lead to improved access to surrounding areas, including Lake Turkana, which is currently mainly serviced by air charter.

**Social Impacts.** Due to the remoteness of the site, especially in a region of high poverty levels, the proposed development will impact the communities in the Project area in the following ways (with proposed mitigants, as required):

- **Physical Displacement on Wind Farm Site:** As discussed in Section 6 a transhumance nomadic clan, of the Turkana pastoralists inhabit the footprint of the wind farm site having an encampment located nearby the C77 road that traverses the wind farm site. Construction hazards on the wind farm site could potentially be hazardous for the general public, tourists and Sirima pastoralists.  
*Mitigants:* Meetings have been held with those pastoralists who use the Sirima encampment to find out what attracts them to the area and in particular this encampment. The opportunity to stop and solicit passing vehicles for water (primarily), food and money are the attraction. The Kenyan government, via the area Member of Parliament, had constructed a seasonal water catchment dam and the Catholic Church had built a school classroom thus these features, with the road nearby, offered and provided opportunities not easily accessible elsewhere in the vicinity or along their pastoral travels within the area. The

community leaders and Sirima pastoralists, having considered the potential dangers, have agreed not to utilise the Sirima encampment area during the construction period; LTWP will make available a managed supply of water and Sirima pastoralists have worked with LTWP in identifying a host encampment area nearby (1.5km north of the public road) but away from the construction activities and associated potential dangers to themselves and livestock. One of the three drilled boreholes, with confirmed potable water, is located 250m from the agreed relocation area.

- **Physical Displacement on Road Rehabilitation Route:** On the road upgrade route three communities have been identified as sensitive receivers which will be impacted by the proposed construction activities. The routes to be rehabilitated are all existing routes (some of which have become overgrown and disused).

*Mitigants:* Limited resettlement will be required along the route as building has not occurred within the road reserve (5m on either side of the 6m width road), other than at Illaut (and possibly Namarei, subject to final route alignment). In addition, at the locations of the three identified sensitive receivers, construction mitigation measures will be implemented to protect the local communities' health and safety. These will include speed retardation methods, traffic control persons, dust sheets or other approved mitigation provisions as deemed necessary to mitigate and protect these communities.

- **Public Health:** Increase in risk of sexually transmitted diseases, such as HIV/AIDS etc. due to influx of migrant workers; solid waste and effluent discharge from construction camps; risk of increase in vectors of schistosomiasis and malaria due to stagnant water associated with construction works/borrow pits etc. Once the road has been rehabilitated, there will be an increase in number of people using it and hence increased interaction between local communities and road users.

*Mitigants:* The construction camps will be carefully managed; the Contractor will provide LTWP with plans upon contract signing, which will need to be approved, detailing the location of the camps and how they will be managed. Areas of ponding will be minimised so as to reduce the risk of water related diseases and borrow pits reinstated. In addition, LTWP is planning for a HIV/AIDs awareness and education programme to commence prior to construction, during and into operations, via its proposed Corporate Social Responsibility (CSR) programme.

- **Community:** The increase in the number of people in the Project area has the potential to lead to a number of negative socio-economic impacts, including increased insecurity and community conflicts, increased incidences of diseases (as mentioned above); increased risk of accidents and occupational hazards; and immigration of construction workers and labour force management challenges.

*Mitigants:* LTWP will continue to undertake engagement and consultation, with the local stakeholders, in line with its Community Engagement Policy and Plan. In the short term, the community using the Project site will be provided a managed water supply. In addition, a community Health & Safety construction traffic awareness programme (along with the HIV/AIDs awareness programme) is to be established along the road rehabilitation route and in the wind farm site vicinity in advance of construction taking place. Furthermore, during construction Emergency Preparedness and Response Plans will be prepared and implemented by the contractors; during operation phase this responsibility lies with LTWP. Finally, draft plans are in place for CSR activities during construction and operations which will focus on healthcare, education and water e.g. proposals are in place to provide assistance in the development of health and education facilities in the wider Project area in order to improve health conditions and literacy of local community, especially any marginalised groups, such as women and youth.

- **Culture:** There is a risk of finding additional modern burial cairns during construction. As the Project progresses, there is a possibility that there will be a dilution of local cultural i.e.

the increased accessibility of the area due to upgrading of roads could lead to an influx of people and thus possibility of introduction of new culture.

*Mitigants:* National Museums of Kenya has undertaken a survey of the wind farm site and deemed the area has 'modest archaeological heritage'. Markers will be placed on site at identified burial cairns. Contractors will make provisions for chance finds of artefacts during construction. Community engagement will continue throughout the life of the Project.

- **Traffic:** Increased traffic, especially construction vehicles. This will mean an increased risk to pedestrians.

*Mitigants:* The contractor will provide LTWP with Traffic Management Plan, which will need to be approved prior to construction. The local nomadic community will be encouraged to avoid areas of construction activities during the construction period. Although during operations there will be increased traffic, the positive impact is that the road system will have been improved.

**Physical Impacts.** The Project activities are likely to cause site-specific negative impacts on the bio-physical environment of the Project area including (with proposed mitigation):

- **Erosion:** Soil exposure due to land clearing during construction.

*Mitigation:* Project site is 8km from Lake Turkana and will be carefully managed during construction. Along the road rehabilitation route, embankments should be re-planted with shrubs and grasses to reduce erosion of road embankments.

- **Loss of Ecology:** Destruction of flora and fauna and disturbance of livestock due to construction (on site and along road rehabilitation profile/borrow pit sites). The increase in noise during construction may scare away wild animals. In addition, the presence of wind turbines and associated facilities may affect local fauna populations by decreasing the area of habitat available.

*Mitigation:* Construction impacts along the road rehabilitation route and on site will be temporary. The footprint of the wind turbines is very small in comparison to other power plants of similar magnitude, hence minimal vegetation loss. The wind farm site boundary will not be fenced, allowing for grazing on site to take place following construction. Note, there are three RAMSAR sites in Kenya, none of which are within the footprint or concession area of the wind farm or road upgrade route. The protected areas (Mt. Kulal Biosphere Reserve and South Island National Park) are situated away to the east and west of the Project area respectively and thus project activities will have minimal impact on them. Note, bat survey and 12 month ornithological monitoring carried out; the results have been assessed as low impact (see Section 6). Recommendations from final survey report to be incorporated.

- **Increased Noise & Vibration:** Noise levels are likely to increase in the Project area (including road rehabilitation route) from traffic and machinery during construction. During operation noise will be emitted from each individual wind turbine; in addition the rehabilitated route will be increasingly utilised.

*Mitigation:* Personal Protective Equipment (PPE) to be worn by construction workers. Moreover, modern Vestas turbines are associated with low noise levels.

- **Decreased Air Quality:** Increase in dust from traffic and construction works; increase in emissions resulting from an increase in road use due to the improved quality of the route during operations.

*Mitigation:* Speed retardation methods will be implemented to reduce vehicle speed such as strict speed restriction obligations within the transportation contracts (e.g. erecting sign posts, monitoring, and policing) during construction thus reducing dust. Vehicles to be used during construction must be regularly maintained. In addition, an approved method of disposal should be used to dispose of used oil filters and oil drained from Contractor's transportation.

- **Decreased Water Quality:** Increase in suspended particles due to construction works; risk of human contamination from construction camps; and competition for water.  
*Mitigation:* Site management to control and minimise pollution. As discussed in Section 6, following LTWP's water investigations, new boreholes will be drilled to ensure no stress is placed upon the local community's water sources. Following construction, boreholes which are no longer needed will be handed-over to the local communities.
- **Visual Intrusion:** Unsightly earthworks and borrow pits during construction. During operations, visual intrusion of equipment on site, including the wind turbines and overhead cables, may be seen as a negative impact at the local level.  
*Mitigation:* Works will be careful sited, borrow pits reinstated; and overhead lines (33kV) diverted so as not to cross over the established Sirima encampment.

A summary of the affected key environmental and social variables and the intensity of impacts can be found in Annex 3.

## 9. Environmental & Social Management/Monitoring Plan

The ESMP, including monitoring plan, has been identified as an important process in the protection of environment of the Project area. This plan serves to protect the communities living in the vicinity; the workers who are implementing the Project; and the natural environment. In addition it will reveal changes and trends brought about by the presence and operations of the installed wind farm facility. The basic attributes for the monitoring program will involve the following: collection and analysis of appropriate environmental data; preparation of periodic reports, including an annual environmental and social performance report to the Project Lenders and liaison with other relevant bodies (e.g. NEMA); identification of unexpected environmental impacts; and formulation of mitigation measures for the unexpected negative impacts.

During the construction phase, responsibility for many of the environmental and social mitigation and monitoring actions will be passed on to the construction contractors. In these situations, LTWP will maintain a monitoring and oversight capability to ensure that contractors are fulfilling their obligations. ESMPs will therefore be drafted and provided to LTWP for approval upon signing of the individual contracts. The individual contractors will then implement the ESMPs, with the overall responsibility for the implementation lying with LTWP. Implementation of the ESMP(s) and grievance mechanism will be ensured through the recruitment of an Environmental Manager to be stationed at site.

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 Manager. CSR activities are separate to the ESMP and will be enacted through the specially formed LTWP CSR Foundation. A breakdown of the cost estimates is presented in the table below:

Project Activity		Cost Estimate (KSh)
1	Remuneration for the Environment Manager to implement the ESMP and the grievance mechanism	2,500,000
2	Purchase of a vehicle and other transportation requirements for the Environment Manager	4,500,000
3	Implementation of Community Engagement Plan	1,500,000

4	Establishment of Lake Turkana Wind Power Project's Foundation for the implementation of the CSR Program.	4,000,000
5	Ornithology monitoring (Years 1, 2, 3, 5, 10 and 15 of operation)	TBC
6	Sample water analysis (chemical and biological, and other samples)	100,000
7	Purchase of consumables (computer, sampling apparatus, field equipment, PPE 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 labour 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 ESMP)	2,000,000
<b>Total Estimated Cost for the ESMP</b>		<b>KSh 20,250,000</b>

**Table 2. Cost Estimates for Environmental and Social Management Plan/Monitoring Program.**

## 10. Complementary Initiatives

**Associated Transmission Line.** The Project area is presently not serviced by any transmission line network. In order for the Project to be able to supply power to the national grid it is necessary for the simultaneous development of a transmission line from the wind farm site to Suswa where it will interconnect to the national high voltage network.

The development of the transmission line was originally envisaged as build and transfer part of the overall LTWP Project as such the environmental and social studies carried out were commissioned by LTWP. This associated facility is now being progressed by KETRACO. KETRACO has confirmed that the transmission line project will also be developed to meet those requirements adopted by LTWP's Lenders.

In 2008 LTWP commissioned Schicon to undertake a power integration and economics study and evaluate the most optimal routing of the transmission line for integration into the existing grid network. Six options were studied and the preferred option was the construction of a new double-circuit 400kV line from Suswa due northwest of Nairobi to the Lake Turkana Wind Power site near Loyangalani, via Naivasha, Gilgil, Nyahururu, Rumuruti, Maralal and Baragoi, a distance of 428km. Subsequent to this, surveyors 42 Geomatic Services were commissioned to identify and explore four routes in detail; the preferred route option has since been extended by approximately 40km in order to avoid passing through the more populated areas.

An ESIA for the transmission line development was undertaken in 2008 and a licence issued. The EIA licence has since been renewed and reissued in KETRACO's name.

Key recommendations from the ESIA:



- There is a need for a Resettlement Action Plan (RAP) to be prepared to guide resettlement activities arising from the clearing of a 60m wide wayleave corridor for the construction of the transmission line.
- The recommendations relating to biodiversity (protection of Pesi Swamp and Malewa River) should be incorporated in the ESMP to ensure that these habitats are not adversely affected by the construction of the transmission line.

LTWP, together with KETRACO, have set up a Task Force to provide oversight management and capacity building in respect to the RAP activities for the transmission line project. Log Associate, the RAP consultants, was awarded the consultancy contract for developing a draft RAP and budgetary purposes via a competitive tender. Log Associates are currently in the process of undertaking the socio-economic survey of the line, valuating assets in order to prepare a draft RAP report by end of December 2011.

**CSR Foundation.** 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 wider Project area, namely 1) education through the construction and operation of schools and vocational training centres, 2) health through the construction and operational costs of medical clinics, focusing on maternal and infant health; 3) potable water distribution and sanitation for human consumption and water points for livestock. The Foundation will try, to the extent possible, to maximise 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 (Euros 300,000 per year for 20 years). The Foundation will be staffed and operated under the guidance of LTWP’s Board of Directors.

**Carbon Potential.** The proposed wind farm Project will achieve CO<sub>2</sub> 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 CO<sub>2</sub> 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. A portion of the carbon credit earned by the Project will be transferred to the Ministry of Energy and the revenue utilised for the benefit of the communities living near the wind farm and along the associated transmission line.

## 11. Conclusion

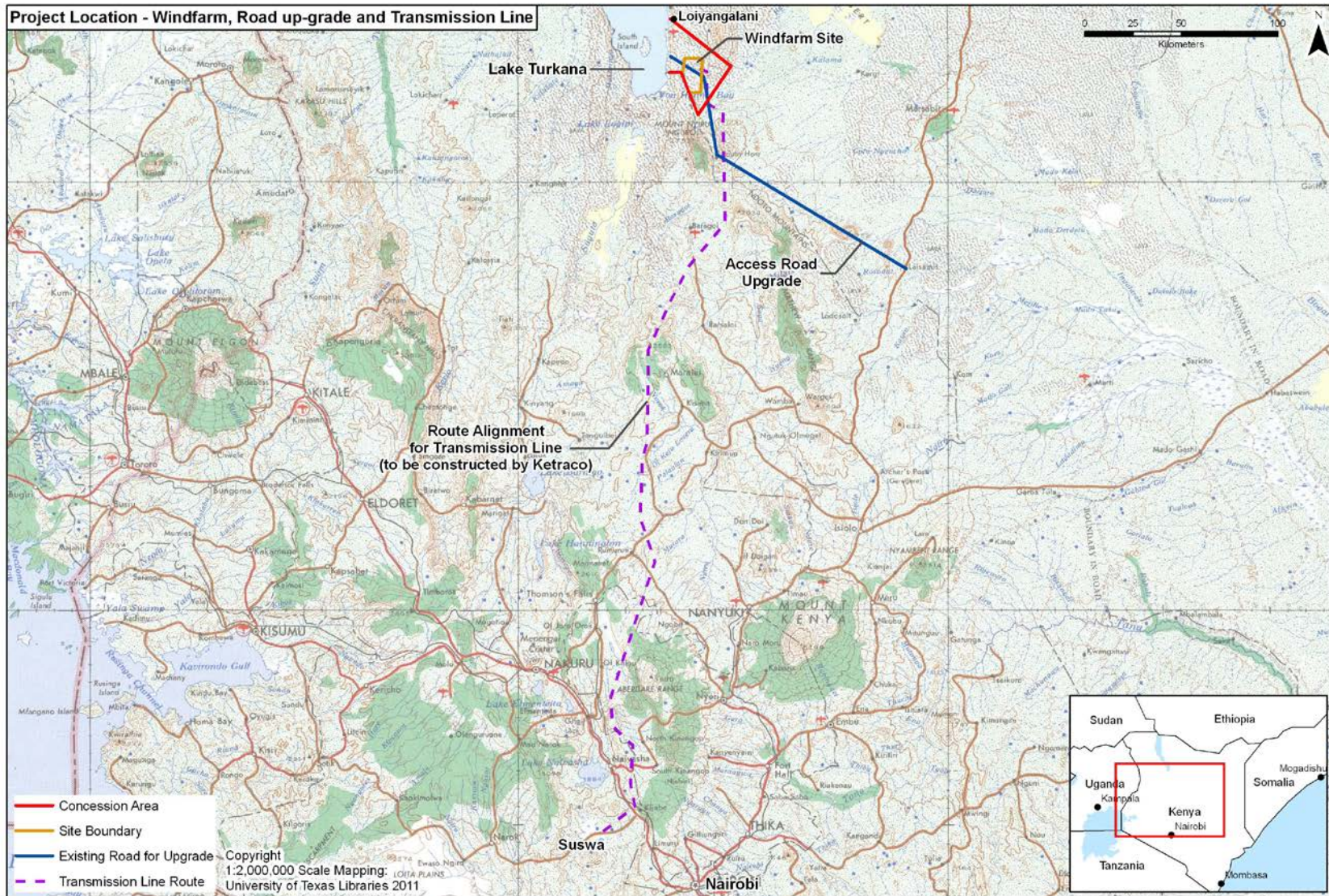
The findings of the environmental and social studies to date indicate that the socio-economic benefits of LTWP’s Project, namely the 300MW wind farm and the proposed rehabilitation of the Laisamis – Namarei – Illaut – Arge - Kargi - Loyangalani Road route, outweigh the limited and site-specific social and environmental costs when enhancements/mitigation measures are effectively and timely undertaken. The vast majority of the impacts, whether they are environmental or social, will be mitigated with conventional industry best practices.

LTWP has actively engaged and consulted the key stakeholders. The local population is positive about the Project and welcomes its installation. It is widely felt that the wind farm development and rehabilitated access road will benefit the area and the communities living in the vicinity. With LTWP’s commitment in the establishment of the Lake Turkana Wind Power Project’s Foundation

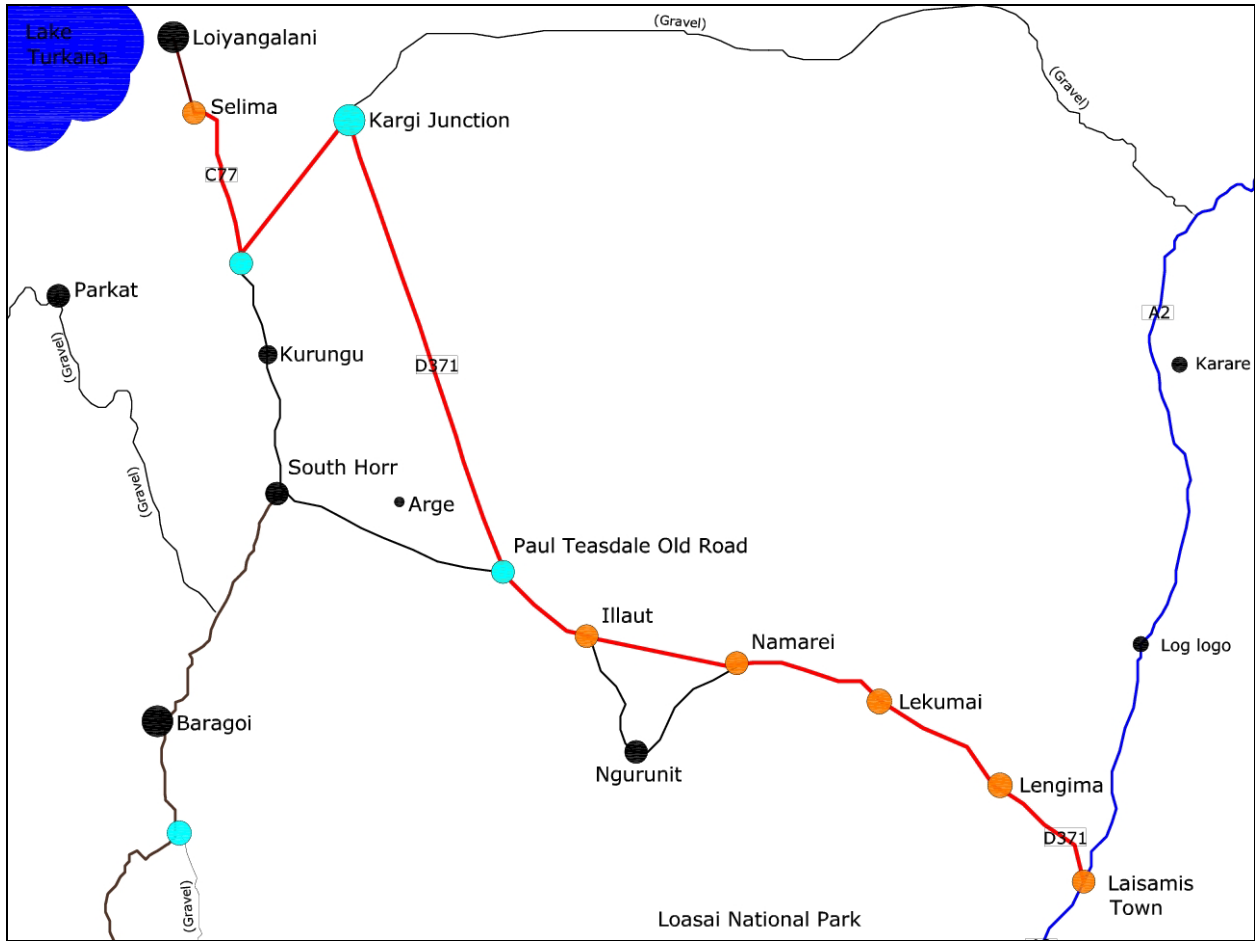
for the implementation of a comprehensive CSR programme, NEMA has stated that the Project is environmentally sound and socially acceptable. In addition, LTWP has also committed a portion of the revenue generated by the wind farm carbon credits for use to fund CSR projects in the communities affected by the associated transmission line development.

## ANNEX

Annex 1 Project location of proposed wind farm and road rehabilitation (approximate route) in conjunction with the associated KETRACO transmission line.



Annex 2 Proposed Laisamis – Namareï – Illaut – Arge - Kargi Junction – Loyangalani Road (in red).



Annex 3 Environmental and Social Impact Matrix

<b>Environmental Parameters</b>	<b>Intensity of Impact</b>
Stabilisation 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

**Key:**

- +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