Environment Impact Assessment (EIA) Study for a Proposed 100MW Wind Energy Project, Kajiado District, Kenya

Report Prepared for

Kipeto Energy Limited

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Kurrent

Complete Energy Solutions

Environment Impact Assessment (EIA) Study for a Proposed 100MW Wind Energy Project, Kajiado District, Kenya

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1 Project Details

Title of Project	**:**	Proposed 100MW Wind Energy Facility, Kajiado, Kenya		
NEMA Reference Number	**:**	NEMA/PR/5/2/9351		
Project Manager	**:**	Galetech Energy Developments Ltd. (Ireland)		
Firm of Experts	**:**	Kurrent Technologies Ltd. (Kenya)		
NEMA License Number	**:**	0191		
Specialists	**:**	Mr. Eliud Wamwangi	:	Geology, Soils, Hydrology and Hydrogeology
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		Ms. Angela Kabiru	:	Archeology and cultural heritage
		Mr. Dickens Odeny	:	Terrestrial ecology
		Mr. Joel Omondi	:	Social impact assessment
		Mr. Cormac McPhillips	:	Visual Impact Assessment
		Ms. Catherine Keogan	:	Traffic Impact Assessment
		Mr. Cormac McPhillips	:	Noise Impact Assessment
		Mr. Cormac McPhillips	:	Shadow Flicker Assessment
Client	**:**	Kipeto Energy Limited		

ABBREVIATIONS AND ACRONYMS

CDM	Clean Development Mechanism
CER	Certified Emission Reduction
CIF	Climate Investment Funds
CO_2	Carbon Dioxide
DOSHS	Directorate of Occupational Safety and Health Services
EMCA	Environment Management and Coordination Act, 1999
EMP	Environment Management Plan
EPR	Environment Project Report
ERC	Energy Regulatory Commission
ESIA	Environment and Social Impact Assessment
ESM	Environmentally Sound Management
FiT	Feed-in-Tariff
GDC	Geothermal Development Company
HV	High Voltage
IPP	Independent Power Producer
KCAA	Kenya Civil Aviation Authority
KenGen	Kenya Electricity Generating Company Ltd.
KETRACO	Kenya Electricity Transmission Company
km^2	Square kilometers
KP	Kenya Power
kW	Kilowatt
LCPDP	Least Cost Power Development Plan 2011 – 2030
LN	Legal Notice
LV	Low Voltage
m/s	Meters per second
m^2	Square meters
MV	Medium Voltage
MW	Megawatt
NEC	National Environmental Council
NEMA	National Environment Management Authority
OSHA	Occupational Safety and Health Act, 2007
PCC	Public Complaints Committee

REA	Rural Electrification Authority
SERC	Standards and Enforcement Review Committee
SIA	Social Impact Assessment
TAC	Technical Advisory Committee
TOR	Terms of Reference
UNDP	Unite Nations Development Program
UNFCC	United Nations Framework Convention on Climate Change
ZVI	Zone of Visual Influence

DEFINITIONS AND TERMINOLOGY

Alternatives	Alternatives are different means of meeting the general purpose and need of a proposed activity. Alternatives may include location or site alternatives, activity alternatives, process or technology alternatives, temporal alternatives or the "do-nothing" alternative.
Anemometer	A device used to measure wind speed. It then transmits that data to the controller in the nacelle.
Blades	The part of a wind generator rotor that catches the wind. Most wind turbines have three blades. Wind blowing over the blades causes them to lift and rotate.
Brake	A disc brake, which can be applied mechanically, electrically or hydraulically to stop the rotor in emergencies.
Clean Development Mechanism (CDM)	An arrangement under the Kyoto Protocol allowing industrialized countries with a greenhouse gas emission reduction commitment (called Annex I countries) to invest in projects that reduce emissions in developing countries as an alternative to more expensive emission reductions in their own countries. The CDM allows net global greenhouse gas emissions to be reduced at a much lower global cost by financing emission reduction projects in developing countries where costs are lower than in industrialized countries. The CDM is supervised by the CDM Executive Board and is under the guidance of the Conference of Parties (COP) of the United Nations Framework Convention on Climate Change (UNFCC)
Controller	Starts the rotation of the turbine blades at the desired wind speed and stops them when the wind speed becomes excessive.
Cumulative impacts	Impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities (e.g. discharges of nutrients or heated water to a river that combine to cause algal bloom and subsequent loss of dissolved oxygen that is greater than the additive impacts of each pollutant). Cumulative impacts can occur from the collective impacts of individual minor actions over a period of time and can include both direct and indirect impacts.
Cut-in speed	The minimum wind speed at which the wind turbine will generate useable power.
Cut-out speed	The wind speed at which a wind turbine will shut down.
Direct impacts	Impacts that are caused directly by an activity and generally occur at the same time and at the place of the activity. These impacts are generally associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable.
Do-nothing alternative	The "do-nothing" alternative is the option of not undertaking the proposed activity or any of its alternatives. The "do-nothing" alternative also provides the baseline against which the impacts of other alternatives should be compared.

Endangered species	Taxa in danger of extinction and whose survival is unlikely if the causal factors continue operating. Included here are taxa whose numbers of individuals have been reduced to a critical level or whose habitats have been so drastically reduced that they are deemed to be in immediate danger of extinction.
Endemic	An "endemic" species is a species that grows in a particular area (is endemic to that area) and has a restricted distribution. It is only found in a particular place. Whether something is endemic or not depends on the geographical boundaries of the area in question and the area can be defined at different scales.
Environment	The surroundings within which humans exist and that are made up of: i). The land, water and atmosphere of the earth; ii). Micro-organisms, plant and animal life; iii). Any part or combination of (i) and (ii) and the inter-relationships among and between them; and iv). The physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being.
Environment Impact Assessment	Environment Impact Assessment (EIA) means the process of collecting, organizing, analyzing, interpreting and communicating information that is relevant to the consideration of the application.
Environment Management Plan	An operational plan that organizes and coordinates mitigation, rehabilitation and monitoring measures in order to guide the implementation of a proposal and its ongoing maintenance after implementation.
Gearbox	Placed between the main shaft and the generator, it increases the speed of the rotor blades to the generator's required rotation speed.
Generator	The generator is what converts the turning motion of a wind turbine's blades into electricity.
Heritage	That which is inherited and forms part of the National Estate.
High-speed shaft	The shaft that drives the generator.
Hub	The hub connects the blades and drives the low-speed shaft.
Hub-height	The height from the ground to the center of the rotor shaft
Indirect impacts	Indirect or induced changes that may occur as a result of the proposed activity (e.g. the reduction of water in a stream that supplies water to a reservoir that supplies water to the activity). These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity.
Least Cost Power Development Plan (LCPDP)	The Least Cost Power Development Plan is an Indicative Energy Plan for Kenya's electricity needs and is prepared by various Government parastatals in the electric-power sub-sector together with the ERC. The purpose of the LCPDP is to guide stakeholders with respect to

	how the sub-sector plans to meet the energy needs of the nation for subsistence and development at least cost to the economy and the environment.
Micro-siting	An international convention with regards to wind energy facilities. It refers to the process of specifically determining the position of each turbine based on the wind resource and topographical constraints in order to maximize production.
Nacelle	The nacelle is a part of the wind turbine that houses the generator, control equipment, gearbox and anemometer for monitoring the wind speed and direction.
Pitch	Controls the blades of the turbine with respect to the wind flow. The blades are turned or pitched out of the wind to keep the rotor from turning in winds that are too high or low to produce electricity efficiently.
Red data species	Species listed in terms of the International Union for Conservation of Nature and Natural Resources (IUCN) Red List of threatened species.
Rotor	The portion of the wind turbine that collects energy form the wind is called the rotor. The rotor converts the energy in the wind into rotational energy to turn the generator. The rotor has three blades that rotate at a constant speed of about 15 to 28 revolutions per minute.
Scaling up Renewable Energy Plan (SREP)	The Program on Scaling-Up Renewable Energy in Low Income Countries (SREP) is a targeted program of the Strategic Climate Fund (SCF), which is within the framework of the Climate Investment Funds (CIF). The SREP stimulates economic growth through the scaled-up development of renewable energy solutions and, it acts as a catalyst for the transformation of the renewables market by obtaining government support for market creation, private sector implementation, and productive energy use. The SREP is financed by the African Development Bank, European Bank for Reconstruction and Development, Inter-American Development Bank and the World Bank
Shadow flicker	Under certain combinations of geographical position and time of day, the sun may pass behind the blades of a wind turbine and cast a shadow. When the blades rotate, the shadow flicks on and off. The effect only occurs inside buildings where the flicker appears through a window opening. The seasonal duration of this effect can be calculated from geometry of the machine and lattitude of the site.
Significant impact	An impact that by its magnitude, duration, intensity or probability of occurrence may have a notable effect on one or more aspects of the environment.
Stakeholder	Individuals or groups concerned with or affected by an activity and its consequences. These include authorities, local communities, investors, work force, consumers, environmental interest groups and the general public.

Tower	The tower which supports the rotor, is constructed from tubular steel. It is approximately 80m tall. The nacelle and the rotor are attached to the top of the tower. The tower on which a wind turbine is mounted is not just a support structure. It also raises the wind turbine so that its blades safely clear the ground and so it can reach the stronger winds at higher elevations. Larger wind turbines are usually mounted on towers ranging from 40m to 80m tall. The tower must be strong enough to support the wind turbine and to sustain vibration, wind loading and the overall weather elements for the lifetime of the wind turbine.
Wind power	A measure of the energy available in the wind.
Wind rose	The term given to the diagrammatic representation of joint wind speed and direction distribution at a particular location. The length of time that the wind comes from a particular sector is shown by the length of the spoke, and the speed is shown by the thickness of the spoke.
Yaw drive	Used to keep the rotor facing the wind as wind direction changes to ensure that the maximum amount of electrical energy is produced at all times.
Yaw motor	Used to power the yaw drive.

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2 Executive Summary

Kipeto Energy Limited proposes to develop a 100MW capacity wind farm approximately 18km north-west of Kajiado town in the Rift Valley Province as shown in Figure 2-1. Relative to Nairobi, the proposed project site is situated approximately 70km south-west of the City. The proposed project will be undertaken in the Esilanke area, Oloiyangani (Kipeto) sub-location, south Keekonyokei location in Kiserian, Kajiado division. The proposed wind farm will be developed on land leased from local landowners; the wind turbines will be sited over a total project area measuring approximately 70km^2.

Kipeto Energy Limited (hereinafter referred to as the "Proponent") is a special purpose vehicle incorporated in Kenya for developing the proposed wind energy facility. The company comprises two partners namely, General Electric Company of the USA, which has 70% equity, and Craftskills Wind Energy International Limited a Kenyan renewable energy company which has 25% equity. Kipeto Energy Limited will contribute 5% of the proceeds arising from power generation to the local Masai community through a trust fund..

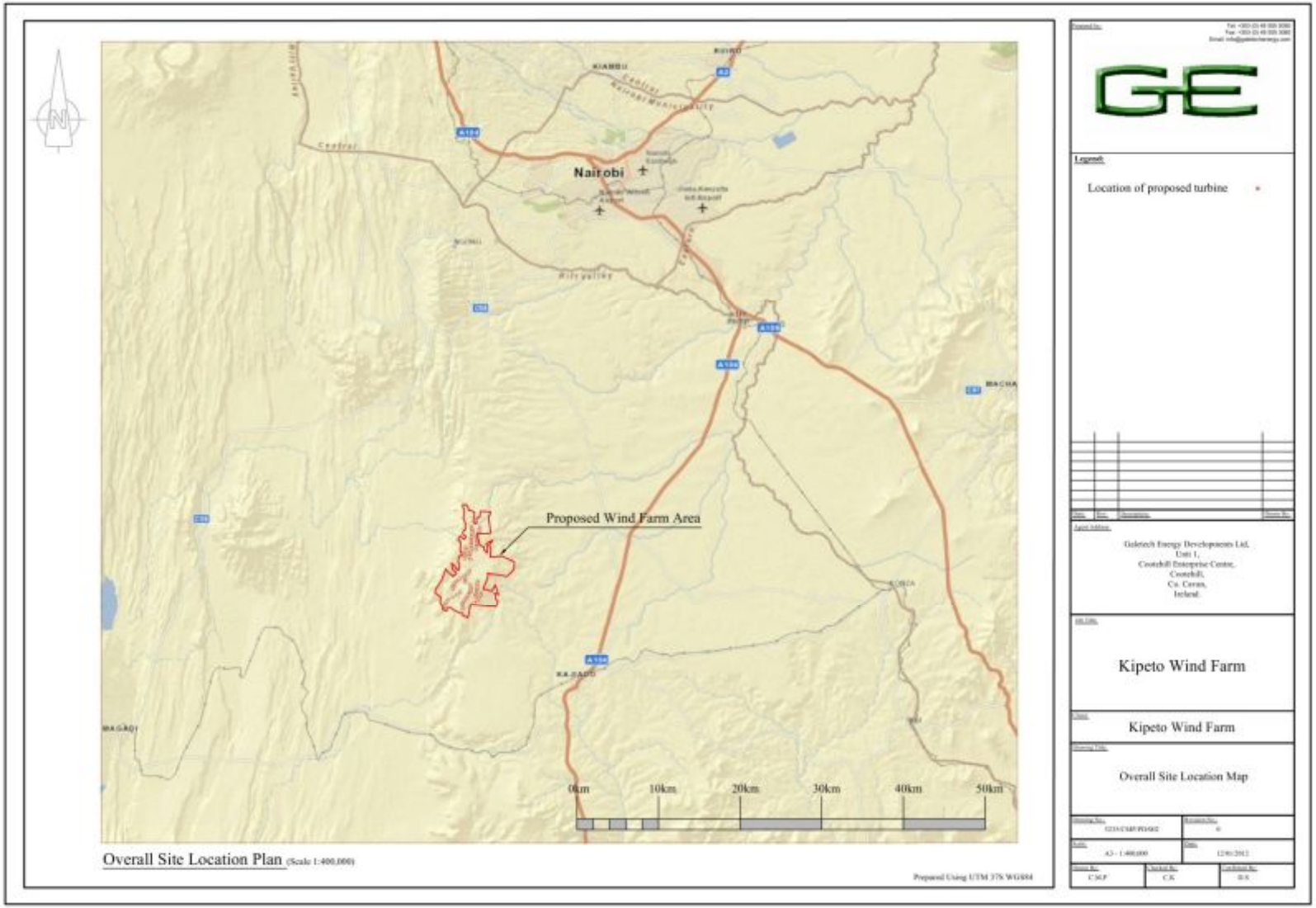
As indicated in Figure 2-1, the proposed project site falls within the Kajiado rangelands

In 2009, the Proponent applied for an Expression of Interest in prospecting for wind energy in the proposed project area and was subsequently granted the "Non-renewable Rights of First Refusal" by the Ministry of Energy.

In March 2011, the Proponent appointed Galetech Energy Developments of Ireland as the Project Manager to oversee the EIA process, design, construction, supervision, project management and commissioning of the project. Galetech Energy Developments is an Irish based internationally focused multi-disciplinary renewable energy consultancy, which specializes in the delivery of feasibility analysis, project design, project management, GIS mapping, permitting & environmental impact assessment reports associated with renewable energy projects.

In June 2011, the Proponent appointed Kurrent Technologies Ltd. to complete the Environmental and Social Impact Assessment (ESIA) and Environment Management Plan (EMP) for necessary environmental authorizations in accordance with the Environment Management and Coordination Act, 1999 (EMCA) and Legal Notice (LN) 101: Environment (Impact Assessment and Audit) Regulations, 2003. It is a legal requirement in Kenya that a local Lead Expert or Firm of Experts registered by the National Environment Management Authority undertakes EIA Studies. Kurrent Technologies Ltd. is a National Environment Management Authority (NEMA) registered Firm of Experts.

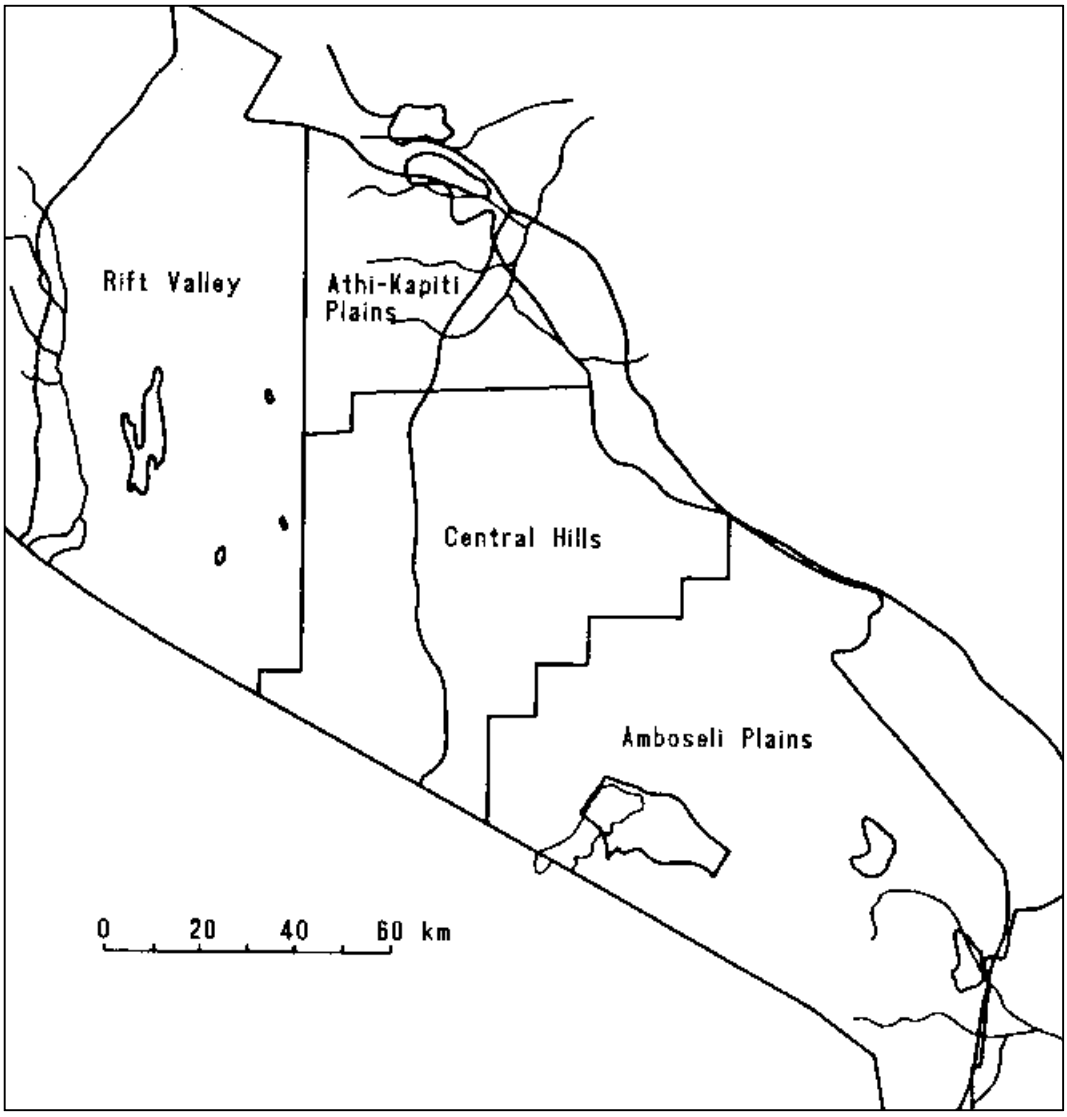
Figure 2-1: Image showing approximate location of the project in Kajiado North



Kajiado County has an area of approximately 19600km^2 (Central Bureau of Statistics, 1981). It is roughly triangular and is bordered by the Nairobi-Mombasa railway to the north-east, the border with Tanzania to the south, and the western wall of the Rift Valley to the west. The eastern boundary is formed by the Chyulu Range and western limit of Tsavo National Park. The County is divided into four eco-zones namely, the Rift Valley, the upland Athi Kapiti Plains, the Central Hills and the Amboseli Plains.

The proposed project falls within the Athi-Kapiti plains eco-zone shown in Figure 2-2. The upland Athi-Kapiti Plains are mainly open, rolling land. The Plains drain towards the Athi River basin in the east. Geologically, they derive from volcanics but there is a band of tertiary sediments running south-west to north-east across the center of the plains. The soils are mostly deep black Vertisols.

Figure 2-2: Map showing eco-zones in Kajiado County



The scope of the project includes design, construction, operation and decommissioning activities. This ESIA Study has evaluated the potential environmental and social impacts associated with all three phases of the project.

The primary components of the project include a wind energy facility including up to 67 wind turbines, one on-site sub-station, underground electrical cabling between turbines and the sub-station, internal access roads and an office/maintenance building on the facility site.

The associated facilities include transmission lines which will emanate from the on-site sub-station and terminate at an appropriate Kenya Power sub-station. The associated facilities are excluded from this ESIA Study as discussions are currently going on between the Proponent and Kenya Power on the transmission lines design, routing and connectivity. The environmental and social impacts related to the associated facilities will be the subject of a separate ESIA Study yet to be undertaken.

This report is Volume I of the ESIA Study undertaken for the proposed wind energy facility in Kajiado county and represents the outcome of the ESIA phase of the process and contains the following chapters:

Chapter 1 indicates the Project Details associated with the proposed wind energy facility.

Chapter 2 is an Executive Summary of the environment and social impacts associated with the proposed project.

Chapter 3 provides a description of the project and its components.

Chapter 4 discusses the methodology used for undertaking the environment and social impact assessment of the proposed project.

Chapter 5 evaluates the project alternatives including the “no-go alternative”.

Chapter 6 provides an overview of the regulatory and legal context for electricity generation projects and the EIA process.

Chapter 7 provides an overview of the baseline environment and social setting of the project.

Chapter 8 discusses the procedures and processes to be used in the implementation of the project.

Chapter 9 discusses the construction process and materials to be used during the construction and implementation of the project.

Chapter 10 provides an overview of the products, by-products and wastes to be generated throughout the project life cycle.

Chapter 11 presents the assessment of environmental and social impacts associated with the project.

Chapter 12 presents the Environment and Social Management Plan (ESMP) associated with the wind energy facility.

Chapter 13 provides a plan for the prevention of accidents and hazardous activities during the construction and operation of the project.

Chapter 14 presents a plan for the prevention of health hazards and implementation of security measures during the life cycle of the project.

Chapter 15 presents the gaps in knowledge and uncertainties encountered while undertaking the environment and social impact assessment.

Chapter 16 provides the conclusions of the Firm of Experts associated with the proposed wind energy facility.

In compiling this ESIA Study, a number of specialist studies were undertaken by the Firm of Experts. These studies are appended in Volume II of this ESIA Study and are listed below for ease of reference.

Appendix	Description of Specialist Study
A	Archeological and Cultural Heritage Report
B	Ecological Impact Assessment Report
C	Geology and Soils Report
D	Hydrology Report
E	Hydrogeology Report
F	Noise Assessment Report
G	Ornithological Study Report
H	Social Impact Assessment Report
I	Transport Assessment Report
J	Landscape and Visual Impact Assessment Report
K	Shadow Flicker Assessment Report

The environment project report phase (scoping phase) identified potential issues associated with the proposed project and defined the extent of the studies required within the ESIA phase. The ESIA phase addressed those identified potential environmental impacts and benefits associated with all phases of the project including design, construction and operation and recommends appropriate mitigation measures for potentially significant environmental impacts.

The ESIA report aims to provide sufficient information regarding the potential impacts and the acceptability of these impacts in order for NEMA and the relevant lead agencies to make an informed decision regarding the proposed project.

This ESIA study will provide stakeholders with an opportunity to verify that the issues they raised through the EIA process have been captured and adequately considered.

The ESIA phase aimed to achieve the following:

- Provide an overall assessment of the social and biophysical environment affected by the proposed project;
- Assess potentially significant impacts associated with the wind energy facility;
- Identify and recommend appropriate mitigation measures for potentially significant environmental impacts; and
- Undertake a fully inclusive public stakeholder consultation process to ensure that stakeholders are afforded an opportunity to participate and that their issues and concerns are recorded.

The conclusions and recommendations of this ESIA study are the result of the assessment of identified impacts by the Firm of Experts and their specialists including the process of public stakeholder consultation. The public stakeholder consultation process has been extensive and every effort was made to include representatives of all stakeholders in the study area.

The most significant environmental impacts associated with the proposed project include:

- Visual impacts on the natural scenic resources of the region;
- Local site-specific impacts as a result of the construction and operational phases of the project;
- Impacts on the social environment.

The findings of the specialist studies undertaken within the ESIA to assess both the benefits and potential negative impacts anticipated as a result of the proposed project concluded that:

- The landowners directly affected by the project have signed leases with Kipeto Energy Limited are not opposed to the project. In order to enhance the local employment and business opportunities, the mitigation measures stated in the report should be implemented. ;
- The environmental impacts associated with the proposed wind energy facility will be minimized provided that the recommended mitigation, monitoring and management measures are implemented and given due consideration during the process of finalizing the wind energy facility layout;
- The proposed project represents an investment in clean, renewable energy which given the challenges created by climate change, represents a positive social benefit for society as a whole.

The significance of the majority of identified negative impacts can generally be reduced by implementing the recommended mitigation measures. Subsequently it is recommended that:

- All mitigation measures stated in this ESIA Study including those indicated in the specialist studies be implemented;
- The Environment Management Plan (EMP) should form part of the agreement with the contractors appointed to build and maintain the proposed wind energy facility, and will be used to ensure compliance with environmental specifications and management measures. Compliance with the EMP throughout the life cycle of the project is considered to be important in achieving the appropriate environmental management standards as detailed for this project;
- As the final turbine positions have not yet been confirmed and a baseline ornithological study has been conducted, the wind energy facility management must implement a monitoring program in order to understand the nature of impacts on avifauna due to the wind energy facility at the site;
- As far as practical, wind turbines and associated lay down areas and access roads which could potentially impact on sensitive receptors should be shifted

to avoid areas of high sensitivities. Where this is not possible, alternative mitigation measures detailed in this report should be implemented;

- Disturbed areas should be rehabilitated as quickly as possible and an on-going monitoring program should be considered to detect and quantify any alien species;
- During the construction phase, unnecessary disturbance to habitats should be strictly controlled and the footprint of the impact should be kept to a minimum;
- A comprehensive stormwater management plan should be compiled for the sub-station footprints prior to construction;
- Applications for all relevant and required permits required to be obtained by Kipeto Energy Limited must be submitted to the relevant lead agencies. This includes permits for transporting all components (abnormal loads) to site.

2.1 Approach to the ESIA

The approach taken in this study is guided by the principles of integrated environmental management. The approach is therefore guided by the principles of transparency which is aimed at encouraging decision making. The underpinning principles of integrated environmental management are:

- Informed decision making;
- Accountability for information on which decisions are made;
- A broad interpretation of the word “environment”;
- Consultation with stakeholders;
- Due consideration of feasible alternatives;
- An attempt to mitigate negative impacts and enhance positive impacts associated with the proposed project;
- An attempt to ensure that social costs of the development proposals are outweighed by the social benefits;
- Regard to individual rights and obligations;
- Compliance with these principles during all stages of planning, implementation and decommissioning of the proposed development; and
- Opportunities for public and specialist input in the decision making process.

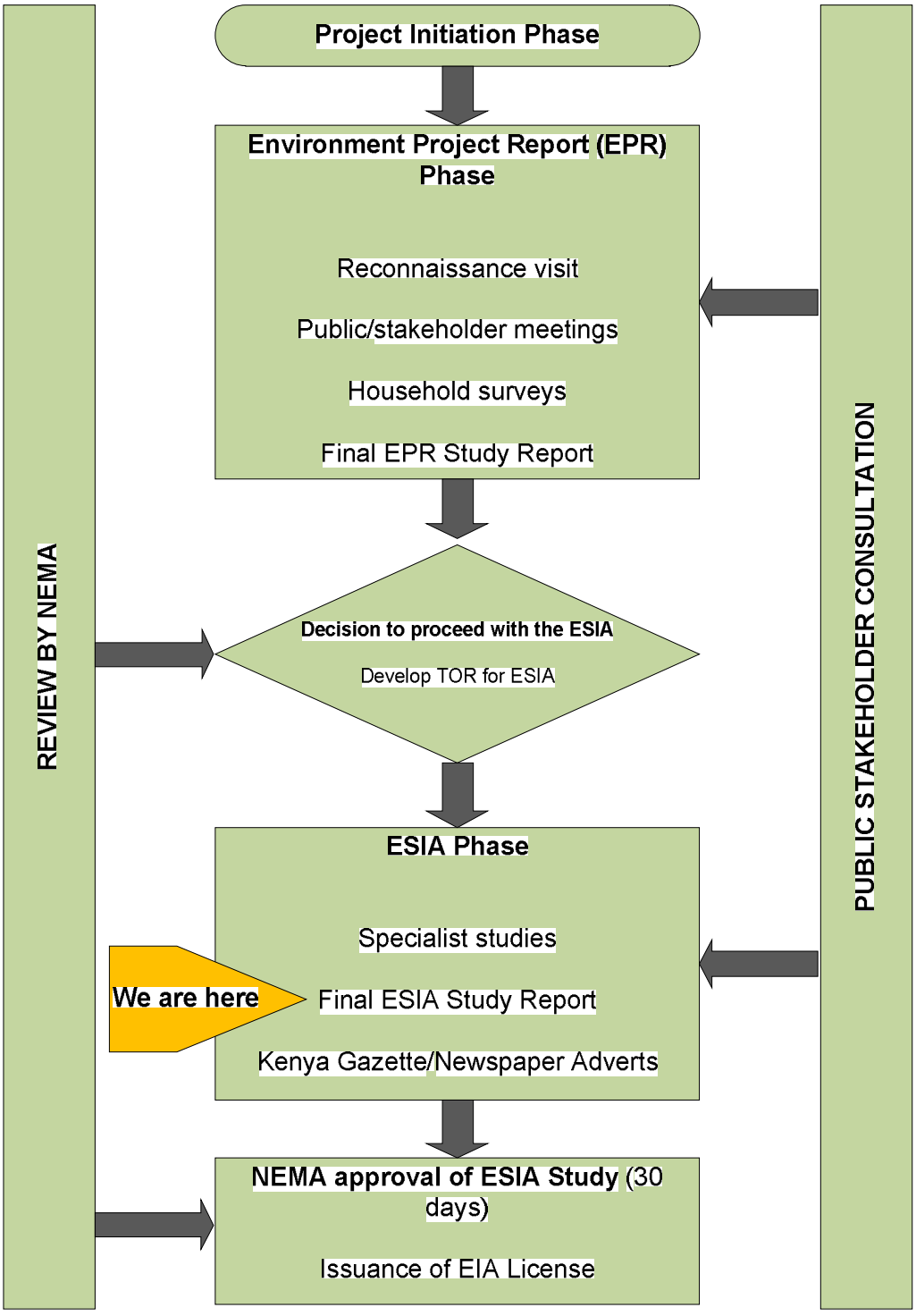
The study has also been guided by the requirements of the EIA Regulations set out in terms of the Environment Management and Coordination Act, 1999 (EMCA).

The ESIA process consists of two phases namely the Environment Project Report (EPR) phase and the detailed Environment and Social Impact Assessment (ESIA) phase as depicted in Figure 2-2. The overall aim of the Environment Project Report (EPR) phase (scoping study) was to determine whether there are environmental issues and impacts that require further investigation in the ESIA.

More specifically, the objectives of the EPR phase for this ESIA were to:

- Develop a common understanding of the proposed project with the authorities and stakeholders;
- Identify stakeholders and engage them on the proposed wind energy project and processes;
- Provide stakeholders with the opportunity to participate in the process and identify issues and concerns associated with the proposed wind energy facility;
- Identify potential environmental impacts that will require further study in the impact assessment phase of the ESIA process; and
- Develop a terms of reference (TOR) for conducting the ESIA Study.

Figure 2-3: The Environment Imapct Assessment Process



The activities that have been conducted thus far as part of the ESIA process include:

- Undertaking a comprehensive household survey to map out physical dwellings within the project area;
- Presentation of the proposed project to various lead agencies associated with the wind power project at the Fairview Hotel on July 13th, 2011;

- Hosting public stakeholder consultation meetings to engage the Masaai community affected by the proposed project on potential environmental and social issues;
- Undertaking baseline data collection of various environmental and social parameters between April and December 2011;
- Preparation of the Environment Project Report for submission to the NEMA for consideration;
- Appointment of environmental and social specialists and completion of specialist study report;
- Compilation of an Environment and Social Impact Assessment (ESIA) Study Report including incorporation of comments raised by stakeholders, specialist studies and an Environment Management Plan (EMP); and
- Submission of the Final ESIA Study Report to the NEMA for onward distribution to other lead agencies associated with the proposed project for consideration.

2.2 Objectives and approach to the ESIA

2.2.1 Objectives of the ESIA

The main objectives of the ESIA are to:

- Inform the broadest range of public about the proposed project and the ESIA process followed;
- Obtain contributions of stakeholders (including the land owners, Proponent, consultants, relevant authorities and the public) and ensure that all issues, concerns and queries raised are addressed in this report;
- Identify and assess significant impacts associated with the proposed development;
- Formulate mitigation measures to minimize impacts and enhance benefits; and
- Compile a Final Environment and Social Impact Assessment (ESIA) Report which will provide all the necessary information for the NEMA to decide whether (and under what conditions) to authorize the proposed development.

2.2.2 Approach to the ESIA phase

The general approach to this ESIA has been guided by applicable legislation and by the principles of integrated environmental management.

The approach has also been governed by the principles of the Environment Management and Coordination Act, 1999 (EMCA) and the EIA Regulations, 2003. Figure 2-1 showed schematically the various elements which comprise the EIA process for the proposed 100MW wind energy facility and the sequence in which they occur.

The range of specialist studies undertaken during the EIA phase were informed by the issues identified in the final Environment Project Report (EPR) Study. The specialist studies and experts used are listed in Table 2-1. Results from these studies have been incorporated into the ESIA Study, particularly into the description of the affected environment and impact assessment.

Table 2-1: List of Specialist Studies undertaken as part of the EIA Study

Specialist Study	Specialist	Appendix in Volume II of this ESIA Study
Archeology and Cultural Heritage Assessment	Ms. Angela Kabiru Ms. Mercy Kinyua	Appendix A
Ecological Impact Assessment	Mr. Dickens Odeny	Appendix B
Geology and Soils	Mr. Eliud Wamwangi	Appendix C
Hydrology	Mr. Eliud Wamwangi	Appendix D
Hydrogeology	Mr. Eliud Wamwangi	Appendix E
Noise Analysis	Mr. Cormac McPhillips	Appendix F
Ornithological Impact Assessment	Ms. Phillista Malaki	Appendix G
Social Impact Assessment	Mr. Joel Omondi	Appendix H
Transport Impact Analysis	Ms. Catherine Keogan	Appendix I
Visual Impact Assessment	Mr. Cormac McPhillips	Appendix J
Shadow Flicker Assessment	Mr. Cormac McPhillips	Appendix K

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3 Description of the project

3.1 Objectives of the project

According to Kenya's Least Cost Power Development Plan (LCPDP) 2011 – 2030, the country has an installed electricity generation capacity of 1,533 MW against an effective capacity of 1,515MW under average hydrological conditions. The unsuppressed peak demand stands at 1,178MW. This leaves no reserve margin to allow for reduced hydro generation as is being experienced currently, and plant breakdowns. In the short term the Government has contracted an emergency power producer to fill the gap by generating 60MW.

The supply of adequate energy for household and industrial needs has in the past faced challenges such as high infrastructure development costs, long lead time required to implement energy projects, over reliance on hydro power, high cost of energy, inability to deliver adequate energy to meet national needs, and low investments in the sector, among others.

The need for additional power generating capacity is highlighted in Kenya's LCPDP. While a combination of electricity saving measures and the global economic downturn may have provided a temporary reprieve, future social and economic development will result in increased electricity demand.

Along with the growth in energy demand, there is a growing concern about the global climate change and diminishing stocks of non-renewable resources. One consequence of this is an increased focus on alternative means of power generation and in this instance wind energy. Wind energy is internationally recognized as a renewable source of power generation as opposed to conventional means such as fossil fueled power plants and is widely used in the western world.

Of all renewable energy sources (solar, geothermal biomass, etc.), wind power is the most mature in terms of commercial development. The development costs have decreased dramatically in recent years. The most recent investment in wind energy in Kenya is KenGen's 5.1MW farm in Ngong comprising six 850kW turbines installed in August 2009. A further 610MW are to be developed by IPP's comprising; 300MW by Lake Turkana Wind Power, 60MW Aeolus Kinangop wind, 100MW Aeolus Ngong' wind, 60MW Osiwo Ngong wind, 60MW Aperture Green Ngong' and 30MW Daewoo Ngong wind.

The best wind sites in Kenya are Marsabit district, Samburu, parts of Laikipia, Meru North, Nyeri and Nyandarua and Ngong Hills. On average the country has an area of close to 90,000 square kilometers with very excellent wind speeds of 6m/s and above.

Kenya is endowed with renewable energy resources that can be alternatives to fossil fuels, but so far they have remained largely untapped. The Wind Energy Resource Atlas of Kenya gives indicative information about the wind potential in various parts of Kenya. The Atlas provides broad information on a national scale. Therefore detailed feasibility studies are required for each site, since wind energy resource potential is site-specific.

Kenya is one of the six pilot countries selected to benefit from the Scaling-up Renewable Energy Program (SREP). This program is financed by multi-lateral development partners and its objective is to demonstrate, through pilot operations in selected countries, the economic, social and environmental viability of low-carbon development pathway to increasing energy access using renewable energy and creating new economic opportunities.

The SREP is Kenya's Investment Plan (IP), which is a country-level and outcome-focused programmatic approach to scaling up renewable energy projects.

The SREP operates under the Strategic Climate Fund (SCF) that supports programs with potential for scaled-up, transformational action aimed at a specific climate change challenge. SCF is part of the Climate Investment Funds (CIF), which promote international cooperation on climate change and support developing countries as they move toward climate resilient development that minimizes greenhouse gas (GHG) emissions and adapt to climate change.

CIF resources are available through Multilateral Development Banks (MDBs), and in case of the SREP program for Kenya, the African Development Bank (AfDB) and the World Bank Group (WBG), including the International Finance Corporation (IFC), will jointly manage the SREP program, with the World Bank (WB) acting as the lead institution.

SREP-funded activities will support scaling up of renewable energy development in Kenya by assuming more risks, addressing key barriers to renewable energy development, catalyzing additional financial resources, focusing on co-benefits that will be felt by the current generation in local communities, and providing opportunities to learn lessons from its operations.

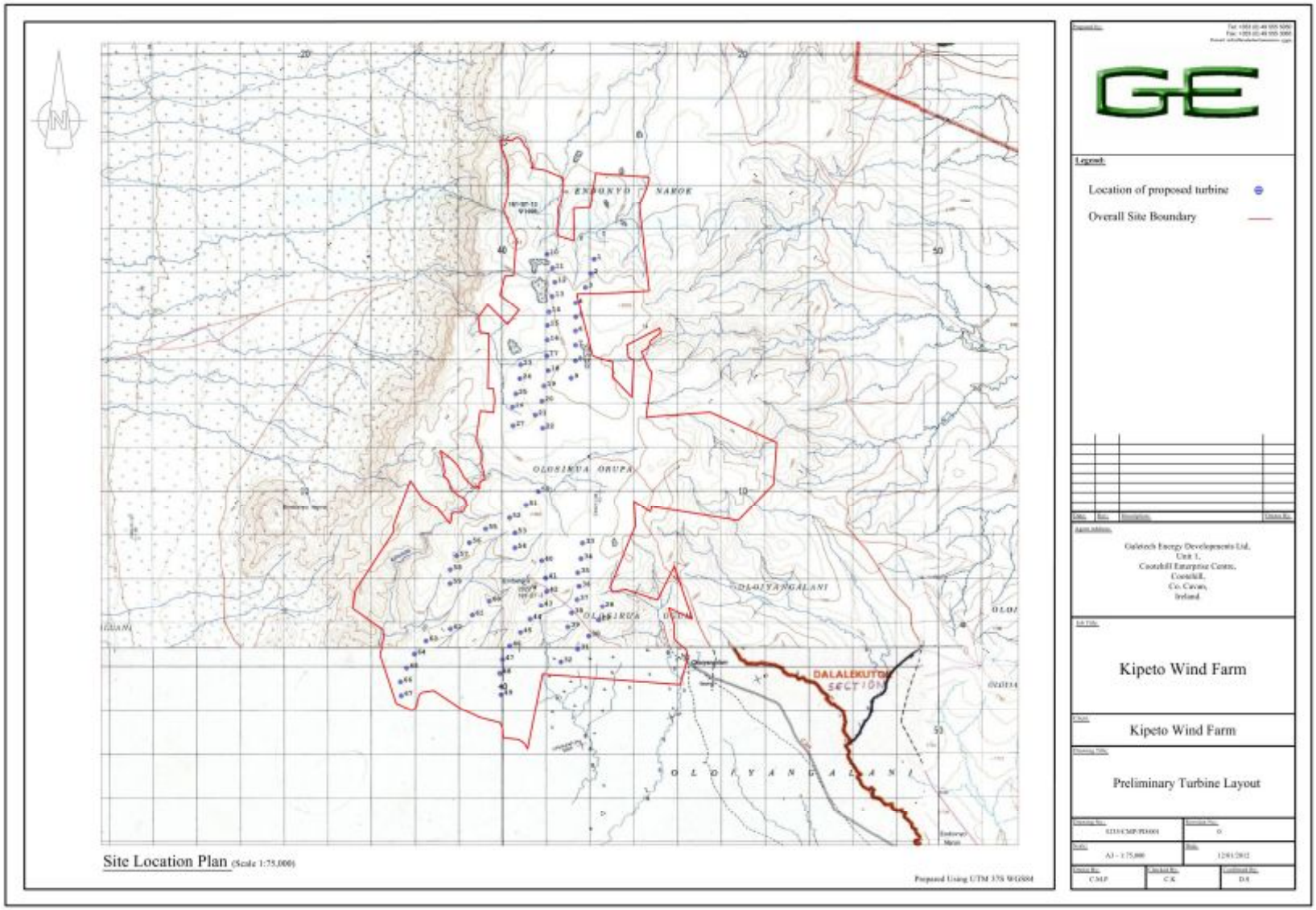
For the proposed project, extensive wind studies are being undertaken in the Kipeto area for purposes of gathering wind data. Three wind measuring masts have been installed at various locations within the 70km2 area and data is electronically transmitted to the USA for the wind studies. Initial results of the wind studies indicate that the Kipeto area has good potential for harvesting wind energy.

The development of the proposed wind energy facility by Kipeto Energy Limited would therefore contribute to energy security both in terms of generating capacity and in terms of diversified supply. Although the proposed project will supply a small proportion of electricity needs in Kenya, it will provide valuable information and experience on what is becoming recognized as a viable and more environmentally sensitive alternative.

3.2 Description of the project

Through a pre-feasibility and site selection process, an area of about 70km2 extent falling within the Esilanke area, Oloyangani (Kipeto) sub-location, south Keekonyokei location in Kiserian, Kajiado division was identified by Kipeto Energy Limited as being potentially suitable for wind energy development as shown in Figure 3-1.

Figure 3-1: Site location plan showing preliminary layout of wind turbines within the proposed project area



This area was put forward for consideration within an EIA process and comprises several parcels of land as indicated in Figure 3-2.

Figure 3-2: Locality map showing parcels of land considered for the wind energy facility

3.2.1 Proposed activities

The proposed wind energy facility is expected to have a generating capacity of up to 100MW. The facility would be operated as a single facility and include wind turbine generators. Each turbine will be 1.6MW in capacity. Ancillary infrastructure will include a sub-station within the wind energy facility site, transmission lines and internal access roads. The transmission lines from the wind energy facility will be subjected by others to a separate Environment Impact Assessment (EIA) process and is therefore excluded from this study.

The overarching objective for the wind energy facility planning process is to maximize electricity production through exposure to the wind resource, while minimizing infrastructure, operational and maintenance costs as well as social and environmental impacts.

The performance of the wind turbines is also determined by disturbances to the wind resource which requires that turbines are appropriately spaced on the site. The wind energy facility is proposed to accommodate up to 67 turbines which will be spread out over an area of approximately 70km^2.

The wind energy facility will be operated as a single facility and include the wind turbines and sub-station. Galetech Energy Developments of Ireland has undertaken a preliminary design layout of the wind energy facility and forms the basis of the EIA Study. The exact location of the wind turbines will be developed by taking cognizance of the wind resource on the site as well as the environmental and social sensitivities and mitigation measures identified through the EIA process. A final layout of the turbine locations within the site will be prepared prior to construction.

The main components of the proposed wind farm are summarized below.

Concrete bases: Each turbine tower will be supported on a reinforced concrete foundation. The area and depth of the concrete foundation are in the region of 225m^2 (footprint) x 4m (depth) depending on the local geological conditions.

Wind turbines: Up to sixty-seven turbines with a power generation potential of approximately 1.6MW each. The proposed turbine design consists of an 85m high tower with a rotor diameter of approximately 100m. A typical turbine tower has an approximate diameter of 3m at the top and 5m at the base. It is generally made of steel and is painted white, with a smooth finish. The turbine has three blades attached to the hub, which typically rotate at 9 – 19 revolutions per minute. The blades are controlled to face into the wind. The turbines would be appropriately spaced based on the site-specific wind resource mapping and on environmental criteria. An example of a typical turbine is depicted in Figure 3-3.

Figure 3-3: Image of GE 1.6MW Wind Turbine

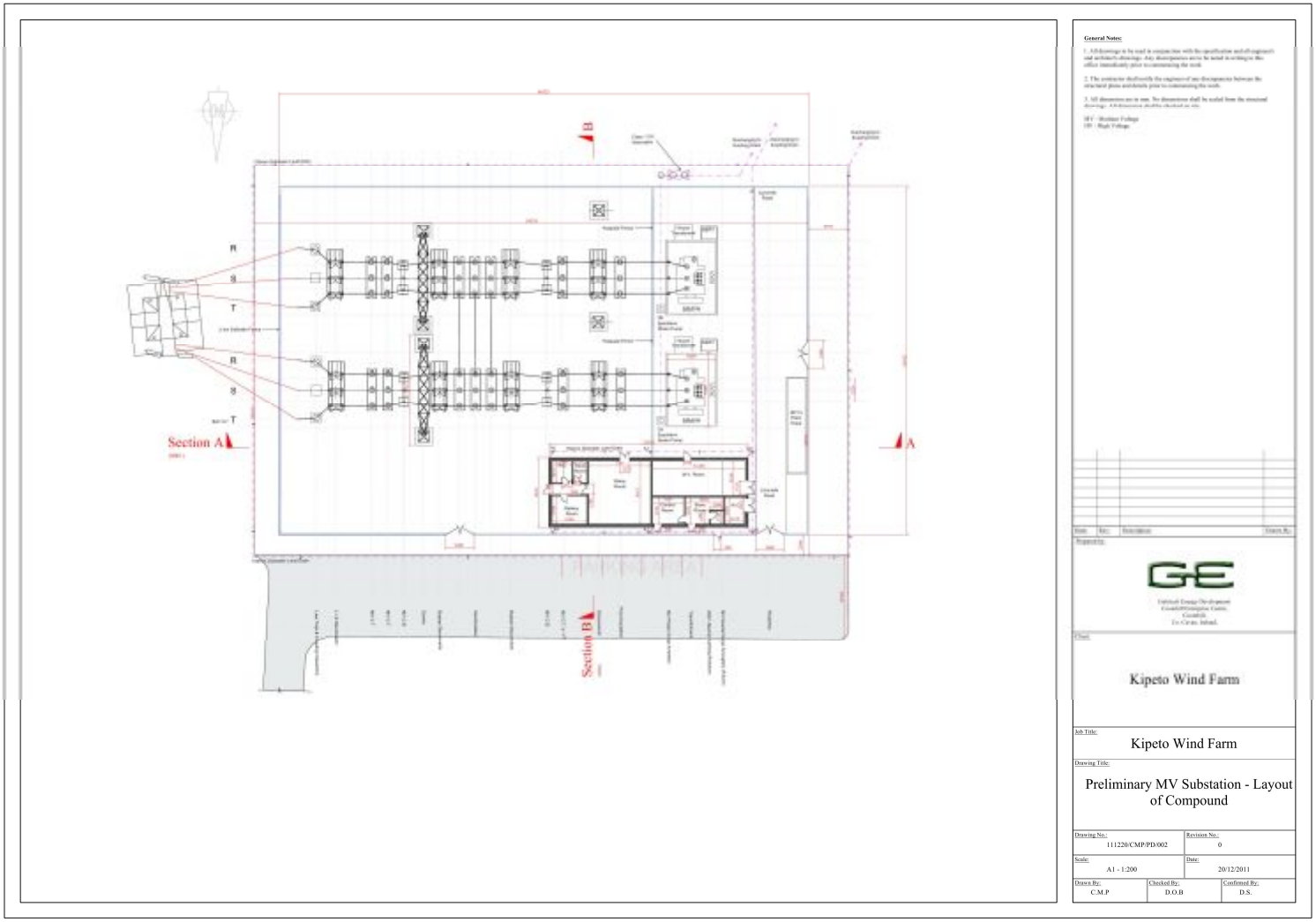
Access Roads: Access from the nearest existing road (Nairobi – Namanga highway) and to each turbine will be required. Although not currently defined, access roads would typically be about 4m wide gravel roads. Existing farm roads will be used as far as possible however, the dispersed distribution pattern of wind turbines will necessitate the construction of a number of new roads.

Control building: this would typically comprise a single storey building to house controls for the wind farm. Depending on Kipeto Energy Limited, it may also incorporate a visitor's center for educational purposes.

Underground transmission lines: Power generated from the wind farm is usually converted from Low Voltage (LV) to Medium Voltage (MV) alternating current and transmitted via underground cables (between the turbines) and overhead lines to a sub-station with transformers to step up to High Voltage (HV). From the sub-station, power is fed into the overhead HV transmission lines.

Sub-station building: A sub-station is required to convert the power supply from MV to HV before feeding it into the distribution grid. An example of a typical sub-station is shown in Figure 3-4.

Figure 3-4: Image of typical wind energy facility on-site sub-station



3.2.2 Site identification and pre-feasibility analysis

The location of the proposed wind energy facility was selected from a number of possible wind resource sites. This was done with the guidance of the Ministry of Energy's Department of Renewable Energy. The existing wind turbines installed in Ngong provided the first indicator of wind resource in the area. The Government of Kenya through Kenya Power had tested for over 10 years two turbines at Ngong hills with good results. Theses turbines were recently replaced with the Ngong 5MW wind Farm.

There was an indication that further south from Kona Baridi into Ilmasin and North of Kipeto the wind resource was fairly good. These areas were unfortunately inhabited and new human settlements were growing at a rapid rate therefore discouraging any development of a wind farm; additionally, the altitude was significantly lower than at the Ngong wind farm site. The other sites compared by the Proponent included Marsabit and Oloitokitok and these two sites had the disadvantage of being remotely located near the Kenya Power grid and load centers which meant that they would require huge investments to evacuate power into the grid.

The proposed project area is situated about 33km south of Kona Baridi and is relatively closer to the Kenya Power grid than Marsabit and Oloitokitok. With an altitude of 2000m above sea level, the wind resource was envisaged to be similar to the Ngong KenGen site.

Kipeto is a plateau with two main ridges on it with almost all parts accessible by car. The site is sparsely populated with landowners having between 100 acres to 1300acres. Kipeto is easily accessible from Kona Baridi and from Kajiado town which is located about 18km south-east of the project site. From the Ministry of Energy records of 2009, the proposed project area had not been allocated to any developer and therefore Craftskills Wind Energy International Ltd was given the first rights of refusal to develop a wind farm in the area.

Meteorological conditions are critical when considering the siting of wind turbines and identifying ideal wind energy facilities. Ultimately the success of the facility is dependent on the available wind resource of a particular site – i.e. wind speed, spatial and temporal variations in the wind climate, turbulence and how the wind resource is affected by terrain.

The Ministry of Energy jointly with the UNEP produced The *Wind Energy Resource Atlas of Kenya* which gives indicative information about the wind potential in various parts of Kenya. Using this information as a baseline, Kipeto Energy Limited installed 3 wind masts in the prospecting area to gain detailed information about the viable wind resource in the area and technical factors. The Kipeto site was identified and investigated on consideration of the following factors:

- Engineering and economic constraints: such as the wind resource in the area, terrain and access to the site, the existing grid and infrastructure in the area and land tenure; and
- Environmental and social constraints: through the EIA process, proximity to residential areas, nature reserves, etc.

Through the data collected by the wind masts, it has been determined that the local wind regime in the project area exhibits potential for a viable wind energy project to generate electricity. In addition, this area supports other technical requirements for a wind energy facility in terms of land availability, accessibility and grid connection to meet transmission integration requirements.

3.2.3 Wind energy as a power generation technology

Wind power is the conversion of wind energy into a useful form, such as electricity using wind turbines. The use of wind for electricity generation is a non-consumptive use of natural resource and produces an insignificant quantity of greenhouse gases in its life cycle. Wind power consumes no fuel for continuing operation and has no emissions directly related to electricity production.

Wind energy is growing electricity generating technology and features in energy plans worldwide. New wind power plants can be permitted and built much more quickly than a conventional generation plant. In addition, wind power plants are attractive because they eliminate fuel price risk, produce no carbon dioxide or air pollutant emissions, do not require water, mining, drilling, or transportation of fuel, and do not generate radioactive or other hazardous or polluting waste. A wind energy facility also qualifies as a Clean Development Mechanism (CDM) project.

Environmental pollution and the emission of carbon dioxide from the combustion of fossil fuels constitute a threat to the environment. The use of fossil fuels is reportedly responsible for approximately 70% of greenhouse gas emissions worldwide. The climate change challenge needs to include a shift in the way that energy is generated and consumed. Worldwide, many solutions and approaches are being developed to reduce emissions. Renewable energy is considered a clean source of energy with the potential to contribute greatly to a more ecologically, socially and environmentally sustainable future. The challenge now is ensuring wind energy projects are able to meet all economic, social and environmental sustainability criteria.

Wind energy has the attractive attribute that the fuel is free. The economics of a wind energy project crucially depend on the wind resource at the site. Detailed and reliable information about the speed, strength, direction and frequency of the wind resource is vital when considering the installation of a wind energy facility as the wind resource is a critical factor to the success of the installation.

Kenya has a proven wind potential of as high as 346W/m^2 in some parts of Nairobi, Rift Valley, Eastern North Eastern and Coast Provinces. The best wind sites in Kenya are Marsabit district, Samburu, parts of Laikipia, Meru north, Nyeri, Nyandarua and Ng'ong hills. Other areas of interest are Lamu, off shore Malindi, Loitokitok at the foot of Kilimanjaro and Narok plateau.

It is estimated that some 2.3 million households are in areas with wind speeds between 4 and 6.98m/s considered good wind potential areas. It is commonly accepted that wind speeds of 7m/s to 8m/s or greater are required for a wind energy facility to be economically viable in Europe.

As a result of the publication of the Feed-In-Tariff in 2008 and revised in 2010, there has been a lot of interest among potential investors to exploit wind as a resource. The Government has given approval to 21 applications with a combined proposed capacity of 1,276 MW and a further 300 MW under negotiated terms. The proposed projects are at various stages of implementation with two having signed Power Purchase Agreements (PPAs) and others undertaking feasibility studies.

The wind speed measurements taken at a particular site are affected by the local topography or surface roughness. This is why local on-site monitored wind speed data is so important for detailed wind energy facility design. The effect of height variation/relief in the terrain is seen as a speeding-up/slowing-down of the wind due to topography. Elevation in the topography exerts a profound influence on the flow of air and results in turbulence within the air stream and this has also to be taken into account in the placement of turbines.

A wind resource management and analysis program is being conducted by 3 Tier of the USA (a company contracted by Kipeto Energy Limited) for the proposed project site as only on-site measured data will provide reliable prediction of the facility's expected wind resource over its lifetime. The design of a wind energy facility is sensitive to the predominant wind directions and wind speeds for the site. Although modern wind turbines are able to yaw to the direction of the wind, the micro-siting of each wind turbine must consider the wind direction and strength of the wind in the optimal positioning of the turbines.

The placement of a wind energy facility and the actual individual turbines should take into account the following technical factors:

- The wind resource;
- Topographical features or relief affecting the flow of the wind
- Effect of adjacent turbines on wind flow and speed – specific spacing is required between turbines in order to reduce the effects of wake turbulence.

Wind turbines typically are spaced approximately 2 to 3 diameters of the rotor blade apart and 5 to 7 diameters where a turbine is behind another. This is required to minimize the induced wake effect the turbines may have on each other. Considering a typical 1.6MW capacity turbine whose rotor is approximately 100m in diameter, each turbine would be separated by approximately 200m to 300m. The erection of turbines in parallel rows one behind the other would require a distance between rows of 500m to 700m to avoid wake effects from one turbine onto another.

3.2.4 Main components of a wind turbine

The basic components of a wind turbine are as follows:

- The rotor;
- The nacelle;
- The gearbox;
- The generator;

- The tower
- The base.

The rotor consists of three blades, mounted on a hub – typical rotor diameters are 100m for today's larger machines. Designed like airplane wings, modern wind turbine blades use lift to capture the wind's energy. Because of the blade's special shape, the wind creates a pocket of pressure as it passes behind the blade. This pressure pulls the blade, causing the turbine to rotate. This modern blade design captures the wind's energy much more efficiently than old farm windmills, which use drag, the force of the wind pushing against the blades. The blades spin at a slow rate of about 20 revolutions per minute (RPM), although the speed at the blade tip can be over 150 miles per hour. Blades are usually made from Glass Reinforced Plastic (GRP) and incorporate lightning protection measures. A typical image of a rotor being transported to site is shown in Figure 3-5.

Figure 3-5: Image of single blade being lowered at a wind farm site

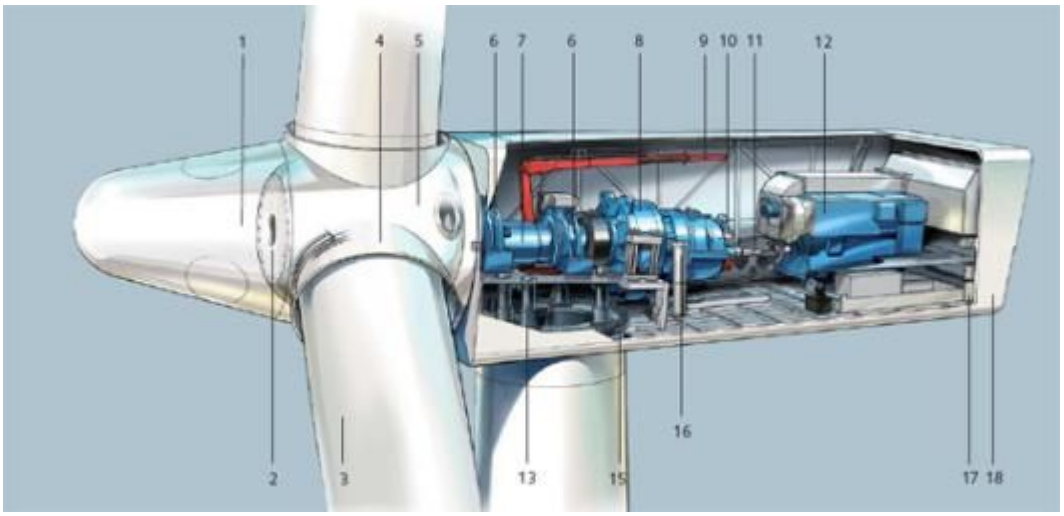
The nacelle houses a generator and gearbox. The spinning blades are attached to the generator through a series of gears. The gears increase the rotational speed of the blades to the generator speed of over 1,500 RPM. As the generator spins, electricity is produced. Generators can be either variable or fixed speed. Variable speed generators produce electricity at a varying frequency, which must be corrected to 50 cycles per second before it is fed onto the grid. Fixed speed generators do not need to be corrected, but are not as able to take advantage of fluctuations in wind speed. A typical image of a nacelle being transported to site is shown in Figure 3-6.

Figure 3-6: Image of a Nacelle on a wind farm site

The gearbox converts the rotational speed of the rotor (typically 10-20rpm) to 1500rpm for the generator. A typical gearbox cut-out is shown in Figure 3-7.

The generator converts rotational movement of the wind turbine blades to electrical energy. Inside this component, coils of wire are rotated in a magnetic field to produce electrical energy.

Figure 3-7: Image of a generator showing its internal components



The numbered parts of the generator in the above image are as follows:

1. Spinner
2. Spinner bracket
3. Blade

4. Pitch bearing
5. Rotor hub
6. Main bearing
7. Main shaft
8. Gearbox
9. Service crane
10. Brake disc
11. Coupling
12. Generator
13. Yaw Gear
14. Tower
15. Yaw Ring
16. Oil Filter
17. Generator Fan
18. Canopy

The Tower is usually a steel tubular structure supporting the nacelle and rotor. Typical tower heights are 60m – 100m. Cables run down the tower taking the electricity from the generator at the top, into the ground and then onto a connection point to the grid. Lifts or ladders fixed internally within the tower allow maintenance crew to access the nacelle. A typical tower section being erected on a wind farm site is shown in Figure 3-8.

Figure 3-8: Image of a wind turbine tower being erected

The base is made out of reinforced concrete typically 15m x 15m x 1m which acts as the foundation for the structure. A typical image of a reinforced concrete foundation or base for a wind turbine is shown in Figure 3-9.

Figure 3-9: Image of a reinforced concrete wind turbine base under construction

3.2.5 Operations of a wind turbine

When the wind blows the turbine hub turns into the wind. When the wind passes over the blade, the shape of the blade means that the air flows more quickly over one side of the blade than the other. This results in the turning of the rotor.

Wind turbines operate when the wind speed is within certain limits. There has to be enough wind for the blades to turn – typically 3-4m/s (or 7-9mph, 6-8 knots). When the wind speeds get to 25m/s (56mph, 49 knots), turbines typically shut down to protect the structure from excessive loads. Wind turbines are certified to specified levels and designed to the highest of these.

Instruments at the top of the nacelle (wind vane and anemometer) measure the wind speed and direction.

Control of the turbine

As wind speeds increase, so the energy generated by the turbine does as well. At some point where wind speeds are around 15m/s (34mph, 29 knots), the maximum (or rated) capacity of the turbine is reached. A limit has to be set to define the sizes of the various components – gearbox, generator, cables and rotor blades).

To control production of wind energy above the rated wind speed, the turbine can use various methods:

- Variable pitch – the blades of the wind turbine are feathered to limit the energy produced as wind speeds increase; and

- Variable speed – on some wind turbines, the rotor is allowed to speed up and slow down as the wind speed varies

In both cases, changes to the pitch or speed can happen several times a second so the wind turbine is always running in an optimized state for the wind conditions it sees, providing the most efficient extraction of energy from the wind and therefore maximizing renewable energy production.

All of the information about the wind turbines are recorded by computers and transmitted to an off-site control center. Wind turbines are for the majority of the time self-sufficient although periodic mechanical checks are usually carried out every few months.

Capacity factor

The productivity of a wind turbine, or any kind of power plant, is referred to as the capacity factor. The capacity factor is the amount of power produced in a given time period compared to what the generator could produce if it ran at full capacity for that time period. If a generator ran full out all the time, it would have a capacity factor of 100 percent, but no power plant runs all the time. In a good location, a wind turbine may produce on average a third of the maximum power of the generator, or have a 33 percent capacity factor. Typical capacity factors are 20 to 25 percent.

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4 ESIA Methodology

An Environment and Social Impact Assessment (ESIA) process refers to that process which involves the identification and assessment of direct, indirect and, cumulative environmental and social impacts associated with a proposed project. The ESIA process consists of two phases namely the Scoping phase and the detailed ESIA phase. The ESIA phase culminates in the submission of an ESIA Study to the NEMA for consideration.

4.1 Environment Project Report (EPR) Study

An Environment Project Report (EPR) Study is the name given to a scoping study in Kenya under the EIA/EA Regulations, 2003. An EPR Study which commenced in April 2011 provided the Maasai community in the project area with the opportunity to receive information regarding the proposed wind energy facility project, participate in the process and raise issues of concern.

The EPR Study Report identified the following:

- Nature and extent of the proposed wind energy facility;
- Identification of potential issues associated with the proposed project; and
- Defining the extent of specialist studies required during the detailed ESIA phase.

This was achieved through an understanding of the proposed wind energy facility, involving the proponent, project manager, specialists and a consultation process involving Government lead agencies and the Maasai community.

The final EPR Study was submitted to the NEMA in November 2011. The NEMA accepted the EPR Study and asked the proponent to initiate the detailed ESIA phase.

4.2 Environment and Social Impact Assessment (ESIA) Study

Through the EPR Study, no environmental fatal flaws were identified to be associated with the proposed wind energy facility and only one absolute “no go” area was identified in the southern part of the broader project area where there was a small concentration of Sandalwood Trees. A number of issues and potentially sensitive areas requiring further study for the proposed wind energy facility were highlighted. These issues have been addressed in detail within the ESIA phase of the process.

The objectives of the ESIA phase included:

- Provision of an overall assessment of the social and biophysical environment affected by the proposed project;
- Assessment of potentially significant impacts associated with the proposed wind energy facility;

- Identification and recommendation of appropriate mitigation measures for potentially significant environmental and social impacts; and
- Undertaking a fully inclusive public/stakeholder consultation process to ensure that that the affected community is engaged throughout the ESIA process and their issues and concerns addressed.

The ESIA addresses potential environmental and social impacts associated with the design, construction and operation of the project and aims to provide the lead agencies with sufficient information to make an informed decision regarding the proposed project.

4.3 Overview of the ESIA phase

The ESIA phase has been undertaken in accordance with the EIA/EA Regulations, 2003 published as Legal Notice 101 in terms of the EMCA. Key tasks undertaken within the ESIA phase included:

- Consultation with relevant lead agencies;
- Undertaking a public/stakeholder consultation process including a detailed household survey of landowners in the proposed project area;
- Undertaking independent specialist studies
- Preparation of this ESIA Study report in accordance with the requirements of L.N. 101: Environment (Impact Assessment and Audit) Regulations, 2003.

4.3.1 Lead agencies consultation

Consultation with lead agencies having jurisdiction with respect to the proposed wind energy facility has continued throughout the ESIA process. Consultations included:

- A meeting held on July 13th, 2011 at the Fairview Hotel in Nairobi with various lead agencies having direct or indirect jurisdiction over the proposed wind energy facility;
- Meetings with the Ol Kejuado County Council on planning permissions for the proposed project; and
- Submission of a final EPR Study to the NEMA for consideration

Lead agencies such as the ERC are known to visit proposed energy facility project sites and subsequently it is expected that consultation with such lead agencies will continue during the ESIA Study review period.

4.3.2 Public/stakeholder consultation

The public/stakeholder consultation process began in 2009 when Kipeto Energy Limited identified the project area for development of the proposed wind energy facility. The objectives of the public/stakeholder consultation process were to ensure that:

- Information containing all relevant facts with respect to the proposed wind energy facility was made available to the affected Maasai communities;
- Participation by the local Maasai community in the project area was facilitated in a manner that the affected persons were able to comment on the proposed project; and
- Comments received from the stakeholders were recorded, considered and incorporated into the ESIA process.

Throughout 2009 and 2010, the consultation process involved conducting local *barazas* with local land owners under the stewardship of the provincial administration, visits by various GE executives to the project site, and one-on-one meetings with relevant lead agencies.

The public/stakeholder consultation process continued during the ESIA phase. This included conducting a detailed household survey (mini-census) of land owners with households within the project area, holding local *barazas* in various locations around the project area, conducting key informant interviews and focus group discussions.

This ESIA Study will be submitted to the NEMA for review and consideration. Concurrently the proponent will be given approval by the NEMA to place an advertisement in the Kenya Gazette and a newspaper of national circulation for the public to comment on the ESIA Study. The advertisement will appear in these publications on one day in two consecutive weeks.

4.3.3 Specialist studies

On the basis of the EPR Study a number of specialist studies were undertaken during the detailed ESIA phase as follows:

- Archeology and Cultural Heritage Assessment;
- Terrestrial Ecological Impact Assessment;
- Geology and Soils;
- Hydrology and Hydrogeology Assessment;
- Noise Analysis;
- Ornithological Impact Assessment;
- Social Impact Assessment;
- Transport Impact Analysis;
- Visual Impact Assessment; and
- Shadow flicker assessment.

The above specialist reports are appended to this ESIA Study as Appendix A – I respectively.

4.3.4 Final ESIA Report

This report has been formatted to align itself with the contents of an EIA Study as required by L.N. 101: Environment (Impact Assessment and Audit) Regulations, 2003. The report will be submitted in the requisite number of soft and hard copies to the NEMA for onward transmission to ten other lead agencies for review. It is expected that on the basis of the advertisement date, the NEMA will allow all lead agencies and the public thirty days for the review of the ESIA Study before determining the project.

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5 Analysis of Alternatives

Legal Notice 101: Environment Impact Assessment and Audit Regulations, 2003 states that an outline of the main alternatives studied by the Proponent and an indication of the main reasons for the Proponent's choice is required in an Environment Impact Assessment. Furthermore where alternatives are available which may still allow the objectives of the project to be met, the existing environment should also be detailed.

Subsequently alternatives for the proposed project have been evaluated from the following perspectives:

- Site alternatives – what is the best site for a proposed development and any infrastructure associated with it?
- Technology alternatives – are there other means to achieve the same objective?
- Layout alternatives – are there potential time constraints and ongoing activities?
- No-go option – what are the implications of not proceeding with the project?

5.1 Site alternatives

The Kipeto site was selected from a number of possible wind resource sites. This was done with the guidance of the Ministry of Energy's Department of Renewable Energy. The Government initially through Kenya Power and later KenGen installed some wind turbines in Ngong about ten years ago and this provided the first indicator of the wind resource in this area. Theses turbines were subsequently replaced with 5MW wind Farm.

There were indications that further south from Kona Baridi into Ilmasin and North of Kipeto the wind resource was fairly good. These areas were unfortunately inhabited and new human settlements were growing rapidly thus discouraging development of a wind farm. Additionally, these areas were at a far much lower altitude than Ngong.

Other alternative site locations that were compared by the Proponent included Marsabit and Oloitokitok which were both found to be quite a distance from the grid and load centers which meant that they would require huge investments to evacuate power into the grid.

The proposed project area is about 33km south of Kona Baridi hence comparatively closer to the Grid. With an altitude of 2000m above sea level the wind resource was expected to be closer to the Ngong KenGen wind farm site.

Kipeto is a plateau with two main ridges on it with almost all parts accessible by car. The site is sparsely populated with landowners having between 100 acres to 1300 acres. Kipeto is easily accessible from Kona Baridi and from Kajiado town just 20km. From the Ministry of Energy's record of 2009, this site had not been allocated to any developer and therefore Craftskills Wind Energy International Ltd was given the first rights of refusal to develop a wind farm in the area.

The main determinants in selecting a location for a wind energy facility include:

- Wind speed;
- Potentially limited environmental impacts;
- Proximity to a grid connection point; and
- Availability of land.

Preliminary investigations identified that the proposed project area met the above listed criteria and so different locations for the current project will not be considered. The connectivity to the grid is a critical factor to the overall feasibility of the project and the study areas proximity to existing Kenya Power grid infrastructure satisfies these requirements.

5.2 Technology alternatives

No alternative technologies are to be considered as part of this EIA Study. It should be noted that the use of wind energy for power generation is in itself and alternative technology to the traditionally used means of power generation in Kenya (hydro, fuel oil) and is inherently a cleaner technology.

Although a wide variety of wind turbine designs exist, the power generation capacity is strongly influenced by height above ground level and rotor diameter. On the basis of first principles, the higher the hub height and the greater the diameter of the rotors, the greater the generating capacity of the turbine. The proposed 80m high tower and 100m diameter rotor is therefore regarded as providing the greatest generation capacity per turbine.

The layout of the wind energy facility provided at this stage is considered preliminary and approximately 80% accurate. The turbine being considered for use at this facility is the GE1.6-100 which has an output of 1.6MW. The turbine will have a hub height of 80m and a rotor diameter of 100m (i.e. each blade will be 50m in length).

5.3 Layout alternatives

The project proponent has developed a preliminary layout that maximizes the amount of turbines (up to 67 turbines) possible for the project study area in question. The findings of the EIA specialist studies conducted for this report, and subsequent geotechnical investigations in the detailed design phase of the project, will ultimately inform the final layout and micro-siting of the turbines.

Additionally, an assessment of the noise quality, terrestrial ecology, avifauna assessment and visual impacts will be incorporated in the detailed design of the wind turbine layout.

Further it is recognized that the precise positioning of the turbines will also be decided on the basis of site specific wind monitoring data.

The final layout of the wind energy facility will also be informed by feasible sites for the sub-station and workshop, internal and access road alignments and feasible route alignments for the transmission lines.

The alternatives for the associated infrastructure (transmission sub-station, overhead power line and access roads) are outlined below.

5.3.1 Transmission sub-station

Currently there are no transmission lines close to the project area; Kenya Power is in the process of upgrading its Isinya, Nkoroi and Matassia sub-stations respectively and subsequently the proposed wind energy facility can evacuate power to any one of these sub-stations.

The Proponent is considering evacuating electrical power to the Matassia sub-station as it appears to be a more feasible option than the other two sub-stations. The routing of a proposed transmission line to the Isinya sub-station passes through uneven terrain which would make it more difficult to construct transmission lines while the Nkoroi sub-station does not currently support the infrastructure required to evacuate power from the proposed wind energy facility.

Additionally the Proponent is considering both underground as well as above ground transmission lines from the wind energy facility to the Matassia sub-station. The proponent is currently discussing these two alternatives with Kenya Power with the view to decide the physical construction of the transmission lines.

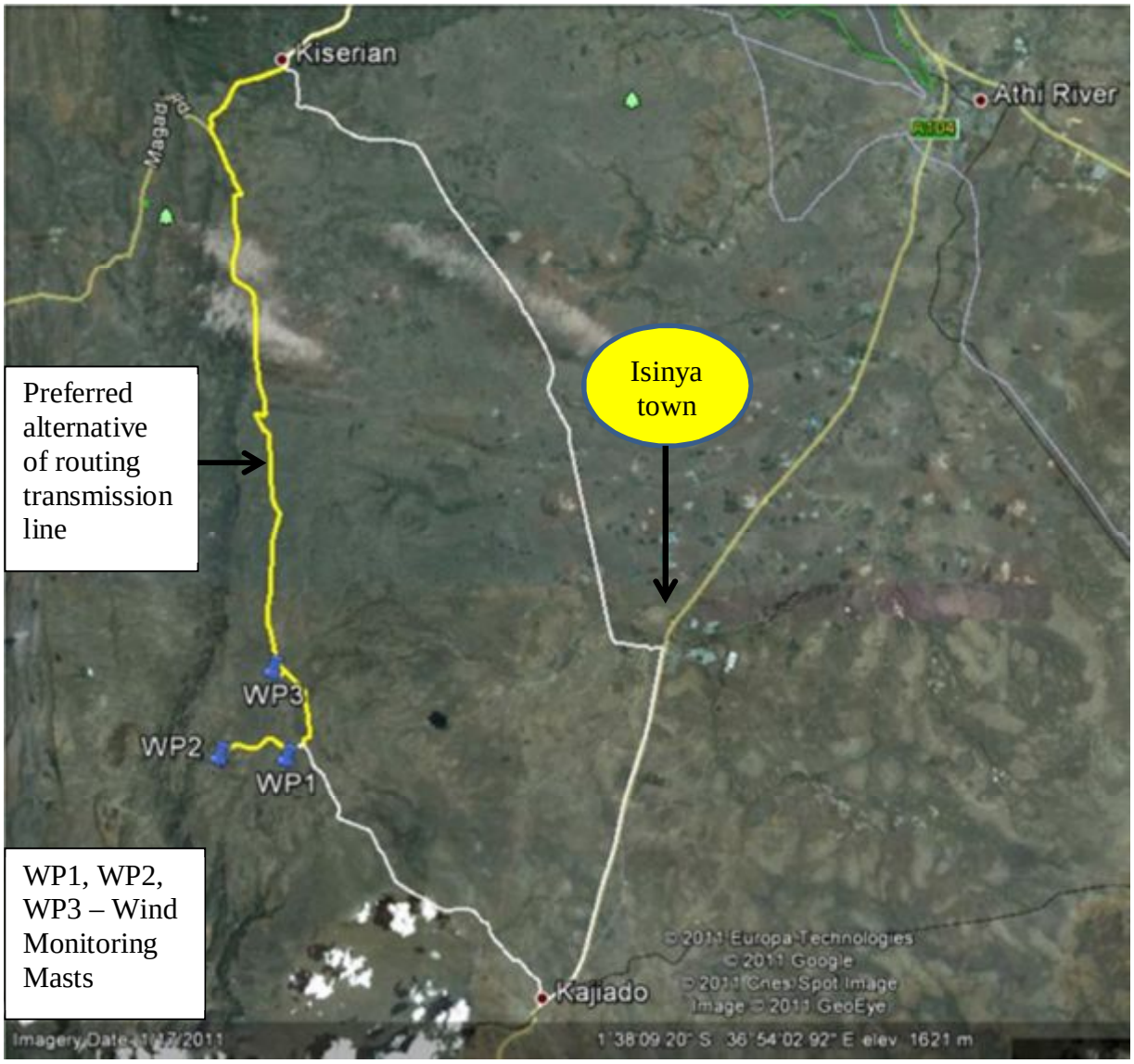
5.3.2 Overhead power line alternatives

Two double circuit 66KV transmission power lines are proposed to connect the wind energy facility to the electricity distribution network at Matassia sub-station. It is unclear at this point whether the above transmission lines will be underground or above ground however the proponent is in discussions with Kenya Power to decide one of the two alternatives.

5.3.3 Access road alternatives

The existing access roads to the project area are shown in Figure 5-1 below.

Figure 5-1: Image showing alternative routes to the project site



There are a limited number of access road alternatives leading into and out of the proposed wind energy facility. The white outlined access road between Kajiado town and WP1 in Figure 5-1 will be used to transport the wind turbine components and associated infrastructure to the project site. The yellow outlined road from WP3 to Kiserian will be used by the empty trucks to leave the project area.

New access roads will be opened up leading to each wind turbine and maintained by the proponent.

5.4 "No-go" alternative

The "No-go" alternative is the option of not constructing the proposed wind energy facility. The alternative would result in no environmental impacts on the site and the surrounding area.

Failure to construct the proposed wind energy facility would likely result in additional consumption of fossil fuels in power plants to achieve the same level of electrical power generation at other locations in the country. In order for Kenya to achieve the objectives of Vision 2030, it is crucial that additional electricity options be developed throughout the country. The Scaling-up Renewable Energy Program (SREP) which is Kenya's investment plan in renewable energy is guided by the need to address climate change as well as the rationale that Kenya has an attractive range of renewable energy resources particularly solar, wind and geothermal. These types of renewable energy are the least cost energy service in many cases and more so when social environment costs are taken into account.

According to the 1st Revision of the SREP undertaken in January 2010, the benefits of investing in renewable energy power generation sources include:

a) Environmental integrity including the reduction of greenhouse gas emissions;

b) Enhancing energy supply security, reducing the country's dependence on imported fuels; and coping with the global scarcity of fossil fuels and its attendant price volatility; and

c) Enhancing economic competitiveness and job creation among others.

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6 Legal and regulatory context of project

6.1 Introduction

Currently environmental legislation in Kenya is provided in over 77 statutes. In order to provide a structured approach to environmental management in Kenya, the EMCA was enacted on January 14th 2000 as a framework law and contains provisions for the ESM of proposed and ongoing Projects respectively in Kenya. With the coming into force of the EMCA, the environmental provisions within the sectoral laws were not superseded; instead the environmental provisions within those laws were reinforced to better manage Kenya's ailing environment. Under the EMCA a number of institutions were created and the following section provides a brief outline on the institutional framework of the EMCA. Given later in this chapter is a brief outline of some of the main sectoral laws associated with the proposed type of project.

6.2 Institutional framework of the EMCA

In order to operationalize the Act, the EMCA established various administrative structures. These included the NEC, the NEMA, the PCC, the NEMA Board, Provincial and District Environment Committees, the SERC and the National Environment Tribunal amongst others.

The apex body under the Act is the NEC which amongst other things is charged with the responsibility of developing the national environmental policy in Kenya as well as to set annual environmental goals and objectives.

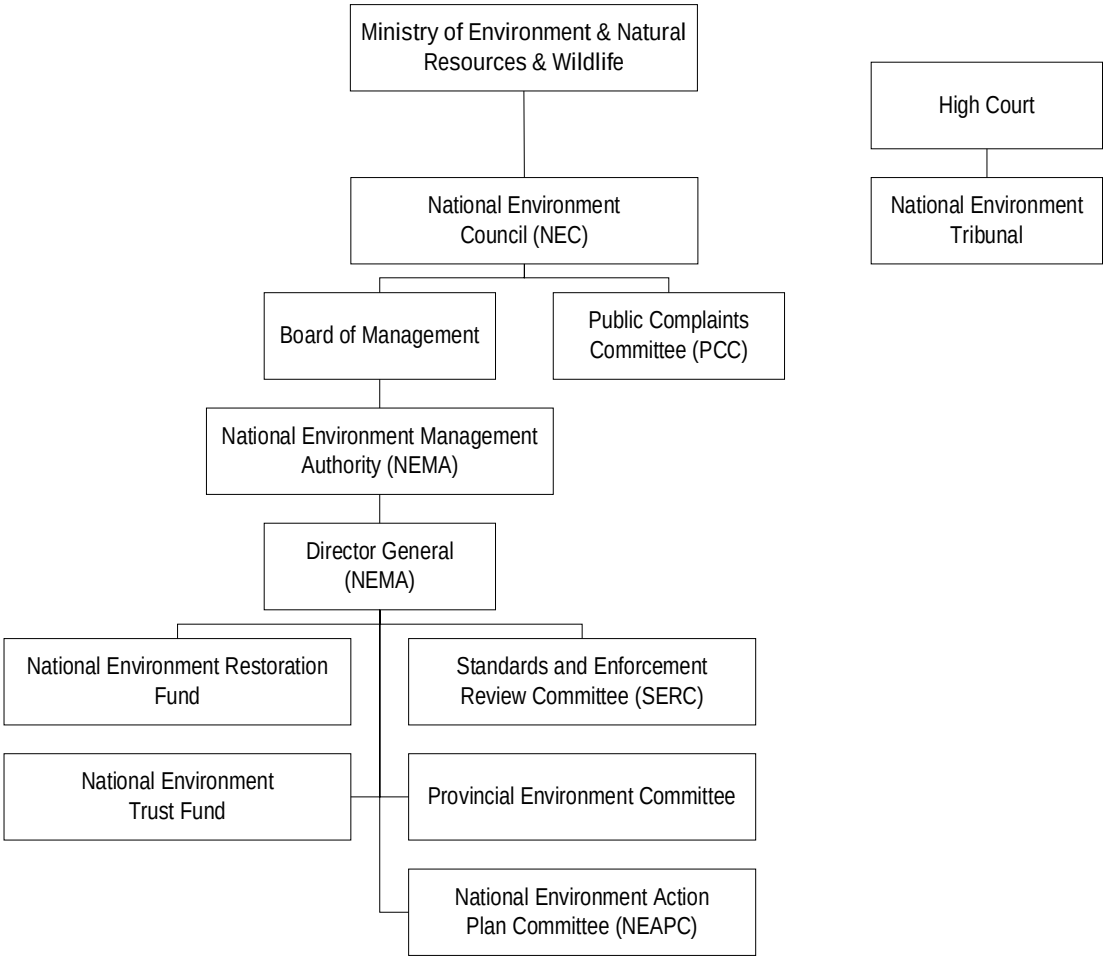
The NEMA is the organ that has been established to exercise general supervision and coordination over all matters relating to the environment in Kenya. Further the NEMA is the Government's principal instrument in the implementation of all policies relating to the environment.

The PCC was formed to investigate environmental complaints against any person, submit their findings/recommendations to the NEC and to submit periodic reports of its activities to the NEC.

The SERC has been established under the Act to advise the NEMA on the criteria and procedures for the measurement of environmental quality in Kenya. Environmental quality relates to air quality, wastewater quality, waste quality, noise quality, land use quality, etc. Additionally the SERC is required to recommend to the NEMA minimum environmental quality standards for all environmental parameters for which subsidiary legislation is or has been promulgated.

The institutional framework of the EMCA is shown in Figure 6-1 indicating the management structure of various organs under the Act.

Figure 6-1: Institutional Framework under the EMCA



6.3 Subsidiary legislation under the EMCA

6.3.1 L.N. 101: EIA/EA Regulations 2003

On June 13th 2003, the Minister for Environment and Mineral Resources promulgated Legal Notice 101: Environment (Impact Assessment and Audit) Regulations, 2003 as provided for under section 147 of the EMCA. These regulations provide the framework for undertaking EIAs and EAs in Kenya by NEMA licensed Lead Experts and Firm of Experts. An EIA or EA Study in Kenya is to be undertaken by a Kenyan duly licensed by the NEMA. The EIA/EA Regulations also provide information to project proponents on the requirements of either an EIA or EA as required by the EMCA. This ESIA Study has been undertaken in accordance with the requirements of the above legislation.

6.3.2 L.N. 120: Water Quality Regulations, 2006

The above regulation was promulgated on September 4th 2006 and became effective on July 1st 2007. This regulation provides for the sustainable management of water used for various purposes in Kenya. For industries in Kenya, the regulation requires that Proponents apply for an "Effluent Discharge License" annually for discharging process wastewater either into the environment, aquatic environment or public sewers. For discharges into the environment and aquatic environment, a Proponent needs to apply directly to the NEMA. For discharges into public sewers, a Proponent needs to apply for the license to the relevant local authority. The regulation contains discharge limits for various environmental parameters into public sewers and the environment.

While the above regulations do not apply to the proposed project during the construction phase, they may be applicable during the operational phase if there is likelihood that potentially contaminated wastewater may be discharged to the environment.

6.3.3 L.N. 121: Waste Management Regulations, 2006

The Waste Management Regulations were promulgated on September 4th 2006 and became effective on July 1st 2007. This regulation is comprehensive and covers the management of various kinds of waste in Kenya. Generally it is a requirement under the regulations that a waste generator segregates their waste (hazardous and non-hazardous) by type and then disposes the wastes in an environmentally acceptable manner.

Under the regulation, it is a requirement that waste is transported using a vehicle that has an approved "Waste Transportation License" issued by the NEMA. Wastes generated in Kenya must be disposed off in a licensed disposal facility. Such a facility will require annual environment audits to be undertaken by NEMA registered Lead Experts.

It is further a requirement under the regulation for a Proponent to install at their premises anti-pollution equipment for treatment of various types of wastes. The treatment options shall be approved by the NEMA in consultation with the relevant lead agency.

The regulation contains definitions of hazardous wastes in the Fourth Schedule. The regulation requires that prior to generating any hazardous waste, a Proponent shall undertake an EIA Study and seek approval from the NEMA. Labeling of hazardous wastes is now mandatory under the regulation and the specific labeling requirements are provided in Rule 18. The treatment options for hazardous waste disposal provided in Rule 19 include incineration or any other option approved by the NEMA.

During the construction phase, the proposed project may generate various types of wastes. For the most part, it is expected that the wastes will be non-hazardous in nature and can be disposed off in accordance with the above regulations. If however any hydrocarbons that may be used at the site in the form of petroleum fuels come into contact with soils, then the contaminated soils will be disposed off in an ESM in accordance with the regulations.

6.3.4 L.N. 61: Noise and Excessive Vibration Control Regulations, 2009

In May 2009, the Minister for Environment and Mineral Resources promulgated the above regulations for management of noise and excessive vibration. The general prohibition states that no person shall make or cause to be made any loud, unreasonable, unnecessary or unusual noise which annoys, disturbs, injures or endangers the comfort, repose, health or safety of others and the environment.

The regulations further provide factors that will be considered in determining whether or not noise and vibration is loud, unreasonable, unnecessary or unusual. For fixed installations, excessive vibration under these regulations is defined as any vibration emanating from the source and exceeds 0.5cm/s at 30m from the source.

Rules 13 and 14 of the regulations define the permissible noise levels for construction sites and are reproduced below.

Facility		***Maximum noise level permitted (L_{eq}) in dB(A)***	
		Day	***Night***
i).	Health facilities, educational institutions, homes for the disabled, etc.	60	35
ii).	Residential	60	35
iii).	Areas other than those in (i) and (ii) above	75	65

Time frame:

Day: 6.01 am – 8:00 pm (L_{eq}, 14 hours)
Night: 8:01 pm – 6:00 am (L_{eq}, 10 hours)

Rules 5 and 6 of the regulations define noise levels for various types of activities that generate noise. The First Schedule to the regulations defines permissible noise levels to be complied with during the operational phase of a project and is reproduced below.

Zone		*Sound Level Limits (dBA) (Leq, 14h)*		*Noise Rating Level (NR) (Leq, 14h)*	
		Day	*Night*	*Day*	*Night*
A.	Silent Zone	40	35	30	25
B.	Places of Worship	40	35	30	25
C.	Residential:				
	Indoor	45	35	35	25
	Outdoor	50	35	40	25
D.	Mixed residential (with some commercial and places of entertainment)	55	35	50	25
E.	Commercial	60	35	55	25

Time frame:

Day: 6.01 am – 8:00 pm (L_{eq}, 14 hours)
Night: 8:01 pm – 6:00 am (L_{eq}, 10 hours)

The regulation further stipulates that a permit will be required during the construction and operational phase of a project if there will be equipment that will produce noise during these two phases.

The main contractor shall apply for a noise permit from the NEMA during the construction phase of the project. The fourth schedule of the regulations contains details of the application for a noise license while the fifth schedule provides a description of the noise permit that the NEMA will grant the main contractor.

6.3.5 Licenses and Permits required under the EMCA

The subsidiary legislation under the EMCA requires a Proponent to apply for various kinds of permits during the operational phases of the project. Those regulations that require permits include:

- Legal Notice 120: The Environment Management and Coordination (Water Quality) Regulations 2006 which requires an Effluent Discharge Permit;
- Legal Notice 121: The Environment Management and Coordination (Waste Management) Regulations 2006 which requires that all wastes are disposed off using NEMA licensed waste transporters; and
- Legal Notice 61: The Environment Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009 which requires noise permits.

Of the above regulations, the Proponent will ensure that they comply with the requirements of L.N. 121 of 2006 and L.N. 61 of 2009 in terms of permitting requirements for the proposed project.

6.4 The Energy Act, 2006

The Energy Act, 2006 is presently the primary legislation in Kenya that contains provisions for the management of the energy sector. The subsidiary legislation to operationalize the Act is yet to be developed but is expected to stipulate HSE licensing requirements for all types of energy related activities such as the proposed project.

The Act which was promulgated in 2006 with an effective date of July 1st 2007 contains several HSE provisions for the environmentally sound management of the energy sector. These are highlighted below and the Proponent will be required to comply with these provisions.

Section 27 of the Act requires a Proponent to apply for an "Electric Power License" from the ERC. Section 28(2) of the Act requires a Proponent to advertise in at least two national and one regional newspaper their desire to generate electrical power. The newspaper advertisement should be made at least fifteen days prior to the official application by the Proponent for an Electric Power License to the ERC. Section 28(2) requires the Proponent to serve a notice to the relevant local authority with the particulars of the application.

Section 30 of the Act provides the criteria used by the ERC in evaluating a license application and includes compliance with EMCA including health and safety management.

6.5 Occupational Safety and Health Act, 2007 (OSHA)

This Act of Parliament was enacted to provide for the health, safety and welfare of persons employed in workplaces, and for matters incidental thereto and connected therewith.

Part II of the Act provides the General Duties that the Occupier must comply with respect to health and safety in the workplace. Such duties include undertaking S&H risk assessments, S&H audits, notification of accidents, injuries and dangerous occurrences, etc. A number of sections under this part shall be applicable to the proposed project.

Part III of the Act provides the Administrative framework for supervision of the Act.

Part IV deals with the enforcement provisions that the DOSHS has been provided with under the Act. It discusses the instances when Improvement and Prohibition Notices can be issued as well as the powers of OSH officers. This part of the Act will be mandatory for the Occupier to comply with for the proposed project.

Part V of the Act requires all workplaces to be registered with the DOSHS. This part will be applicable for the proposed project as the Occupier will have to apply for registration of their project with the DOSHS on completion of the construction phase and before the operational phase of the project.

Part VI of the Act gives the requirements for occupational health provisions which include cleanliness, ventilation, overcrowding, etc. Some sections of this part of the Act will apply to the Occupier during the operational phase of the project.

Part VII of the Act contains provisions for the safe operation of machinery and includes all prime movers and transmission equipment. Additionally this part includes the safe operation of cranes, chains, ropes, lifting tackles, pressure vessels and their statutory examination by DOSHS Approved Persons. This part of the Act will apply to the Occupier during the construction and operational phases respectively of the project.

Part VIII of the Act contains provisions for general safety of a workplace especially fire safety. This part of the Act will apply to the proposed project during the design, construction and operational phases respectively of the project.

Part IX of the Act deals with Chemical Safety. This will be applicable to the proposed project as it will receive, store, handle and distribute materials such as petroleum fuels, lubricants, etc. The Occupier will be required to have MSDS sheets for all hazardous materials handled in the workplace including labeling of all receptacles containing such hazardous materials.

Part X of the Act deals with the General Welfare conditions that must be present during the operational phase of the project. Such conditions include first aid facilities, supply of drinking water, accommodation for clothing, ergonomics, etc.

Part XI of the Act contains Special Provisions on the management of health, safety and welfare. These include work permit systems, PPE requirements and medical surveillance. Some sections of this part of the Act will be applicable to the proposed project during the construction and operational phase.

Part XII of the Act deals with Special Applications such as platforms erected over water and workplaces where steam boilers or hoists and lifts are used. This part of the Act will not be applicable to the proposed project.

Part XIII of the Act stipulates the various fines and penalties associated with non-compliance of the Act. It includes those fines and penalties that are not included in other sections of the Act and will be important for the Occupier to read and understand the penalties for non-compliance with S&H provisions.

Part XIV of the Act is the last section of the Act and contains miscellaneous provisions which are not covered elsewhere in the Act. Some sections under this part of the Act will be apply to the proposed project and it is in the interest of the Occupier to read, understand and ensure compliance with it.

Some of the important subsidiary legislation which operationalizes the Act and is applicable to the proposed project is described below.

6.6 Subsidiary legislation under OSHA

6.6.1 L.N. 31: The Safety and Health Committee Rules 2004

These rules came into effect on April 28th, 2004 and require that an Occupier formalize a Safety and Health (S&H) Committee if there are a minimum of 20 persons employed in the work place. The size of the S&H Committee depends on the number of workers employed at the place of work.

For the Proponent and Contractor, the Occupational Safety and Health Act and the S&H Committee Rules 2004 are important as they require compliance with the following measures:

- Posting of an Abstract of the Factories and Other Places of Work Act in key sections of each area of the factory or other workplace;
- Provision of first aid boxes in accordance with Legal Notice No. 160 of 1977;
- Ensuring that there are an appropriate number of certified first aiders trained by an approved institutions and that the certification of these first aiders is current;
- Provision of a General Register for recording amongst other things all incidents, accidents and occupational injuries;
- Appointment of a S&H Committee made up of an equal number of members from management and workers based on the total number of employees in the workplace;
- Training of the S&H Committee in accordance with these rules;
- Appointment of a S&H management representative for the Proponent;

The S&H Committee must meet at least quarterly, take minutes, circulate key action items on bulletin boards and may be required to send a copy of the minutes to the DOSHS provincial office.

Appropriate recordkeeping including maintenance of all current certificates related to inspection of critical equipment such as cranes, air compressors, lifts, pulleys, etc. Such inspections need to be undertaken by a approved person registered by the Director of the DOSHS.

6.6.2 L.N. 24: Medical Examination Rules 2005

These rules provide for Occupiers to mandatorily undertake pre-employment, periodic and termination medical evaluations of workers whose occupations are stipulated in the Second Schedule of the Act and the First Schedule of the above Regulation. Workers that fall under the above two schedules are required to undergo medical evaluations by a registered medical health practitioner duly registered by the DOSHS.

It will be incumbent on the main Contractor to ensure that Material Safety Data Sheets (MSDSs) for chemicals used in the construction phase are studied for toxicological and epidemiological information. If any of these products present negative impacts to human health, the workers exposed to the chemicals will be required to undergo medical examinations in accordance with the above Rules.

6.6.3 L.N. 25: Noise Prevention and Control Rules 2005

These rules were promulgated on March 10th 2005 for occupational noise exposures and apply to workplaces in Kenya. The regulation is applicable to the project as there will be noise potentially generated by construction equipment that may exceed the permissible noise levels given below. The rules may be applicable to the Proponent during the operational phase of the project.

The rules set the permissible level for occupational noise in any workplace (which includes construction sites) as follows:

- 90 dB(A) over an 8-hour TWA period over 24-hours; and
- 140 dB(A) peak sound level at any given time.

Additionally the rules set permissible limits for community noise levels emanating from a workplace as follows:

- 50 dB(A) during the day; and
- 45 dB(A) at night.

If noise levels exceed the above permissible levels, the Occupier is required to develop, rollout and implement a written hearing conservation program which should include the following sections as a minimum:

- Undertaking a Noise Level Survey;
- Education and training of persons affected by excessive noise;
- Engineering noise control methods;
- Hearing protection requirements;
- Posting of notices in noisy areas;
- Audiometric testing methods and frequencies for those exposed to high noises; and
- Annual program review.

The Proponent is to ensure that any equipment brought to a site in Kenya for use shall be designed or have built-in noise reduction devices that do not exceed 90 dB(A). The Proponent shall request the supplier of the machine or equipment for its noise characteristics.

There is also a requirement for a Proponent to medically examine those employees that may be exposed to continuous noise levels of 85 dB(A) as indicated in Regulation 16. If found unfit, the occupational hearing loss to the worker will be compensated as an occupational disease.

It is expected that during the construction phase of the project, there may be plant and equipment that exceeds the threshold levels of noise stipulated under the Rules. It will therefore be incumbent on the main contractor and their sub-contractors to ensure that their equipment is serviced properly and/or use equipment that complies with the threshold noise values given above. Alternatively the main contractor will be required to develop, rollout and implement a written hearing conservation program during the construction phase.

6.6.4 L.N. 59: Fire Risk Reduction Rules, 2007

These rules were promulgated by the Minister for Labor on April 16th 2007 and apply to all workplaces. A number of sections of the rules apply to the proposed project as enumerated below.

Regulation 5 requires Proponents to ensure that fire resistant materials are used for construction of new buildings. A number of minimum specifications of materials are provided in the regulation.

Regulation 6 requires that all flammable materials to be stored in appropriately designed receptacles.

Regulation 7 requires that all flammable storage tanks or flammable liquid containers be labeled with the words "Highly Flammable" in English or Kiswahili. It is therefore practical for the Proponent to use a system similar to the Hazardous Material Identification System (HMIS) of labeling their product containers. The regulation requires a Proponent to consult the product's MSDS for appropriate labeling requirements.

Regulation 8(3) requires a Proponent to have a spill prevention, response and countermeasures plan (SPRCC). This may be important if there will be chemicals stored at the construction site.

Regulation 16 requires Proponents to ensure that electrical equipment is installed in accordance with the respective hazardous area classification system. It is also a requirement that all electrical equipment is inspected 6-monthly by a competent person and the Proponent is required to keep records of such inspections.

Regulation 17 requires Proponents to clearly delineate fire escape exits. The regulation provides for the minimum standards to be applied in marking out all fire escape exits. This section may not apply to the proposed project.

Regulations 20 – 23 require Proponents to have trained firefighting teams within their premises. The above regulations provide for the minimum number of fire team members based on the total number of employees that may be present at any given time within the Proponent's premises. Each of the fire team members must undergo a training course in fire-fighting to be provided by a DOSHS approved institution. The DOSHS may develop a curriculum for this training including the minimum number of contact hours required.

Regulation 22 provides a description of the functions of a fire-fighting team. Regulation 23 requires Proponents to mandatorily undertake fire drills at least once a year.

Regulations 24, 26 and 27 refer to the communication system to be employed by Proponents for alerting staff. All premises must have properly marked assembly points and suitable means of alerting workers about a fire. Regulation 27 specifically requires Proponents to display "No Smoking" signs wherever flammable vapors may be present.

Regulation 28 requires Proponents to install fire detection systems in their premises (offices, workshops, etc.). Such systems must be connected to audible and visual flashing devices and the system must be maintained regularly to ensure its integrity at all times.

Regulations 29 – 31 refer to the installation and maintenance of firefighting systems in workplaces. Fire extinguishers are to be mounted at least 60cm above ground while a fire hose reel must be located within a radius of 30m of a fire hazard. The firefighting system shall be maintained annually by a competent person and records maintained by the Proponent.

Fire extinguishers shall be hydrostatically tested once every 5 years. Any fire extinguisher that does not pass a hydrostatic test or is damaged mechanically shall be put out of service. Regulation 31 provides the types of firefighting appliances required for different flammable and combustible materials and the minimum distances between firefighting appliances that must be maintained.

Regulation 32 requires Proponents to color code all their pipelines according to the product being conveyed by them. All fire water pipes will be colored in red. Additionally this regulation provides for the color coding to be adopted for fire extinguishers.

Regulation 33 requires Proponents to have adequate fire water storage capacity. As a minimum this regulation requires Proponents to have at least $10m^3$ of dedicated fire water storage capacity.

Regulation 34 requires Proponents to develop, rollout and implement a comprehensive written Fire Safety Policy. This policy should contain a Fire Safety Policy Statement signed by the CEO, a Fire Safety Policy Manual and a brief summary of the Fire Safety Policy of the company.

Regulation 35 requires a Proponent to notify the nearest OSH area office of a fire incident within 24 hours of its occurrence and a written report sent to the Director of DOSHS within 7 days.

Regulation 36 requires Proponents to undertake annual fire safety audits by a DOSHS registered fire safety auditor and submit a report to the DOSHS within 14 days. The definition of a fire safety audit includes a fire risk assessment. The cost of undertaking fire safety risk assessments and fire safety audits shall be borne by the Proponent.

6.6.5 L.N. 60: Hazardous Substances Rules, 2007

These rules were promulgated by the Minister of Labor on April 16th 2007 and may apply to the proposed project if it is expected to handle chemicals that can potentially expose employees to hazardous substances.

The Rules state that the Proponent shall ensure that where chemicals come into contact with employees, the exposure limits set out in the First Schedule of the Regulations are not exceeded. Where employees may be exposed to two or more chemicals in the workplace the Proponent shall work out the combined exposure using the narrative given in the Second Schedule of the Regulations. The Minister of Labor is empowered to change the exposure limits given in the First Schedule of the Regulations.

It is the responsibility of the Proponent to ensure that all employees exposed to chemicals in the workplace are protected adequately from exposure to hazardous substances that may be present using the hierarchy of hazard control methods. Such methods include elimination of the chemicals, substitution of the chemicals with less hazardous ones, engineering controls, administrative controls, use of PPE and emergency response planning. If engineering controls are applied, the Proponent will undertake the maintenance and testing of the engineering controls once every 24 months using a DOSHS approved Engineering Controls Examiner who will submit his report to the Director DOSHS within 30 days.

Regulation 12 – 15 requires Proponents to have a chemical safety program developed and implemented at their workplace if chemicals will be stored and handled. The Proponent is required to maintain an inventory of all MSDSs for the chemicals stored and handled in their workplace. As a minimum, the MSDS shall comply with the format indicated in the Third Schedule of the Regulations and will be disclosed fully to the employees handling the chemical. All unused, obsolete or expired chemicals must be disposed off in an environmentally sound manner. All containers containing chemicals must be labeled appropriately as indicated in the MSDS for that chemical. Training of employees on the hazards associated with handling chemicals safely in the workplace will be provided at the Proponent's cost.

Regulation 16 requires the Proponent to monitor chemical exposure levels in the workplace annually by engaging a DOSHS registered Air Quality Monitor. The cost of the exposure monitoring survey will be borne by the Proponent. The Air Quality Monitor shall submit a report to the DOSHS Director within 30 days.

Regulation 19 requires Proponents that use hazardous chemicals in the workplace to subject those employees to medical examinations in accordance with the requirements of Legal Notice 24: The Factories and Other Places of Work (Medical Examination) Rules 2005.

6.7 Public Health Act, Cap 242

The Public Health Act was promulgated for securing the health of workers and communities working around projects. It came into force on September 6th, 1921 and has been revised several times with the latest revision being done in 1986.

Part IV-A: General Provisions of the Act deals with the prevention and suppression of infectious diseases and certain sections of this part will be applicable to the project.

Part IX of the Act deals with the governance of sanitation and housing associated with a project. Certain section of this part will be applicable to the project during the construction and operational phases of the project respectively.

6.8 Physical Planning Act, Chapter 286

The Physical Planning Act was promulgated for the preparation and implementation of physical development plans and connected purposes. This Act which was promulgated in 1996 requires the Proponent of a Project to submit an ESIA Study to the respective local authority if in the opinion of the local authority the Project is anticipated to have adverse environmental impacts (Section 36 of the Act).

6.9 Water Act, 2002

Under the Water Act, the principle requirement for the Proponent will be to apply for a water abstraction permit from the relevant water services board and pay the requisite licensing fees. This will be applicable as the proponent may wish to drill a few boreholes for construction of the wind turbine foundations and the access roads and tracks associated with the proposed wind energy facility.

6.10 Least Cost Power Development Plan (LCPDP)

Kenya's power industry generation and transmission system planning is undertaken on the basis of a Least Cost Power Development Plan (LCPDP). The LCPDP is updated annually to take into account new information and any promising technologies with potential to generate power at competitive costs.

The LCPDP is developed jointly by the Ministry of Energy, ERC, KenGen, Kenya Power, GDC, KETRACO, REA and the Kenya National Bureau of Statistics. The main objective is to update the least cost power development plan to account for the following developments that have taken place since the last update:

- Review load forecast assumption including variables, data set and load forecasting methodology taking into account anticipated performance of the macro-economy;
- Review the commissioning dates for committed power generation and transmission projects; and
- Review and update the power system simulation data including plant types, system constraints and costs.

The LCPDP for the period 2011 – 2030 indicates that Kenya has an installed wind capacity of 5.1MW in Ngong. Phase II of the project, estimated to be up to 15MW is currently under procurement. A further 610MW are to be developed by IPP's comprising 300MW by Lake Turkana Wind Power, 60MW by Aeolus Kinangop Wind, 100MW Aeolus Ngong Wind, 60MW Osiwo Ngong' Wind, 60MW Aperture Green Ngong and 30MW Daewoo Ngong wind.

According to the LCPDP for the period 2011 – 2030, the best wind sites in Kenya for wind prospecting are Marsabit district, Samburu, parts of Laikipia, Meru north, Nyeri and Nyandarua and Ngong hills. Other areas of interest are Lamu, off shore Malindi, Loitokitok at the foot of Kilimanjaro and Narok plateau.

It is estimated that 3.75 million households in Kenya are in areas with wind speeds of less than 4 meters per second considered as low energy areas. Some 2.3 million households are in areas with wind speeds between 4 and 6.98 meters per second considered good wind potential areas. Only 132,000 households are in areas considered very good to excellent of wind investment which also provide good opportunity for development of large wind farms as there would be minimal human interference.

The LCPDP has identified the following specific areas as promising and worth further investigations:

- Aberdare Mountains (Central Province, Nyeri and Nyandarua Districts);
- Wider surroundings of Mount Kenya, incl. the entire area between Aberdare Mountains, Mount Kenya and Nyambeni Hills (northern districts of Central and central districts of Eastern Province);
- Escarpments to the Rift Valley (mainly Rift Valley Province);
- Areas around Marsabit (Northern Kenya, northern part of Eastern Province, Marsabit District; already under consideration);
- Coastal area (Coast Province: Kwale, Mombasa, Kilifi, Tana River and Lamu Districts, plus North Eastern Province: southern part of Ijara District; with slightly lower potential).

The proposed project falls adjacent to the escarpment to the Rift Valley and wind studies undertaken so far indicate that there is a good potential for development of wind power.

6.11 Scaling-up Renewable Energy Program (SREP)

The Scaling-up Renewable Energy Program (SREP) is Kenya's investment plan for renewable energy. The SREP is supported by the Climate Investment Funds (CIF) which is a pair of funds to help developing countries pilot low-emissions and climate-resilient development.

Kenya is one of six pilot countries under this program to benefit from the CIF and the SREP. The CIF is channeled through the African Development Bank, Asian Development Bank, European Bank for Reconstruction and Development, Inter-American Development Bank and the World Bank Group.

The Least Cost Power Development Plan (LCPDP) 2011 – 2031 envisions that Kenya's electricity peak demand will increase from the current 1,302MW to 15,026 MW by 2030. This is in line with the Vision 2030 which envisages energy as a key enabler for economic growth across the country. To meet the increased electricity demand due to the enhanced economic activities, the LCPDP has identified various generation sources targeting 5,110 MW from geothermal, 1,039MW from hydro, 2,036 MW from wind, 3,615MW from fossil thermal, 2,000 MW from imports, 2,420 MW from coal and 3,000 MW from other sources.

On the basis of the above demand, the proposed project is in alignment with Kenya's Vision 2030 and will go a long way in meeting the demands of electric power generation from renewable energy sources.

6.12 United Nations Framework Convention on Climate Change (UNFCC)

The Convention on Climate Change sets an overall framework for intergovernmental efforts to tackle the challenge posed by climate change. It recognizes that the climate system is a shared resource whose stability can be affected by industrial and other emissions of carbon dioxide and other greenhouse gases.

The Kyoto Protocol is an international agreement linked to the United Nations Framework Convention on Climate Change. The major feature of the Kyoto Protocol is that it sets binding targets for 37 industrialized countries and the European community for reducing greenhouse gas (GHG) emissions. These amount to an average of five per cent against 1990 levels over the five-year period 2008-2012.

The major distinction between the Protocol and the Convention is that while the Convention encouraged industrialized countries to stabilize GHG emissions, the Protocol commits them to do so.

Recognizing that developed countries are principally responsible for the current high levels of GHG emissions in the atmosphere as a result of more than 150 years of industrial activity, the Protocol places a heavier burden on developed nations under the principle of "common but differentiated responsibilities."

The Clean Development Mechanism (CDM), defined in Article 12 of the Kyoto Protocol, allows a country with an emission-reduction or emission-limitation commitment under the Protocol (Annex B Party) to implement an emission-reduction project in developing countries. Such projects can earn saleable certified emission reduction (CER) credits, each equivalent to one ton of CO_2, which can be counted towards meeting Kyoto targets.

The mechanism is seen by many as a trailblazer. It is the first global, environmental investment and credit scheme of its kind, providing a standardized emission offset instrument, CERs.

A CDM project activity might involve, for example, a rural electrification project using solar panels or the installation of more energy-efficient boilers.

The mechanism stimulates sustainable development and emission reductions, while giving industrialized countries some flexibility in how they meet their emission reduction or limitation targets.

The proposed wind energy project is an example of a sustainable development project which uses a carbon-neutral energy source (wind) to generate electrical energy and subsequently this project is mooted on the basis of the CDM.

6.13 Feed-in-Tariff Policy

In March 2008, the Kenya Government developed the Feed-in-Tariff (FiT) Policy for wind, biomass, small-hydro, geothermal, biogas and solar resource generated electricity; the FiT Policy was subsequently revised in January 2010. A Feed-in-Tariff is an instrument for promoting generation of electricity from renewable energy sources. A Feed-in-Tariff allows power producers to sell renewable energy sources generated electricity to a distributor at a pre-determined fixed tariff for a given period of time.

The objectives of the FiT system are to:

a) Facilitate resource mobilization by providing investment security and market stability for investors in electricity generation from Renewable Energy Sources.

b) Reduce transaction and administrative costs and delays by eliminating the conventional bidding processes.

c) Encourage private investors to operate their power plants prudently and efficiently so as to maximize returns.

The advantages of renewable energy sources generated electricity include:

a) Environmental integrity including the reduction of greenhouse gas emissions;

b) Enhancing energy supply security, reducing the country's dependence on imported fuels; and coping with the global scarcity of fossil fuels and its attendant price volatility;

c) Enhancing economic competitiveness and job creation among others.

It is envisaged that by adopting the FiT system, Kenya's energy sector will improve its rating as an attractive destination for substantial private sector capital thereby facilitating the exploitation of the abundant local renewable energy sources.

To attract private sector capital in wind resource electricity generation, the Ministry of Energy established a fixed tariff not exceeding US Cents 12.0 per Kilowatt-hour of electrical energy supplied in bulk to the grid operator at the interconnection point. This tariff is applicable to individual wind power plants (wind farms) whose effective generation capacity is above 500kW and does not exceed 100 MW, subject to the first cumulative 300 MW capacity of wind power plants developed in the country under this tariff policy. This tariff shall apply for 20 years from the date of the first commissioning of the wind power plant.

The proposed project falls within the above category of first cumulative 300MW capacity of wind power to be developed in Kenya and therefore should enjoy a FiT of US12 cents per KW-hour of electricity supplied at the interconnection point.

The Feed-in-Tariffs include interconnection costs – transmission, substations and associated equipment.

The FiT Policy also includes the following aspects associated with renewable energy projects that the proponent will need to comply with.

- Purchase obligations of Grid Operators;
- Implementation procedures of the FiT Policy by private investors; and
- Compliance with technical, legal and regulatory requirements.

6.14 Regulatory hierarchy for energy generation projects

The Kenyan energy industry is evolving rapidly with regular changes to legislation and industry role-players. The regulatory hierarchy for an energy generation project of this nature consists of two tiers of authority who exercise control through both statutory and non-statutory instruments – that is National and local levels.

At the National level, the main regulatory agencies associated with the proposed wind energy facility include:

Ministry of Energy: This is the parent ministry responsible for energy matters in Kenya and is responsible among other things for developing the energy policy in alignment with Kenya's Vision 2030, developing the electric power sub-sector in Kenya and having an oversight role over various energy sector related parastatals and statutory bodies.

Energy Regulatory Commission: The Energy Regulatory Commission (ERC) was established as an Energy Sector Regulator under the Energy Act, 2006 in July 2007. ERC is a single sector regulatory agency, with responsibility for economic and technical regulation of electric power, renewable energy, and downstream petroleum sub-sectors, including tariff setting and review, licensing, enforcement, dispute settlement and approval of power purchase and network service contracts.

National Environment Management Authority: The National Environment Management Authority (NEMA) was established is to exercise general supervision and co-ordination over all matters relating to the environment and to be the principal instrument of Government in the implementation of all policies relating to the environment. The NEMA is charged with granting the EIA License for the proposed project.

Directorate of Occupational Safety and Health Services: The Directorate's main mandate is to ensure compliance with the provisions of the Occupational Safety and Health Act, 2007 that seeks to promote safety and health at the workplace. It also ensures compliance with the provisions of the Act Work Injury Benefits Act, 2007 through prompt compensation of employers against work related injuries.

Ministry of Roads: The Ministry of Roads is charged with the responsibility of providing basic infrastructure facilities to the public. These include development, maintenance and rehabilitation of road network in the country. Among other functions, the Ministry of Roads coordinates the activities undertaken by the Parastatals/Authorities namely the Kenya Roads Board, Kenya National Highways Authority, Kenya Urban Roads Authority and Kenya Rural Roads Authority. The proponent will seek authorization from the relevant roads authority under this ministry for movement of abnormal wind turbine load components between Mombasa and Nairobi.

At the local level, the local authorities are the principal regulatory authorities responsible for planning, land use and the environment. The local authority responsible for the Kipeto Energy Limited wind energy facility is the Ol Kejuado County Council.

As Kenya develops wind energy projects, there may be several non-statutory bodies such as wind energy associations and environmental and social lobby groups that may play a role in various aspects of planning and the environment that will influence wind energy development.

6.15 Legislation and guidelines that have informed the preparation of the EIA report

The following legislation has informed the scope and content of this ESIA Study:

- Environment Management and Coordination Act, 1999
- Environment (Impact Assessment and Audit) Regulations, 2003
- Environment Management and Coordination (Water Quality) Regulations, 2006
- Environment Management and Coordination (Waste Management) Regulations, 2006
- Environment Management and Coordination (Noise and Excessive Vibration Pollution) Regulations, 2006
- Occupational Safety and Health Act, 2007 and its subsidiary legislation

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7 Baseline environmental conditions

This section provides a brief description of the project environment and is based on a review of the existing information, site visits undertaken by the project team and discussions with the public/stakeholders.

7.1 Regional setting

At a regional level, the study area falls within the Kajiado district in the rift valley province. The site is located on the edge of the Rift Valley between Kajiado and Kiserian.

The study area has a rural character. There is only one commercial activity that occurs within the broader project area which is a set of three telecommunications masts as shown in Figure 7-1.

Figure 7-1: Image of Telecommunications masts within the project area

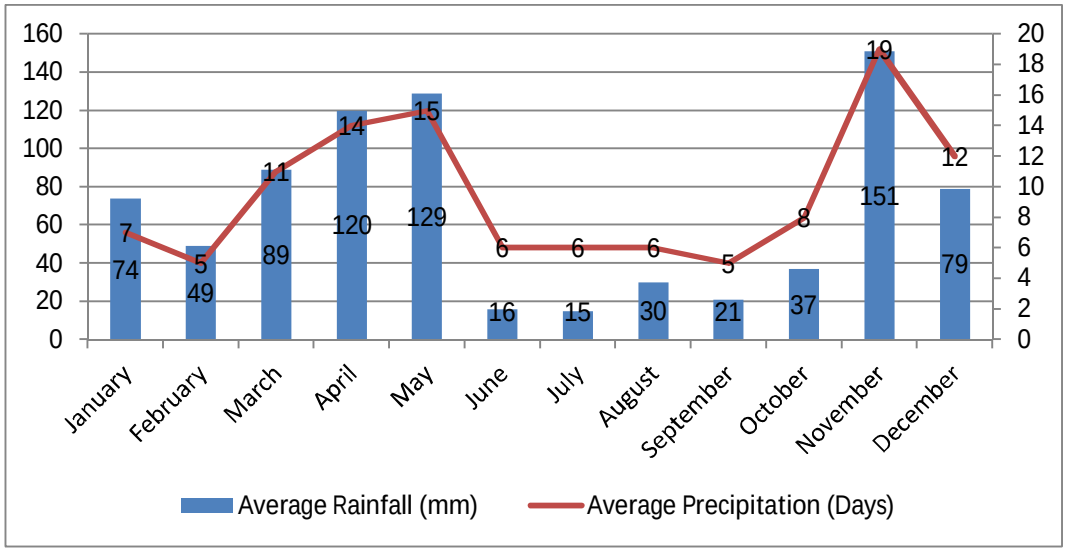
The study area is relatively remote and is situated between minor access roads on the edge of the Rift Valley escarpment. The nearest main road is the A104 which is at least 18km towards the east of the project area. There are a number of local access roads such as E406, E407 and E2011 that make up the study area.
Towards the south of the project area lies the Magadi – Konza railway line which runs in the same direction as the E406 road.

7.2 Climate

7.2.1 Rainfall and temperature

The mean annual rainfall in Kajiado district ranges from 300mm to 800 mm. The rainfall is bimodal, with short rains occurring from October to December and long rains from March to May. Distribution of rainfall between the two seasons changes gradually from east to west across Kajiado District. More rainfall occurs during the "short rains" in eastern Kajiado than during the "long rains". In western Kajiado the majority of rain falls during the "long rains". The annual rainfall is influenced by altitude. A graph showing the average monthly rainfall in the Kajiado area and the average monthly days of precipitation is given in Figure 7-2.

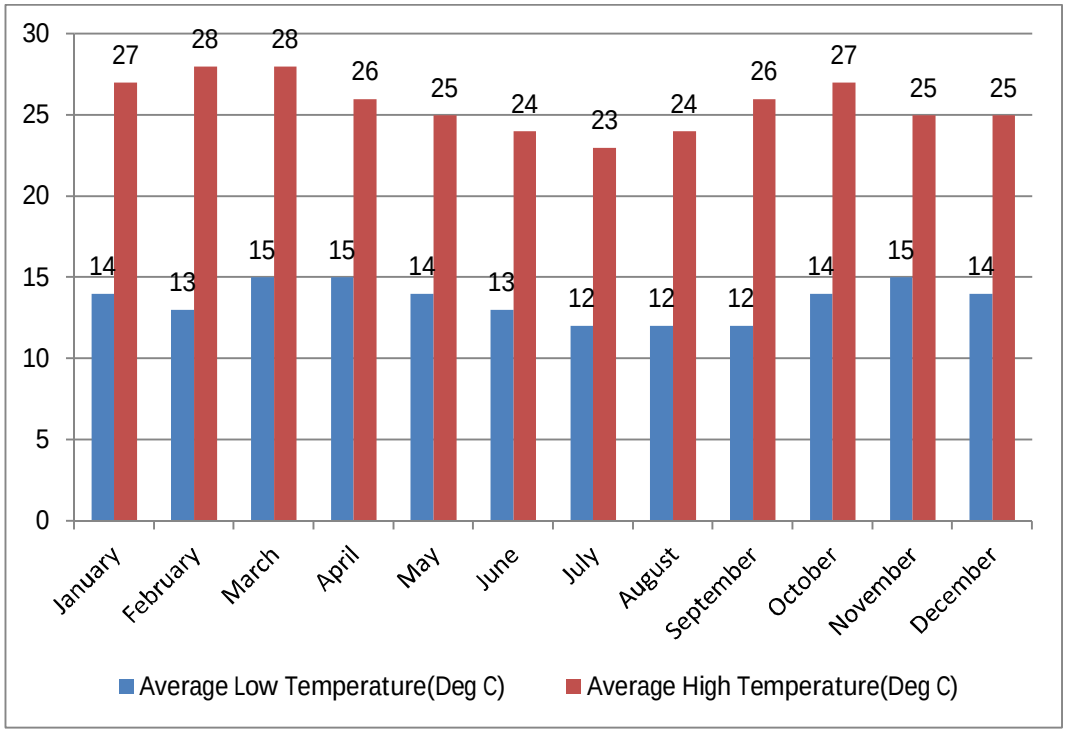
[1]Figure 7-2: Average rainfall and precipitation days in Kajiado



Temperature of Kajiado District also varies with altitude. The average monthly low and high temperatures experienced in Kajiado is shown in Figure 7-3.

[1] Source: World Weather Online, http://www.worldweatheronline.com/weather-averages/Kenya/1218180/Ol-Kejuado/1220620/info.aspx accessed on December 25th, 2011

[2]Figure 7-3: Average monthly low and high temperatures (^{0}C) in Kajiado



7.3 Geology and soils

The Kipeto area is generally a highland volcanic plain and plateau standing above the lower Athi plains to the east and the Rift Valley System to the west. Kipeto area is predominantly covered by black cotton soil which is underlain by volcanic rocks, mainly agglomerates, tuffs and phonolites. The area has several faults running in a north-south direction.

There are also small to medium sized caves found in some of the outcrops of the volcanic rocks spread out in the area.

The project area is overlain by relatively shallow mainly black cotton soils which in some areas grade into more grayish colored loamy soils. These soils are products of weathering of the underlying volcanic rocks – the Oldoinyo Narok Agglomerates and Kerichwa Valley tuffs. There are scattered outcrops of agglomerates and welded tuffs which mean there is no soil cover.

Between the black cotton soil and bedrock is a layer of lateritic soil that is grayish-brown in color and often contains rounded gravel.

[2] Source: World Weather Online, http://www.worldweatheronline.com/weather-averages/Kenya/1218180/Ol-Kejuado/1220620/info.aspx accessed on December 25th, 2011

The project area lies in the Ol Doinyo Narok plateau which ranges between 1850 and 2035m above mean sea level. The area has numerous faults running north-south and is associated with the Rift Valley system that has a similar trend. Small to medium sized caves were also observed with the small ones averaging around three meters wide by one meter high and two meters horizontal depth. The largest cave was about 25m wide, 7.5m high and 10m deep. Not much is known about the genesis of these caves but some had indications of being enhanced erosion by water. The geological map of the Kajiado area indicating the approximate location of the proposed wind energy facility is indicated in Figure 7-4.

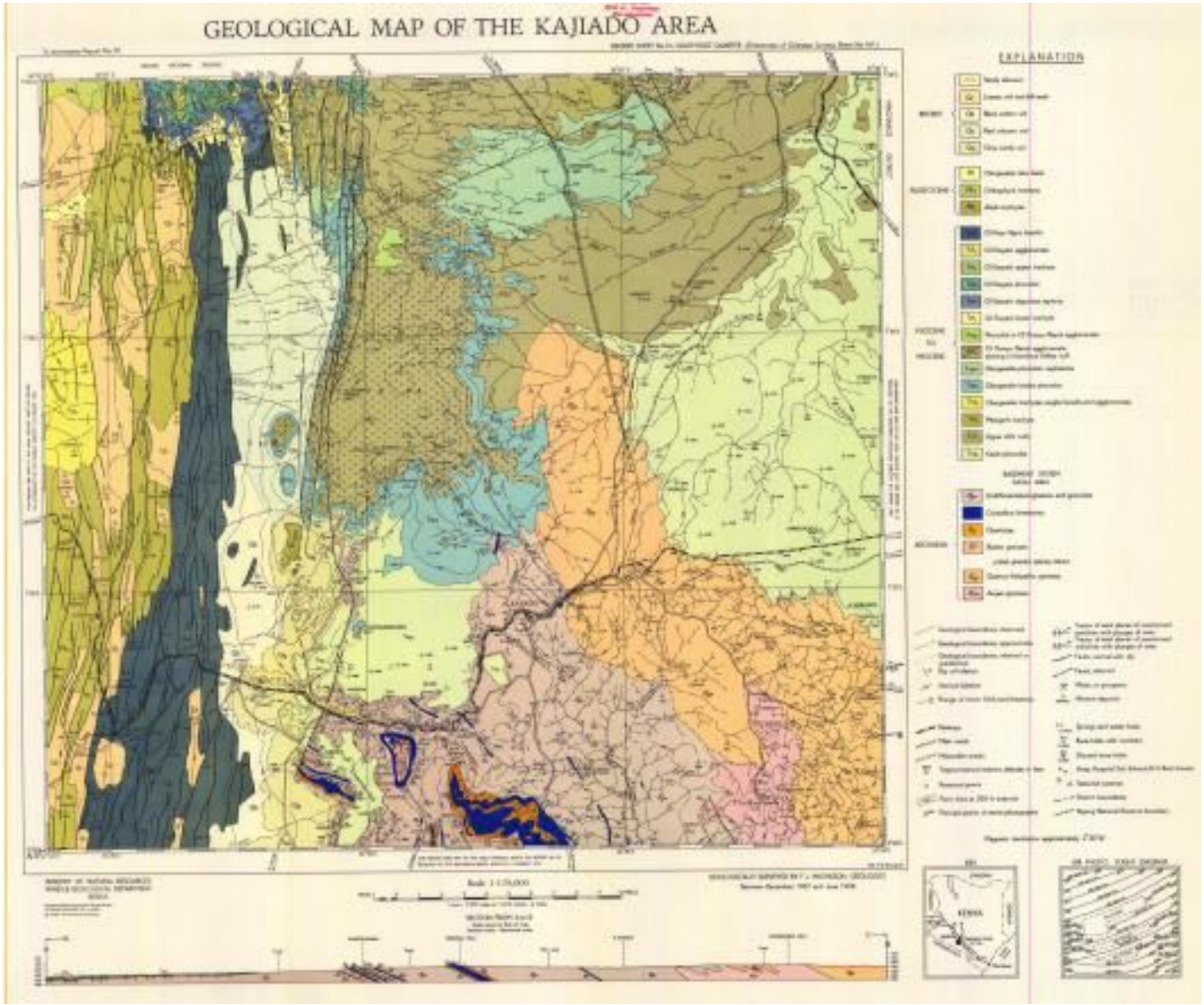
7.4 Topography

The general topography of Kajiado district is characterized by plains and occasional volcanic hills. The land rises from about 500 meters above sea level around Lake Magadi to about 2,500 meters above sea level in the Ngong Hills area. The district can be divided into four topographic areas: The Rift Valley, Athi Kapiti Plains, Central *Broken Ground* and the Amboseli Plains.

The Rift Valley is a low depression on the west side of the district which runs from north to south. The depression has important features such as Mount Suswa and Lakes Magadi and Natron. Both lakes have substantial deposits of soda ash but commercial exploitation is going on in Magadi only. On the far western Nguruman Escarpment, there are three main rivers namely, Oloibortot, Entasopia and Sampu which support significant irrigation agriculture.

The Athi Kapiti Plains consist mostly of open rolling land. The area also includes the Ngong Hills with an altitude of 2,460 meters above the sea level and is the source of Athi River. The river is fed by its major tributaries Mbagathi and Kiserian both of which are permanent rivers. The *Central Broken Ground* comprises a 20 to 70 kilometer wide stretch from the North-eastern border across the district to the south west. There are permanent water sources draining this area. This area is also crisscrossed by many dry river beds which are important sources of sand for building and construction industry in Nairobi and the district itself. The Amboseli Plains are characterized by gently undulating plains with deep reddish brown clay loamy soils and flat sedimentary plains with poorly drained cotton soils.

Figure 7-4: Geological map of Kajiado area



7.5 Hydrology and hydrogeology

The district faces an acute water shortage due to low and unreliable rainfall, limited permanent water resources and pollution of water sources. On average, women travel between 10 and 15 kilometers to access water and are not included when water management decisions are made.

Kajiado District has scarce permanent natural sources of surface water. The main ones are the Uaso Nyiro River in the Rift Valley, two streams in the northern part of the Athi-Kapiti Plains, the Kiboko River, which drains much of the Central Hills and the northern part of the Amboseli Eco zone, and several springs in the southern part of the Amboseli zone. Generally, Kajiado District experience severe shortage of water due to lack of surface waters mostly rivers and streams due to their seasonality. There is low precipitation in most parts of the district and frequent drought experienced in nearly all parts of the district. Most of areas around Ngong form catchments of the Upper Athi River.

Kipeto drainages are seasonal that feed into the Kitengela River during rainy season. Kipeto area occurs in lifted Plain landscape with drainages emerging from the area in radial pattern. These drainages or rivers/streams are seasonal but during rainy seasons they deliver large volume of water from Kipeto landscape (catchment). An escarpment that occurs to the western part of Kipeto marks the eastern highlands of the Rift Valley where the Aberdare Forest, Nairobi area, Kiserian/Ngong areas occur. This escarpment drops suddenly and forms drainage features that direct runoffs to the floor of the Rift Valley serving inland water system such as the Lake Magadi to the west and Lake Natron to the south west.

A survey of the water resources revealed existence of substantial water resources in Kipeto area that serve during dry seasons in the area. The seasonal river has dry beds during dry seasons but has “wells” on the beds that contain waters during dry season. Some of these can serve local community water requirements, livestock and wildlife drinking waters throughout the year. However, most of the valleys are very rugged to be accessed by people and livestock. There are few existing developed water resources in the area mainly constructed by the Ministry of Water and local initiatives. One dam occurs almost at the centre of the project area at Esilanke Trading Center along a seasonal river that drains to the valley south west wards discharging to Lake Magadi. According to the local community the dam can serve throughout the year. However, it is normally congested by livestock during dry seasons but near it, there is a water basin that receives water pumped from borehole constructed by the Ministry of Water. These are more reliable sources of water but are located far away from most people in the area. Through individual initiatives small water-pans are constructed however their lifespan is uncertain in dry seasons. An estimated 5 small water-pans were recorded within the open grassland areas in Kipeto that potentially serve livestock and wildlife occurring in the Kipeto plain. There is also indication on the ground that more water-pans would be constructed by individual landowners in the near future since there is demand for water.

7.6 Air quality

Considering the rural nature of the proposed project area and the absence of industrial or other sources of airborne pollution, air quality at the proposed wind energy facility site is likely to be good. During the operational phase, the proposed development will not have any impact on the air quality of the project area and its environs.

7.7 Noise quality

Noise pollution has been identified as one of the more significant impacts of wind power generation. The level of noise pollution caused by wind farms depends on aspects such as average wind speed, the design of the wind turbine and the distance to affected individuals. Modern wind turbines have very low mechanical noise, and the most significant sound produced by wind turbines is the aerodynamic "swooshing" of the blades.

In terms of the existing state of the receiving environment, ambient noise levels are likely to be low and consistent with other rural areas of a similar type. Noise pollution impacts will be examined in more detail in the subsequent phases of the environmental authorization process.

7.8 Ecology

7.8.1 Vegetation types in the study area

The common vegetation types predominant in Kajiado District are open grasslands, wooded and bushed grassland, bush and woodland, and forests. Among these types, bushes and woodland occupy a larger area of the district ranging about 44% of the total area of the district. This is followed by the open grasslands, and wooded and bushed grasslands, which occupy 26% each. Forests cover only 2% of the district.

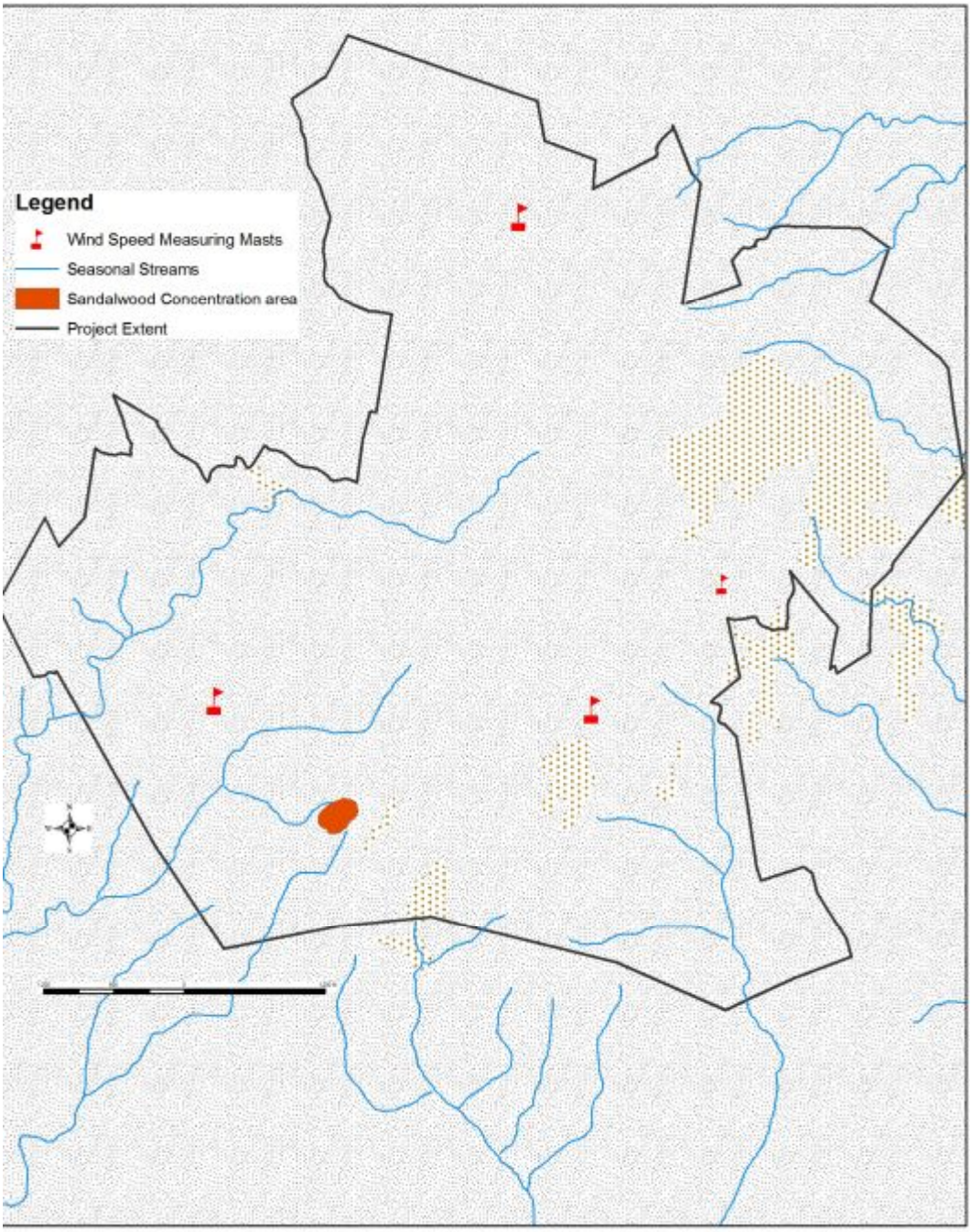
The proposed project area is characterized by unique vegetation covers comprising of open grassland dominated by *Themeda, Digitaria, Chloris, Pennisetum* and *Sporobolus* species. The project area is further characterized by bushland and woodland dominated by *Combretum, Grewia, Acacia, Rhus, Premna, Acacia tortilis –Commiphora* species. Most of woodland and bushland tends to be near or in the valleys in the area.

7.8.2 Plant species of conservation concern

Plant species of conservation concern are those that are given special attention at international and/or national levels. Only one plant species was recorded in project area occurring in an isolated section and mixed up with other plant species.

Osyris lanceolata (Sandalwood tree) is a plant species that is locally endangered due to its value in fragrance industries that makes it a commodity of trade. It was very rare in occurrence in the area; it was not recorded in any of the sampling plots or transect but outside these areas while making general observation of plant species. Figure 7-5 shows the location where the Sandalwood tree was observed within the project area during the site walk-about survey.

Figure 7-5: Map showing approximate location of Sandalwood tree in the project area

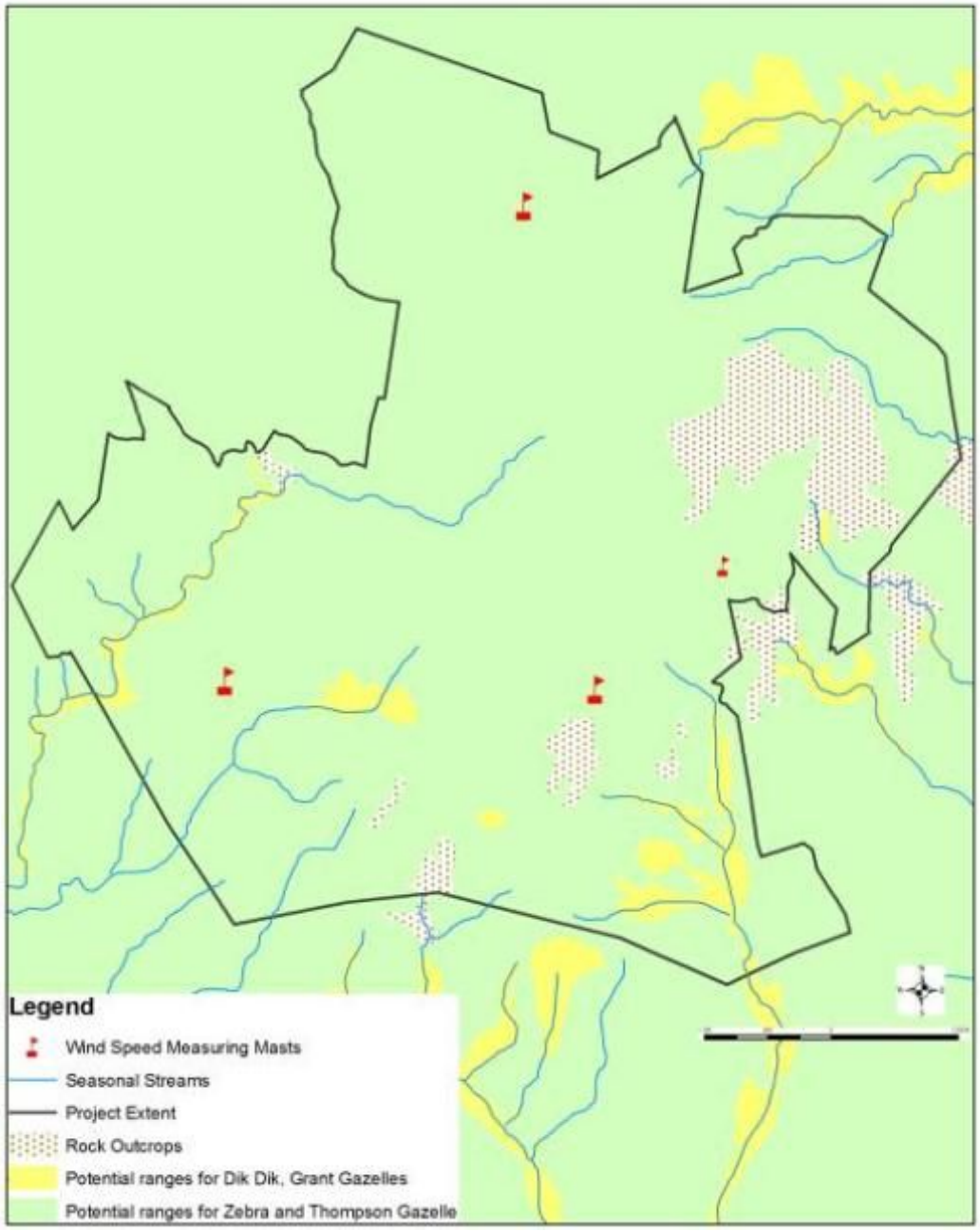


7.8.3 Animal species in the project area

Two conspicuous herbivores observed in the project area include Zebras and Thompson Gazelles. Additionally insect pollinators such as bees and butterflies were recorded mostly near or in the valleys with vegetation. There were marked differences in observations made on the distribution of mammals and insect pollinator species in dry and wet seasons, and grassland and bush/woodland in Kipeto area.

Generally most of the mammal species were observed in bushland/woodlands near riverine areas. During the dry season the number of species and population observed were few compared to the wet season. Figure 7-6 shows the distribution of herbivores in the project area.

Figure 7-6: Map showing distribution of mammals in the project area



Thomson gazelle are wide spread in the plain areas with grasses in Kipeto. During wet season when grasses were abundant, large population occurred near flocks of Zebra. However, during dry season they were widespread occurring in population of 2 – 5 individuals. Zebra were observed in open grasslands and bushes with high grass cover during wet season but dry season observation spotted the population in the bushes and woodland areas towards river valleys throughout the survey.

Dik-Diks were distributed in the bushland within the project area during the wet and dry seasons. They were observed in bush/woodland habitats. The African Hare is also distributed all over Kipeto plains and valleys.

Herpetofauna such as snakes, geckos on tree bark and on rocks and frogs in wells and seasonal streams were observed during the transect surveys although these groups were not easy to spot.

7.8.4 Insect pollinators

The survey during the dry season yielded significant changes in occurrence and distribution of insect pollinators. During this season, there were short grasses in the project area and in some places there was bare soil and exposed stony surfaces. Most of the shrubs in the plains had lost their leaves; except for the *Acacia drepanolobium* which had its leaves intact in the period. In the seasonal valleys occurred shrub species with green leaves particularly *Carissa edulis* bushes and the flowering *Acacia nilotica*. These conditions generally determined the distribution of the insect pollinators and abundance across the project landscape.

During wet season survey, 25 species were observed across the landscape. Three species of butterflies *Papilio demodocus,* Dixeia *pigea, Dixeia spp., Charaxes zoolona* were recorded in bush and woodland areas occurring in or near the riparian areas. About five species were recorded in overlaps of grassland and bush/woodland (2-20 % bush/woodland); Figure 7-7 shows images of different sorts of butterflies observed during the wet season. In bush and woodland (20-40% bush/woodland) areas, about 13 species were recorded, while three species were recorded in bushland/woodland (20-40% bush/woodland) and grassland near bushland/woodland (2-20 % bush/woodland).

Out of 25 species recorded during wet season only five species were realized during survey in dry season. *Zizula hylax* was recorded in grassland (0-2 % bush/woodland) and bush/woodland (2-20 % bush/woodland). *Colotis aurigineus, Colotis antevippe, Colotis evagore* was restricted to bush and woodland areas (2-40 % bush/woodland) while *Dixeia pigea* was restricted to bush and woodland areas (20-40 % bush/woodland) in or near riparian areas.

Figure 7-7: Images of butterflies observed during the wet season

Zizula hylax (Courtesy of Wikipedia)

Azanus jesous (Courtesy of Wikipedia)

Colotis aurigineus (Courtesy of Wikipedia)

Colotis antevippe

(Courtesy of www.learnaboutbutterflies.com)

Colotis evagore (courtesy of www.biodiversityexplorer.org)

Papilio demodocus

7.9 Avifauna in the study area

7.9.1 Vegetation types and bird micro-habitats

The project area is a mosaic of habitat types including open grass fields, rocky outcrops, scattered wetlands (dams, ponds and seasonal streams), short and tall *Acacia drepanolobium* woodland, grass with scattered acacia, residential/ developed patches, and cleared corridors of rural roads. The wide variety of habitat types explains the rich species diversity and distribution in the study area.

In order to characterize the avifauna in the study area, survey points were established in a fashion that allowed extensive coverage of the habitats and all vegetation types present. Most of the short acacia woodlands occurred in the western portion of the project area. The central portions were dominated by grassland areas; residential development also characterized the area. The eastern portion was mainly dominated by medium tall *Acacia drepanolobium* woodland and rocky outcrops. Overall, it was observed that bird activity was higher in the woodlands along the valleys with the same trend observed for raptors. It was subsequently deduced that vegetation is an important determinant of species use and distribution within the project area.

The following sensitive micro-habitat types were observed during the site visit:

- Streams/water pans – these are important for birdlife as they act as an attractant to many species and can bring the birds close to the proposed turbines. These areas hold water during the wet season, however the duration in which they hold water is unknown.
- Ridges presented important habitats for a number of species. Most relevant to this study were raptors, storks, vultures, swifts and swallows which prefer flying along ridges where there are favorable air currents to provide lift and thereby using less flight energy. The increased wind speed in the ridge areas may also imply that birds have less control of their own flight and are less able to adjust to avoid obstacles such as wind turbines.

7.9.2 Monthly vantage point observations

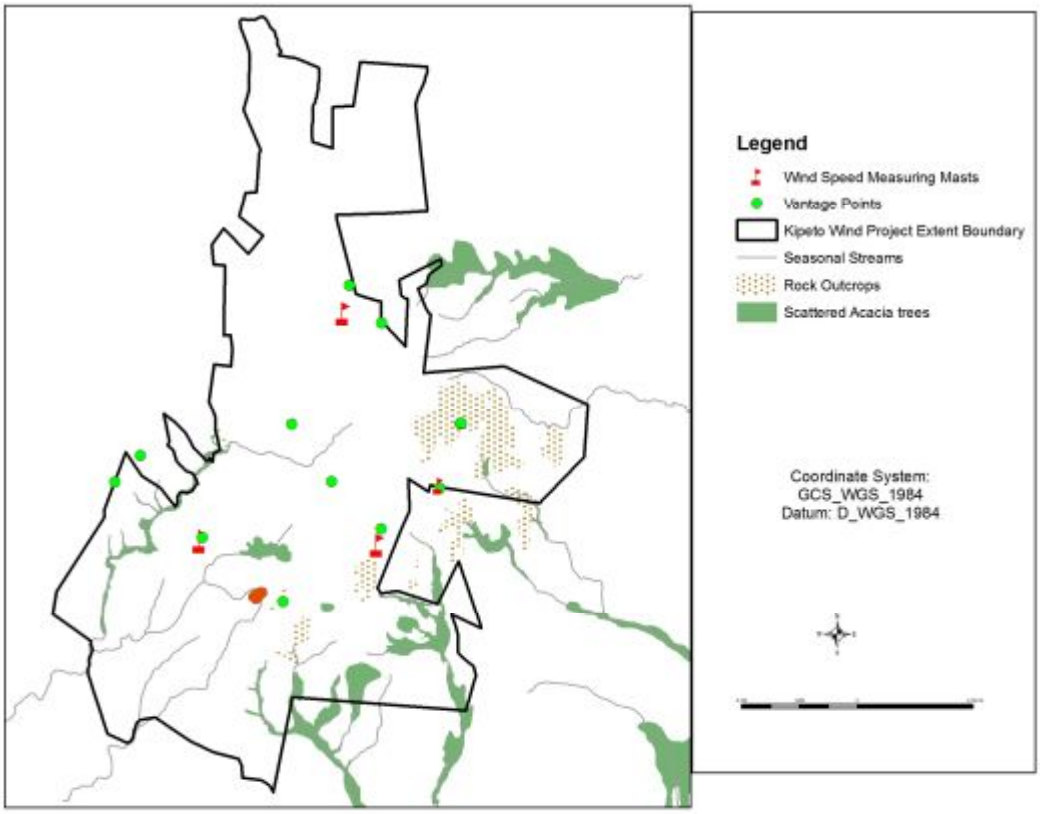
For the avifauna study, monthly observations were recorded of bird species in the project area. The observations were carried out for 7 days in each month over a period between April and December 2011.

Different groups of birds were recorded at different vantage points within the study area; there were more groups of birds recorded in the month of April than in subsequent surveys as the months of April coincides with the migratory season. Target species at the vantage points were wholly restricted to medium sized species e.g. raptors, plovers, cranes, storks, ducks, bustards etc.

Although the data collected indicates that the majority of species are at relatively low densities outside the migration season, high density of raptors are likely to be observed during the migration seasons both during the hot and cold seasons. This is evidenced by the fact only few target species birds were recorded during the subsequent transect and vantage point surveys; in transects where birds were recorded these were only in low numbers.

Figure 7-8 shows the vantage points that were used to record the avifauna over the study area.

Figure 7-8: Image showing vantage point locations for avifauna study



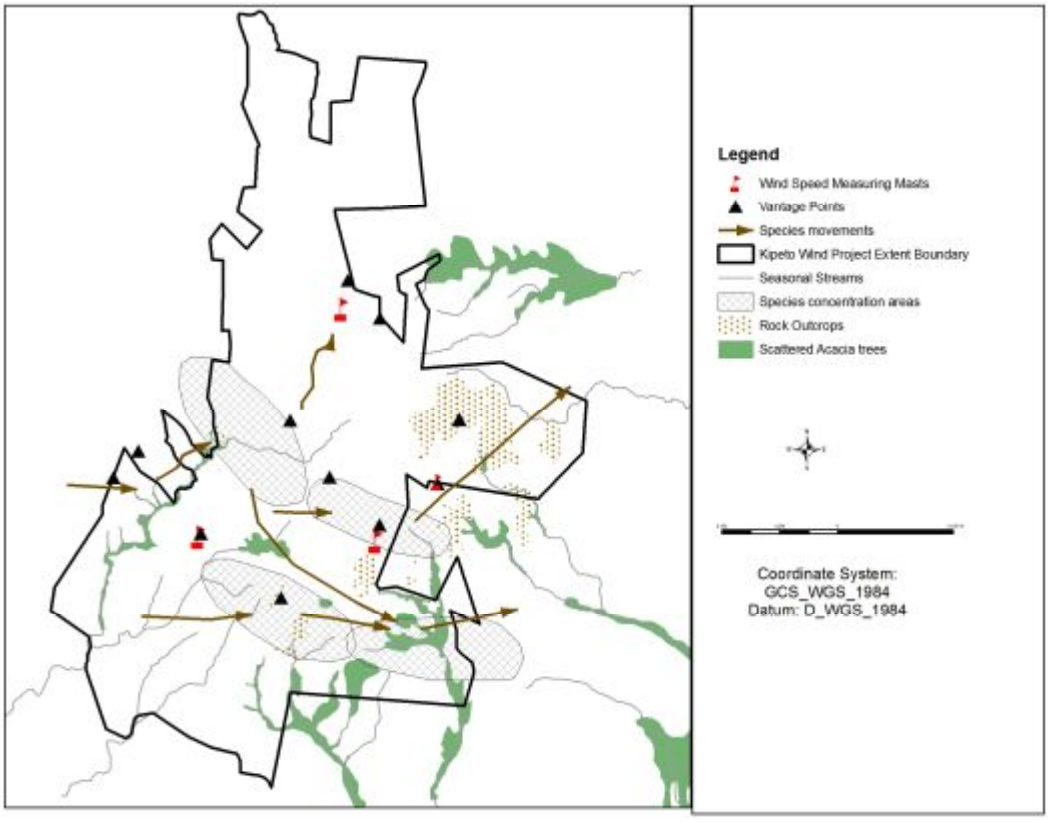
7.9.3 Species diversity

Over 100 species were recorded in the project study area site during the survey. The species comprised different groups of birds including raptors which are among the target species and considered most vulnerable under the current situation. Other medium sized birds and water birds were also observed (e.g. the Egyptian goose though in low numbers), grassland birds such as larks and pipits dominated the grassland habitats and are also common residents of the area, woodland birds mostly warblers dominated the Acacia woodlands within the riparian habitats. Figure 7-9 shows the avifauna distribution over the project area.

The avifauna study confirmed that the site is an important passage and feeding site for migratory birds both raptors and passerines. The area is used predominantly for feeding, flight route and passageway. Some common resident birds were recorded breeding and included the Rufus sparrows, weaver birds and Kori Bustard. Other birds that showed breeding signs included plovers which are mainly ground dwellers. No raptors were observed to breed and none showed any signs of breeding. Most of the birds occurred within the riparian habitats and most raptor movement followed the same pattern coinciding with the ridges concentrated on the western side.

The most common species during the survey was Lesser Kestrel with counts of at least 500 individual birds/flight per day, followed by Eurasian Hobbies <20 individuals, Amur falcons arrived just as the survey was concluded and up to 100 individuals were counted. These species of migrants only occurred in April during the migratory period and were not recorded in subsequent surveys. Other species of significant focus for the proposed project included Steppe buzzard, Tawny eagle, Steppe eagle, Martial eagle, Rüppell's griffon vulture, Lappet face vulture (IUCN Listed as Near-threatened), although this were observed only on one occasion during the monthly surveys, Pallid harrier, Black-shouldered kite. Other non-raptor target species recorded included Kori Bustard also observed nesting with young, White-bellied Bustard, White Storks, Ostrich, Crowned plovers, Egyptian geese. These were recorded in only small numbers. Other small land birds were also recorded.

Figure 7-9: Image showing avifauna distribution over the project area



7.10 Archeology and cultural heritage

7.10.1 Geological formations

The oldest rocks in Kajiado District are gneisses, limestone and quartzite that form the Basement system that is known to be of the Precambrian age. They are all sedimentary and also cover a large part of East Africa. The lower layers were probably laid down in deep water, and later depositions were made in shallow water. Subsequent compression and folding of the basement rock led to the formation of mountain chains which have been intensely eroded, and by the end of the cretaceous the whole area had been reduced to a peneplain, now remnant at Lemilebbu hill. More uplift and erosion led to the formation of the sub-Miocene peneplain, onto which the volcanics of Tertiary age were deposited. The Kapiti phonolite is the oldest of these volcanic and covers a vast area to the east and north east of Kajiado. As no central volcanoes have been located, the phonolite may have been extruded from small vents. Phonolite is the main raw material for the Early Stone Age industries at Olorgesailie and Isenya prehistoric sites.

The volcanoes of Olorgesailie and Ol Esakut are younger than the phonolites as they both lie on the earlier volcanic of Kapiti and Kerichwa Valley Tuff respectively. The faulting that followed placed the two main volcanoes on the floor of the Rift Valley, while further volcanic activity introduced basalt and trachytes on the floor of the Rift Valley. Where Basement soils occur, they degrade into grey sandy soils, while black cotton soils such as those found in the proposed project area are formed on volcanic soils. The proposed project area is part of what is known as the Ol Doinyo Narok plateau, covered by Ol Doinyo Narok agglomerates and Kerichwa Valley tuffs. The agglomerate is responsible for the great number of lava blocks strewn across the surface, and also the phonolites and trachytes that are both coarse and fine grained.

Other deposits in this area have been transported to location, such as those in the now dry lake Olorgesailie bed, and the layers of diatomite that formed when the lake was fed by the Ol Keju Nyiro river, and that now signal the existence of a once thriving wet land that supported large herds of big mammals and plants.

7.10.2 Archeology of the project area

Early Stone Age

The oldest stone tools attributed to the genus Homo (Mode 1 industry) have not been recorded anywhere in Kajiado district. However, tools belonging to Mode 2 that date to between 1.7m- 200kya are well represented. These later tools also referred to as Acheulian, have been found in various parts of the district, with the most famous sites excavated being Olorgesailie and Isenya.

Olorgesailie Prehistoric Site (GwJj sites 1-23) is located on the floor of the Rift Valley between Mt. Ologesailie and Ol ESakut, 80 km south of Nairobi off the Nairobi – Magadi Road. The site stands in a depression that formerly contained a lake that dried up about 200,000 years ago. The drying up of the lake was caused by a series of earth movements that caused the Ol Keju Nyiro River to flow through the area towards the south. The earth movements also lifted the deposits in the western half relative to the eastern half thereby creating a slope out of which the fossils and artifacts wash out. This is where the excavations were first carried out, and where the site museum is located.

Middle Stone Age

There are a few middle Stone Age sites in Kajiado district which include those at Olorgesailie (GwJj 24), HaJi5, HaJi3, GxJj0/7 and Turoka (GxJk1).

Later Stone Age

Later Stone Age tools are very diverse and reflect stronger cultural diversity than in earlier times. *Homo sapiens* experimented with diverse raw materials (bone, ivory, stone), the level of craftsmanship increased, and different groups sought their own distinct cultural identity and adopted their own ways of making things. Collections from later Stone Age sites around the proposed project area include microliths, potsherds, rubbing stones and palettes, and Ostrich egg shell beads.

Later Stone Age open sites can be in open areas, but cave sites become more common at this time, and human burials within rock shelters are a common feature. Reported sites with later Stone Age assemblages in Kajiado district include Ongata Ilturot (GxJi2), Pickford's site (GuJj14), Salasun GuJj13, GuJj 10, 12Olorgesailie Rockshelter Ngong GvJk2, GxJj0/6, GxJj0/1, Turoka GxJk1and Olkena.

7.10.3 Cultural heritage

This community is made up of two major clans and several sub clans who are culturally similar. The two major clans are *Odonongi* and *Orok'kiteng*. *Odonongi* is made up of *Ilmolelian*, *Ilmokesen*, and *Irkerinkishu* sub clans while *Orok'kiteng* is made up of *Ilukumae* and *Ilaiser* sub clans.

The community has an age set system of social organization. The first age group according to a key informant was *Iltalala*. This is the age group that migrated from Kerio valley and settled in Kinangop. *Ilpeles* was the next age group and the one that continued the journey from Kinangop to settle in their present location in Kajiado. Other subsequent age groups are *Iltuati*, *Iltraenkolong*, *Ilmishuki*, *Iloshoron*, *Ilmaridani*, *Ilnyangusi* (the key informant's age group), *Iseuri*, *Irkitoip* and *Ilkeshiro* in that order. There is an interval of approximately twenty years between age groups.

The Maasai are traditionally polygamous but this tradition is slowly dying out as it has become increasingly difficult to maintain a large number of wives and children. Most of the younger men now have one wife and send all their children to school, in contrast to older men who still selectively send only the male children to school. This then results in girls getting married at a very young age as soon as they are initiated. The younger the age at which the girls get married, the higher the likelihood of having many children, and there are records of women having as many as 12 children. In the past it was easy for a man to marry several wives because it was also easy to maintain large herds of cows, but the number of animals kept by each family has reduced drastically in recent years. This is due to several factors, mainly, a rise in population and a shortage of pasture for the animals. The Maasai keep cows, goats, sheep and donkeys. The large numbers of animals required by the Maasai to maintain their livelihood, the effects of climate change and their displacement from the Northern grazing lands have all contributed to a change in their subsistence to a certain extent. The private ownership of land and fencing off what was once accessible grazing lands have restricted the movement of the Maasai in search of pasture for their animals, with the result that they lose nearly all their animals during droughts. Their diet now no longer consists of milk, meat and blood, and they have to rely on other Kenyan staple foods such as *ugali* and beans.

7.11 Economic profile

The economic baseline profile demarcates the employment levels and labor force, housing, transport, services, and crime to provide an overview of the economic context of the study area. The household remains a major economic production unit. Increasingly women also join into economic activities especially for predominantly polygamous Maasai households.

Male sons are considered economic assets as they inherit both land and livestock which are the main production units. Male children also provide labor services to the household production units.

7.11.1 Masai household as a production unit

Like many pastoral societies, the Maasai community in the project area comprises autonomous family production units or households, the size of which is determined by the labor needed to manage the herds and flocks that support the household. These households compete for pasture and water; the more livestock a household has the larger the part of the common resources it exploits. However, in other ways the pastoral households cooperate; in the past they organized to fend off aggression or to wage war to acquire more resources. In times of stress they cooperate to assist less-fortunate households by giving them food and loaning them animals. Individual households are thus the basic units of pastoral production, and their production activities, decisions and interactions with society and the environment were the focus of the study reported here. A household is here defined as an independent male producer and his dependents.

Each pastoral producer manipulates the resources under his control to provide subsistence for his household and ensure its viability during periods of drought. If he succeeds he increases his social status and may accumulate wealth and gain prestige. The household's livestock are thus the basis of its material and social well-being.

7.11.2 Maasai Livestock in the project area

Livestock holdings in this study refer to the number of animals under the management of the household. These include livestock not yet owned by a son, or those borrowed or allocated but not transferred to sons living independently in *bomas* other than those in which their fathers resided.

Livestock are an important medium of social exchange for the Maasai. A pastoralist with many animals can be generous to his friends and relatives giving them animals during ceremonies, when they are ill, or purely as a sign of friendship. He can help poorer households by giving or lending them animals. A man with many animals can afford to marry more wives and have more children. He can also take in impoverished friends or relatives as dependents, adding to his prestige and his labor force. The Maasai believe that a successful man is like a tree on a hot sunny day; he shelters many people under his shade.

Pastoral households interact with each other through livestock and resource management activities. The inter-household interactions begin with encampments *(bomas),* and grow into larger units of neighborhoods, clans, sections and tribes.

A primary livestock production goal for the Maasai is to produce milk for consumption by the household; little milk is usually sold. Animals are sold for cash primarily to buy subsistence goods, services and production inputs. Cash may also be lent or given to relatives and friends as part of social transactions.

The productivity of the Maasai pastoral livestock production system depends largely on animal management, availability of water and the distribution, productivity and quality of forage. Forage and water resources are largely determined by the geomorphology and soil types of the grazing area, altitude and rainfall. Of these, rainfall has the greatest effect on forage production. The amount and distribution of rainfall received in Kajiado rangelands vary widely between seasons and years and results in large fluctuations in forage productivity, and hence in livestock productivity.

7.11.3 Employment level and labor force

A large number of Maasai men are employed to graze cattle and a number of children miss school to graze cattle. The economy is less diversified and limited subsistence agriculture is seen in most household compounds mainly due to lack of skills or water. There is a particularly high level of people who are ‘Not Economically Active’, or work in the urban centers around the area. Women are increasingly involved in handmade Maasai artifacts for sale mixed with keeping their sheep and doing household activities.

The individual monthly income is mainly generated from livestock farming and most Maasai would not give you a clear statistic of the number of livestock they have. However the rich ones are known and talked about by the amount of land bought and the number of livestock in their farms. Initial household studies show approximately 59% of household monthly incomes in the region of KShs 10,000 to 20,000 mainly from the sale of livestock. However the larger richer households have higher monthly incomes.

7.11.4 Housing

The most common type of materials used in many households is corrugated iron sheets (*mabati*) for construction of their homes. The traditional Maasai *Manyatta* house is still found in all households where there is still the older generation of parents. All houses are owned, self-constructed and fully paid off. There has been an increase of "NEW" mabati houses as the proposed wind energy project continues to make payments for land leases. However there are also a large number of new houses as a result of sons building their "*bomas*" in land pieces inherited from their parents. The number of Stone Houses is also on the rise but mainly for the more established locals working in the surrounding urban areas, or White residents who have bought pieces of land in strategic locations and constructed tourist-attractive homes.

7.11.5 Utilities and services

Most of the population residing in the project area has limited access to water in the form of household water inside their dwellings. However it was observed that the construction of water tanks and rain-water harvesting is on the rise. The majority of the community residing in the project area has access to the Esilanke Dam within some distance to their households and others still have to use the local streams to access water. There is increasing privatization of water use from private dams as is grazing land. Community water dams are also being built. Initial results show sanitation levels are still low with 'Bush' still being the main toilet facility.

Firewood is required for basic needs such as cooking, heating and lighting. A large population approximately 99% residing in Kipeto area use paraffin for lighting and firewood for cooking. There is a significant expectation that the local community will have access to electricity in their homes once the proposed wind energy facility is completed.

7.11.6 Transportation services

According to observations and interviews, the predominant mode of travel which individuals use to travel to work and school is by foot (60%). This is followed by travel using a private vehicle of a local (30%), and by car as a driver (6.2%). The time taken for local travel on foot is a large burden especially on women and men and also on school going children. The distances covered are large per day. Being a passenger in a private vehicle is used for travel to local towns. However, there is still the requirement to upgrade much of the local road infrastructure and the Project will significantly change this. Transport is therefore a constraint to employment in terms of access.

7.11.7 Communications

Cell phones are the main mode of communication and the most widely held asset in each household. Almost everybody owns a mobile phone. 100% of the households said they have a mobile phone, while almost 99% said they own a radio while only 10% said they own a television.

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8 Procedures and processes to be used in the implementation of the project

Section 8 of this ESIA Study describes in detail the construction phase technologies, procedures and processes to be used in constructing the proposed wind energy facility.

This section highlights the procedures and processes that will be used for development of the wind energy facility including:

- Site selection process;
- Project feasibility process;
- Detailed assessment;
- Planning application;
- Construction process; and
- Operational process.

The section describes the steps that will be taken for development of the wind energy facility for Kipeto Energy Limited and provides an overview of the various aspects that play a role in the development of the proposed wind energy facility.

For the proposed project, Kipeto Energy Limited has appointed two professional companies listed below for the engineering and ESIA work including the permitting process associated with the wind energy facility.

Galetech Energy Developments Limited: is an Irish based company specializing in wind energy projects worldwide. Galetech are the project managers for the wind energy project in Kajiado

Kurrent Technologies Ltd.: is a Kenyan based company specializing in providing complete energy solutions for clients in sub-Saharan Africa. Kurrent Technologies Ltd. has been appointed as the Firm of Experts to undertake the Environment and Social Impact Assessment (ESIA) Study of the proposed wind energy facility in Kajiado.

This section of the ESIA Study is divided into the areas outlined below.

- Technical and commercial considerations: Provides the various technical aspects of the wind energy facility in Kajiado including wind speed, accessibility, infrastructure and construction issues.
- Environmental and social considerations: Includes the environmental and social analysis of the Kajiado wind energy facility project site.
- Public/stakeholder consultation process: Provides the processes that have been adopted for engaging the project affected communities and land owners, Government lead agencies and other stakeholders in the Kajiado area associated with the proposed wind energy facility.

8.1 Kipeto Energy Limited

Kipeto Energy Limited is a special purpose vehicle for development of a 100MW wind energy facility in the Esilanke area of Kajiado. Its shareholding is made up of General Electric of the USA (GE), Craftskills Wind Energy International Ltd. (CWEIL) – a Kenyan wind energy company and, the Masai community in the Esilanke area.

GE is one of the world's largest companies and will supply the wind turbines for the proposed project. GE is proposing to use their GE1.6-100 model of wind turbines for the project. This is the latest model of GE wind turbines and is the world's most efficient wind turbine with the highest capacity factor in its class – 53% at 7.5 m/s.

CWEIL is charged with the responsibility of signing up leases with land owners in the project area where the wind turbines will be erected and installed.

8.2 Site selection process

The first step in the development of a wind energy facility is the site selection and the process involves looking at a chosen area in order to identify one or more sites which may be suitable for development. During the screening process, the developer identifies suitable sites and further defines and technical, commercial or environmental constraints in order that only the most favorable sites are taken forward.

8.2.1 Technical/commercial considerations

The initial site selection process for the Kipeto Wind Energy Project was done in 2008/2009 by CWEIL following extensive consultations with the Ministry of Energy on potential sites for wind prospecting in Kenya. Subsequent to the consultations, CWEIL identified the Esilanke location of Kajiado district as an area for prospecting for wind energy. On August 12th, 2009, the Ministry of Energy approved an Expression of Interest by Kipeto Energy Limited and granted them the "non-renewable rights of first refusal" to prospect for wind energy in the Esilanke area.

Subsequent to the above, Kipeto Energy Limited undertook an initial technical analysis of the project including:

- Desk-top and literature reviews to establish the estimated wind speeds in the area;
- Engaging Kenya Power to evaluate whether an electrical connection to the national grid is technically and commercially feasible;
- Undertaking a desk-top and physical study tour of the project area to understand the local road network in order to understand the likely access constraints to the proposed site; and
- Consideration of how land for the wind energy facility will be acquired or leased.

Subsequent to the above, Kipeto Energy Limited appointed Galetech Energy Developments of Ireland in March 2011 as Project Managers for the wind energy facility. In June 2011, Kurrent Technologies Ltd. was appointed to undertake the EIA Study for the proposed project.

8.2.2 Initial environmental considerations

Concurrent with the technical considerations, proponents should consider the environmental and social acceptability of potential sites for wind farm development. One way of achieving this is by undertaking an Environment and Social Impact Assessment (ESIA) Study of the project.

In the early stages of site selection, proponents should endeavor to address the range of environmental and social issues at a preliminary level and which could limit the environmental and social acceptability of the project.

During the environmental site selection screening process, Kipeto Energy Limited undertook desk-top and field studies associated with the following environmental and social aspects:

Visual aspect: The proponent assessed the visibility of the proposed site and the potential visibility of the proposed development from perceived public viewpoints;

Proximity to households: The Masai community within the Esilanke area are both monogamous and polygamous and subsequently field visits were conducted to evaluate locations of wind turbines without unreasonably affecting the amenity of the dwellings within a household through noise, shadow flicker ,visual domination ,etc.;

Terrestrial ecology: In selecting the location of the proposed wind energy facility, the proponent took account of the existing information relating to both ecological designations and particular protected species found in the project area;

Archeological/cultural heritage: The Masai community has a rich cultural heritage and the Proponent engaged the community about the project at the early stages of the site selection process. Fortunately, the Masai community in the project area is supportive of the proposed wind energy facility in their community;

Telecommunications: There are three telecommunication masts which are installed within the project area and clustered together. This is the only commercial operation identified within the project area. The proponent considered the impact of their proposed wind energy facility on the three telecommunication masts during the site selection process.

8.2.3 Initial public/stakeholder consultation

Kipeto Energy Limited has from the onset had engagement sessions with the Ministry of Energy, land owners in the project area, Ol Kejuado County Council, NEMA among others.

The engagement sessions have been fruitful in explaining the proposed project to the communities residing in Esilanke and getting their approval for signing up land leases for the wind energy facility.

8.3 Project feasibility process and procedures

During this phase, Kipeto Energy Limited undertook further examination of the proposed wind energy facility including:

- On site wind monitoring to determine a draft design layout for the project; and
- An Environment Project Report (EPR) Study to identify specific environmental constraints and opportunities prior to undertaking the detailed ESIA.

During the feasibility stage, Kipeto Energy Limited continued engaging the communities in the project area.

8.3.1 Technical/commercial considerations

The technical and commercial considerations in the site selection process are usually desk-top based with limited site visits. During the project feasibility stage, the focus of the technical work will be on gathering site specific information by visiting and/or surveying the site to determine further its suitability and viability as a wind energy facility. The investigations undertaken during the feasibility stage are described below.

Wind resource: While an approximate estimate of the wind speed over the site can be obtained from databases, the sensitivity of the energy yield to wind speed requires more accurate determination by actual site measurements. At the proposed wind energy facility, three wind measuring masts each having a height of 81m were installed by Kipeto Energy Limited at different locations within the project area to collect wind data.

Approval was sought and granted by the Kenya Civil Aviation Authority (KCAA) on March 11th, 2011 for erecting the masts with conditions. The individual land owners on whose property the masts are erected consented to them and also provide the security for them. Data gathered from the wind measurement will be entered into specialized computer modeling software to enable more accurate wind resource to be established in the project area.

Ground conditions: The ground conditions at the proposed wind energy facility have been examined in more detail to consider whether construction of the foundations for the wind turbines, erection of the machines and provision of access roads is practical and economic.

Access roads: The construction of a wind energy project requires access by heavy goods vehicles to the site. Subsequently access to the site must be assessed to determine the suitability of existing public and private roads and what improvements may be required to serve the development.

During the feasibility stage, Kipeto Energy Limited conducted a preliminary assessment of the potential access roads that could be used for transporting the various components of a wind turbine between Mombasa and the project site.

Grid connection: During the feasibility stage, the developer assessed the possible routes for and the nature of the connection to the existing national grid including the location of the sub-station.

For the proposed wind energy facility, Kipeto Energy Limited engaged Kenya Power on possible interconnection points to the national grid. During the feasibility stage, the Kenya Power Isinya sub-station and Nkoroi sub-station were identified as possible grid connection points. However, these two alternatives were not feasible and a new sub-station location at Ngong was identified as the preferred grid connection point for the project.

Preliminary project design: The Firm of Experts undertook a comprehensive household survey to physically map household information including GPS coordinates of dwellings within a household.

On the basis of the above factors during the feasibility stage, the developer determines the scale of the wind energy facility. Kipeto Energy Limited considered the range of design and layout options for the project including turbine sizes and numbers.

8.3.2 Environment Project Report (EPR)

During the initial site selection process, the screening process for site selection included environmental parameters. During the feasibility stage, a scoping study is undertaken to identify the environmental issues that will be studied in more detail during the ESIA phase.

The EIA Regulations in Kenya require that a proponent undertake a scoping study to agree the scope of the environmental assessment required during the detailed ESIA phase. This is referred to as an Environment Project Report (EPR) Study and was undertaken by Kurrent Technologies Ltd. with the report submitted to NEMA for consideration.

8.3.3 Public/stakeholder consultation

Public/stakeholder consultation is a continuous process throughout the project life cycle. During the feasibility stage, Kipeto Energy Limited continued to engage the communities in the project area through public meetings.

The public information provided during this stage gave a clear indication of the future stages of consultation and development process to enable individuals know what opportunities are available for commenting on issues of concern to them. During this phase, Kipeto Energy Limited also provided information to the communities in the project area about the detailed environmental studies that would be undertaken for the project. Communities in the project area were encouraged to provide their views as part of the social impact assessment process for the project.

8.4 Detailed assessment process and procedures

A wind energy facility developer will only undertake a detailed assessment of the project if the site selection process and feasibility studies indicate that the project is commercially and environmentally viable.

8.4.1 Technical/commercial considerations

Throughout the detailed assessment phase, Kipeto Energy Limited has continued to gather wind monitoring information and continued to re-appraise the economic viability of the project.

8.4.2 Wind turbine selection

Generally the wind speed profile determines the choice for a wind turbine, while the supply of wind influences the relative dimensions of the rotor, generator and shaft height.

The wind turbine proposed for the proposed wind energy facility is the GE1.6-100 which incorporates the latest GE technology for wind turbines in that class. Some of the features and benefits of this model of turbine include:

- High Annual Energy Production (AEP);
- Highest capacity factor in its class;
- Designed to meet or exceed the 1.5 MW platform's historic high availability;
- Grid friendly options are available - Enhanced Reactive Power, Voltage Ride Thru, Power Factor Control;
- Wind Farm Control System; WindSCADA™;
- Sharing of components with family products;
- Ultra-quiet power production Low Noise Trailing Edge serrations; and
- Available in both 50 Hz and 60 Hz versions for global suitability.

8.4.3 Environmental considerations

Where the NEMA believes that the proposed wind energy facility is likely to have significant effects on the environment by virtue of factors such as its nature, size or location, then it may require the developer to undertake a detailed ESIA Study.

For the proposed project, the NEMA approved the TOR on December 7th, 2011 for the ESIA Study and asked the developer to undertake a detailed environmental assessment of the project.

A number of baseline studies have been undertaken for this ESIA Study as outlined below and have been used to predict the environmental impacts and propose mitigation measures.

Visual Impact Assessment (VIA): A VIA describes the existing landscape and the potential landscape and visual impact of the proposed development. A "Zone of Visual Influence" is created (and a map produced indicating where the wind energy facility will be visible from) and photomontagesrepresenting views of the wind farm from specified locations. The photomontages for the proposed project were taken from important and representative viewpoints from which the visual impact of the wind energy facility could be assessed. The viewpoints selected included local settlements and included a range of distances from the proposed project. A specialist report is appended to this ESIA Study for visual impact assessment.

Noise assessment: The recommended distance between residences and a proposed project will depend on a variety of factors including local topography, the character and level of the local background noise and the size of the development. For the proposed project, the wind energy project designers have allowed a 750m buffer zone to prevent noise impacts to dwellings within the project area. A noise impact assessment has been undertaken for purposes of this ESIA Study and the specialist report is attached as an appendix to this report.

Terrestrial ecological assessment: The flora and fauna found at the proposed wind energy facility should be considered in relation to the loss of habitat, to their sensitivity to disturbance and to their importance nationally. As part of the ESIA Study, an ecologist was engaged to undertake a baseline study of the flora and fauna in the project area.

Ornithological impact assessment: Ornithology is the scientific study of birds. For wind turbines, ornithology is important due to the potential collisions of birds with wind turbines while in-flight. For the proposed project, a seven month study of bird movements over the project area was undertaken and is ongoing. A specialist report was produced and is attached as an appendix to this ESIA Study.

Archeological and cultural heritage assessment: This ESIA Study has considered the archeological and cultural heritage associated with the proposed wind energy project including the likelihood of further, as yet undiscovered remains. The physical impact of the proposed wind energy project has further been examined and a specialist report appended to this ESIA Study produced.

Soils and geology: The soils and geology should be described in relation to the surficial and bedrock geology found in the project area. This information will be useful when undertaking the detailed geotechnical investigation prior to the commencement of construction to determine the size of reinforced concrete foundations for each wind turbine tower. For the proposed project, a specialist soils and geology report has been developed and is appended to this ESIA Study.

Hydrological assessment: An assessment of the impact of the proposed development on water courses is necessary. For the proposed project, a hydrological assessment has been conducted and is appended as a specialist report to this ESIA Study.

Transport assessment: Turbine parts are usually large and heavy and some of the components may require transportation using special permits. A number of turbine parts require to be transported on purpose built vehicles which are unavailable in Kenya. A single turbine could potentially require up to eight one-way truck trips to be made for transporting the various parts. Due to the heavy nature of turbine components, an evaluation of the transport route needs to be undertaken. For the proposed wind energy facility, a transport assessment has been undertaken to evaluate the above aspects and impacts and the report is appended to this ESIA Study.

Electrical grid connection: Parallel to the wind energy facility, transmission lines will be installed to the nearest suitable Kenya Power electrical sub-station. Careful account should be taken of the potential impacts on the environment and on land use and appropriate measures should be taken of the potential impacts on the environment and on land use. Appropriate measures should also be taken to avoid unnecessary adverse impacts during installation of the line.

A separate ESIA Study will be required for the transmission lines emanating from the proposed wind energy facility to the selected and agreed upon Kenya Power sub-station. This ESIA Study report does not include the environmental and social impacts associated with the transmission lines from the Kipeto wind energy facility to the selected Kenya Power sub-station.

Effects on local economy: The ESIA Study should endeavor to estimate the number of temporary or permanent jobs created and the value of contracts available locally.

The proposed wind energy facility of 100MW capacity is the first one of its kind in Kenya and it is unknown at this stage how many temporary or permanent jobs will be created. However the proponent will provide the first opportunity for employment to the local youths and communities in the project area on the basis of the skills-set available.

8.4.4 Public/stakeholder consultation

The developer should maintain a continuing dialogue with the appropriate statutory and non-statutory consultees and the public throughout the ESIA process.

For the proposed wind energy facility, public/stakeholder consultation has been an on-going process. Public meetings with the provincial administration and local land owners were held throughout the detailed environmental assessment phase. Additionally focus group discussions and key informant interviews were held over a six month period.

The public/stakeholder consultation process will continue into the pre-construction, construction and operational phases of the project respectively.

8.5 Planning application process and procedures

On completion of all detailed environmental and social specialist studies, the Firm of Experts compiles an ESIA Study for consideration by the NEMA. The completed ESIA Study is submitted in ten hard copies and one soft copy format.

The NEMA forwards a copy each of the ESIA Study to ten lead agencies associated directly or indirectly with the proposed project for review and comments.

Additionally the proponent is required to place advertisements for one day in two consecutive weeks in a national newspaper and the Kenya Gazette. This is to allow the public to view the ESIA Study deposited in various offices and provide their comments on the project.

The public review period is usually given as thirty days from the date of the first advertisement, however it is not uncommon for the NEMA to allow ninety days for the review. During this period the NEMA can call for a public hearing associated with the project and/or can form a Technical Advisory Committee (TAC) to review the ESIA Study.

On completion of the ESIA Study review period, the NEMA provides conditional approval of the ESIA Study. The proponent is required to accept the NEMA conditions and on formally doing this is issued with an EIA License.

8.6 Construction phase process and procedures

Environmental considerations will continue into the construction phase of the project and the developer will refer to the ESIA Study and NEMA conditions under which the EIA License is granted.

8.6.1 Technical considerations

In view of the number of separate contractors involved in the construction works for a wind energy project, Kipeto Energy Limited will identify an individual with responsibility for site management. This individual will have responsibilities for all aspects of the work. Kipeto Energy Limited will ensure that all contractors are aware of and abide by the requirements of the EIA License and any other planning conditions set by the Ol Kejuado County Council.

8.6.2 Environmental considerations

A small percentage of the total project area will directly be affected by the construction activities. The main contractor will ensure that areas of construction will be delineated and measures taken to avoid unnecessary impacts such as vehicle use on areas outside the defined work boundary.

The ecological assessment for the proposed wind energy facility has identified areas of ecological importance within the project area. Kipeto Energy Limited will ensure that such areas are left undisturbed during the design, pre-construction, construction and operational phases of the project respectively.

Similarly the contractors will avoid damage to any archeological or cultural heritage resources that they may come across during the construction phase of the project and notify Kipeto Energy Limited of such locations.

Other environmental considerations include giving due regard to those using public rights-of-way.

8.6.3 Public/stakeholder consultation

Kipeto Energy Limited will ensure that on-site and off-site works are undertaken with minimal disruptions to the Masai community in the project area. As the proposed wind energy facility is the first large scale project of its kind, it will continue to generate interest from Kenyans in general.

Subsequently it would be prudent for Kipeto Energy Limited to make provision from commencement of works for the handling of enquiries or visitors. This can be done using an information board displayed in a publicly accessible location at all times giving the name and contact details of Kipeto Energy Limited's site representative or other contact.

It is further suggested that consideration be given to the formation of a community liaison group providing the opportunity for dialogue between Kipeto Energy Limited and the local Masai community.

In the event of any comments or complaints about the construction works, Kipeto Energy Limited will be accessible to the local community and will deal with such comments and complaints expeditiously.

Kipeto Energy Limited will establish an emergency response plan for 24-hour support to the project works in case of unforeseen contingencies e.g. theft, security, etc. The emergency response plan will contain contact details of emergency and security services.

8.7 Operational phase process and procedures

The proposed wind energy facility is not expected to have significant environmental impacts during the operational phase as Kipeto Energy Limited has sited and designed the project well.

However on the basis of the environmental conditions issued by NEMA, Kipeto Energy Limited will continue to monitor any key impacts and keep relevant stakeholders informed of the results.

8.7.1 Environmental considerations

The potential environmental impacts of a wind energy project typically relate to effects on humans and the project site's flora and fauna. If it should become apparent during the operational phase that the proposed wind energy facility has a significant ecological impact, Kipeto Energy Limited will cooperate with the individuals concerned and the relevant statutory or voluntary conservation bodies to determine the nature of the problem with a view to finding a solution.

Kipeto Energy Limited will further consider having a formal process for recording and dealing with complaints from the public. The proponent will endeavor to investigate the complaints from the public and work with relevant authorities to resolve them.

8.7.2 Public/stakeholder consultation

As a member of the community, Kipeto Energy Limited will allow local individuals to raise any concerns they may have about the operation of the proposed wind energy facility. The proponent will consider nominating a local representative to whom individuals can voice their concerns. This local representative will be accessible to the local Masai community.

In order to share lessons learned and continued best practices, Kipeto Energy Limited will disseminate information about their experiences through wind energy associations, appropriate consultees and environmental/development conferences.

8.8 Decommissioning phase process and procedures

8.8.1 Extent of decommissioning

The extent of decommissioning is as follows:

The decommissioning of the wind farm is expected to take three months to complete, and will involve the following operations.

Wind Turbines

These will be removed from the site entirely and their foundations substantially broken out to below ground level. All materials arising from demolition will be disposed of in accordance with relevant waste management regulations. Disturbed areas will be covered in topsoil and seeded with an appropriate local mix.

Cables

Wind turbine interconnecting cables will be de-energised, cut, ends removed and left in place at their placement depth. This is considered less damaging than their complete removal. Cable marker signs will be removed.

Switchroom

The decommissioning of the switchroom will involve the removal of fencing, the switchroom container and then demolition of the foundations to below ground level. Disturbed areas will be covered in topsoil and seeded with an appropriate local mix.

Access Tracks

Although removal of the site access tracks is feasible the process of track removal (considering the considerable intervening time for track reinstatement) may cause more environmental damage than leaving them in situ. It is proposed that decisions on their removal be undertaken at the time of decommissioning in conjunction with the landowner and local planning authority. In the meantime, the tracks will have provided a useful means of access to the land for the lanowners.

8.8.2 Decommissioning process

The decommissioning process will comprise the following tasks:

Wind Turbines

1. Lower blades;
2. Lower hub;
3. Lower nacelle;
4. Lower tower sections;
5. Cut blades, load and dispose;
6. Strip out generator and gearbox and dispose;
7. Strip out sundry electrical equipment and dispose;
8. Load and dispose nacelle & yaw ring;
9. Strip out tower sections and dispose ladders; and
10. Divide tower sections, load and dispose.

Foundations

1. Break-up concrete foundation for transformer plinth, and dispose at registered site in accordance with stated regulations;
2. Back-fill with soil;
3. Break-up reinforced concrete foundation plinths for wind turbine leaving base slab in location at approximately – 1.2m, and dispose of broken concrete at registered tip/recycle site in accordance with stated regulations;
4. Burn-off holding down bolts; and
5. Back-fill with indigenous material.

Tracks

1. Scarify track surface, dress with 50mm top-soil, roll, seed;
2. Scarify for passing bays, crane hardstandings and maintenance parking area; and
3. Backfill drainage ditches with adjacent material.

This work will be restricted to areas that have not re-vegetated over the working life of wind farm. This will include the running surfaces kept bare by maintenance vehicles, and those areas purposely kept clear such as paths to turbine doors. This model assumes 25% surface area will require treatment.

8.8.3 Financial estimate

The cost of decommissioning is based on the value of turbine at decommissioning, less:

- Cost of taking down turbine
- Transporting turbine off site
- Reinstatement of civil works on site

As a guide (using European examples):

Value of 20 year old used turbine: KES 22,000,000

Less – Cost of taking down turbine KES 4,300,000

Less – Cost of transporting turbine off site KES 4,300,000

Reinstatement of civil works around turbine (i.e. topsoil over roads, hardstands & foundation – also break down foundation to below surface level) - KES 5,500,000 per turbine.

Therefore based on the above calculation decommissioning the proposed wind farm would cost KES 355,100,000.

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9 Construction phase, procedures and processes for implementing the project

This section provides a description of the various construction processes that will be used in constructing the proposed wind farm. Descriptions of the facilities that make up the footprint of the wind energy facility are described below.

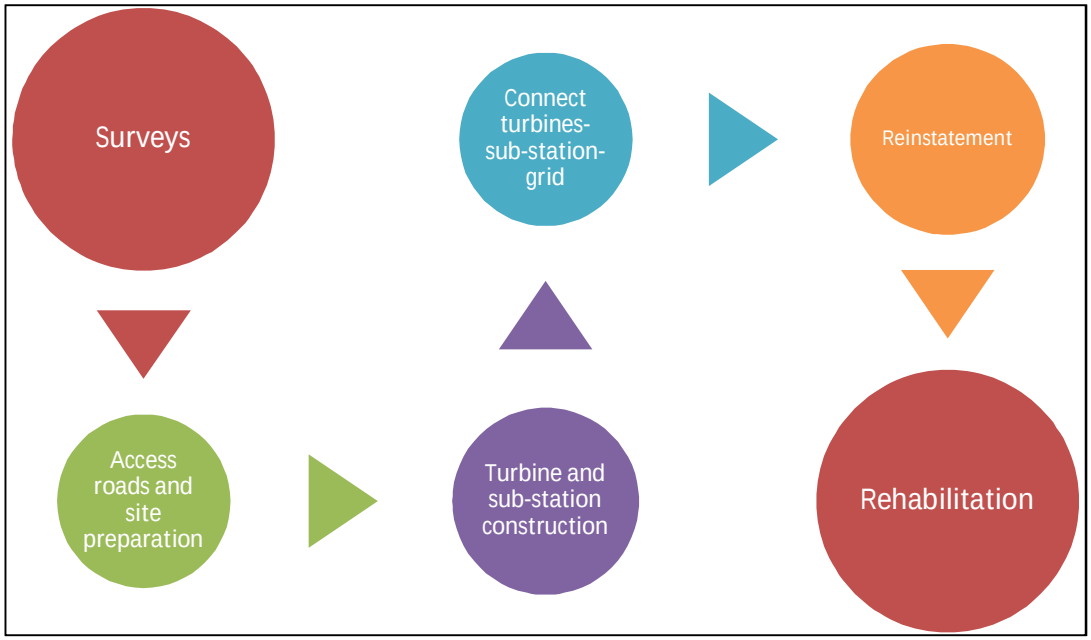
It is anticipated that there will be 67 wind turbines to be installed at the wind energy facility with a total construction period of about 12 months. As the Kenyan construction industry is a labor intensive one, it is envisaged that there will be direct employment created for skilled, semi-skilled and unskilled workers during the construction phase of the project. It is further envisaged that specialist construction teams will be required for erection of the wind turbines.

There will be a limited number of workers accommodated at the project site during the construction phase as the neighboring towns of Kajiado, Ongata Rongai, Kiserian and Isinya will be able to provide labor for the project that resides in these towns. The specialized construction teams for erection of the wind turbines may also be housed in hotels within these towns. Subsequently workers will be transported to and from the project site on a daily basis. Overnight on-site worker presence would be limited to security staff.

Construction is envisaged to begin in the second quarter of 2013 if all project approvals have been acquired from relevant lead agencies, a construction permit issued by the ERC and a Power Purchase agreement signed with Kenya Power.

The construction of the proposed wind energy facility and associated infrastructure will involve a number of activities listed below.

Figure 9-1: Construction process for the proposed wind energy facility



9.1 Conduct surveys

During this phase of construction, the following types of surveys will be undertaken:

- Geotechnical investigation to determine soil strengths for the wind turbine foundation, access tracks, crane hardstandings and substation;
- Site survey and confirmation of the turbine micro-siting layout;
- Survey of internal access roads;
- Survey of the sub-station location; and
- Survey of transmission line from the wind energy facility to the a national grid sub-station.

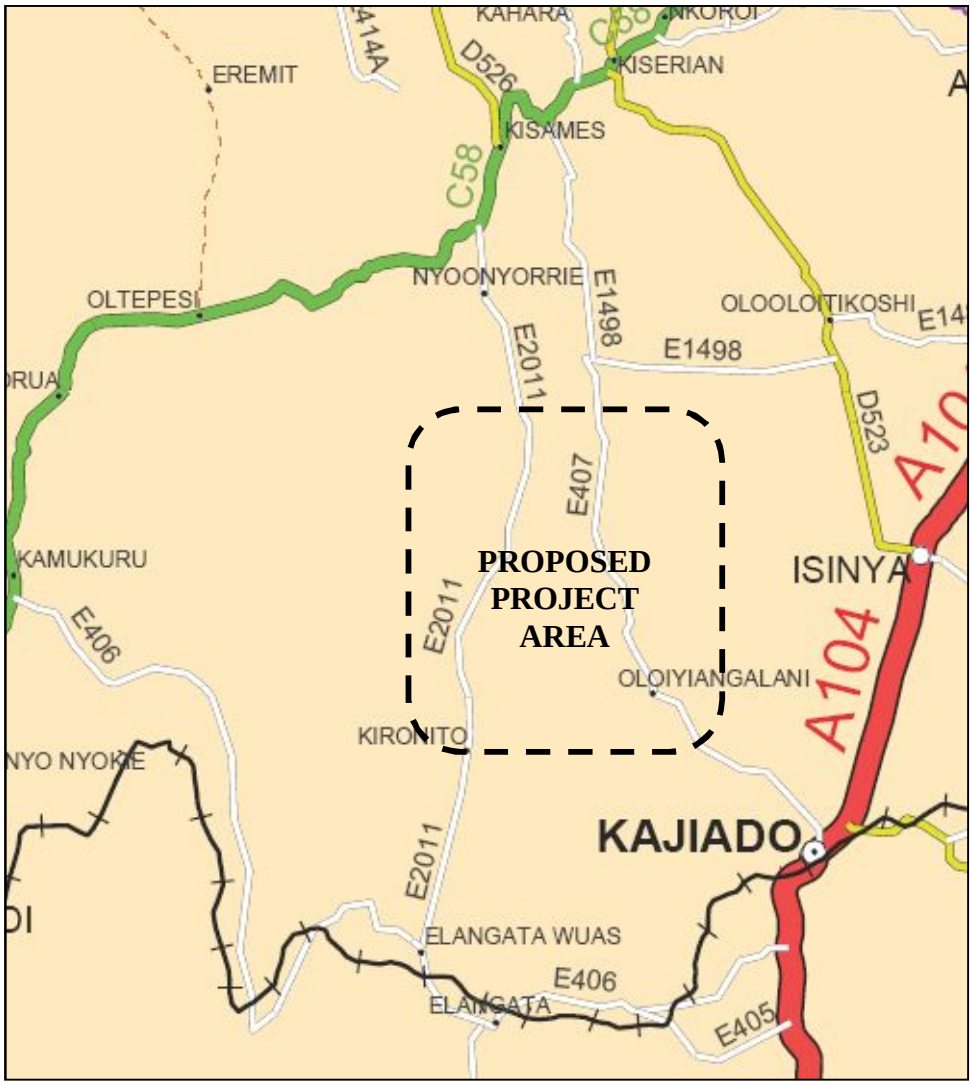
9.2 Establishment of access roads to the site

The proposed wind energy facility can be accessed by the following roads:

- Athi River – Namanga Highway (A104) turning off at the Kajiado town and heading along the E407 to the project site;
- Magadi Road – Kona Baridi junction, then onto the E1498 and E407 to the project site; and
- Kiserian – Isinya road to the E407 junction.

A map showing these roads is given in Figure 9-2.

Figure 9-2: Map showing access roads to the project area



Within the site itself, access will be required between the turbines for construction purposes (and for maintenance purposes in the operational phase). The tracks will be surfaced and designed to standards that ensure control of water and integrity of the road surface.

The design requirements are for a road capable of carrying large vehicles approximately 50m long and capable of sustaining the construction and operational phase traffic to the project area.

Permanent internal roads will require a minimum width of 5-6m although these may temporarily increase during the construction phase. The road width will be increased proportionately for bends and passing/turning places.

Roadside drains will have a depth of not less than 250 mm below the formation edge and a longitudinal gradient of not less than 2%. Catch pits, settlement ponds and filters will be provided in and adjacent to the drains to avoid pollution and sedimentation of watercourses. Roadside drains will not be led directly into watercourses. Further description of track drainage appears in Section 8.9 (Control of Water) below.

The road alignment and gradients will be set out to fit existing landforms as far as possible and shall be marked out prior to commencement of the works.

Cut–and-fill operations will be designed to achieve a good balance where possible and will be designed to cause the minimum amount of impact to the area. Surface soils will be used to dress the slopes and verges if required. Three bridges will be constructed to enable vehicles carrying wind turbine components to move without encumbrances.

9.2.1 Widening of Existing Roads

A site walk-over would be conducted and any soft or rutted areas identified and dealt with prior to any large construction plant arriving. Sections of track requiring minor widening will be excavated to a suitable formation. The excavated material will be either stockpiled adjacent to the tracks or transported to the borrow pit areas to be used for final reinstatement. Rock will be transported from the borrow pit to the point of deposition and widening undertaken in line with the specification set out by the Ministry of Roads and Public Works.

Selected smaller material from crushing operations will be used to finish off the tracks to the required profiles and to provide a smooth watertight running surface. Several sections of track may require widening in areas with steep cross falls. Areas requiring fill to be placed to comply with longitudinal gradients will be designed to minimize the overall footprint of the embankment.

9.2.2 New Access Track Construction

The new access track construction will follow the same design principle as the road widening. Areas of cut-and-fill will be designed to achieve a suitable balance. The track footprint will be designed to cause minimal disruption.

In areas clear of trees, the area will be cleared of all vegetation and surface soils and set aside for reinstatement. Material removed from cuttings will be hauled to fill areas where suitable.

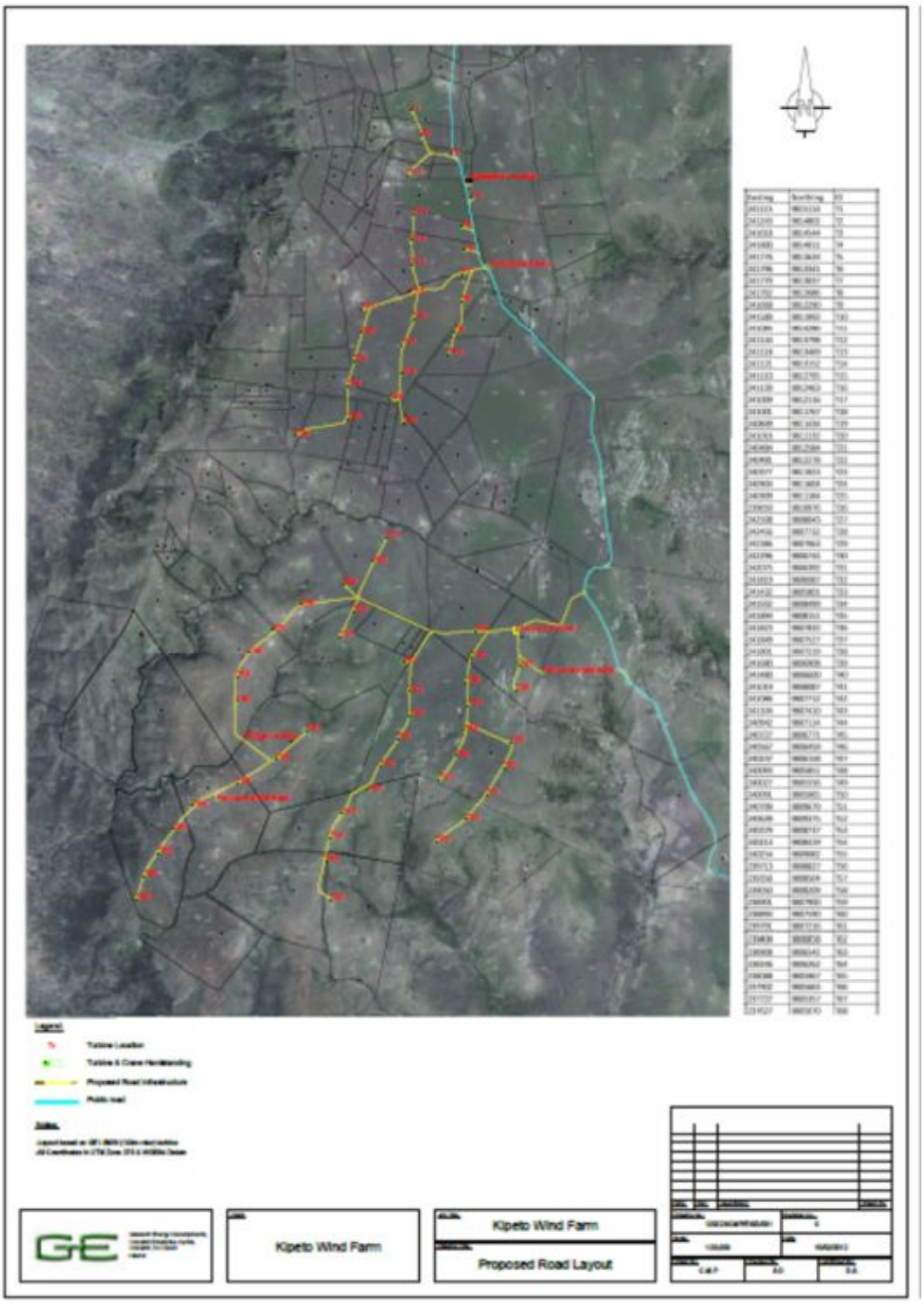
Suitable rock from either cut-and-fill or a quarry/borrow pit will be spread and compacted in layers. Final profiles will be completed with crushed material and graded to form the required profile. Selected smaller material from the crushing operations will be used to finish off the tracks to the required profiles and to provide a smooth watertight running surface.

Drainage ditches will be provided on either side of the tracks, if required (see also Section 8.9) and cross culverts will be used where necessary to minimize flow.

Culverts will either be upgraded or replaced at water crossing locations identified either on maps or physically, and any other locations along existing access tracks where existing culverts are found, in the event that the tracks at the culverts need upgrading. On new tracks, culverts will be installed on any additional channels that are not large enough to be shown on existing maps. However, these additional culverts will only be installed where there is a need to prevent significant disruption to the natural drainage pattern. One bridge will be constructed south of the site to enable the vehicles carrying wind turbine components for safe delivery.

The location of cable tracks and crossings will be considered and sections of ditch piped where required. During the construction period, the road drainage will be planned in such a way so as to minimize the production of silty run-off water. A preliminary layout of the access tracks is given in Figure 9-3.

Figure 9-3: Preliminary layout showing proposed access tracks



9.3 Site Compound

During the construction period, a civil and an electrical construction compound may be required; this will include a laydown and storage area for components of the wind energy facility awaiting installation and for equipment required for that installation.

Surface soils will be excavated and set aside for reinstatement on completion of the project. These soils will be separated following best practice for re-use. Any existing drainage ditches will be diverted around the extent of the compound where necessary. Unsuitable soils will be excavated and stockpiled until a suitable formation is reached.

As the final grid connection route selected by Kipeto Energy Limited is in Ngong town towards the north of the project area, the electrical construction compound will be located north of site. Dependent upon the civil contractor's design, geotextiles may be placed where required to ensure optimal weight distribution. Rock excavated from the borrow pits and/or the cut–and fill operations will be spread and compacted in layers. Finer crushed rock will be used in the final layers to provide an adequately smooth running surface.

Appropriate pollution control measures will be used as determined by the civil contractor.

Welfare facilities will be provided in accordance with the Occupational Safety and Health Act, 2007 and the Public Health Act. Facilities for waste management, refueling, power, water supply and chemical storage will be provided. All welfare facilities will be provided for the duration of the construction; during the operational phase of the project, welfare facilities will be provided in the permanent control building depending on the final grid connection and hence substation location.

9.4 Borrow Pit

Borrow pits and/or quarries will be identified during the detailed engineering design stage of the project.

In general, borrow pits are usually worked in strips to ensure that only enough aggregate for the project is obtained, and to limit the impacts of the borrow pit to as small an area as possible. A borrow pit design and restoration plan should be produced prior to commencement of the work. Any top soils and sub-soils will be separated and progressively stored in a temporary storage area. The storage mound should also be terraced, where possible, to ensure stability. All temporarily stored materials shall be utilized in the restoration of the borrow pit.

9.5 Crane Hardstandings

Crane pads are required to provide a suitably robust and level area, upon which cranes are used to lift turbine components into place.

The location of the crane pads will be optimized to make best use of the existing topography where possible, and chosen erection procedure. As with access tracks, topsoil and sub-soils will be excavated and stored for later reinstatement.

The area will be set out to the required dimensions and excavated to a suitable formation. Plate bearing tests will be conducted at regular intervals across the excavation to prove the bearing capacity of the underlying strata.

Coarse rock fill will then be placed and compacted in layers using compaction equipment. Grading is likely to be carried out to determine the compaction methodology. Geotextile matting to facilitate better distribution of weight may be used depending on the suitability of the underlying strata.

The final surface will be formed from selected granular material and trimmed to allow surface water run-off, to drainage ditches (see also Section 8.9 below).

Crane pads will be formed as the construction of site tracks progress. However the pads may be formed initially to provide lay-down areas for materials associated with wind turbine foundation materials and finalized closer to the lifting operations.

9.6 Cable Laying

Cables are required between the turbines and the substation depending on the final grid connection and hence substation location, and will be located alongside the access tracks. The cables will be laid with minimal disturbance to vegetation and hydrology at the site where possible.

The trench will fall within the envelope of felling for the access track. The position of trenches will be marked out and the line stripped of surface soils and set aside for reinstatement. The trench will be excavated to the required dimensions and the spoil set aside for backfill if suitable. Trenches will be excavated to follow the profile of the existing ground where practical.

Typically, sand bedding will be placed and leveled following insertion of earth conductors (if required). The cable will be laid onto the sand bedding and a further layer of sand installed to provide suitable protection to the cable.

Following testing by the electrical works contractor, the trench will be backfilled and compacted in layers with suitable material and reinstated with previously excavated surface soils.

Cable ducts will be used over water crossings, under sections of track and hardstandings. When going up and down hills, the cable trenches will be bunded to ensure that the trench does not become a drain. Cable markers will be used to mark the route of cables.

In areas where cables go up/down a hill the trench will be bunded by installing concrete berms every 50m to avoid the trench becoming waterlogged during rainy periods.

9.7 Turbine Foundations

Large reinforced concrete foundations are required to support the large turbine structures. The bases will need to be constructed with minimal disturbance to the vegetation and surrounding hydrology.

The position of each wind turbine will be set out with the extent of the foundation will be marked on the ground and an allowance made for working space and shuttering. Any adjacent ditches which would convey surface water towards the area will be diverted in advance of any excavations. The required area will be excavated with the topsoil and sub-soils set aside for reinstatement.

The area will be excavated to a suitable formation and cleared of all loose, fractured rock.

Drainage ditches will be excavated around the perimeter to keep the excavation dry. An outfall ditch will be created where possible or a sump formed for pumping out of the excavations. Batters will be formed where appropriate and in cases where these are adjacent to site tracks, berms will be formed along the top edge. In some instances, it may be the case that site tracks need to be widened to allow safe passage of construction plant and vehicles.

Blinding concrete will be placed and leveled to the required dimensions and level and finished with a vibrating power screed. The base will be set out to the required dimensions and offered for inspection prior to steel fixing.

Reinforcement bar will be delivered to site and stored adjacent to the excavation. A telehandler will deposit the largest bundles of bars onto the blinding concrete to cut down on manual handling. Steel fixers will form the reinforcement cage to the required dimensions and levels as indicated on the design drawings and schedules. All steel will be adequately supported on chairs, cover blocks and tied securely. The area will be cleared of all debris prior to edge formwork being inserted.

All ducts, earth connectors, drainage pipes and bolt assemblies will be inserted in accordance with the drawings.

Once the steelwork has been partially completed, a foundation tower adapter provided by the turbine manufacturer will be lifted into the center of the foundation by a mobile crane. This adapter will then be thoroughly leveled by an engineer and tied into the remaining foundation using reinforcement bar – and designed so that it will remain at least 300mm proud of the finished concrete surface of the foundation.

Edge formwork will be positioned to the required dimensions and adequately shored. Height checks will be set where necessary and on completion the base will be offered for inspection in advance of the concrete pour.

The concrete will be delivered to the turbine locations in truck mounted mixers and discharged through a mobile concrete pump into the formwork until the required profile and level is achieved. Concrete deliveries will be slump tested and cubes taken at the required frequency for later testing. The exposed faces will be finished and an appropriate curing agent applied in accordance with the manufacturers recommendations. Covers will be applied when necessary.

Formwork will be removed on satisfactory curing and care taken so as not to damage any ducts or inserts.

Extensive earthing protection will be installed to the foundation for turbine earthing, and lightning protection. This would typically take the shape of bare copper wires laid underground from the 4 corners of the base for about 30m outwards (the actual length would be determined by the calculation completed after the electrical resistivity testing).

9.8 Turbine Erection

The components of the wind turbine (towers, nacelles and blades) will be delivered directly from the highway network via the access tracks (to the working area at the prepared wind turbine bases.

The cranes will be brought to the site in a disassembled condition. All counterweights and boom sections will be delivered by articulated Lorries.

The tail cranes will be smaller, hydraulic, and telescopic, rough-terrain cranes that may also require one or two articulated Lorries to supply the counterweights and other parts. Before moving on the site the main cranes will require disassembling to reduce the overall weight and the axle loading.

The towers will be erected from the delivery trailer onto the foundation. The heavy goods vehicles and cranes will operate from the track and the hardstanding at each base location.

The nacelle will be unloaded from its trailer and laid adjacent to the base within the base working area prior to erection on the tower using the crane.

Upon delivery, the blades will be fitted onto the rotor. The rotor assembly will then be lifted onto the previously erected nacelle by crane. Alternatively the hub may be lifted and attached to the nacelle followed by a one-at-a-time installation of the blades.

It is anticipated that the installation of each turbine will take 2 lifting days in good weather; however, the construction program will make allowance for an amount of weather downtime.

9.9 Control of Water

Control of water is of great importance during construction to prevent exposed soils eroding and silting up surrounding watercourses. It is essential that the works have little or no impact on the existing hydrology due to the ecology of the surrounding countryside.

There are two ways in which concrete pours can take place for the wind turbine foundations namely an on-site concrete batching plant or an off-site concrete batching plant. The Proponent is considering using an off-site batching plant to reduce water abstraction from existing boreholes near the project area or sinking new ones.

It is envisaged that the following quantity of water will be required for the project:

- $100m^3$ of water will be required daily for dust suppression purposes during the dry season. Assuming that construction works are undertaken 22 days in a month, it is anticipated that about $2200m^3$ of water per month will be required for dust suppression; and
- $1m^3$ will be required for curing each concrete foundation, which implies that a total of about $70m^3$ will be required in total.

The maximum water demand per month is expected to be approximately $2200m^3$. This water demand could be satisfied in one of three ways namely:

- Abstraction of water from the existing boreholes in the area after getting formal consent from the borehole owner; or
- Use of water bowsers and storage of water in tanks in the laydown area; or
- Sinking new boreholes in accordance with the Water Resource Management Authority (WRMA) requirements including maintenance of a spacing of 0.8km from an existing borehole.

During the construction phase of the wind energy facility, measures will be adopted in order to prevent silt, chemicals and/or other contaminants from being washed into existing watercourses. Areas exposed due to the removal of vegetation are more susceptible to erosion during heavy rainfall so areas will be reinstated as soon as possible to minimize this effect. Where areas are disturbed, the following measures may be implemented to minimize these effects:

- Ditches shall be provided adjacent to all roads and other operational areas, where practicable and required, and will primarily be used to hold water temporarily and to encourage infiltration/discharge into the ground locally to where the rainfall hits the ground.
- Under track drainage/pipes will be provided with associated sumps. The under track drainage will provide a means for flows to pass from a ditch on the uphill side of the slope to the downhill side of the slope.
- The level of silt in run-off during construction shall be monitored and if it is excessive in any area this can be managed by providing sumps around the problem areas. These will filter the run-off and trap silt.
- During construction of the turbine bases, hardstandings, and inter-turbine roads, drainage will be impacted either through ditches draining to mini settlement ponds (where practicable) or to infiltration trenches. These will either infiltrate the water to the ground or discharge over open vegetated areas across the site. Any watercourses where there is a risk of being contaminated by silty run-off water will be protected by silt fences as a precautionary measure.

- Silt run-off from stockpiles and excavated spoil heaps will be contained through the placement of geotextile silt fences, mats or straw bales on the downhill side of the stockpile.

Ditches will remain in place to convey surface water flows during the operational life of the wind energy facility. The ditches will therefore be seeded as soon as they have been formed to ensure their maximum effectiveness.

9.10 Reinstatement

A detailed Restoration Plan will be agreed upon with the selected construction contractor.

For the purposes of this ESIA Study, the broad restoration measures proposed for the wind energy project are described below.

General restoration will be required at turbine bases, crane pads and the construction compound together with the edges of new or widened tracks and cable routes. Specific restoration will also be required around water crossings, the control building and borrow pits.

As detailed in the various construction activities, areas will be carefully cleared and then topsoil will be excavated and stored locally. Subsequently topsoil and subsoil layers will be excavated and stockpiled for use during reinstatement. The stockpiles will be located away from surface water flows and their surfaces smoothed or covered to prevent erosion through rainfall.

Excess sub-soils will be transported for use at other areas on site, i.e. reinstatement of borrows pits.

The areas will be restored with the materials previously set aside as soon as reasonably practical.

Turbine bases will be reinstated once all cables and transformers are installed. The crane pads will be left in position for future lifting operations and if required will receive a cover of subsoil and turfs where possible. A turning head will be left for maintenance vehicles.

Site tracks and access roads will be dressed off once the drainage ditches and cable trenches are complete. Soils and vegetation will generally be kept within their natural habitat and any excess used to cover areas where available soils are minimal.

The site compound will be removed to the original formation level with all imported rock, geogrids and geotextile removed. All slabs and drainage facilities will be removed and backfilled. Previously set-aside materials will be used to backfill the area.

The works will be carried out to follow progress as much as possible. The reinstated areas will be protected so as to prevent any erosion while vegetation re-establishes.

9.11 Pollution Prevention Measures

9.11.1 Fuel and Oils

All construction plant will be in good condition with no excessive emissions of exhaust, oil, fuel or coolants. Plant operators will check machines daily for oil/fuel leaks and take appropriate action. All re-fuelling will be by an approved mobile fuel bowser using a suitable pump and hose. Absorbent material (spill kits) will be available on site and will be deployed to contain drips and small spillages. All other fuels, oils and potential contaminants will be stored within the site compound in secure, fit for purpose containers within bunded containment as appropriate.

9.11.2 Noise quality

Construction phase noise levels will be generated by construction plant and equipment such as excavators, lifting equipment, dumper trucks, compressors, generators, etc. All construction plant and equipment will be maintained in accordance with the preventive maintenance schedules indicated in the manufacturer's instructions to ensure that such equipment does not produce excessive noise and vibration. In order to minimize potential construction noise impacts, construction plant and equipment will operate about 350m away from non-involved properties during excavation of wind turbine foundations and access track construction. During the foundation/turbine erection, an approximate distance of 500m will be maintained between these activities and non-involved properties.

9.11.3 Concrete

All concrete will be delivered directly to the location of the foundation and transferred to the formwork by truck mounted concrete pump or by crane and skip method. Optionally direct discharge from the delivery truck into the formwork may be used or excavator bucket as appropriate.

Formwork will be constructed to ensure that no concrete loss occurs at joints. Any concrete loss will be either removed or contained.

All vehicles, tools and buckets will be cleaned within a designated area.

If a concrete spillage occurs during transfer it will be cleared immediately in accordance with the requirements detailed in the Emergency Response Plan.

9.11.4 Silt

A number of silt and sediment specific measures are detailed above in the respective sections, particularly where they refer to tracks or quarrying activities.

There is to be no discharge or disposal of any material directly into any river, stream or drainage ditch.

All discharges will be via settling tank or lagoon prior to discharge to the nearest watercourse. Where silty water is to be pumped out of excavations, the water will be pumped out from a sump within the excavation in order to avoid disturbance to sediments.

Where necessary a series of settling lagoons will be used to ensure that no silty water is discharged. Pumps will be small-bore and will operate continually to prevent large volumes of silty water building up in the excavation. Settled silt will be emptied into the excavation when the lagoon is removed.

Water will be prevented from entering excavations by the use of cut-off ditches where appropriate.

All site roads will be kept free of soil and mud deposits, weather permitting.

Surface water will be directed away from construction activity to avoid silty runoff entering watercourses or ecologically sensitive areas. Where there is a high risk of fines or silt washing off stockpiles their size and the duration for which they will be in such a location will be minimized as far as is reasonably practicable.

9.11.5 Waste and Litter

Contractors will be required to provide a Site Waste Management plan which will include details on waste minimization, recycling and disposal of the waste streams. The requirements of this plan will be implemented on site as required.

With respect to the control of 'litter' on site, all such waste will be collected and stored within sealed containers within the site compound and serviced by a NEMA licensed waste carrier. No disposal of litter will be permitted at other locations.

9.11.6 Site Induction and Training

All employees and sub-contractors will undergo a site induction to ensure that they are familiar with the site rules prior to any work commencing on site. In addition, the contractor will ensure that all operatives and sub-contractors responsible for handling fuel, oil, concrete or cement or other potential pollutants undergo a thorough induction program with respect to the proposed pollution control measures. The program will include, as a minimum, the following:

- Potential sources of pollution and their effects on the environment;
- Requirements of the contract and legislation with respect to pollution;
- The contractor's pollution avoidance plan;
- Traffic management and routing, including areas where access is not permitted;
- Emergency Response Plan;
- Training in the use of pollution control equipment.

9.12 Emergency Response Plan

The appointed contractors will implement an Emergency Response Plan in the event of a pollution incident.

The contractor will provide and maintain on site, suitable oil spill response kits to deal with pollution emergencies. The contractor will replenish materials which are removed or expended as soon as possible.

In the event that a spill occurs on site, the following immediate action will be taken to limit the amount of spill by isolating and controlling/stopping the source. The spill will be contained by applying absorbent material (and in the case of spillage to a watercourse) by the use of booms. Action will be taken to ensure that no ecologically sensitive area can be contaminated.

Clean-up operations can proceed by either excavation and removal of contaminated ground and mop-up material and removal from the site in a skip, for controlled disposal of hazardous waste in accordance with L.N. 121: Waste Management Regulations, 2006.

9.13 Prohibited Activities

In order to ensure the sympathetic development of the site, given below are some practices which could potentially have a negative effect on the ecology of the site following construction, and will therefore be prohibited.

- Entry of plant to or trampling of marked sensitive zones;
- Entry of plant to areas outside of designated working areas;
- Disposal of waste materials on site;
- Lighting of fires;
- Vehicles parking outside of designated parking areas;
- Interference with local wildlife; and
- Fuelling outside of designated area.

In addition, a set of site rules will be developed based on previous experience and introduced to all authorized persons working on the site. Visitors will be escorted at all times by authorized site personnel.

In accordance with best practice, disturbance of protected species sites will be avoided. Areas supporting protected species will be carefully demarcated during the construction phase. Demarcation will be by the placement of colored plastic fencing or tape to mark out areas where protected species are present and that are not to be disturbed during construction. No construction work, no vehicles or machinery and no storage of materials or spoil will be permitted within the marked off area.

9.14 Working Hours

The construction program will be based on a working week of 5.5 days, 07:00 to 19:00 on weekdays and 07:00 to 13:00 on Saturdays. Generally, night time or Sunday work will not be permitted except for security personnel. However, working at night, outside daylight hours and on Sundays may be required to disassemble, move and re-assemble the main cranes, if for any reason this work is not completed within normal working hours. It is essential that the crane movement takes place as programmed in order not to slow down turbine erection work. Furthermore, critical operations, (e.g. a foundation concrete pour that cannot be stopped before completion or the lifting of turbine parts where the work has to continue to a safe condition) may require working outside of standard hours.

The work potentially to be carried out outside normal working hours will involve operation of generators, machines and cranes.

Heavy goods vehicle access to the wind farm site will also be restricted to these hours where possible.

Floodlighting may be provided during extended working hours or periods of early darkness to ensure safe working conditions. The floodlights will be positioned in such a way as to limit light pollution in the direction of local residents. Lighting will be powered by mobile generators which will have drip traps and will be re-fuelled by an approved mobile fuel bowser using a suitable pump and hose.

9.15 Staff Movements

It is generally necessary for security guards to be present on the site. Other than the security guards, it is envisaged that there will be no overnight presence on the construction site. All personnel will meet in the morning and depart after completing their work. It is assumed that most workers will use minibuses to travel to the site, although there may be a number of private cars used to reach the site along with various contractors' four-wheel-drive vehicles.

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10 Overview of the products, by-products and wastes to be generated

This section provides an overview of the products, by-products and wastes to be generated by the proposed wind energy project. Most of these will be generated during the construction phase of the project while a limited amount will be generated during the operational phase.

10.1 Construction Phase

10.1.1 Products

The completed footprint will be the primary product of this phase of the project. The footprint will include:

- A wind energy facility comprising up to 67 wind turbines whose model is GE1.6-100;
- A sub-station where electrical power cables emanating from each of the wind turbines will terminate into;
- An administration and maintenance building; and
- A vehicle parking area.

10.1.2 By-products

By definition a by-product is a secondary product derived from a manufacturing process or chemical reaction. It is not the primary product or service being produced. A by-product can be useful and marketable or it can be considered waste.

During the construction phase of the wind energy project it is envisaged that the by-products might include any excess construction materials brought to the project site by the contractor which can be reused later.

10.1.3 Waste

During the construction phase of the proposed project, several waste products are expected to be generated. These shall include:

Domestic Wastes

- The construction workers are expected to be supplied with various forms of foodstuffs packed in plastic or other types of containers. These are expected to occur within the site area and in the immediate vicinity. The management of such waste will need to be incorporated by the Contractor in the Construction HSE Management Plan.

- Other forms of waste include sanitary waste and therefore the provision of sanitary facilities will need to be considered both for the site construction workers and the visiting population.
- Kiosks selling various items may also emerge.

Site Construction Waste

The project will generate waste from the site construction activities which includes:

- Demolition wastes;
- Excavated soils and vegetation;
- Construction equipment maintenance wastes;
- Dusts and fumes;
- Scrap metals;
- Packaging materials, etc.

Dust

The construction activities that will occur particularly during the site excavation process may potentially generate a considerable amount of dust and other particulates that will be released into the atmosphere.

Smoke Emissions

The site machinery, equipment and trucks brought in by the Contractor are expected to generate smoke emissions when in operation during the construction activities. The concentration of emissions will depend on the maintenance levels of the equipment, machinery and trucks used by the Contractor.

10.2 Operation Phase

10.2.1 Products

The primary product of the project during the operational phase will be electricity. This is the product that the Proponent will eventually evacuate to the Kenya Power from the wind energy facility. A double circuit 66kV high voltage sub-station within the battery limits will evacuate electricity to transmission lines that will be constructed for evacuating the electrical power generated by the project.

10.2.2 By-products

During the operational phase of the project there will be minimal amounts of by-products generated.

10.2.3 Waste

Domestic Waste

The daily operations of the facility buildings in which there will be occupancy will generate wastes such as papers and other sanitary wastes.

Sewage Waste

The employees of the Proponent that will be based within the project area are expected to generate sewage waste which will be channeled through an onsite sewage collection and disposal system.

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11 Environment and social impact assessment

A number of ecological, social and cultural issues associated with the proposed development have been identified by the Firm of Experts and specialists. The impacts identified in Section 11.1 below cover all project phases, that is, construction, operations and decommissioning.

Each impact identified is evaluated using a risk ranking criteria before any mitigation measures and after applying appropriate mitigation measures. In instances where impacts were not considered significant by the specialists, an assessment table has not been included.

To facilitate cross referencing, impact identification numbers have been used in the environment impact assessment and the EMP.

11.1 List of potential impacts

- ACH: Archeology and Cultural Heritage
  - ACH1: Impacts on archeology
  - ACH2: Impacts on cultural heritage
- E: Ecology
  - E1: Impacts on terrestrial vegetation
  - E2: Impacts on sensitive habitats
  - E3: Impacts on priority plant species
  - E4: Impacts on insect pollinators
  - E5: Impacts on mammals and their movements
  - E6: Impacts on herpetofauna
- SW: Surface water
  - SW1: Soil erosion and silt laden water runoff
  - SW2: Contamination of surface water
- GS: Geology and soils
  - GS1: Soil erosion
  - GS2: Contamination of soils
  - GS2: Destruction of soil structure by heavy machinery
- GW: Groundwater
  - GW1: Pollution of groundwater
- N: Noise
  - N1: Noise during construction and commissioning
  - N2: Noise during operation

- O: Ornithology
  - O1: Bird mortality and collision
  - O2: Displacement of birds from project area
  - O3:Habitat change and loss
- SE: Socioeconomic
  - SE1: Creation of employment
  - SE2: Demand for construction materials
  - SE3: Impact on transport infrastructure
  - SE4: Impacts on livestock farming
  - SE5: Impacts on local economy
  - SE6: Impacts on land value
  - SE7: Impacts on tourism
  - SE8: Impacts on education
  - SE9: Changes in social lifestyles
- T: Transport
  - T1: Damage to roads and other infrastructure
  - T2: Increased traffic and road safety hazard
- LVA: Landscape and visual assessment
  - LVA1: Impacts of landscape and visual assessment
- SF: Shadow flicker
  - Impacts of shadow flicker
- HS: Health and safety
  - HS1: Occupational health and safety
- C: Cumulative impacts
  - C1: Archeology and cultural heritage
  - C2: Ecology
  - C3: Surface water
  - C4: Geology and soils
  - C5: Noise
  - C6: Ornithology
  - C7: Socio-economics
  - C8: Landscape and visual assessment
  - C9: Health and safety

11.2 ESIA methodology

The potential impacts associated with the proposed development have been assessed using the criteria given below.

Table 11-1: Criteria for assessing significance of impacts

CONSEQUENCE

Magnitude of impact	Rating
Negligible	1
Minor	2
Marginal	3
Significant	4
Catastrophic	5

LIKELIHOOD

Frequency of activity	Rating
Annually or less	1
6 monthly/temporary	2
Monthly/infrequent	3
Weekly/life of the operation	4
Daily/permanent	5

Geographic Extent of impact	Rating
Activity specific	1
Project specific	2
Local area	3
Regional	4
National	5

Frequency of impact	Rating
Almost impossible	1
Highly unlikely	2
Unlikely	3
Possible	4
Definite	5

Impact duration	Rating
<1 month	1
1 - 12 months	2
13 - 36 months	3
37 - 72 months	4
>72 months	5

Definitions	
Activity:	Distinct process or task undertaken by an organization for which a responsibility can be assigned
Frequency of activity:	Refers to how often the proposed activity will take place
Frequency of impact:	Refers to the frequency with which a stressor (aspect) will impact on the receptor
Magnitude of impact:	Refers to the degree of change to the receptor status in terms of reversibility of the impact
Geographic extent of impact:	Refers to the geographical scale of the impact
Impact duration:	Refers to the length of time over which the stressor will cause a change in the resource or receptor

Table 11-2: Significance ratings matrix

SIGNIFICANCE

LIKELIHOOD (Frequency of activity + Frequency of impact)	CONSEQUENCE (Magnitude+Geographic Extent+Duration of impact)														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	
3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	
4	8	12	16	20	24	28	32	36	40	44	48	52	56	60	
5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	
6	12	18	24	30	36	42	48	54	60	66	72	78	84	90	
7	14	21	28	35	42	49	56	63	70	77	84	91	98	105	
8	16	24	32	40	48	56	64	72	80	88	96	104	112	120	
9	18	27	36	45	54	63	72	81	90	99	108	117	126	135	
10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	

POSITIVE/NEGATIVE MITIGATION RATINGS

Significance Rating	Value	Negative impact management recommendation	Positive impact management recommendation
Very High	126-150	Propose mitigation measures	Maintain current management
High	101-125	Propose mitigation measures	Maintain current management
Medium - High	76-100	Propose mitigation measures	Maintain current management
Low - Medium	51-75	Maintain current management	Maintain current management
Low	26-50	Maintain current management	Propose mitigation measures
Very Low	1-25	Maintain current management	Propose mitigation measures

11.3 Subjectivity in assigning significance

Despite attempts at providing a completely objective and impartial assessment of the environmental implications of development activities, EIA processes can never escape the subjectivity inherent in attempting to define significance. The determination of the significance of an impact depends on both the context (spatial scale and temporal duration) and intensity of that impact. Since the rationalization of context and intensity will ultimately be prejudiced by the observer, there can be no wholly objective measure by which to judge the components of significance, let alone how they are integrated into a single comparable measure.

This notwithstanding, in order to facilitate informed decision-making, EIAs must endeavor to come to terms with the significance of the potential environmental impacts associated with particular development activities. Recognizing this, the Firm of Experts and specialists have attempted to address potential subjectivity in the current EIA process as follows:

- Being explicit about the difficulty of being completely objective in the determination of significance, as outlined above;
- Developing an explicit methodology for assigning significance to impacts and outlining this methodology in detail in this ESIA Study. Having an explicit methodology not only forces the assessor to come to terms with the various facets contributing towards the determination of significance, thereby avoiding arbitrary assignment, but also provides the reader of the ESIA with a clear summary of how the assessor derived the assigned significance;
- Wherever possible, differentiating between the likely significance of potential environmental impacts as experienced by the various affected parties; and
- Utilizing a team approach and internal review of the assessment to facilitate a more rigorous and defendable system.

Although these measures may not totally eliminate subjectivity, they provide an explicit context within which to review the assessment of impacts.

11.4 Assessment of impacts

The key impacts identified by the Firm of Experts are evaluated in this section, according to the relevant project phases. Design and planning issues have informed the mitigation measures which are presented for the construction, operations and decommissioning phases respectively.

In applying the impact assessment methodology, the Firm of Experts used the precautionary principle to establish significance of impacts and their management and mitigation, that is, where there is uncertainty or insufficient information, the Firm of Experts erred on the side of caution.

11.4.1 Archeology and cultural heritage (ACH)

11.4.1.1 Impacts on archeology (ACH1)

No archaeological features were located or recorded on the proposed development area. Features are elements of an archaeological site that cannot be removed from the site without losing its physical integrity. Postholes, walls, and stone hearths are examples of features.

A number of archaeological artifacts were noted and collected from locations that are recorded as scattered as well as from areas thought to represent actual sites. A site is defined as a place that contains the remains of past human activity in its original context. Sites include concentrations of debris from making stone tools, artifact-filled pits, food remains and burials. Even in areas where a definite concentration cannot be located, the widespread occurrence of material is an indication of human activity, either as living, manufacturing or disposal sites. The sites found in this area have been recorded as Early Stone Age (ESA), Later Stone Age (LSA) and/or Neolithic based on the material found at each location.

The archeological artifacts found during the archeological and cultural heritage impact assessment were located below the grade level, i.e. in the subsurface. During the detailed field surveys, the proposed project area potentially exhibited at least ten Neolithic sites, many scatters that could potentially be Later Stone Age sites and five Early Stone Age sites. The National Museums of Kenya has previously undertaken minimal archeological and cultural heritage work within the project area. However, following an analysis of the artifacts collected during the field surveys, it is evident that the integrity of sites over the Ol Doinyo Narok plateau upon which the proposed wind energy facility is to be constructed has reasonable potential for archeological finds.

The main impacts to archeology could potentially arise during the construction phase when excavations for the wind turbine foundations may destroy artifacts in the subsurface. It will therefore be valuable to have an archeologist present during the excavations for the wind turbine foundations and internal access tracks/roads to be upgraded/constructed in the project area.

There will be minimal impacts on archeology during the operational phase of the project and therefore the impact is not assessed for this phase.

Construction Phase

Unmitigated Impact: Impacts on archeology				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
3	2	2	2	4
Result: Low (-42)				
Comments/Mitigation: *The proponent should engage an archeologist during the construction phase to monitor excavated areas for each turbine location to enable the recovery of any exposed artifacts. Where turbines, roads, camps or other works will be situated close to an archeological site, a buffer of 200m around the site should be maintained to minimize trampling.*				
Mitigated Impact: Impacts on archeology				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
2	2	2	2	2
Results: Very low (-24)				

11.4.1.2 Impacts on cultural heritage (ACH2)

The Maasai community in the project area comprises two major clans and several sub clans who are culturally similar. The two major clans are *Odonongi* and *Orok'kiteng*. The *Odonongi* clan comprises *Ilmolelian, Ilmokesen*, and *Irkerinkishu* sub clans while the *Orok'kiteng* clan comprises *Ilukumae* and *Ilaiser* sub clans.

The Maasai are traditionally polygamous, however this is changing as it is becoming more difficult to maintain several wives and children. Culturally, women tend to do all household chores while the men are involved in livestock farming and grazing. Young Maasai couples generally send their children to school; older couples generally send their sons to school. Girls who are not sent to school are wedded at an early age.

It was observed that the Maasai are keeping less animals nowadays probably due to the lack of grazing land and smaller land parcel sizes. Subsequently their diet is also changing from the traditional milk, meat and blood and now includes *ugali* and beans.

The proponent has paid landowners a leasehold fee and it is expected that each landowner that gets a windmill in his plot will be paid an additional amount of money. This additional income will no doubt have an impact on the cultural heritage in the project area. Additionally the 5% equity that has been given to the Maasai community in the project area will have an impact on the cultural heritage especially if the funds are not used for communal activities that retain the rich Maasai heritage.

The effects of new sources of income from the project are visible for example; some of the landowners that have received payments from the proponent for land leases now build homes made out of galvanized iron sheets instead of the traditional mud, sticks and dung.

The Maasai do not bury their loved ones in communal grounds but instead burials take place in individual farms.

Pre-Construction and Construction Phase

Unmitigated Impact: Impacts on cultural heritage				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
4	3	5	4	4
Result: Medium-high (-96)				
Comments/Mitigation: *The proponent should consider providing financial education to the local Maasai coummunity to enable them prudently manage the new sources of income arising from the proposed project.* *The proponent should also take care when excavating for foundations near known burial sites to ensure that the excavation does not exhume remains of loved ones.*				
Mitigated Impact: Impacts on cultural heritage				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
3	3	5	2	3
Results: Low-medium (-55)				

11.4.2 Terrestrial ecology (E)

11.4.2.1 Impacts on terrestrial vegetation (E1)

Grass cover comprises the largest vegetation cover in the Kipeto area and is utilized for grazing livestock. The herbivore wildlife found in the broader project area also feeds on grasses, which can easily be affected through trampling by vehicles, clearing of vegetation for road construction and foundations for the wind turbine bases. Additionally the woodland in Kipeto is an important biodiversity area for birds and wildlife; the *Acacia sp*. is a specific type of tree that is found in the savannah-woodland of Kajiado County.

During the construction phase, vegetation will be cleared for upgrading the existing E407 road, constructing new access tracks to each of the turbine clusters and individual turbine foundations. The top soil will be removed and stockpiled adjacent to the cleared area for use during reinstatement.

Additionally it is common with construction sites that earth moving equipment such as trucks can potentially introduce alien invasive species of vegetation in the proposed project area. It has been observed that roadsides of most newly constructed roads are invaded by invasive plants or opportunistic species such as *Datura stramonium* and *Parthenium*. Also, the area has *Acacia niloticus*, which is considered invasive and can take over other indigenous *Acacia* species.

There will be minimal impacts on terrestrial vegetation during the operational phase and are therefore not assessed.

Construction Phase

Unmitigated Impact: Impacts on terrestrial vegetation				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
3	2	2	3	3
Result: Low (-42)				
Comments/Mitigation: *Most of the vegetation species are of least concern to conservation in the IUCN list of threatened species.* • *Where possible, avoid destruction of trees and bushes.* • *Construction during extreme dry weather period should be avoided. If not, water sprinklers should be used for dust suppression.* • *Construction should take place when long or short rains are subsiding in the area. This will avoid uncertainties associated with runoffs. Constructing foundations and roads should not be conducted during extreme dry season as this will affect structural capacity of soil to resist erosion during subsequent rainy season.* • *Stockpiles of soil should be bunded to prevent erosion and sedimentation run-off.* • *Operating vehicles and other equipments should be cleaned thoroughly to remove sticking soils on wheels and other parts of the vehicle to avoid carrying propagules of the invasive species to the site.* • *Most of soils for compaction of murraam roads should be obtained locally to avoid incidental carrying of propagules of invasive plant species from other places.*				
Mitigated Impact: Impacts on terrestrial vegetation				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
2	1	2	2	2
Results: Very-low (-20)				

Operational phase

Unmitigated Impact: Impacts on terrestrial vegetation				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
2	3	3	4	3
Result: Low-Medium (-56)				
Comments/Mitigation: • *Livestock and wild-herbivores should be allowed to graze/browse over most of the landscape to sustain dispersal and spatial recruitment of plant species.* • *Operating vehicles should be cleaned thoroughly to remove sticking soils on wheels and other parts of the vehicle to avoid carrying propagules of the invasive species to the site.* • *In case of invasion by invasive plant species during operation phase of the project, strategies for controlling the invasive plants should be devised such as uprooting the plants or use of herbicides, for controlling them.* • *Low speed limit should be adopted for operation in the area to avoid dust propagation.*				
Mitigated Impact: Impacts on terrestrial vegetation				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
1	2	2	2	2
Results: Very-low (-20)				

11.4.2.2 Impacts on sensitive habitats (E2)

Sensitive habitats comprise areas that contain unique cover of floral species (such as endangered species) and vegetation mosaic that support animal diversity throughout the dry and wet seasons. Additionally, livelihoods of the locals depend on it. Examples of sensitive habitats include riverine areas (valley bottoms).

During the wet season, wild-herbivores are widely dispersed in the project area including grazing livestock. During the dry season, the valleys remain the only areas with substantive shrubs that provide forage to browser animals such as grant gazelles and goats. Normally, the valley areas support a diverse species of birds during dry seasons due to the substantial amount of fruit they store. Within the bottom of the river valleys, isolated wells of water support wildlife, livestock and some locals with water for domestic activities.

During the construction phase, any excavation, etc. in the valleys within the project area may have potential adverse effects on sensitive habitats to support ecological services. Project activities such as clearing and excavation can contribute to reduction in size of habitats. Consequently, this might render the habitat vulnerable to natural forces and exploitation of resources by the local community. Sometimes, clearing for access roads or construction of turbine foundations can potentially lead to partial or total loss of the sensitive habitat, although this is unlikely in the case of the proposed project.

There will be minimal impacts to sensitive habitats on completion of the construction phase of the project and therefore the impact is not assessed for the operational phase.

Pre-construction and Construction Phase

Unmitigated Impact: Impacts on sensitive habitats				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
3	3	2	1	4
Result: Low (-40)				
Comments/Mitigation: *The proponent should consider micro-siting the turbines away from riverine areas which support sensitive habitats. Additionally, if turbines are micro-sited on the banks of riverine areas, the proponent should avoid stockpiling excavated soils on such banks which can wash away into the riverine system. stockpiled soil can also kill vegetation by suffocation.*				
Mitigated Impact: Impacts on sensitive habitats				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
2	1	2	1	2
Results: Very-low (-18)				

Operational phase

Unmitigated Impact: Impacts on sensitive habitats				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
2	3	2	3	3
Result: Low (-42)				
Comments/Mitigation: • *Vegetation mosaics should be improved by planting trees to allow animal species to connect to other habitats in the area* • *Encourage regeneration of plants in the riverine areas*				
Mitigated Impact: Impacts on sensitive habitats				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
1	1	2	2	2
Results: Very-low (-16)				

11.4.2.3 Impacts on priority plant species (E3)

Priority plant species are generally those that are endangered or threatened. Unlike animals, plant species are susceptible to project activities due to their immobility.

During the field survey, one species of plant listed under priority species of conservation concern to Kenya was recorded in the project site. This is the East African Sandalwood (*Osyris lanceolata*), which is covered by the Kenya Wildlife Services in conservation of priority species.

(www.kws.org/research/priority_ecosystems.html)

The spatial distribution of the *Osyris Lanceolata* within the project area is limited; however, without mitigation, the potential adverse consequences of the proposed wind energy facility on priority plant species such as *Osyris Lanceolata* may include:

- Fragmentation of the affected plant species population;
- Reduction in size of area occupied by the species; and
- Loss of genetic variations within affected species.

The location of the priority plant species was plotted on a map of the project area and a buffer zone of 500m created around it in which no wind turbine and associated infrastructure construction activities can occur. The potential impacts on the priority plant species will occur mainly in the construction phase and subsequently no operational phase impacts are anticipated.

Pre-construction and Construction Phase

Unmitigated Impact: Impacts on priority plant species				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
4	2	3	2	3
Result: Low (-45)				
Comments/Mitigation: *The proponent should ensure that no construction activities occur within a radius of 500m of any Osyris Lanceolata distribution. It is further recommended that area populated by Osyris Lanceolata be fenced out of reach to people. This will also encourage their growth to significant heights. Development of soil dumps should be avoided near or on areas containing Osyris Lanceolata trees.*				
Mitigated Impact: Impacts on priority plant species				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
2	1	2	1	2
Results: Very-low (-15)				

Operational phase

Unmitigated Impact: Impacts on priority plant species				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
3	2	3	3	2
Result: Low (-40)				
Comments/Mitigation: • *Livestock grazing should be avoided around the Osyris Lanceolata areas in order to allow the plants to grow.* • *Access to the project site around the Osyris Lanceolata plants should be restricted. Other than the known local people, only authorized persons should be allowed to enter the area.* • *If possible, the Osyris Lanceolata area of occurrence should be fenced out of reach to people and regeneration encouraged.*				
Mitigated Impact: Impacts on priority plant species				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
2	2	2	2	2
Results: Very-low (-20)				

11.4.2.4 Impacts on insect pollinators (E4)

Insect pollinators such as bees and butterfly depend on various habitat types and in particularly certain vegetation types for their livelihood. The distribution of insect pollinators in a project area is affected by flowering herbs, shrubs and trees. Some of the pollinator species are conditioned to certain habitats and/or localised to an area.

Disturbance of the habitats by the proposed wind energy project might adversely affect the activities and behaviours of the pollinator species. Some of the insects can fly long distances over several habitats. These particular species may not be affected by the project compared to localized species.

Destruction of the vegetation will culminate in the threat to insect pollinator populations since they rely on trees, shrubs, herbs and grasses for their habitat, food, breeding areas and shelter.

The Kipeto area dries up during the dry season resulting in grasses that completely die. Most of bushes and woodland areas remain without leaves except for trees in the riparian areas (seasonal streams) that survive the harsh conditions. Notable greens in the project area are *Carissa edulis* that were observed in the valleys with some flowering and others with fruits.

Insect pollinators were hardly observed in the plain land areas since there were no grasses and herbs to rely on for food and shelter against strong wind blowing over the area. The riparian areas serve as important refugia for the insect pollinators. Destruction of vegetation will limit refugia habitats for the group hence their population.

Pre-construction and Construction Phase

Unmitigated Impact: Impacts on insect pollinators				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
2	2	2	1	3
Result: Low-medium (-24)				
Comments/Mitigation: *If possible, the proponent should endeavor to undertake construction activities immediately after the wet season. Additionally the proponent should ensure that no construction occurs in riverine areas which sustain flowering and fruiting plants even in the dry season thus allowing insect pollinators to sustain themselves.*				
Mitigated Impact: Impacts on insect pollinators				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
1	1	2	1	2
Results: Very-low (-12)				

Operational phase

Unmitigated Impact: Impacts on insect pollinators				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
2	2	2	2	2
Result: Low-medium (-24)				
Comments/Mitigation: • *Improvement of habitat (vegetation) connections should be enhanced by conserving grasses and bushes that occur in the wider landscape.* • *The access roads and tracks should have natural small growths of grasses to provide attractive passage to the other side of the road. Zizula hylax and Azanus jesous have been observed on murram roads with small grasses. The species were observed mostly on road sides of murram roads.* • *Improvement of habitat (vegetation) connections should be enhanced by conserving grasses and bushes that occur in the wider landscape.*				
Mitigated Impact: Impacts on insect pollinators				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
1	1	2	1	2
Results: Very-low (-12)				

11.4.2.5 Impacts on mammals and their movements (E5)

The Kipeto Project development will potentially affect activities and behaviours of mammal species. The species depend on the area for habitats, foraging grounds and migration during dry season. Some of the mammals prefer woodlands or bushlands, riverine, grasslands and rocky areas. Activities leading to interference to movements of the animal are viewed as adverse to the species.

Generally, during the construction of turbines there will be movements of vehicles, noise produced by vehicles and construction equipment. Literature accounts detrimental effects that noise can have on animals. This includes risk of death changing delicate balance in predator or prey detection and avoidance. Also, it potentially interferes with the use of sounds in communication in reproduction and navigation. Other than these, noise can cause reduction of use of habitat; however, it is important to note that most of the area is already fenced affecting movements of large mammals in between the plots. Most affected mammal herbivore is the Zebra that are now observed in plots with grasses and bushes not fenced or which their fences are damaged. Vehicle movement can potentially cause road kills on mammals especially at night.

Construction phase

Unmitigated Impact: Impacts on mammals and their movements				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
3	3	2	2	4
Result: Low (-48)				
Comments/Mitigation: *The proponent should ensure that construction plant and equipment meets the requirements of relevant Kenyan or international noise limits for open construction sites.* *Unless necessary, construction activities should be undertaken between 07:00 hrs and 18:00 hrs.* *The use of flood lights should be limited especially in areas perceived to be used by the animals frequently*				
Mitigated Impact: Impacts on mammals and their movements				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
1	2	2	1	2
Results: Very-low (-15)				

Operational phase

Unmitigated Impact: Impacts on mammals and their movements				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
2	3	2	2	2
Result: Low (-28)				
Comments/Mitigation: • *Improvement of habitat (vegetation) connections should be enhanced by conserving grasses and bushes that occur in the wider landscape.* • *Potential road kills of large mammals can be reduced by limiting speed to 30 at night and 40 day time to reduce impacts of accidents when vehicle collide on animals also the speed can give drivers lapsing period for braking.* • *Vehicles should avoid use of full lights at night as this confuses animals while on road and increases chances of accidents.*				
Mitigated Impact: Impacts on mammals and their movements				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
1	2	1	1	2

Results: Very-low (-12)

11.4.2.6 Impacts on herpetofauna (E6)

Herpetofauna species live in diverse habitats such as woody areas, grasslands, stony areas, wetlands. Most of them crawl on ground and climb trees. Construction of turbines would potentially destroy their physical habitats and affect their food source, which are largely insects. Vibrating machines would scare away the species from construction areas. The excavation of soils potentially affects some, which live in holes, where they occur. Some of the species like toads, snakes, lizards may be trapped in pits before turbines are anchored. This can increase rate of deaths during construction.

Construction phase

Unmitigated Impact: Impacts on herpetofauna				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
3	3	2	2	3
Result: Low (-40)				
Comments/Mitigation: *The proponent should avoid cutting trees where possible in order to provide the herpetofauna them with areas they can use for trapping insect food and habitat.* *Excavation of the mounds should be done with a lot of care as some species prefer inhabiting termite mounds as an area for their food source or habitation.*				
Mitigated Impact: Impacts on herpetofauna				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
1	2	2	1	2
Results: Very-low (-15)				

Operational phase

Unmitigated Impact: Impacts on herpetofauna				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
2	2	1	2	2
Result: Low (-40)				
Comments/Mitigation: *Potential road kills of reptiles and amphibians can be reduced by limiting speed to 30km/h at night and 40km/h during the day to enable drivers to brake as they cross the road.*				
Mitigated Impact: Impacts on herpetofauna				

Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
1	2	1	1	2
Results: Very-low (-12)				

11.4.3 Impacts on surface water (SW)

11.4.3.1 Soil erosion and silt laden water run-off (SW1)

The excavation works on site will loosen the soil and make it susceptible to erosion through silt-laden runoff during the rainy season and by wind during the dry season. A large amount of excavation will take place during the construction phase of the project due to the large sizes of turbine foundations to be constructed, the extensive cabling network, and the access tracks to each turbine. This excavated material could end up in the ephemeral streams in the area if proper drainage mechanisms are not put in place.

Accidental spills or leakage of oil/petroleum products could end up into the drainage channels and finally into other water surface bodies if mitigation measures are not put in place.

During the operational phase, there will be minimal impacts to the surface water. However, it is expected that the proponent will maintain the access roads and tracks in a good state of repair to avoid silt-laden run-off. Additionally the proponent will maintain the drainage system along the access tracks leading to each turbine to ensure that silt-laden run-off is minimized.

Construction phase

Unmitigated Impact: Soil erosion and silt laden water run-off				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
3	3	2	3	3
Result: Low (-48)				
Comments/Mitigation: *Stockpiles of excavated soils from the turbine foundations and access tracks should be bunded to minimize potential for generation of silt laden runoff.* *The proponent should direct surface water runoff from excavated areas to settlement/silt ponds to remove suspended solids prior to discharge to nearby watercourses.* *The proponent should ensure that excavations remain open for limited periods before placement of fill to minimize potential for entry of surface water runoff into excavations.* *Directing surface water runoff away from and around access tracks by implementing a suitably designed drainage system to minimize potential for landslides along the access tracks. Watercourse crossings to comprise culverts*				

of suitable design.				
Mitigated Impact: Soil erosion and silt laden water run-off				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
2	2	1	3	2
Results: Very-low (-25)				

Operational phase

Unmitigated Impact: Soil erosion and silt laden water run-off				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
2	3	2	2	2
Result: Low (-48)				
Comments/Mitigation: *The proponent should maintain the access tracks to the wind turbines and E407 in a good state of repair by regulalry grading and compacting the surfaces. The grading and compacting should be carried out in the dry season in order to prevent silt-laden water run-off. Additionally the proponent should consistently maintain the drainage channels adjacent to the access tracks and E407 and prevent silt from running off to open water systems.*				
Mitigated Impact: Soil erosion and silt laden water run-off				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
1	1	1	2	2
Results: Very-low (-12)				

11.4.3.2 Contamination of surface water (SW2)

The Maasai community living within the project area has limited access to water for various uses including for their livestock. There are a few watering points such as dams and water pans in the project area that are used for water abstraction purposes. Women walk long distances to collect water from such watering points. Subsequently contamination of catchment within the project area can have adverse consequences on the Maasai community with respect to the use of limited water sources.

During the construction phase, there will be heavy equipment and machinery that will be used for construction of the access roads and tracks as well as foundations for the wind turbines. If this equipment is not maintained in a good state of repair, hydrocarbon related leaks from construction plant and equipment could be part of the surface water run-off leading to water pans thus adversely affecting water quality.

During the operational phase, the number of vehicles will be limited to maintenance of the wind turbines and subsequently no adverse impacts are expected during this phase.

Construction phase

Unmitigated Impact: Contamination of surface water				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
3	3	3	2	3
Result: Low (-45)				
Comments/Mitigation: *The proponent will endeavor to ensure that all construction plant and equipment is maintained in a good state of repair with minimal leaks. Additiionally storage of chemicals and hydrocarbon products will be in bunded areas of sufficient capacity. Refueling will be carried out in designated areas using strict protocols.*				
Mitigated Impact: Contamination of surface water				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
2	1	2	1	2
Results: Very-low (-15)				

11.4.4 Geology and soils (GS)

11.4.4.1 Soil erosion (GS1)

The project area is overlain by relatively shallow mainly black cotton soils which in some areas grade into more grayish colored loamy soils. These soils are products of weathering of the underlying volcanic rocks – the Oldoinyo Narok Agglomerates and Kerichwa Valley tuffs. There are scattered outcrops of agglomerates and welded tuffs, which means there is no soil cover. Between the black cotton soil and bedrock is a layer of lateritic soil that is grayish-brown in color and often contains rounded gravel.

During construction, the excavation of access tracks and foundations for the wind turbines will irreversibly alter the soil structures in the project area. It is expected that the excavated top soils will be stock piled for use during reinstatement while the underlying black cotton will be carted away to approved dumpsites.

If excavated areas and stockpiled soils are left unmanaged, they can propagate erosion during both the wet and dry seasons.

During the operational phase, soil erosion will not occur as all construction foot print areas will be reinstated to as near original conditions and subsequently soil erosion is not assessed for the operational phase.

Construction phase

Unmitigated Impact: Soil erosion				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
3	2	2	2	2
Result: Low (-28)				
Comments/Mitigation: *The proponent will implement silt control measures such as silt fences and silt traps. Stockpiles of excavated materials should be stored appropriately in designated areas and at a minimum distance of 50m from any nearby watercourses or drains. Measures should also be taken to avoid direct rainfall on stockpile materials or exposed areas of ground that may result in slippage and washout of sediments into nearby drainage channels. The control of silt laden surface water runoff will be by means of the use of mitigation measures such as bunds, settlement ponds, silt fences, silt traps or by covering the stockpiles with plastic sheeting. Long term stockpiles will be sealed at a suitable gradient and grass planted..*				
Mitigated Impact: Soil erosion				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
2	1	1	2	2
Results: Very-low (-16)				

11.4.4.2 Contamination of soils (GS2)

The construction of the proposed wind energy facility requires upgrading the existing E407 road as well as constructing new access tracks to each wind turbine location. Additionally there will be a central laydown area which will be used by the contractor for storing their construction plant and equipment safely.

The construction of the proposed wind energy facility will require the use of heavy mechanical construction plant and equipment. This activity will most likely be outsourced to Kenyan based contractors. The integrity of construction plant and equipment owned by some contractors is questionable leading to fugitive hydrocarbon leaks and spills as evidenced in other construction sites.

The contamination of surface and sub-surface soils by hydrocarbons is an adverse effect that can potentially occur during the construction phase of the project depending on the type of contractors selected for the access road and wind turbine foundation construction processes.

In addition to the above, it is possible that contractors may need to refuel their construction plant and equipment within the project area given its remote location with respect to petrol stations. The refuelling operations may take place within the central laydown areas resulting in surface and sub-surface soil contamination if such areas are not bunded properly.

During the operational phase, the only vehicles expected in the project footprint area are those that will be used for maintenance of the wind turbines. These types of vehicles are expected to be four-wheel drive in nature and properly maintained by the operations and maintenance company that will run the power plant. Subsequently there will be minimal soil contamination impacts during the operational phase of the project and are subsequently not assessed.

Construction phase

Unmitigated Impact: Contamination of soils				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
2	3	2	2	2
Result: Low (-28)				
Comments/Mitigation: *Storage of chemicals will be in bunded areas of sufficient capacity while refueling of vehicles/machinery will be expected to be done offsite. Where necessary, construction machinery will be re-fuelled onsite by means of a mobile fuel bowser done by trained personnel. This will be done in designated, bunded areas of hard-standing that are situated a minimum of 50m from surface water bodies. A spill tray and an emergency response spill kit will be brought onto the site with the mobile fuel bowser during refueling operations*				
Mitigated Impact: Contamination of soils				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
1	1	1	2	2
Results: Very-low (-12)				

11.4.4.3 Destruction of soil structure by heavy machinery (GS3)

During the construction phase, the continuous use of heavy machinery and other vehicles on unsealed areas of ground has the potential to adversely impact on the soil structure through compaction. This can potentially limit the rate of surface water infiltration into the sub-surface thus increasing the rate of silt-laden run-off.

The wind turbines and associated structures will be located in rangeland areas and therefore the use of machinery will be limited to assigned access tracks and areas agreed with landowners. The time taken for the use of heavy machinery on each part of the site will be limited.

During the operational phase, there will be no requirement for the use of heavy machinery and subsequently no impacts will arise during this phase.

Construction phase

Unmitigated Impact: Destruction of soil structure by heavy machinery				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
2	3	2	2	3
Result: Low (-35)				
Comments/Mitigation: *All construction plant and equipment will utilize approved access routes and the contractors will be encouraged to use stone and laterite (murram) on access tracks to protect underlying soil. These imported soils will be well compacted in order to carry the weight of the expected heavy vehicles. The access tracks will be constructed to allow for easy drainage of surface run-off on either side of the track. In sloped areas the drainage channels on the sides of the tracks should have concrete barriers at intervals to be determined on-site (depending on the slope) to check erosion and cutting into the drainage channel.*				
Mitigated Impact: Destruction of soil structure by heavy machinery				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
2	2	2	2	2
Results: Very-low (-24)				

11.4.5 Groundwater (GW)

11.4.5.1 Pollution of groundwater (GW1)

There has been little groundwater development in the project area and therefore knowledge of the aquifer systems in the area is limited. Four boreholes were identified in the project area all of which are quite recent. The oldest borehole is in Oloyiankalani Secondary School and was drilled in July 2009 while the most recent is Edonyo Sidai Primary School borehole drilled in July 2011.

The hydrogeological data of the boreholes in the project area is shown in the table below.

Name	**Total Depth (m)**	**Water Struck Level (m)**	**Water Static Level (m)**	**Pumping Water Level (m)**	**Tested Yield (m^3/hour)**
Oloiyankalani Sec. School	200	112, 144	-	-	22
Esilanke	160	122-136	66	-	4
Mr. Christian	220	129	74	169	3
Edonyo Sidai Primary School	250	88, 224	48	-	1.8

The hydrogeology of the project area is characterized by relatively deep aquifers at about 88 to 144 meters below ground surface and another deeper one beyond 200 meters depth. These depths may be explained by the large number of faults and fractures in the area that may be causing the water to seep down to deep lying aquifers. The aquifer yields show a significant variance of between 1.8 and 22m^3/hour. The groundwater potential may therefore be characterized as medium to low.

During the construction phase, the hydrogeology of the project area could potentially be affected if any leaked hydrocarbons permeate into the sub-surface and through cracks in the bedrock geology come into contact with the groundwater. The sources of hydrocarbons will be construction plant and equipment that may not be properly maintained by the contractors or leakages that may occur from refuelling areas that are not bunded or bermed.

There will be minimal impacts to the groundwater in the operational phase and subsequently hydrogeology impacts are not considered for this ESIA Study.

Construction phase

Unmitigated Impact: Pollution of groundwater				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
2	2	2	3	2
Result: Low (-30)				
Comments/Mitigation: *It is expected that vehicles used on the site will be refueled offsite. Vehicle maintenance and repairs is also expected to take place offsite. In the exceptional cases, a mobile fuel bowser may be brought onto the site for refueling operations and should only take place at a designated, bunded area of hard-standing that is situated a minimum of 50m from surface water bodies. An emergency response spill kit will be brought onto the site with the mobile fuel bowser during refueling operations while personnel operating machinery or vehicles on the site will be trained in the use of these emergency spill kits.*				
Mitigated Impact: Pollution of groundwater				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
1	1	1	2	2
Results: Very-low (-12)				

11.4.6 Noise (N)

11.4.6.1 Noise during construction and commissioning (N1)

The proposed wind energy facility will be situated in an area with a rural character which is fairly remote. Increased noise levels are directly linked with various activities associated with the construction of the facility and related infrastructure as well as the operational phase of the activity.

During the construction phase, the following activities may generate noise levels:

- Construction of access roads and tracks;
- Establishment of turbine foundations and electrical sub-station;
- Possible establishment, operation and removal of concrete batching plants;
- Delivery of turbine and sub-station components to the site;
- Digging of trenches to accommodate underground power cables; and
- Construction of turbine towers and assembly of wind turbines.

The equipment likely required to complete the above tasks will typically include:

- Excavator, graders, bulldozers, dump trucks, vibrating roller, wheel loader, rock breaker, flatbed trucks, concrete trucks, cranes, fork lifts and various four wheel drive and service vehicles.

Noise levels during the construction phase may also emanate from concrete batching plants and the use of borrow pits. It is not envisaged that blasting will be required for the proposed project.

A significant source of noise during the construction phase is additional traffic to and from the project site as well as traffic on the site. The use of borrow pit(s) and a concrete batching plant will significantly reduce heavy traffic vehicle movement to and from the site. Construction traffic is expected to be generated throughout the entire construction period, however the volume and type of traffic generated will depend on construction activities being conducted which will vary during the construction period.

Construction phase

Unmitigated Impact: Noise during construction and commissioning				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
3	3	3	3	3
Result: Low-medium (-54)				
Comments/Mitigation: • *The proponent should ensure that all construction plant and equipment is fitted with silencers (where possible).* • *The proponent should consider the noise emission characteristics of equipment when selecting equipment for the project and, select the least noisy machine available to perform the specific work (this is a requirement*				

of OSHA 2007). • *Work together with the Maasai community in the project area and provide prior warning when a noisy activity is to take place; this will reduce the probability of the impact.* • *Ensure that the 750m buffer zone is maintained between a wind turbine and the nearest household.* • *Decrease traffic speeds and use well maintained vehicles*

Mitigated Impact: Noise during construction and commissioning

Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
2	3	2	2	2
Results: Low (-28)				

11.4.6.2 Noise during operation (N2)

During the operational phase, two sources of noise are predicted namely, aerodynamic noise associated due to the passage of air over the wind turbine blades and mechanical noises which are associated with components of the power train within the turbine such as the gearbox, generator and control panel. Additionally there will be lesser noise sources such as that emanating from the sub-station as well as transmission line noise (corona noise).

In order to predict the noise generated by the completed wind energy facility during the operational phase, a noise receptor survey was undertaken in order to quantify the number of properties within 1km of the proposed turbines; in total 53 receptors were found.

In order to predict the noise generated at these properties, noise modelling was conducted using WindPRO software, version 2.7.468. The general direction of the wind in the project area is easterly meaning that households to the west and downstream of the wind turbines are the ones that can potentially be affected by operational phase noise levels.

The noise prediction model was run using the critical wind speed calculated at 9m/s at 10m. All criteria were based on L_{A90} levels rather than L_{Aeq}; L_{A90} is the 90^{th} percentile noise level, which is exceeded for 90% of the time. As wind turbines will be operating continuously throughout its particular operating range the L_{A90} level is much more useful in identifying noise which may be attributed directly to the wind farm rather than L_{Aeq} which will be affected by short term influences such as a passing car or plane or short-term noise from external influences including wildlife or man-made sources.

The results of the noise modelling predicted that for the 53 households in the vicinity of the site, the lower fixed noise level limit is 43dB L_{A90} for non-involved houses and the lower fixed noise level limit for involved houses is 45dB L_{A90}. It should be noted that these predictions represent downwind propagation in all directions, which clearly cannot happen at all locations simultaneously.

The predicted noise levels lie within the adopted criteria in all cases.

Operational phase

Unmitigated Impact: Noise during construction and commissioning				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
3	3	5	4	3
Result: Low-medium (-54)				
Comments/Mitigation: • *It is recommended that a buffer zone of 750m be maintained during the design stage to ensure minimal disruption to sensitive receptors* • *The proponent should undertake additional post development noise monitoring in accordance with international noise standards in particular ISO 1996: "Description and measurement of environmental noise" to monitor accurately the acoustic impact of the development according to site atmospheric conditions and corrected for background speeds at any potentially sensitive locations*				
Mitigated Impact: Noise during construction and commissioning				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
2	3	5	2	2
Results: Low (-40)				

11.4.7 Ornithology (O)

11.4.7.1 Bird mortality and collision (O1)

The main threat posed by the wind turbines on avifauna is collision with the rotors during the operational phase. Bird mortality impacts during the construction phase are minimal and therefore not assessed. Direct mortality or lethal injury of birds may result from collisions with rotors and associated structures such as guy cables, power lines and meteorological masts.

A number of factors influence bird mortality at wind farms. These factors may relate to bird species, numbers and behavior, weather conditions and topography and the nature of the wind farm itself, including the use of lighting if applicable.

Landscape features can potentially channel birds towards certain areas influencing their flights and foraging behavior. Ridges and slopes such as those observed in Kipeto are important factors in determining flight behavior and hence a function of collision risk.

The number of turbines in a wind farm also influences the risk of collision with more collision expected in areas with more turbines. Lighting of turbines and other infrastructure have the potential to attract birds especially night migrants and nocturnal species thereby increasing the risk of collision with turbines.

The risk is expected to be greater on or near areas regularly used by large numbers of feeding or roosting birds or on migratory flyways or local flight paths, especially where the turbines intercept these. Large birds with poor manoeuvrability (such as ducks and geese) will be at greater risk of collision with structures

There is a likely risk of collision with structures when visibility is poor due to fog or rain although this effect will be to some extent offset by lower levels of flight activity in such conditions. Birds that are already on migration, however, cannot avoid poor weather conditions, and will be more vulnerable if forced by low cloud to descend to a lower altitude or land.

Operational phase

Unmitigated Impact: Bird mortality and collision				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
4	2	5	4	4
Result: Medium-high (-88)				
Comments/Mitigation: *Devices defined as critical, such as the rotor, generator, gearbox, and cooling system, should be equipped with protection systems to ensure safe and proper shutdown of the equipment in sensitive periods. The operation of the turbines and maintenance vehicle traffic may result in disturbance to the breeding habitat of grassland bird species, including some of those in the Study Area.* *Appropriate wind turbine design, considering turbine height, number of turbines and micro-siting should be considered outside these natural features.*				
Mitigated Impact: Bird mortality and collision				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
2	1	3	1	3
Results: Very-low (-24)				

11.4.7.2 Displacement of birds from project area (O2)

The presence of wind turbines at the proposed project site could potentially deter some birds from using the area resulting in a disturbance impact. During the construction phase, human presence on the site will increase adding further to potential displacement of birds from the project area.

The displacement of birds from areas within and surrounding wind farms due to visual intrusion and disturbance is expected because of habitat loss. Displacement may occur during both the construction and operational phases of wind farms, and may be caused by the presence of the turbines themselves through visual, noise and vibration impacts, or because of vehicle/tracks and personnel movements related to site maintenance.

The effect of birds altering their migration flyways or local flight paths to avoid a wind farm is also a form of displacement. This effect is of concern because of the possibility of increased energy expenditure when birds have to fly further because of avoiding a large array of turbines and the potential disruption of linkages between distant feeding, roosting, moulting and breeding areas. The effect is dependent on the species, type of bird movement, flight height, distance to turbines, the layout and operational status of turbines, time of day and wind force and direction.

Construction phase

Unmitigated Impact: Displacement of birds from project area				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
4	2	2	3	4
Result: Low-medium (-56)				
Comments/Mitigation: • *Infrastructure such as access roads should be limited to existing paths;* • *Tree clearing (if required) should be minimized by locating access roads outside the natural habitats such as woodlands and wetlands;* • *Tree and/or bush clearing should be completed prior to or after the core breeding season for woodland and grassland birds;* • *Should clearing be required during the breeding bird season prior to construction, surveys should be undertaken to identify the presence/absence of nesting birds or breeding habitat;* • *The work areas should be restored to pre-construction conditions following construction;* • *Disturbed areas of the construction site should be stabilized immediately and re-vegetated as soon as conditions allow;* • *Construction should be done outside main breeding season. A pre-operation survey should be conducted for breeding birds and nest locations. The effects are expected to be short-term in duration and spatially limited to the work areas and immediately adjacent areas. Additionally, avoidance of the sensitive periods for breeding birds will eliminate impacts to these species during these times*				
Mitigated Impact: Displacement of birds from project area				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
2	1	4	2	2
Results: Low (-28)				

Operational phase

Unmitigated Impact: Displacement of birds from project area				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
4	2	3	1	3
Result: Low (-32)				
Comments/Mitigation: • *A post-construction monitoring study for birds should be developed. Considering the limited extent of permanent works and the periodic nature of maintenance activities, it is likely that resident birds will adapt to the Project.* • *Thorough post-construction monitoring should be completed to allow the identification of any effect and application of appropriate additional mitigation measures.*				
Mitigated Impact: Displacement of birds from project area				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
2	1	2	1	2
Results: Very-low (-15)				

11.4.7.3 Habitat change and loss (O3)

Habitat change and loss could potentially result from the area taken by the turbine foundations, access track and any other associated construction. Indirect loss of habitat changes because of alterations in land use should be expected. The presence of wind turbines may indirectly affect local fauna and bird populations by decreasing the area of habitat available for breeding, feeding, nesting, resting etc. This will mainly be brought about by land taken for the construction of infrastructure including access roads and turbine foundations. Birds flying at the same height as the wind turbine rotor blades within the wind farm area will be at risk of colliding with those blades.

During the construction phase, bird habitats are expected to be affected through various processes and activities as outlined below.

- Construction activities will result in destruction of habitats in paths leading to the turbine sites. Installation of wind turbines will result in habitat removal;
- Both human and increased vehicle traffic along local roads and trampling on vegetation will have negative effects on ground dwelling birds, including effects on their habitat and nests due to trampling; and
- Limited amounts of field habitat removal for access roads and, to a lesser extent, turbine footprints have the potential to fragment habitat, and make it less attractive to area-sensitive grassland species such as Larks and pipits. Fragmentation could also result in increased rates of nest parasitism and predation.

Construction activity, such as increased traffic, noise, or dust, also has the potential to indirectly disturb birds and bird habitats. Disturbance of birds may occur during all phases of the project as a result of increased on-site human activities (e.g. site preparation, turbine assembly, maintenance activities). However, a certain level of disturbance to wildlife resources in the Study Area already exists from ongoing agricultural, rural, and domestic activities.

During the operational phase, lighting of turbines and other infrastructure has the potential to attract birds thereby increasing the risk of collisions with turbines. Nocturnal migrants navigate using stars and mistake lights for stars. Lights may also attract insects, which in turn attract birds. Changing constant lighting to intermittent lighting has been shown to reduce attraction and mortality and changing white flood light to red flood lights could also result in significant reduction in mortalities.

Construction phase

Unmitigated Impact: Habitat change and loss				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
4	2	2	3	4
Result: Low-medium (-56)				
Comments/Mitigation: *Good site practices and procedures should reduce the environmental effects identified. These practices may include:* • *Specifications regarding disposal, dust control, artificial drainage system maintenance and soil compaction control.* • *All disturbed areas of the construction site should be stabilized immediately and re-vegetated as soon as conditions allow after construction, to replicate the habitat* • *Maximizing use of existing tracks for access roads to minimize removal of vegetation* • *Avoid disturbance to wet grassland areas onsite.* • *If possible, construction works should be avoided during wet/rainy conditions*				
Mitigated Impact: Habitat change and loss				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
1	1	2	1	1
Results: Very-low (-8)				

Operational phase

Unmitigated Impact: Habitat change and loss				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
3	2	4	1	4
Result: Low (-45)				
Comments/Mitigation: • *Wind turbines should be the same make and model. Disturbance to land will be minimized during construction, which will in turn reduce the effects to aesthetics of the Project areas during the operation phase.* • *The installation and operation of the wind turbines will permanently alter the existing views for the life of the Project; appropriate turbine coloring and lighting should reduce the extent of this effect.*				
Mitigated Impact: Habitat change and loss				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
2	1	2	1	2
Results: Very-low (-15)				

11.4.8 Socio-economic impacts (SE)

11.4.8.1 Creation of employment (SE1)

Creation of employment opportunities is perceived to be the most important benefit of the proposed project by the communities in Kipeto. This is mainly expected to benefit the unemployed youth living within and around the project area.

There is a high expectation that several job opportunities will arise especially during the construction phase of the project as the youth unemployment level is high in the project area. during the construction phase, it is envisaged that there will be between 50 and 100 job opportunities available for semi-skilled and unskilled labor.

Creation of employment will generally improve the living conditions of the locals. It is expected that due to the increase in income distribution, the locals will be able to afford better housing, healthcare and entertainment.

During the operational phase, local labor required will be minimal as the operations and maintenance costs associated with modern wind energy facilities is low.

Construction phase

Unmitigated Impact: Creation of employment				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
2	4	2	2	3
Result: Low (+40)				
Comments/Mitigation: • *In order to manage expectations, the youths within the project area should be given first priority in recruitment for skilled, semi-skilled and unskilled job opportunities.* • *Communication and information programs should be used to manage expectations and target local service providers. Local authorities should be consulted when recruiting local workers and service providers.*				
Mitigated Impact: Creation of employment				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
3	3	3	2	5
Results: Low-medium (+63)				

Operational phase

Unmitigated Impact: Creation of employment				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
3	2	4	4	4
Result: Low-medium (+72)				
Comments/Mitigation: • *The wind energy facility requires limited maintenance during the operational phase. The proponent should transfer knowledge to Kenyans on operations and maintenance of the wind turbines.*				
Mitigated Impact: Creation of employment				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
3	2	4	4	5
Results: Medium-high (+81)				

11.4.8.2 Demand for construction materials (SE2)

The construction phase of the proposed wind energy facility will require significant amounts of construction materials including sand, cement, water, ballast, reinforcement, electrical cabling, etc. some of which is readily available in the broader project area.

Additionally there will be a requirement for various types of stone from quarries for upgrading the E407 road, and constructing new access tracks and crane pads for the wind turbines.

At this preliminary stage of the engineering design for the proposed project, it is unclear whether a concrete batching plant will be procured by the proponent and installed at the project site for preparing the turbine foundation concrete. If a small concrete batching plant is installed on site, there could be opportunities for the local Maasai community in the project area to supply the raw materials required for concrete batching. Alternatively, if an off-site concrete batching plant is used, the opportunities for the local Maasai community to supply raw materials diminish; in this scenario, the Maasai community may be able to supply raw materials depending on where the concrete batching plant is installed.

There is an expectation that the main contractor will install a concrete batching plant within the project area. This will enable the main contractor to purchase locally available construction materials (sand, stone and ballast) through land owners that can supply such construction materials.

An on-site concrete batching plant could potentially have positive effects in the project area as small business could supply general hardware, timber and steel products to the project.

During the operational phase, there will be minimal requirements for construction materials and therefore this impact is not considered for that phase.

Construction phase

Unmitigated Impact: Demand for construction materials				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
2	2	2	3	3
Result: Low (+36)				
Comments/Mitigation: • *As the primary construction materials will be cement, sand, quarry stone, ballast and water for cosntruction of the wind turbine foundations, the proponent should consider installing an on-site concrete batching plant instead of outsourcing it.* • *Prior to the construciton phase, the proponent should engage the local Maasai community to identify suppliers and evaluate the amount of construction raw materials that can be provided through the community.*				
Mitigated Impact: Demand for construction materials				

Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
3	4	2	3	4
Results: Low-medium (+63)				

11.4.8.3 Impact on transport infrastructure (SE3)

Currently there are a limited number of access roads traversing the proposed project area. There are also no delineated access roads within the project area leading to each of the plots. The E407 from Kajiado to the project site is a Government classified road whose maintenance falls under the Kenya Rural Roads Authority (KeRRA). During the field surveys, it was observed that this road is not maintained consistently by KERRA and will be a major artery for the logistical movement of the wind turbine components from the A104: Athi River – Namanga highway to the project site. The micro siting of the wind turbines will require new access tracks to be built emanating from the E407 road.

The transportation of wind turbine components and associated infrastructure requires road surfaces without imperfections. Secondly, as the existing roads may have depressions, there will be a need to upgrade these by constructing box culverts and building up the roads in order to provide level grade surfaces. Subsequently the proponent will work with KERRA and the Ol Kejuado County Council for upgrading the existing E407 and building new access tracks leading to the positions of each of the wind turbines.

The upgrading of E407 and construction of new access tracks in the project area will be beneficial to the local communities as it will provide a faster route between Kajiado and Kiserian. The road will be upgraded between Kajiado town and the project area and will be built to a standard that can accommodate heavy abnormal loads. The upgrading of this section of the E407 will enable businesses to mushroom along the road and provide goods and services to the road users. Additionally vehicle maintenance costs should also come down if there is a better road that users have access to than the existing one.

During the construction phase, the upgrading of the road will be widened to accommodate abnormal loads. Nearby quarries will be used to provide the materials for the sub-grade, grade and base of the upgraded road. During this phase, there will be intermittent inconveniences for road users who may experience delays due to the road upgrading and building of new access tracks.

During the operational phase, the E407 and newly constructed access tracks will be used for maintenance of the wind turbines. The access tracks and E407 will also be open for use by other road users between Kajiado and the project area.

Construction phase

Unmitigated Impact: Impact on transport infrastructure				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
2	3	2	2	3
Result: Low (+35)				
Comments/Mitigation: • *Prior to construction, the proponent should engage the community on the road upgrade plan in order to avoid inconveniences to existing E407 road users.* • *The road contractor should engage the local community on sources of raw materials for the road upgrade and access tracks in order to allow the local community to participate in the process of road construction.* • *The conrtactor should develop a construction phase traffic management plan to reduce inconvenience to road users during this phase of the upgrade work.*				
Mitigated Impact: Impact on transport infrastructure				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
3	4	4	4	4
Results: Medium-high (+88)				

11.4.8.4 Impacts on livestock farming (SE4)

Agricultural activities in rangelands such as those found in the project area are changing. The following are bringing about the changes:

- Land sizes are diminishing resulting from land sub-divisions taking place within the project area;
- Loss of interest in farming activities by the youth in the project area;
- Changing climatic conditions leading to less grass output per acre for livestock.

The above evolutionary changes are having a strain on the traditional Maasai predominant occupation of livestock farming resulting in lower livestock inventories due to lack of grazing lands; thus leading to a loss of potential income from such activities. In the dry seasons, the Maasai community is forced to walk long distances in search of reasonable pasture sizes for their livestock; in the process, they tend to lose some of the livestock due to weakness.

The above changes are felt more by the small landowners than the larger ones and subsequently the impacts below are assessed for this type of landowner.

During the pre-construction phase, the proponent signed leases with landowners having different sizes of parcels for purposes of erecting wind turbines. Some of the smaller landowners that will get a wind turbine in their plot of land will have an alternative income to livestock rearing through the lease signed with the proponent as well getting payment for wind turbines erected on their land.

During the construction phase, small landowners may be inconvenienced with respect to limited grazing land available for their livestock. This will be a temporary impact that will last for a few months as the turbine(s) is installed within the parcel of land.

During the operational phase, it is expected that any small landowner that gets a turbine on their land, will be eligible to a payment for that wind turbine(s) from the proponent. This will be an alternative income source to livestock rearing and subsequently the impacts on livestock farming are not assessed for this phase.

Construction phase

Unmitigated Impact: Impacts on livestock farming				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
2	3	3	4	4
Result: Low-medium (-64)				
Comments/Mitigation: • *As part of the Corporate Social Responsibility (CSR) program, the proponent should consider providing educational programs targeting the youth on Maasai cultures and traditions of livestock rearing.* • *Within small landowner parcels of land, the contractor will ensure that the minimum amount of grass is excavated to minimize the impacts of reduced grazing land available to livestock. Alternatively, the proponent may wish to consider provision of hay to small landowners during the construction period for livestock.* • *The contractor should endeavor to reinstate lands on which turbines are built immediately after construction and plant grasses that can grow quickly.*				
Mitigated Impact: Impacts on livestock farming				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
2	3	2	3	3
Results: Low (-42)				

11.4.8.5 Impacts on local economy (SE5)

Currently the main activities in the project area are livestock farming. Additionally, there is a market at Esilanke near the Esilanke church where additional economic activities such as the main market are situated. Livestock farming is undertaken by the males within the Maasai community while women are involved in household chores, sheep rearing and making of ornaments.

The main market day in the project area is Thursday where the Esilanke market is usually vibrant.

The proposed project will have significant impacts on the local economy of the project area as outlined below.

During the pre-construction phase, landowners signed 25-year leases with the proponent for the project. This implies that those landowners that have leased their land will continue getting payments for the leases they signed. This additional disposable income may be used for various types of economic activities. Additionally each landowner that gets a turbine(s) erected on his land, will be entitled to a payment for each wind turbine thus providing additional income that hitherto was not available. During the field surveys, it was observed that with the payments made so far by the Proponent for the leases, some of the local Maasai community have begun changing the characteristics of their households. It was observed that instead of constructing the traditional *manyatta*, the household owner is now using modern construction materials such as galvanized iron sheets for construction.

During the construction phase, there could be potential opportunities to supply various construction related goods and services. These include stone, sand, cement, labor work force, meat and other food products. Such opportunities will no doubt have a direct impact on the local Maasai community living in the project area who will have additional disposable income available to them for economic activities.

During the operational phase, the local Maasai community are expected to receive 5% of the net sales through a trust fund. The management of these funds will be used for initiatives that the trust feels will benefit the local Maasai community.

Pre-construction phase

Unmitigated Impact: Impacts on local economy				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
2	3	2	3	3
Result: Low (+42)				
Comments/Mitigation: *The proponent should consider providing educational programs to the local Maasai community on financial management as these skills are currently lacking among most landowners that have been paid monies for the lease payments.*				
Mitigated Impact: Impacts on local economy				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
3	3	2	3	4
Results: Low-medium (+56)				

Construction phase

Unmitigated Impact: Impacts on local economy				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
2	2	2	2	3
Result: Low (+30)				
Comments/Mitigation: • *The proponent should engage the local communities to establish the types of construction raw materials they can provide for the proposed project.* • *Subsequently the proponent should provide the local communities with priority in supplying such construction raw materials before going outside the project area.* • *The proponent should consider providing financial management training to the local communities for prudent management of income that may be earned through provision of raw materials to the project.*				
Mitigated Impact: Impacts on local economy				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
3	3	2	2	4
Results: Low (+48)				

Operational phase

Unmitigated Impact: Impacts on local economy				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
2	3	3	3	3
Result: Low (+48)				
Comments/Mitigation: • *As the proponent will have presence on the community trust fund, it should utilize its knowledge in guidng the trust fund on the types of projects the local communities can engage in for improvement of their livelihoods.* • *The proponent together with the trust fund should endeavor to educate the local community to identify and invest in projects that will especially benefit youth groups and women in the project area*				
Mitigated Impact: Impacts on local economy				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
3	3	4	3	3

Results: Low-medium (+60)

11.4.8.6 Impacts on land value (SE6)

Presently, land prices in rangelands such as those characterized by the project area do not escalate significantly due to the poor climatic conditions and low agricultural potential of such lands. However this could potentially change with the development of the proposed wind energy facility.

As part of the development of the project, the E407 will be upgraded while new access tracks will be constructed leading to each turbine. Development of infrastructure in an area is a precursor to socio-economic development and the ingredients for this in the Kipeto area will potentially be available once the project construction commences.

Secondly, the community trust fund to be set up as part of the project should consider investing the earned resources for other utilities such as piped water and electricity. Such infrastructure could potentially add value to the existing land prices within the project area thus making the area more marketable to potential investors.

The above impacts will potentially be felt in the construction and operational phases of the project respectively.

Construction and Operational phases

Unmitigated Impact: Impacts on land value				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
3	2	2	2	4
Result: Low (+42)				
Comments/Mitigation: • *The proponent should upgrade and maintain the E407 between Kajiado and the project site during the construction and operational phases of the project respectively.* • *The Maasai trust fund to be created during the operational phase of the project should consider investing in utilities infrastructure such as piped water and electricity during the operational phase of the project.*				
Mitigated Impact: Impacts on land value				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
4	3	4	3	4
Results: Medium-high (+77)				

11.4.8.7 Impacts on tourism (SE7)

The wind energy facility is bound by the Great Rift Valley on the western part of the project area and provides scenic views of the escarpment and the Rift Valley floor. The local community has created some viewpoints from which one can absorb the vastness of the Great Rift Valley. Additionally the project area has a variety of flora and fauna that exists within the area.

A few white immigrants have purchased land towards the western edge of the project area and constructed small cottages which are sometimes rented out to tourists.

During the various baseline studies, it was observed that the project area contains some caves which are embedded in various landowner plots.

At the Esilanke market, Maasai women make ornaments for sale to those that wish to buy such ornaments.

The above attributes of the project area indicate that there is a potential for eco-tourism in the Kipeto area if exploited sustainably.

With the upgrading of the E407 between Kajiado and the project area, there is potential for the local community to benefit from tourism related facilities which in turn can potentially create jobs in the hospitality industry within the project area.

These opportunities can be capitalized during the operational phase of the project and subsequently the construction phase impacts are not assessed.

Operational phase

Unmitigated Impact: Impacts on tourism				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
2	3	2	3	3
Result: Low (+42)				
Comments/Mitigation: • *Together with the Ol Kejuado County Council, the Maasai community trust fund should consider selectively marketing the project area for eco-tourism purposes.*				
Mitigated Impact: Impacts on tourism				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
3	5	4	4	4
Results: Medium-high (+96)				

11.4.8.8 Impacts on education (SE8)

During the operational phase, it is envisaged that there may be interest in educational subjects related to wind energy in the schools within and outside the area. Increasing awareness of pupils in primary, secondary and tertiary educational facilities on courses related to wind energy/renewable energy, environment and social work can potentially improve in Kipeto, the larger Kajiado area and the country in general.

CSR in the community and operations of the Maasai community trust fund is expected to provide more built educational facilities and provide equipment and facilities for such institutions.

Operational phase

Unmitigated Impact: Impacts on education				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
2	2	2	2	2
Result: Very-low (+24)				
Comments/Mitigation: • *As part of the CSR program, the Proponent should consider sponsoring awareness programs jointly with the community to identify areas of educational needs and the facilitation of the same.*				
Mitigated Impact: Impacts on education				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
3	3	4	4	4
Results: Medium-high (+80)				

11.4.8.9 Changes in social lifestyles (SE9)

Currently social lifestyles in the Kipeto area are centered on church activities in the Esilanke area and subsequently residents generally partake in church related activities.

However with the project becoming operational and residents potentially having increased disposable income, it is anticipated that there may be additional social amenities such as bars, restaurants, etc. that may mushroom; these may potentially impact the existing lifestyles in the Kipeto area.

Demand for on-site catering and accommodation may be satisfied by building self-contained accommodation facilities that also include bars and restaurants. Increase in disposable income may lead to demand for spending on alcohol and social recreation associated with urban centres. The youth engagement in alcohol, drugs and commercial sex may also rise.

Construction and operational phases

Unmitigated Impact: Impacts on education				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
2	3	2	2	3
Result: Low (-35)				
Comments/Mitigation: • *The proponent and/or Trust Fund should consider setting up financial education programs for the Maasai community in the project area as they will have new sources of income arising from the proposed project. Such programs include prudent financial management courses, how to invest, etc. Additionally it is recommended that peer education be provided on sexually transmitted diseases, alcohol and drug abuse.*				
Mitigated Impact: Impacts on education				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
1	3	4	1	2
Results: Very-low (-24)				

11.4.9 Transport (T)

11.4.9.1 Damage to roads and other infrastructure (T1)

The proposed wind energy facility will require road transportation of various turbine components from Mombasa to the project site in Kipeto; special purpose vehicles will be imported for transporting the wind turbine components. The components for the wind turbines are generally heavy; some of the components are long, for example, each wind turbine blade is about 50m long and has to transported on a special purpose vehicle. Similarly, each of the three tower sections of the wind turbine is between 22m and 30m long and 4.3m in diameter. The table below indicates the characteristics of the 67 wind turbines that are proposed for erection within the project area.

Load type	Length	Height	Width	Weight(Kg)	Quantity (No.)
TYPE 1: Tower sections (80m Hub)					
-Top	29.5m	4.3m	4.3m	34,080	67
-Mid	25.9m	4.3m	4.3m	41,174	67
-Base	21.9m	4.3m	4.3m	51,696	67
TYPE 2: Tower Sections (100m Hub)					
-Top	22.4m	4.3m	4.3m	32,170	67
-Mid A	21m	4.3m	4.3m	37,665	67
-Mid B	21m	4.3m	4.3m	48,967	67
- Mid C	18m	4.3m	4.3m	56,940	67
-Base	15m	4.3m	4.3m	65,386	67
TYPE 3: Hub and Blades					
Load type	**Length**	**Height**	**Diameter**	**Weight(Kg)**	**Quantity**
Hub & Nose Cone Assembly	3.85m	4.68m	3.2m	28,000	67
Blades	48.7m	-	2.92m	6,500	201
TYPE 4: Other equipment					
Load type	**Length**	**Height**	**Width**	**Weight(Kg)**	**Quantity**
Machine Head	8.8m	3.8m	3.6m	66,500	67
Controller	2.3m	2.7m	0.9m	2,700	67
Gearbox	2.7m	2.4m	2.5m	16,500	67
Generator	3.42m	2.20m	1.62m	8,450	67
Crane				33,0000	3

As can be seen from the above table, each wind turbine will come in the form of a completely knocked down kit that will be assembled at the project site. It is estimated that each wind turbine could potentially take up to eight (8) truck trips to transport the turbine components from Mombasa to the project site in Kipeto which implies that there could potentially be up to five hundred and thirty (530) one way trips for transporting the 67 wind turbines.

A Swept Path Analysis has been undertaken using vehicles fitted with rear axle steering. Swept Path Analysis is the calculation and analysis of the movement and path of different parts of a vehicle when that vehicle is undertaking a turning maneuver. At a basic level this includes calculating the path taken by each wheel during the turn and also calculating the space needed by the vehicle body during the turn.

Due to the size and scale of the wind turbine components, there is a potential for deterioration of the road infrastructure when the components are being transported from Mombasa to Nairobi. The section of the Mombasa – Nairobi highway between Kipevu and Mazeras is potentially at risk if axle load limits are not complied with. The section of the Mombasa – Nairobi highway at Jomvu is notorious as it is poorly maintained with traffic jams experienced regularly in that section.

A detailed transport survey will be carried out prior to construction to identify sections of the road network between Kipevu and the project site that may need to be demolished to accommodate the abnormal sizes of the wind turbine components.

Most of the impacts associated with the transportation of the wind turbine components will occur in the construction stage with minimal impacts during the operational phase.

Construction phase

Unmitigated Impact: Damage to roads and other infrastructure				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
4	5	2	3	4
Result: Medium-high (-77)				
Comments/Mitigation: • *The proponent should ensure that all wind turbine components are transported in appropriate vehicles that adhere to the axle load limits.* • *For upgrading the E407 and construction of new access tracks, the proponent will ensure that during the construction phase, the road contractor adheres to the axle load limits when delivering construction raw materials to the site.* • *All contractors should refrain from opening up new tracks which are not part of the access tracks leading to the wind turbines.* • *Additionally speed limits for all construction related vehicles shall be adhered to at all times to prevent damage of roads and other infrastructure*				
Mitigated Impact: Damage to roads and other infrastructure				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
3	4	2	2	3
Results: Low (-45)				

11.4.9.2 Increased traffic and road safety hazard (T2)

As stated above, the wind turbine components are defined as abnormal loads that will be transported from Mombasa to the project site in Kipeto. Special purpose vehicles will be used to transport the components; as wind turbine projects are uncommon in Kenya, the sheer size of the components will arouse significant interest by other road users. Secondly, the special purpose vehicles will move carefully and slowly to ensure that the wind turbine components are not damaged during transportation. This could cause traffic jams along the Mombasa – Nairobi highway as the special purpose vehicles will move slowly.

The wind turbine components will be transported under security and escorts during specific times of the day. The transport process will be undertaken in accordance with the Traffic Act and other relevant road laws in Kenya.

Subsequently it is anticipated that most impacts will occur during the construction phase of the project.

Construction phase

Unmitigated Impact: Increased traffic and road safety hazard				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
3	5	2	3	4
Result: Low-medium (-70)				
Comments/Mitigation: • *The proponent should undertake a detailed transport survey of the route between Kipevu and the project site and conduct a route hazard survey for the Mombasa – Nairobi highway.* • *The proponent should conduct a supplier risk assessment of a road transport company that can provide professional and safe abnormal load escorts for road safety purposes involving special purpose vehicles.* • *High visibility colors should be used during the transportation of the wind turbines to the project site.* • *The Kenya Police, Traffic Department should be engaged for provision of traffic safety while the wind turbine components are being transported to the project site.*				
Mitigated Impact: Increased traffic and road safety hazard				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
2	3	2	2	3
Results: Low (-35)				

11.4.9.3 Landscape and visual assessment (LVA)

Galetech Energy Developments (GED) of Ireland undertook a landscape and visual impact assessment as part of the ESIA Study. The objective of the assessment was to assess the landscape and visual impacts of the proposed project from a variety of receptor types, viewing angles and viewing distances.

Desk studies and fieldwork comprising professional evaluation by landscape consultants was undertaken. The methodology for undertaking the landscape and visual assessment for the proposed project included:

- Establishing a Study Area to reflect the potential visibility of the proposed development;
- Preparation of a Zone of Theoretical Visibility (ZTV) map to indicate areas from which the development is potentially visible in relation to terrain within the Study Area;
- Selection of potential Viewshed Reference Points (VRP) to be investigated during fieldwork for actual visibility and sensitivity (VRP's are the representative locations used as the basis for the landscape and visual assessment);

- Description of proposed development and ancillary/associated structures;
- Description of the geographic location and landscape context of the proposed wind farm site;
- General landscape description concerning essential landscape character and salient features of the Study Area, discussed with respect to landform, vegetation, land use and structures;
- Consideration of design guidance, the planning context and relevant landscape designations;
- Semi-quantitative assessment of landscape sensitivity;
- Detailed assessment of photomontages produced by GED Ltd;
- Estimation of the likely degree of impact on landscape; and
- Recommendation of mitigation measures where appropriate and possible.

The impact of the proposed development upon landscape was assessed using three (3) distinct categories of receptor type as listed below:

- Local community views taking consideration of those people that live or work in close proximity to the proposed wind farm;
- Centres of population e.g. Kajiado, Ngong, etc.; and
- Major routes.

11.4.9.4 Outline description of Viewshed Reference Points (VRPs)

The results of the ZTV analysis provide the basis for selection of Viewshed Reference Points (VRP's), which are the locations used to study the visual and landscape impact of the proposed wind farm in detail. It is not warranted to include every single location that provides a view of this development as this would result in an unwieldy report and make it extremely difficult to draw out the key impacts arising from the project. Instead, the assessors endeavoured to select a variety of location types that would provide views of the proposed wind farm from different distances, different angles and different contexts. This involved desk study analysis using the ZTV map and fieldwork to establish likely visibility and the relative sensitivity of the VRP locations as well as the grid coordinates of positions from which photomontages can be prepared.

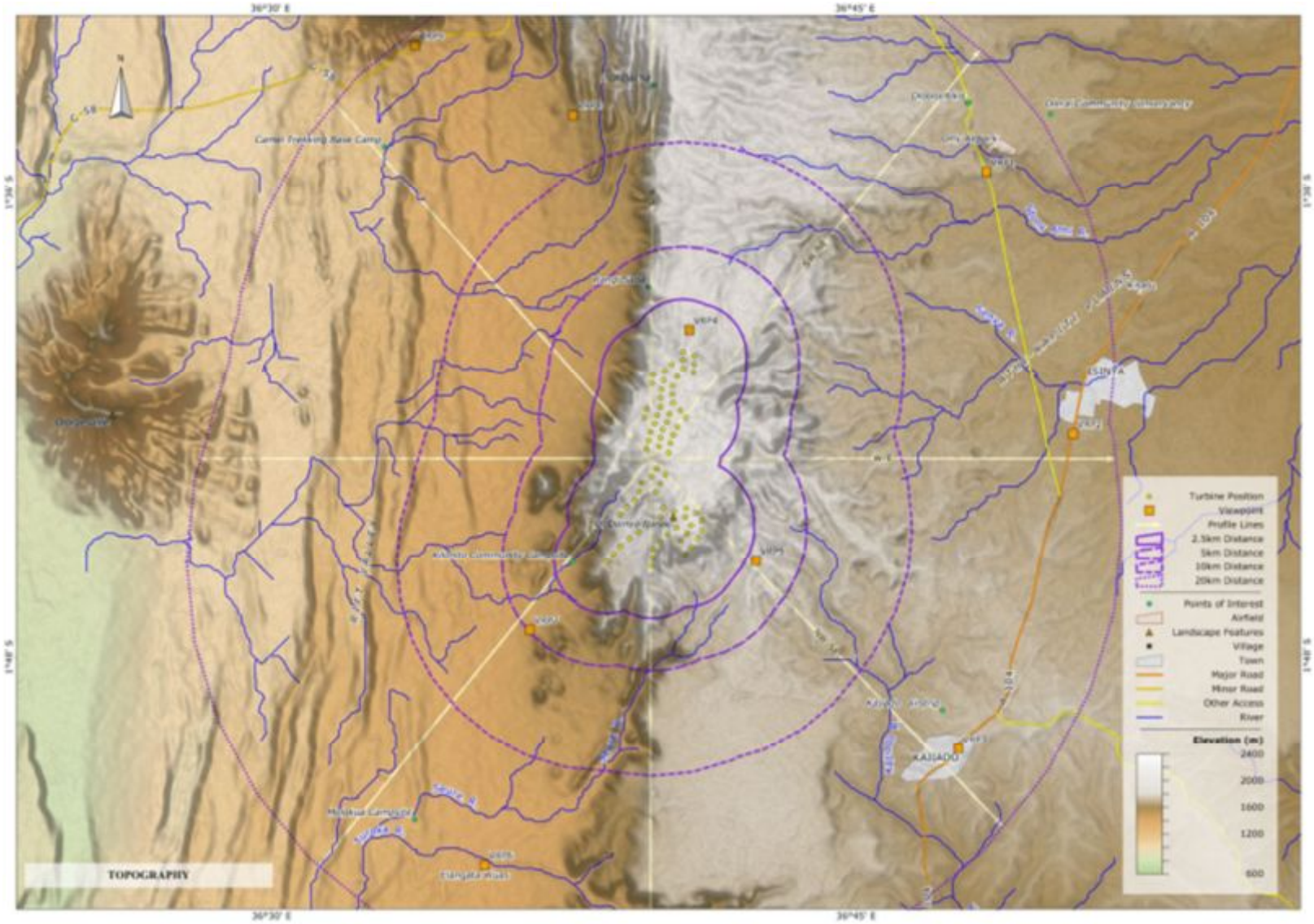
Subsequently nine (9) Viewshed Reference Points (VRPs) were selected as outlined in Table 3. These nine VRPs are also shown in Figure 1.

Most of the landscape and visual impacts of the proposed wind energy facility will occur in the operational phase and subsequently, no assessment has been done for the construction phase.

Table 11-3: Outline description of Viewshed Reference Points

VRP No.	Location	Direction of view
	Local Community views	
VRP4	North of proposed site, 1.5km from nearest turbine	S
VRP5	Small settlement (Ilyagaleni) east of the proposed site, 3km from nearest turbine	NW
VRP7	In Rift Valley near a small settlement (Kilonito) south-west of site, 4.6km from nearest turbine	NE
VRP8	North-west of site on a local road, 12.5km from nearest turbine	S
	Centers of population	
VRP2	Isinya on the A104	W
VRP3	Kajiado on the A104	NW
VRP6	Elangata Wuas	NNE
	Major Routes	
VRP1	Kiserian-Isinya road, near the Orly Aerodrome	SW
VRP2	A104 just south of Isinya	W
VRP9	C58 near a number of Maasai villages	SE

Figure 11-1: Topographic map of the study area showing profile lines, viewpoints and latest turbine positions



11.4.9.5 Impacts on local community views (LVA1)

Low sensitivity and minor adverse aesthetic impact indicate a slight significance of impact for VRP4 even though the turbines are dominant in the view. The significance of impact will be moderate for VRP5 due to the dominant visual presence of turbines and their moderate adverse aesthetic impact on the view. VRP7 has a medium sensitivity to the development due to its sense of remoteness, and the visual presence of turbines on the ridge above the viewpoint will be dominant, but the aesthetic impact is minor adverse. A moderately significant impact is therefore expected for VRP7. VRP8 has a high sensitivity, but due to its distance from the wind farm site the significance of impact is expected to be slight.

Operational phase

Unmitigated Impact: Impacts on local community views				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
4	3	5	4	3
Result: Medium-high (-84)				
Comments/Mitigation: • *Minimize presence of ancillary structures on the site by avoiding fencing, minimizing roads, burying intraproject power lines, and removing inoperative turbines;* • *Avoid steep slopes, implement erosion measures, and promptly revegetate cleared land with native species only;* • *Maintain uniform size and design of turbines (e.g. direction of rotation, type of turbine and tower, and height);* • *Paint turbines a uniform, matt non-reflective colour, while observing air navigation marking regulations;* • *Avoid including lettering, company insignia, advertising, or graphics on the turbines.*				
Mitigated Impact: Impacts on local community views				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
2	3	5	4	2
Results: Low (-60)				

11.4.9.6 Impacts on centers of population (LVA2)

The main populated centres are far from the proposed wind farm site and the significance of impact is slight to imperceptible for viewpoints VRP2, VRP3 and VRP6 corresponding to Isinya, Kajiado and Elangata Wuas respectively.

Operational phase

Unmitigated Impact: Impacts on centers of population				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
3	3	4	4	3
Result: Low-medium (-70)				
Comments/Mitigation: • *Minimize presence of ancillary structures on the site by avoiding fencing, minimizing roads, burying intraproject power lines, and removing inoperative turbines;* • *Avoid steep slopes, implement erosion measures, and promptly revegetate cleared land with native species only;* • *Maintain uniform size and design of turbines (e.g. direction of rotation, type of turbine and tower, and height);* • *Paint turbines a uniform, matt non-reflective colour, while observing air navigation marking regulations;* • *Avoid including lettering, company insignia, advertising, or graphics on the turbines.*				
Mitigated Impact: Impacts on centers of population				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
2	3	3	4	2
Results: Low (-48)				

11.4.9.7 Impacts on major routes (LVA3)

The major routes in the Study Area are too far from the proposed wind farm site for views to be much affected. For VRP1 and VRP9 the significance of impact will be imperceptible, and for VRP2 it will be slight.

Operational phase

Unmitigated Impact: Impacts on centers of population				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
2	3	3	4	3
Result: Low-medium (-56)				
Comments/Mitigation: • *Minimize presence of ancillary structures on the site by avoiding fencing, minimizing roads, burying intraproject power lines, and removing inoperative turbines;* • *Avoid steep slopes, implement erosion measures, and promptly revegetate cleared land with native species only;* • *Maintain uniform size and design of turbines (e.g. direction of rotation, type*				

of turbine and tower, and height); • *Paint turbines a uniform, matt non-reflective colour, while observing air navigation marking regulations;* • *Avoid including lettering, company insignia, advertising, or graphics on the turbines.*
Mitigated Impact: Impacts on centers of population

Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
1	3	2	4	2
Results: Low (-36)				

11.4.10 Shadow flicker (SF)

11.4.10.1 Impacts of shadow flicker (SF1)

A shadow flicker assessment was conducted on properties within 1km from the proposed development of 67 wind turbines. The shadow flicker assessment for the proposed wind energy facility was based on a wind turbine hub height of 80m and a blade diameter of 100m.

The possible occurrence of shadow flicker was assessed using EMD WindPro Version 2.7.486 software. The software calculates how often and in which intervals of the year a specific receptor will be affected by shadows generated by one or more of the wind turbines. The proposed development was modelled to assess the likelihood of shadow flicker impacting on dwellings within 1km (10 rotor diameters) of a turbine.

International guidelines suggest that if the shadow flicker is greater than 30 minutes per day or 30 hours per year, mitigation measures should be proposed. The results of the shadow flicker modelling indicate that shadow flicker could potentially affect nine households as follows:

- 6 landowners' houses are predicted to exceed 30min per day of shadow flicker;
- 1 household is predicated to exceed 30hrs per year of shadow flicker; and
- 2 landowners' houses are to exceed both 30min per day and 30hrs per year of shadow flicker.

The shadow flicker impacts are expected to be felt during the operational phase when wind turbines will be functional.

Operational phase

Unmitigated Impact: Impacts of shadow flicker				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
2	3	2	4	3
Result: Low (-49)				
Comments/Mitigation: • *A detailed receptor survey shall be carried out on each of the 9 no. households at the micro-siting stage and the location of each receptor shall be fed into the model in order to calculate shadow flicker hours at each receptor/window.* • *The 8 out of 9 affected landowners will be requested to relocate their households within their own parcels of land voluntarily to prevent overexposure to the internationall accepted guidelines for shadow flicker* • *Should the head of the household not consent to acceptance of the higher shadow flicker limit, the standard mitigation measure will be applied which is to fit a sensor to the impacted receptor. The sensor will cause the turbine responsible to shut down if the receptor receives more than 30hrs shadow flicker per year or more than 30min per day.* • *The proponent may consider planting trees and hedging to prevent or limit the potential for shadow flicker*				
Mitigated Impact: Impacts of shadow flicker				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
1	2	1	4	2
Results: Very-low (-24)				

11.4.11 Health and safety (HS)

11.4.11.1 Impacts of occupational health and safety (HS1)

The development of the proposed wind energy facility will involve a range of activities that could potentially be unsafe to workers and the local community without mitigation measures. Examples of such activities include excavation for wind turbine foundations, use of pneumatic drills for cutting through hard rock, working at heights, trenching, etc. Such activities require the use and operation of heavy-duty earth moving equipment, machinery and vehicles.

During the construction phase, the potential occupational safety and health risks could emanate from:

- Injury to workers from the operation of machinery, equipment and construction vehicles;
- Injuries while working at heights;

- Road accidents; and
- Exposures to diseases including malaria, HIV/AIDS and TB.

During the operational phase, the potential occupational safety and health risks include injuries to workers from routine monitoring and maintenance activities (vehicle accidents, replacement of components/parts, etc.) and emergencies such as equipment malfunction, fires, etc.

Construction phase

Unmitigated Impact: Impacts of occupational health and safety				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
4	4	2	3	4
Result: Low-medium (-70)				
Comments/Mitigation: • *The proponent will comply with the requirements of health and safety (H&S) legislation in Kenya as it applies to the proposed project. This will include development, rollout and implementation of appropriate H&S policies and procedures for the safe management during the construction phase of the project.* • *The contractor will comply with the Occupational Safety and Health Act, 2007 including all relevant subsidiary legislation under the Act.* • *The contractor on site will be required to undertake appropriate H&S risk assessments jintly with the workers and produce a safety method statement for each activity that will be carried out during the construction phase.* • *H&S induction and on-going training will be provided to the workers to ensure that they inculcate a safety culture always while working in construction areas. Additionally tool-box talks will be undertaken regularly to identify any unknown hazards to the construction workers.*				
Mitigated Impact: Impacts of occupational health and safety				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
3	2	2	2	3
Results: Low (-35)				

Operational phase

Unmitigated Impact: Impacts of occupational health and safety				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
3	3	2	2	3
Result: Low (-40)				
Comments/Mitigation: • *A health, safety and environment (HSE) management system will be developed, rolled out and implemented. This system which will be based on the Deming Cycle will be reviewed annually or after a major accident or incident. Periodic H&S inspections and annual statutory audits will be undertaken to verify and validate the competency of the HSE management system with changes being made as necessary.*				
Mitigated Impact: Impacts of occupational health and safety				
Magnitude of impact	Geographic extent	Duration of impact	Frequency of activity	Frequency of impact
2	2	1	2	2
Results: Very-low (-20)				

11.4.12 Cumulative impacts (C)

Cumulative impacts are those that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities. For the proposed wind energy facility, given below are the predicted cumulative impacts on the terrestrial environment resulting from the construction and operational phases respectively.

11.4.12.1 Archeology and cultural heritage (C1)

The archeological and cultural heritage impact assessment was done from the perspective of impacts on potential archeological discoveries and cultural heritage. It is anticipated that the cumulative impacts during the operational phase will be lower than those in the construction phase.

During the construction phase, there is a potential "chance find" cumulative impact on archeological or paleontological artifacts.

11.4.12.2 Ecology (C2)

In the previous section, an assessment was done on project related impacts associated with terrestrial vegetation, sensitive habitats, priority plant species, insect pollinators, mammals and their movements and herpetofauna.

From the assessments, it can be predicted that the cumulative impacts on ecology associated with the wind energy facility include permanent loss of vegetation that could lead to additional loss of habitat. Additional loss of habitat can arise from soil erosion and alien invasions.

11.4.12.3 Surface water (C3)

The previous section assessed surface water impacts resulting from the proposed project from a soil erosion/silt laden water run-off perspective and contamination of surface water.

Soil erosion, alien invasions and hydrocarbon contamination of surface water arising from the construction phase of the project may lead to potential cumulative impacts on dams, water pans, etc. that are used by the local Maasai community.

11.4.12.4 Geology and soils (C4)

The previous section analyzed geology and soils impacts from the perspective of soil erosion, contamination of soils and destruction of soil structure by heavy machinery.

The cumulative impacts associated with the above perspectives are as follows:

- Removal of soil and/or rock for foundations and road cuttings is considered moderate due to the number of wind turbines and roads.
- Site clearance including cut and fill operations for the entire site is considered moderate with mitigation
- Contamination of soils is from all development activities associated with the wind energy facility is considered low if mitigation is applied diligently
- Destruction of soil structures by heavy machinery is considered low if mitigation measures are adhered to.

11.4.12.5 Noise (C5)

During the construction and operational phase, the ambient noise quality will be altered and there will be additional noise generated throughout these two phases of the project. this impact is cumulative with the existing ambient background noises.

11.4.12.6 Avifauna (C6)

The previous section assessed the impacts on avifauna from the perspective of bird mortality and collision, displacement of birds from the project area, and habitat change and loss.

As there are no other wind energy facilities in the vicinity of the project area, it is not anticipated that there will be significant cumulative impacts on the avifauna resulting from the proposed project.

11.4.12.7 Socio-economics (C7)

The creation of employment opportunities is seen as a cumulative impact arising from the proposed project. The opportunities include upgrading and improving skills in the area. however due to the relatively short construction period (8 – 10 months), this opportunity is likely to be limited. During the operational phase, there are potential opportunities for skills development associated with the operations and maintenance of the wind energy facility.

With the introduction of construction workers in the project area, there is a potential cumulative impact on family and community relations that may persist for an extended period of time. Also in cases where unplanned/unwanted pregnancies occur or members of the community are affected by a sexually transmitted disease (STD), the cumulative impacts may be permanent on affected individuals and/or their families and the community.

Given that other wind energy facilities could be planned for the future in the area, poor management of cultural heritage resources could in part sterilize future resource use and the physical history of the area.

There is a potential cumulative impact on eco-tourism that can be introduced in the area as the road network will be upgraded. Due to its location, there is a potential to attract more visitors to the area which in turn would benefit the local tourism sector.

11.4.12.8 Landscape and visual assessment (C8)

The construction of up to 67 wind turbines together with a sub-station and a proposed transmission line will increase the cumulative visual impact within the region. The current rural sense of place will be lost as a result of the project.

11.4.12.9 Health and safety (C9)

During the construction phase, there will be potential noise, dust and safety impacts associated with the movement of construction related traffic to and from the site.

If damage to roads is not repaired, then this will impact on livestock farming activities in the area and also result in higher maintenance costs for vehicles of road users. The costs will be borne by the road users who were not responsible for the damage.

Any health and safety related accidents or incidents that occur during the construction and operational phases of the project will have extended or permanent cumulative impacts on individuals and/or their families and the community.

Table 11-4: Summary of significance of each identified impact

Impact	Code	Significance rating					
		Construction		Operation		Decommissioning	
		Without mitigation	With mitigation	Without mitigation	With mitigation	Without mitigation	With mitigation
Archeology and cultural heritage (ACH)							
Impacts on archeology	ACH1	Low (-)	Very Low (-)				
Impacts on cultural heritage	ACH2	Medium-high (-)	Low-medium (-)				
Terrestrial ecology (E)							
Impacts on terrestrial vegetation	E1	Low (-)	Very Low (-)	Low-medium (-)	Very Low (-)		
Impacts on sensitive habitats	E2	Low (-)	Very Low (-)	Low (-)	Very Low (-)		
Impacts on priority plant species	E3	Low (-)	Very Low (-)	Low (-)	Very Low (-)		
Impacts on insect pollinators	E4	Low-medium (-)	Very low (-)	Low-medium (-)	Very low (-)		
Impacts on mammals and their movements	E5	Low (-)	Very Low (-)	Low (-)	Very Low (-)		
Impacts on herpetofauna	E6	Low (-)	Very Low (-)	Low (-)	Very Low (-)		

Impact	Code	Significance rating					
		Construction		Operation		Decommissioning	
		Without mitigation	With mitigation	Without mitigation	With mitigation	Without mitigation	With mitigation
Impacts on surface water (SW)							
Soil erosion and silt laden water run-off	SW1	Low (-)	Very-low (-)	Low (-)	Very-low (-)		
Contamination of surface water	SW2	Low (-)	Very-low (-)				
Geology and soils (GS)							
Soil erosion	GS1	Low (-)	Very-low (-)				
Contamination of soils	GS2	Low (-)	Very-low (-)				
Destruction of soil structure by heavy machinery	GS3	Low (-)	Very-low (-)				
Groundwater (GW)							
Pollution of groundwater	GW1	Low (-)	Very-low (-)				
Noise (N)							
Noise during construction and commissioning	N1	Low-medium (-)	Low (-)				
Noise during operation	N2			Low-medium (-)	Low (-)		

Impact	Code	Significance rating					
		Construction		Operation		Decommissioning	
		Without mitigation	With mitigation	Without mitigation	With mitigation	Without mitigation	With mitigation
Ornithology (O)							
Bird mortality and collision	O1			Medium-high (-)	Very-low (-)		
Displacement of birds from project area	O2	Low-medium (-)	Low (-)	Low (-)	Very-low (-)		
Habitat change and loss	O3	Low-medium (-)	Very-low (-)	Low (-)	Very-low (-)		
Socio-economic impacts (SE)							
Creation of employment	SE1	Low (+)	Low-medium (+)	Low-medium (+)	Medium-high (+)		
Demand for construction materials	SE2	Low (+)	Low-medium (+)				
Impact on transport infrastructure	SE3	Low (+)	Medium-high (+)	Low (+)	Medium-high (+)	Low (+)	Medium-high (+)
Impacts on livestock farming	SE4	Low-medium (-)	Low (-)				
Impacts on local economy	SE5	Low (+)	Low (+)	Low (+)	Low-medium (+)	Low (+)	Low-medium (+)
Impacts on land value	SE6	Low (+)	Medium-high (+)	Low (+)	Medium-high (+)		

Impact	Code	Significance rating					
		Construction		Operation		Decommissioning	
		Without mitigation	With mitigation	Without mitigation	With mitigation	Without mitigation	With mitigation
Impacts on tourism	SE7			Low (+)	Medium-high (+)		
Impacts on education	SE8			Very-low (+)	Medium-high (+)		
Changes in social lifestyles	SE10	Low (-)	Very-low (-)	Low (-)	Very-low (-)		
Transport (T)							
Damage to roads and other infrastructure	T1	Medium-high (-)	Low (-)				
Increased road traffic and road safety hazards	T2	Low-medium (-)	Low (-)				
Landscape and visual assessment (LVA)							
Impacts on local community views	LVA1			Medium-high (-)	Low (-)		
Impacts on centers of population	LVA2			Low-medium (-)	Low (-)		
Impacts on major routes	LVA3			Low-medium (-)	Low (-)		

Impact	Code	Significance rating					
		Construction		Operation		Decommissioning	
		Without mitigation	With mitigation	Without mitigation	With mitigation	Without mitigation	With mitigation
Shadow flicker (SF)							
Impacts of shadow flicker	SF1			Low (-)	Very-low (-)		
Health and Safety impacts (HS)							
Impacts on health and safety	HS1	Low-medium (-)	Low (-)	Low (-)	Very-low (-)		

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12 Environment and Social Management Plan (ESMP)

The purpose of the ESMP is to ensure that social and environmental impacts, risks and liabilities identified during the ESIA process are effectively managed during the construction, operation and closure of the proposed project. The ESMP specifies the mitigation and management measures to which the Proponent is committed and shows how the Project will mobilize organizational capacity and resources to implement these measures. The ESMP also shows how mitigation and management measures will be scheduled.

The key objectives of the ESIMP are to:

- Formalize and disclose the program for environmental and social management; and
- Provide a framework for the implementation of environmental and social management initiatives.

Best practice principles require that every reasonable effort is made to reduce and preferably to prevent negative impacts while enhancing the benefits. These principles have guided the ESIA process. In many cases, potential negative impacts have been avoided through careful design and location of facilities.

The ESIA involved concurrent and ongoing data collection and public consultation activities to date.

12.1 Structure of the ESMP

The ESMP stipulates the environmental standards to be adhered to by the parties involved in the various phases of the project life cycle. As such the ESMP comprises of a section for each of the following project life cycle phases:

- Planning and design;
- Pre-construction and construction activities;
- Operation; and
- Decommissioning

12.2 Planning and design

The planning and design phase of the project is not expected to have any direct impacts on the environment and consequently no management control measures are required and/or proposed.

Various layout options were considered to minimize the environmental imapcts and the currently proposed layout plan has been chosen on the basis of these considerations.

12.2.1 Environmental procedures and specifications

12.2.1.1 Site layout and land matters

a) Ideally, turbines should be positioned at least 750m (10 rotor diameters) from residences to avoid shadow flicker and noise impacts;

b) If this is not possible, affected households should be assessed for shadow flicker;

c) If the shadow flicker analysis confirms flicker, the layout must be modified and/or certain turbines switched off at certain times (i.e. when shadow flicker occurs over the recommended 30 hours per year or 30 minutes per day);

d) Consideration must be given to orderly and precise arrangement of the turbines to minimize the negative visual impacts;

e) To accommodate future expansion, the layout should be able to accommodate additional turbines in a manner that reinforces the original pattern;

f) Consideration must be given to the loss or destruction of habitat and species of special concern, in order to minimize impacts on threatened or protected species;

12.2.1.2 Turbine design

a) The turbines should be painted either white/off-white/very light grey color with matt coating.

12.3 Pre-construction and construction

This section deals with the pre-construction and construction related activities.

12.3.1 Scope of construction EMP

The construction EMP is intended for use by the appointed contractor(s) and Kipeto Energy Limited during the construction phase of the project. construction related activities associated with the proposed wind energy facility include:

- Surveying of the site;
- Setting up of construction camp(s);
- Storage of construction materials and equipment in laydown areas;
- Excavation (for wind turbine foundations);
- Sourcing and storage of fill materials;
- Identification of sites for spoil material (if required);
- Cement mixing and pouring (for wind turbine foundations);
- Site leveling and fencing;
- Construction of buildings/sub-station;

- Upgrading of the E407 road and construction of new access roads to each wind turbine;
- Installation of electrical infrastructure;
- Operation of construction plant and equipment along the access roads and on the project site; and
- Clearance of vegetation for:
  - Site camp;
  - Construction area;
  - New access roads;
  - Sub-station; and
  - Equipment and material storage areas.

The following sections detail management and mitigation measures that will be undertaken to address the environmental impacts that have been identified in the ESIA, in addition to general environmental good practice.

12.3.2 Roles and responsibilities

The general roles and responsibilities of various parties are outlined below.

12.3.2.1 Kipeto Energy Limited

Kipeto Energy Limited (Proponent) has assigned Galetech Energy Developments (GED) of Ireland as their project manager for the proposed wind energy project. Irrespective of other duties assigned to them, GED shall be responsible for:

- Ensuring that the contractor is duly informed of the EMP and associated responsibilities and implications of this EMP;
- Appoint an HSE officer to monitor the implementation of this EMP during the construction phase of the project. the appointed HSE officer shall be a qualified HSE professional with relevant HSE expertise;
- Ensuring that the construction contract makes provision for rehabilitation to the satisfaction of the relevant authorities, of any environmental damage resulting from the proposed project as well as non-compliance with the EMP, environmental regulations and relevant legislation carried out by the contractor.

12.3.2.2 The HSE Officer

The HSE officer shall be a qualified HSE professional. The HSE officer shall be responsible for checking compliance of the contractor(s) with the requirements of this EMP and any other relevant environmental legislation for all activities associated with the contract.

The general duties of the HSE officer are as follows:

- Being familiar with the environmental management requirements contained in this EMP;

- Regular auditing of the contractor(s) with the view of ensuring that all activities on the site are undertaken in accordance with the EMP;
- Issuing regular audit reports to the Project Manager and contractor(s) regarding compliance with this EMP;
- Providing ad-hoc environmental advice including environmental legal requirements to the Project Manager, Proponent and the contractor(s) regarding issues that may arise during the contract.

12.3.2.3 The Contractor(s)

The contractor(s) must ensure that all aspects of the contract comply with both this EMP and other relevant environmental legislation. The contractor(s) shall be responsible for:

- Appointing an HSE officer (on-site) who irrespective of other duties will also be responsible for overseeing all activities associated with the contract;
- Ensuring that the HSE officer has the means to carry out his/her tasks;
- Be responsible for rehabilitation of, or the cost of rehabilitation of any environmental damage that may arise out of non-compliance with this EMP and/or environmental legislation. Such rehabilitation shall be to the satisfaction of the relevant authorities and/or the Project Manager.

12.3.2.4 Contractor(s) HSE Officer

The contractor(s) HSE officer shall be responsible for implementation of this EMP and any other environmental requirements that may be identified by the Project Manager during the course of the contract. The contractor(s) HSE officer shall have received basic HSE training either as part of the contract or previously. In addition to any other responsibilities, the general duties of the contractor(s) HSE officer shall be:

- Ensuring that all personnel (including sub-contractors) are duly informed of the requirements contained in this EMP, and the associated responsibilities and implications of this EMP;
- Ensuring that all records needed to demonstrate compliance with the EMP requirements are obtained, filed and readily available for inspection by the Project Manager or the Proponent;
- Consulting with the Client's HSE Officer regarding interpretation of the EMP and any other aspects of the contract that may impact significantly on the environment;
- Ensuring that all personnel demonstrate respect and care for the environment in which they are operating;
- Acting as a point of contact for local residents and community members.

12.3.3 Environmental procedures and specifications

12.3.3.1 Procedures

This section outlines the overall processes/procedures associated with the implementation and monitoring of this construction EMP.

Compliance auditing

a) The client's HSE officer and the contractor(s) HSE officer shall conduct a pre-construction site inspection to identify sensitive environments, no-go areas, location of site camps, etc.;

b) The client's HSE officer will prepare a pre-construction audit report which will include photographs of the general condition of the key features of the site. the photographs shall be used for comparison purposes on completion of the contract i.e. after rehabilitation of the construction areas;

c) The client's HSE officer will conduct monthly site audits of all construction related activities described in section 12.3.1;

d) On completion of the construction activities, the client's HSE officer together with the contractor(s) HSE officer will conduct a site inspection. Any items requiring attention shall be included in a post-construction audit report;

e) On completion of the defects liability period, the client's HSE officer shall accompany the Project Manager and the contractor with the view of determining whether outstanding matters from the post-construction audit have been adequately addressed.

HSE incidents

a) The contractor(s) HSE officer shall maintain a register of all HSE related incidents occurring as a result of the activities associated with the contract. HSE related incidents that shall be recorded include (but not limited to):

- Fires;
- Accidents;
- Spills of hazardous materials that contaminate soil or water resources;
- Improvement orders/notices issued by the NEMA or DOSHS or other relevant lead agencies; and
- Non-compliance with this EMP.

b) Each HSE related incident will be investigated by the client's HSE officer and an incident report forwarded to the contractor and project manager. An incident report will be presented within five working days;

c) HSE incident reports will include as a minimum, a description of the incident, actions taken to contain any damage to the environment, personnel or the public, and the corrective actions to repair/remediate any damage; and

d) Prescribe additional measures that may be required to remediate damage resulting from the incident and/or to prevent similar incidents occurring in the future.

Training

The contractor is responsible for ensuring that their workers are provided HSE training as stipulated in the OSHA 2007 and its subsidiary legislation. In addition to formal training, the contractor should undertake tool-box talks. A training register should be kept on site for all training conducted as proof for auditing purposes. The HSE training should include among other topics:

- The importance of conforming with all HSE policies;
- The HSE impacts of the proposed activities;
- HSE benefits of improved personal performance;
- Worker roles and responsibilities in achieving conformance with the client's HSE policy, procedures and this EMP including associated procedures and emergency preparedness and response requirements;
- Potential consequences of departure from specified operating procedures; and
- Mitigation measures required to be implemented when carrying out their work activities.

12.3.3.2 Specifications

General environmental specifications

a) Construction workers shall be prohibited from entering areas of the site that fall outside the work area and no harming of wild or domestic animals or destruction of vegetation shall be allowed;

b) No wildlife or indigenous vegetation may be harmed or removed unless approved by the client's HSE officer in conjunction with the necessary permits;

c) New tracks must be constructed in such a way as to reduce the denuded land and subsequent visual contrast;

d) Vehicles and/or plant and personnel shall only be permitted within the demarcated construction areas or on existing roads and/or access tracks between demarcated areas;

e) Where topsoil is disturbed/excavated, such topsoil shall be stockpiled on the site where it originated from for later use during rehabilitation. Stockpiles will be protected by suitable means from wind and water erosion.

Site demarcation and vegetation clearing

a) The construction camp should be located away from the public domain and where it can be screened by existing vegetation; if possible it should not be visible from any prominent roads;

b) Clearing of vegetation shall be kept to the minimum required and where possible, shall be avoided and areas for construction related activities shall be located where the natural habitat has been transformed;

c) All construction sites and camp site areas should be clearly demarcated;

d) Temporary construction camps and storage areas must be located on previously transformed portions of the site;

e) Areas where priority plant species are growing must be demarcated as no-go zones;

f) All disturbed or cleared areas should be kept clear of alien invasive plants for the duration of the construction and defects notification period;

g) Access tracks should avoid sensitive areas, especially steep gradients;

h) No clearing of vegetation, storage of materials or other construction related activities shall be permitted outside the demarcated construction area.

Materials handling and storage

a) Materials for construction shall be stored within demarcated construction areas

12.3.3.3 Control of hazardous materials

Measures aimed at preventing contamination of soil, surface water or groundwater by environmentally hazardous materials (e.g. fuels, oils, cement, etc.) during the construction phase include:

a) All hazardous materials shall be stored away from water courses and drains and handled over an impermeable surface at all times;

b) Hazardous materials shall be stored in properly bunded areas to contain any leaks and drip trays shall be in place under all fuel bowsers;

c) Appropriate spill kits must be available in areas of proximity to watercourses and drains;

d) Should any hazardous materials spills occur, the contaminated soil shall be removed and disposed off in accordance with L.N. 121: Waste Management Regulations, 2006;

e) Any material used to soak up hazardous material spills must be disposed off in accordance with L.N. 121: Waste Management Regulations, 2006;

f) Spilled hazardous materials within bunded areas shall either be recovered or disposed off in accordance with L.N. 121: Waste Management Regulations, 2006;

g) All cement mixing shall be conducted on an impervious surface and where possible ready-mix cement will be used;

h) All wastewater that is contaminated with hazardous substances shall be collected in a container, allowed to evaporate and the sludge disposed off as hazardous waste;

i) All personnel shall be trained and educated during induction on the safe handling of hazardous substances on site.

12.3.3.4 Control of possible heritage impacts

a) The Proponent should consider appointing an archeologist during the construction phase to monitor and oversee vegetation clearing and earth moving process to avoid negative impacts on archeological material;

b) Construction managers/foremen should be informed before construction starts on the possible types of archeological artifacts they may encounter and the procedures to follow when they find such sites;

c) Sufficient time must be allowed to remove/collect such material;

d) If archeological material already identified during the archeological impact assessment will be impacted upon by the wind turbine footprint, mitigation in the form of test pits, systematic excavation and sampling must be undertaken before trenching and any other earth moving activity is carried out.

12.3.3.5 Waste management

The project manager in consultation with the contractor(s) will be responsible for ensuring that waste management is undertaken in conformity with the requirements of L.N. 121: Waste Management Regulations, 2006. Some of the aspects that will be incorporated for waste management include:

a) Sufficient weather and scavenger-proof bins (with lids to prevent the escape of litter) shall be provided and be accessible at all points where waste is generated;

b) The project area should be kept clean and free of litter and no litter from the site shall be allowed to disperse to surrounding areas;

c) All personnel shall be instructed to dispose of all wastes in a proper manner;

d) The contractor shall identify and separate materials that can be reused or recycled to minimize waste;

e) All construction materials should be suitably stored and protected so that they do not become damaged and unusable;

f) The contractor shall be responsible for the regular disposal of all waste generated as a construction of the wind energy facility;

g) No dumping within the surrounding area shall be permitted and no waste may be buried or burned.

12.3.3.6 Fire prevention and control

a) The contractor will undertake to ensure that they develop and implement a fire safety policy in accordance with L.N. 59: Fire Risk Reduction Rules, 2007;

b) No burning of vegetation whether to clear vegetation or of cleared vegetation shall be permitted;

c) No cooking or heating fires shall be permitted except in designated areas within the construction camp;

d) Sufficient firefighting equipment shall be maintained and accessible at all times. In particular such firefighting equipment shall be readily available where hot works may be required;

e) In the event that a fire is too large for on-site personnel to control, the fire brigade shall be called to extinguish it.

12.3.3.7 Sewage and stormwater

a) No wastewater shall be disposed off to the surrounding soil or natural water resources;

b) All effluent from the camp/office sites shall be disposed off in accordance with relevant requirements of L.N. 120: Water Quality Regulations, 2006;

c) Wastewater that is contaminated with soaps, detergents, grease, oils, paints and other undesirable materials shall be collected in conservancy tanks and disposed off in accordance with L.N. 120: Water Quality Regulations, 2006 and L.N. 121: Waste Management Regulations, 2006;

d) An adequate number of portable toilets for male and female workers in accordance with the Public Health Act shall be positioned in all construction areas. These toilets shall be regularly serviced by the contractor or an outside service provider;

e) Sanitary requirements should be to the satisfaction of the client's HSE officer and in compliance with the Public Health Act.

12.3.3.8 Dust and noise control

a) To minimize dust impacts, areas to be cleared of vegetation or topsoil shall be cleared only when required and shall be rehabilitated immediately on completion of the construction activity in that area;

b) Access roads should be kept to a minimum and shall be limited to designated construction areas;

c) Vehicle speeds should be limited to 30km/h on unpaved surfaces;

d) When necessary, dust suppression measures (wetting of soil) shall be implemented;

e) To minimize disturbance to neighboring landowners, activities that are likely to generate noise should be restricted in accordance with L.N. 61: Noise and Excessive Vibration Pollution Control Regulations, 2009.

12.3.3.9 Equipment maintenance

a) All construction plant and equipment, tanks and machinery shall be maintained in a good state of repair throughout the construction period;

b) Equipment maintenance will be carried out on an impermeable surface;

c) Leakage from equipment will be prevented by regular inspection and repair;

d) Should a leak or equipment malfunction be detected, appropriate personnel shall be notified immediately and every effort made to prevent further leakage.

12.3.3.10 Rehabilitation of disturbed areas

a) All disturbed/cleared areas will be rehabilitated as soon as construction in that area has been completed as part of the construction contract;

b) Stockpiled topsoil from the cleared areas shall be spread over the disturbed areas after construction in each area has been completed and rehabilitated with indigenous vegetation;

c) Excess sub-soil will be carted away to an approved location advised by the Ol Kejuado County Council;

d) All cleared areas must be re-vegetated and rehabilitated as soon as construction in that area has been completed;

e) Compacted areas due to movement of construction plant and equipment will be scarified to loosen soil and enable re-growth of vegetation.

12.4 Operation

This section deals with environmental aspects that are relevant during the operational phase of the proposed wind energy facility and associated infrastructure.

12.4.1 Scope of EMP

The operational phase of the wind energy facility refers to all activities that take place on the site after construction completion and/or may be required for effective functioning of the development. The activities include:

- Maintenance of the access roads including trimming of vegetation;
- Routine maintenance of the turbines; and
- Operation of the control building.

12.4.1.1 Roles and responsibilities

The management of HSE aspects related to the proposed wind energy facility will be the responsibility of the operations and maintenance company.

12.4.2 Procedures

The proponent will as required conduct both routine and abnormal maintenance of the proposed wind energy facility as the need arises. The aim of the specifications providedin this section is for the personnel conducting inspections and/or maintenance to take not of HSE matters and to report these to relevant parties.

12.4.3 Environmental procedures and specifications

a) A monitoring program should be implemented to increase the existing knowledge on the impact of the wind energy facility on avifauna. The monitoring program should collect data on a host of environmental factors including avifaunal collisions; the monitoring program should be conducted by an ornithologist;

b) In the event of a high rate of avifaunal (e.g. bats) mortalities, exceeding generally accepted international standards:

   i). The use of alternative methods such as radar to alert bats to the presence of wind turbines should be implemented and the effectiveness thereof monitored. Alternative methods may also include turning turbines off under certain conditions or at certain times; or

   ii). Turbines should be shut-off in low wind conditions at night when the bats are foraging

c) Turbines should be shut down in extreme low visibility events such as thick cloud or mist;

d) The facility should be maintained in a neat and tidy way;

e) Components of the wind turbines shall be maintained in a good state of repair so that impacts (such as noise) caused by malfunctioning are prevented;

f) Future maintenance and repair work must be undertaken with minimal visual intrusion;

g) Routine maintenance should be conducted during the day and on weekdays with emergency maintenance being an exception;

12.5 Closure

The proposed wind energy facility is expected to have an operational life span of at least 25 years. However it is anticipated that turbines and components will be replaced with new ones as and when required. After 25 years, the option will exist to continue to apply for the appropriate permits to continue to operate, to replace the turbines and components with more up to date technology or to decommission the wind farm. Therefore the lifespan of the proposed development is potentially indefinite. No detailed closure/decommissioning phase is therefore proposed. The following management control measures are required if and when the facility ceases operation:

a) All turbine components (including towers, rotor blades, nacelles, etc.) are to be dismantled and removed from site preferably for reuse elsewhere or alternatively, for recycling of materials; and

b) Infrastructure associated with the development (e.g. roads, power lines and buildings) which has no immediate use or value to the landowner, must be decommissioned and the property rehabilitated to the landowners satisfaction.

12.6 Contractor health and safety

It is noted that this EMP is not a health and safety (H&S) plan. It is the contractor(s) responsibility to ensure that a H&S plan as per the requirements of the OSHA is prepared prior to any physical work occurring on the site.

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13 Prevention and management of foreseeable accidents and hazardous activities

This section describes the framework for managing incidents and near misses as well as communication of hazards associated with the proposed project.

It is therefore essential that the project is constructed and operated in a safe and incident free manner in compliance with the Occupational Safety and Health Act, 2007 and its subsidiary legislation particularly Legal Notice No. 40: Building Operations and Works of Engineering Construction Rules, 1984.

This section outlines an incident prevention and hazard communication action plan for the contractor to consider prior to the construction phase of the project.

13.1 Incident Prevention – Construction Phase

Contractor health and safety is an essential component of incident prevention during the construction phase of the project. It is recommended that the main contractor's HSE management system be implemented for the project and containing some of the elements described below.

13.1.1 Responsibilities with regard to safety

The responsibilities with regard to safety must be documented by the main contractor for all their sub-contractors to follow while working at the project site. The main contractor's responsibility is to issue procedures, safety rules and safety induction training for all their workers and sub-contractors working on site. It is the responsibility of all sub-contractors to strictly adhere to the main contractor's HSE standards and to ensure that every person in the sub-contractor's employment observes the requirements of the main contractor's regulations.

Each sub-contractor will be required to nominate a contractor supervisor for their specific discipline of the project. This person will be responsible for all HSE compliance requirements of subordinates and will issue instructions regarding HSE which have to be carried out by all contract employees.

The contractor supervisor will be responsible for training all new contractor personnel in HSE as well as the dangers inherent to the area where work is to be performed.

13.1.2 Designation of First Aiders

The main contractor will train a sufficient number of first aiders as required by L.N. 160: First Aid Rules, 1977. Additionally each sub-contractor shall ensure that an adequate number of certified first aiders are available at the project site with properly equipped first aid boxes.

13.1.3 Contractor Employee Responsibility with regard to Safety

Any contractor worker who observes or is involved in an accident will immediately report such incident to the contractor supervisor who will record the details in a General Register as stipulated under the Occupational Safety and Health Act, 2007. The Contractor Supervisor on site shall fill out an Accident Report Form known as DOSH 1 which is available for free from the local DOSHS office and submit it to the nearest provincial DOSHS office within 7 days of the accident; any fatality on site must be reported to the local DOSHS office within 24-hours.

13.1.4 Temporary Buildings

During the construction phase the contactor and sub-contractors may erect temporary buildings for use during the construction period. The design of the buildings shall be approved by the project manager before erection commences.

13.1.5 Safety Induction Training

The main contractor will arrange for HSE induction training of their workers and sub-contractors prior to the ground breaking at the project site. All new employees shall undergo such training prior to being allowed to work on the project site. The main contractor's nominated sub-contractor(s) shall also provide HSE induction training to all their workers including frequent tool box talks.

13.1.6 Personal Conduct

It will be the responsibility of the main contractor and sub-contractor to ensure that their employees do not engage in any of the following practices during the construction phase of the project:

- Horseplay;
- Personal business; and
- Misconduct.

13.1.7 Personal Protective Equipment (PPE)

The main contractor and their sub-contractors working at the project site shall ensure that all their employees are provided with appropriate and adequate PPE. The sub-contractor will be required to maintain a register indicating the issuance, control and use of PPE which includes the following:

- Safety shoes;
- Safety helmets (hard hats);
- Hand protection (gloves);

- Eye and face protection (safety glasses);
- Fall protection (full body harness);
- Hearing protection (ear plugs, ear defenders); and
- Clothing (overalls).

13.1.8 Safety Procedures

The main contractor will be required to issue the Proponent with a comprehensive Construction Safety Method Statement for carrying out each phase of the construction works. The main contractor will further be required to comply with the safety procedures of the Proponent.

13.1.9 Fire and Emergency Procedures

The main contractor, their nominated sub-contractors and all the employees working for them shall be required to be familiar with the Proponent's fire and emergency procedures. The HSE induction training to be provided by the main contractor for all their nominated sub-contractors working at the project site will include emergency and evacuation procedures.

13.1.10 Security Procedures

The main contractor's nominated sub-contractors and their employees will be required to familiarize themselves with the main contractor's security procedures and shall ensure that all workers comply with those security procedures.

13.1.11 Working Tools and Equipment

The main contractor and nominated sub-contractor(s) will ensure that no unsafe tools are used at the project site. The sub-contractor will further ensure that all scaffolding and ladders, cranes, welding machines, compressors, etc. are in good serviceable condition at all times during the construction phase of the project and relevant plant have been certified by DOSHS approved persons.

13.2 Incident Prevention – Operational Phase

13.2.1 Proponent's HSE Management System

The proponent will develop, rollout and implement a detailed HSE management system for operating the proposed project incorporating Kenyan HSE laws and regulations and international best practice HSE requirements within the system.

13.2.2 Emergency Response Plan

In the event of an emergency at the project site, the Proponent's Emergency Response Plan will be activated in accordance with the procedures laid out in it. It will therefore be necessary for the Proponent to develop, rollout and implement their documented emergency response plan prior to the construction phase.

A suggested format for an emergency response plan is given below.

- Introduction;
- Purpose;
- Scope;
- Abbreviations;
- Definitions;
- Emergency response organization;
- Emergency notification system;
- Evacuation procedures;
- Emergency response plan activation;
- Contingency plans;
- Emergency management resources and logistics;
- Crisis control center;
- Deactivation and recovery plan;
- Training;
- Emergency response plan maintenance; and
- Emergency response plan distribution.

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14 Prevention of health hazards and implementation of security measures

This section describes the types of health hazards that may be present during the construction and operational phases of the project respectively and methods of preventing such hazards. In order to prevent health hazards, the main contractor and their nominated sub-contractors will be required to fully comply with relevant requirements of the Public Health Act.

14.1 Health Hazards – Construction Phase

14.1.1 Sanitary Site Conditions

The proposed project site is expected to have a sizeable number of employees during the construction phase. The lack of provision of adequate and hygienic ablution facilities will potentially create health hazards for the workers. It will therefore be essential for the main contractor and their nominated sub-contractors to ensure that during the construction phase, an adequate number of male and female ablution facilities are provided and that the effluent is managed in an environmentally sound manner.

The number of ablution facilities will be in compliance with the Public Health Act. Rule 85 of The Public Health (Drainage and Latrine) Rules recommends one latrine for every 25 male workers and one latrine for every 25 female workers up to the first 100 workers.

14.1.2 Cooking of Meals

It is common practice on construction sites in Kenya for hawkers to provide cheap meals for construction workers on site. The health hazards associated with provision of meals to workers is that the source of water used for cooking is generally unknown. Secondly the source of ingredients used for preparing meals is unknown. Such practices may give rise to health hazards at the project site and the main contractor and their nominated sub-contractors are encouraged to consider providing meals for their workers.

14.2 Health Hazards – Operational Phase

During the operational phase, there will be minimal health hazards arising from the wind energy facility.

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15 Gaps in knowledge and uncertainties encountered

15.1 Introduction

Wind energy facilities are new developments in Kenya and have not been implemented on a large scale to date. Therefore, certain gaps in knowledge, assumptions and uncertainties are likely to occur during the ESIA process. These are discussed below.

15.2 Assumptions

The following assumptions have been made during the ESIA and in the compilation of this document:

- The motivation as to the selection of the proposed development site (including details pertaining to the wind resource, etc.) provided by Kipeto Energy Limited and Galetech Energy Developments is sufficient and defendable;
- Only one site is available for the establishment of the proposed wind energy facility and has been considered in the ESIA and no other sites are available to be included as alternative sites in the ESIA. This is based on the detailed wind analysis (with specific measurements on site) which has been done to date as well as on land availability, access to the site, grid connectivity, etc.;
- It is assumed that the development site identified by Kipeto Energy Limited represents a technically suitable site for the establishment of a wind energy facility and associated infrastructure;
- The ESIA Study was undertaken based on a preliminary layout of the wind energy facility provided by Galetech Energy Developments;
- The information regarding the proposed developments as presented in this ESIA study will not change significantly;
- The concerns and issues raised by the public and stakeholders are representative of the broader public who may have an interest in the project but did not participate in the public stakeholder meetings conducted throughout the ESIA process;
- The site specific wind resource monitoring by means of three 80m masts currently erected in the project area confirm that it is economically feasible for the proposed development.

Details of specific assumptions, limitations and/or gaps in knowledge for each of the environmental aspects/specialist studies undertaken are briefly highlighted below.

15.2.1 Ecological impact assessment

- The study of impact of wind turbines on biodiversity is new in the country. Interpretation of impact of the project development was challenging. In addition acquiring secondary data from local institutions was challenging.
- The survey of threatened species in the IUCN red list was difficult due to the paucity of collection records that make it difficult to predict whether or not a species may occur in an area. This was because the species are rare in distribution hence difficult to locate. The data collection methodology was stratified and random including walking over the project area to improve on recording of species. As the project area is extensive, the only species identified and nationally protected is *Osyris lanceolata*.
- The project area is normally windy and cold in the morning. This condition does not favor most insects and reptiles as it is the time such species ought to be actively feeding. These species would take cover in the bushes and on tree trunks to avoid extreme weather conditions. Subsequently, it was difficult to sight insects and reptiles in the morning.
- Typically, ecological studies can take several months to determine the movement of mammals in different seasons. For this particular ecological impact assessment, local knowledge was used to delineate mammal movements.

15.2.2 Avifauna study

During the period of study a number of factors affected the avifauna study as outlined below.

- Daily observations were mainly affected by unpredictable changes in diurnal weather conditions (i.e. poor visibility, rains, and chilly mornings). Consequently, the study team observed avifauna generally between mid-morning and sunset.
- During the construction and operational phases, it would be prudent to undertake additional surveys as it could not be established with certainty whether the project area is primarily used as passage route to the breeding grounds or also for wintering. There was an expectation of high bird activity from wintering birds but this was not the case during the avifauna study and subsequently an extended survey during the construction and operational phase would confirm this.
- Migrating raptors were absent from the site during the October/November surveys which was contrary to the study team's expectations.

15.2.3 Hydrogeology study

- The limited number of boreholes in the area means that the variation of the hydrogeological condition of the project area could not be derived. With sufficient data it would have been possible to derive groundwater potential maps, groundwater flow maps, among others. This would have been even more important due to the high variance shown in the yields of the existing boreholes.
- The hydrogeology specialist report indicates that boreholes could potentially be drilled in the project area for sources of water for construction purposes but the yields cannot be ascertained. This is because there are minimal borehole records at the Ministry of Water's offices; four boreholes were identified during the study with significantly varying water yields. Subsequently the Proponent would need to seek the consent of the Water Resource Management Authority (WRMA) on borehole licensing requirements depending on the water demand for the project.

15.2.4 Geology and soils

- The caves in the Kipeto area have not been studied and no previous literature on the same was available. The genesis of these caves is not clearly known although some showed enhanced effect of water erosion cutting into the agglomerates and pyroclastics.
- It could not clearly be determined either from visual observation or from the geophysics conducted in the area whether the caves phenomena is also found in the subsurface. This has direct implication on the location of the turbines and kind of foundations to be constructed. This however will be resolved by carrying out Geotechnical surveys for each location marked for a wind turbine construction.

15.2.5 Socio-economic assessment

- The demographic data used in the study is based on the 2009 National Census data when the last comprehensive national census was undertaken. The 2009 National Census demographic and socio-economic data covers provinces and district levels of administration and not location and sub-location levels. While this data provides useful information on the general demographic profile of the affected area, the actual data is now dated and should be treated with care.
- To overcome gaps in knowledge where possible, this data was updated by conducting household surveys and administering questionnaires providing demographics and socio-economic profiles of the Maasai community living in the Kipeto area.

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16 Conclusions

Kipeto Energy Limited is proposing to establish a commercial wind energy facility and associated infrastructure on a site approximately 18km north-west of Kajiado town. A study area of about 70km^2 is being considered as the area for the construction of the proposed wind energy facility.

The Environment and Social Impact Assessment (ESIA) for the proposed wind energy facility has been undertaken in accordance with the Kenyan Environment Management and Coordination Act, 1999 (EMCA) and its subsidiary legislation Legal Notice 101: Environment (Impact Assessment and Audit) Regulations, 2003.

The ESIA Study aimed to achieve the following:

a) Provide an overall assessment of the social and biophysical environment affected by the proposed alternatives put forward as part of the project;

b) Assess the potentially significant impacts associated with the proposed wind energy facility;

c) Comparatively assess identified technically feasible alternatives put forward as part of the project;

d) Identify and recommend appropriate mitigation measures for potentially significant environmental impacts;

e) Undertake a fully inclusive public stakeholder consultation process to ensure that communities living within the project area are accorded the opportunity to participate and that their issues and concerns are recorded.

16.1 Evaluation of the proposed project

The preceding chapters of this report together with the specialist studies contained within Appendices A – K provide a detailed assessment of the environmental impacts on the social and biophysical environment as a result of the project. This chapter concludes the ESIA Study by providing a summary of the conclusions of the assessment of the proposed site for the wind energy facility. In so doing it draws on the information gathered as part of the EIA process and the knowledge gained by the Firm of Experts and Specialists associated with the proposed project.

From an archeological and cultural heritage perspective, the National Museums of Kenya has not undertaken prior work in the Ol Doinyo Narok plateau where the proposed project site is located. However, from the specialist study conducted, it appears that there may be some potential Neolithic sites within the project area as indicated in the specialist report. This was evident from the artifacts collected by the archeologists during the field surveys. The potential impact of construction of the turbines, sub-station and access roads on archeology and cultural heritage was the only potential impact, assigned low. Account has been taken of the sites identified in the report in relation to placement of turbines and roads (including upgrading of roads).

Overall, the proposed wind energy facility is expected to have a low-medium to low impact on ecology within the project area prior to mitigation. This could be reduced to very-low after mitigation. The primary negative impacts are the result of both direct and indirect factors. Direct impacts include loss of natural vegetation in development footprints and direct long-term loss of natural vegetation in areas that will be disturbed by heavy construction machinery, laydown areas, etc or impacts on certain priority plant species.

The impacts on surface water quality is expected to be low without mitigation and can be reduced to very-low with mitigation. The primary negative impacts are the result of contamination of water bodies during the construction phase due to silt laden water run-off and hydrocarbon contamination arising from construction plant and equipment.

The findings of the geology and soils study have highlighted certain constraints which could have potential adverse effects on the design process. These constraints should be verified through a detailed geotechnical investigation which should be commissioned by the proponent before the pre-construction phase. The proposed wind energy facility is expected to have a low impact on the geological environment and these impacts can be largely mitigated to a resultant very-low significance if appropriate measures are diligently applied. The planning of construction activities should take consideration of areas which are potentially sensitive to erosion such as drainage lines. A buffer of about 50m along drainage lines has been incorporated into the layout. No insurmountable geotechnical problems were identified in the geology and soils study and the site appears to be suitable for the development as planned.

The primary concern for the proposed wind energy facility on avifauna is the collision of birds with the wind turbines. The impact on avifauna is potentially of medium-high significance but can be reduced to very-low with the implementation of mitigation measures. Bird monitoring will continue at Kipeto until June 2012.

Most of the potential positive socio-economic impacts as a result of the construction of the proposed wind energy facility are expected to be low without enhancement and low-medium to medium-high with enhancements. The positive impacts relate to temporary change in the employment and economic profile of the local area by means of employment opportunities, which in turn leads to a positive economic impact on local households as well as the broader social benefits, associated with the development of clean renewable energy. It is also expected that with the upgrading of the E407 road between Kajiado and the project site, business opportunities during the operational phase will be enhanced. The limited negative social impacts were assessed to be of low-medium significance without mitigation measures and low with mitigation measures applied.

The damage to roads and infrastructure and increased road traffic and safety hazards is expected to be from low-medium to medium-high without mitigation measures and low after implementation of the mitigation measures. A detailed transportation study will be undertaken in the pre-construction phase to map out the risks associated with transportation of heavy turbine components from the port of Mombasa all the way to the project site.

The noise impact on the surrounding areas is of low-medium significance. The potential impact on sensitive receptors within the proposed wind energy facility is potentially low depending on the final turbine placement. It is important that the results of the noise predictions be considered during the final design of the wind energy facility to reduce potential impacts to a more acceptable low significance.

The placement of the wind energy facility will have a visual impact on the natural scenic resources and rural character of the project area and Kajiado county in general. Potential visual impacts are of medium-high to low-medium significance. The visual impact of the core facility (mainly the wind turbines) is not readily mitigated due to the size of the structures in the landscape and the remoteness of the site from large human settlements.

The placement of each wind turbine currently shows that the potential impacts of shadow flicker are of low significance without implementation of any mitigation measures and of very-low significance after implementing mitigation measures. There are potentially nine households that may be affected by the conservative shadow flicker assessment, however the landowners will be engaged to find ways of mitigating the impacts.

The overall evaluation of the proposed wind energy project from an environmental perspective indicates that there are a number of issues that require mitigation. The mitigation measures and the EMP included in this report are essential risk mitigation components that should be implemented during the pre-construction, construction and operational phases respectively.

16.2 Overall conclusion

Internationally there is increasing pressure on countries to increase their share of renewable energy generation due to concerns such as climate change and exploitation of resources. Kenya has been selected by the Climate Investment Funds (CIF), which is an arm of the UNFCC as a pilot country for a scaling-up renewable energy program (SREP) that includes wind energy. The Kenya Government is subsequently promoting the use of renewable energy although targets have not been set for such energy in the overall energy mix of the country.

Through feasibility assessments including continuous wind measurements within the Kipeto area for over a year now, the viability of establishing a 67-trubine wind energy facility in Kajiado County has been established by Kipeto Energy Limited. The positive implications of establishing a wind energy facility on the demarcated site within Kipeto area include:

- The project would assist the Kenya Government in promoting the SREP program by generating electrical power from a renewable energy source such as wind;
- The potential to harness and utilize good wind energy resources at an inland site would be realized;
- The national electricity grid in Kenya would benefit from the additional generated power;
- Promotion of clean, renewable energy in Kenya;

- Potential for the creation of eco-tourism opportunities within the project area; and
- Creation of local employment and business opportunities for the area.

The findings of the specialist studies undertaken within this ESIA to assess both the benefits and potential adverse impacts anticipated as a result of the proposed project conclude that:

- There are no significant shortcomings that should prevent the proposed wind energy facility from proceeding on the identified site provided that the recommended mitigation measures and EMP are implemented and given due consideration during the process of finalizing the wind energy facility layout;
- On the basis of the social impact assessment, none of the landowners who have signed leases with Kipeto Energy Limited are opposed to the project. in order to enhance the local employment and business opportunities, the mitigation measures listed in the report should be implemented;
- The proposed development also represents an investment in clean, renewable energy which given the challenges created by climate change, represents a positive social benefit for society as a whole.

The significance levels of the majority of identified negative impacts can generally be reduced by implementing the recommended mitigation measures.

16.3 Overall recommendation

It is the opinion of the ESIA project team that the potential environmental and social impacts associated with the proposed wind energy facility in Kipeto can proceed, if appropriate mitigation measures are implemented. This opinion is based on the nature and extent of the proposed project, the local level of disturbance predicted because of the construction and operation of the wind energy facility, the findings of this ESIA and, the understanding of the level of significance of potential impacts.

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