



**Environment Impact Assessment (EIA) Study
for the Proposed 220kv Transmission Line
Project, Kajiado County, Kenya**

Report Prepared for

Kipeto Energy Limited

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Kurrent

Complete Energy Solutions

Environment Impact Assessment (EIA) Study for the Proposed 220kv Transmission Line Project, Kajiado County, Kenya

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1 Project Details

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This work has been undertaken in accordance with the Quality Management System of Kurrent Technologies Ltd.

List of Acronyms

DOSHS	Directorate of Occupational Safety and Health Services
EIA	Environment Impact Assessment
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
GDP	Gross Domestic Product
GE	General Electric (USA)
GEL	Galetech Energy Developments Limited
GIS	Geographical Information System
GPS	Global Positioning System
HSE	Health, Safety and Environment
ISO	International Organization for Standardization
IUCN	International Union for the Conservation of Nature
KEL	Kipeto Energy Limited
KETRACO	Kenya Electricity Transmission Company Limited
KP&LC	Kenya Power and Lighting Company Limited
KTL	Kurrent Technologies Ltd.
KWS	Kenya Wildlife Services
L.N.	Legal Notice
NEC	National Environmental Council
NEMA	National Environment Management Authority
OSHA	Occupational Safety and Health Act, 2007

PCC	Public Complaints Committee
SERC	Standards and Enforcement Review Committee
SIA	Social Impact Assessment
TAC	Technical Advisory Committee
TOR	Terms of Reference

Definitions and Terminology

Alien species	Animals and plants invading and becoming established in areas where they do not normally occur
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.
Ambient	Refers to the surrounding environment and/or conditions
Biodiversity	The number and variety of living organisms on earth, the millions of plants, animals, and micro-organisms, the genes they contain, the evolutionary history and potential they encompass, and the ecosystems, ecological processes, and landscapes of which they are integral parts.
Compaction	Compression of the soil such that it is difficult to plough, and water cannot drain through it effectively or an increase in the density of something.
Cultural resources	A broad term covering any physical, natural and spiritual properties and features that are adapted, used and created by humans, in the past and the present. Cultural resources include traditional systems of cultural practice, belief or social interaction.
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.
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.
Domestic Waste	Solid waste, composed of garbage and rubbish, which normally originates from residential, private households, or apartment buildings. Domestic waste may contain a significant amount of toxic or hazardous waste from improperly discarded pesticides, paints, batteries, and cleaners.
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.
Economic growth	Percentage change in GDP, generally measured in terms of a calendar year.

Ecosystem	Organisms together with their abiotic environment, forming an interacting system, inhabiting an identifiable space.
Effluent	That water which flows out of a man-made system into a river, usually wastewater.
Emissions	Referring to pollutants released into the atmosphere.
Employment	Number of people employed in jobs in the formal sector of the economy.
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: <ul style="list-style-type: none"> 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.
Environmental impact	The degree of change in an environment resulting from the effect of an activity on the environment, whether desirable or undesirable. Impacts include both the direct or indirect consequences of an activity.
Environmental Impact Assessment Report	In-depth assessment of impacts associated with a proposed development. The second Phase of an Environmental Impact Assessment.
Environmental Management Plan	A legally binding working document, which stipulates environmental and socio-economic mitigation measures that must be implemented by several responsible parties throughout the duration of the proposed project.

Erosion	Wearing away of rock and soil by physical or chemical action, especially by wind or water, leading to removal of particles.
Fauna	The animal life of a region.
Flora	The plant life of a region.
Groundwater	Subsurface water in the saturated zone below the water table.
Habitat	The normal abode or locality of a living organism defined by the set of physical, chemical and biological features. the natural home of species of plants or animals.
Hazardous	Processes or substances which have the potential to cause significant danger or harm to human health or the environment (e.g. hazardous waste).
Hydrology	The study of the occurrence, distribution and movement of water over, on and under the land surface.
Indigenous	Born, growing, or produced naturally (native) in an area, region, or country.
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.
Industrial	Resource use patterns linked to or influenced by commercial / industrial benefits.
Land	Terrestrial bio-productive system that comprises soil, vegetation and other biota, as well as the ecological and hydrological processes that operates within the system.
Legal requirements	Identification and listing of the specific legislation and permit requirements which could potentially be infringed upon by the proposed project, if mitigation is necessary should the proposed development impact on a heritage resource.
Migration	The number of people entering and leaving the country. Internal migration refers to the relocation of people within the country.
Monitoring	In an environmental context, the repetitive and continued observation, measurement and evaluation of environmental data to follow changes over a period of time to assess the efficiency of control measures.
Negative impact	A resultant change due to an activity that reduces the quality of the environment (e.g. by reducing indigenous species diversity and the reproductive capacity of the ecosystem; by damaging health; property or by causing nuisance).
Noise	Any acoustic phenomenon producing any aural sensation perceived as disagreeable or disturbing by an individual or group. Noise may therefore be defined as any unwanted sound or sound that is loud, unpleasant or unexpected.

Perennial	Flow throughout the year.
Pollutant	A substance that contaminates.
Pollution	Defilement or unfavorable alteration of the surroundings, normally as a result of human actions. In the water environment, any foreign substance that impairs the usefulness of water.
Pollution prevention	Complete prevention of releasing hazardous substances having polluting properties to any public stream or water body.
Positive impact	A resultant change due to an activity that improves the quality of the environment (e.g. restoring natural species diversity and ecosystem functioning, by removing nuisances or improving amenities).
Rare and endangered species	Species, which have naturally small populations, and species which have been reduced to small (often unstable) populations by man's activities.
Red data species	Species listed in terms of the International Union for Conservation of Nature and Natural Resources (IUCN) Red List of threatened species.
Rehabilitation	The restoration of a disturbed area which has been degraded as a result of activities such as mining, road construction or waste disposal, to a land use in conformity with the original land use before the activity started.
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.
Soil	A mixture of organic and inorganic substances, the composition and structure of the latter is derived from the parent rock material. Soil also contains bacteria, fungi, viruses and micro-arthropods, nematodes and worms.
Solid Waste	Any solid, semi-solid, liquid, or contained gaseous materials discarded from industrial, commercial, mining, or agricultural operations, and from community activities. Solid waste includes garbage, construction debris, commercial refuse, sludge from water supply or waste treatment plants, or air pollution control facilities, and other discarded materials.
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.
Surface Water	All water naturally open to the atmosphere (rivers, lakes, reservoirs, ponds, streams, seas, estuaries) and all springs, wells, or other collectors directly influenced by surface water.
Topography	Referring to natural features on the surface of the earth.
Topsoil	The top few centimeters of soil that contains most of the soil organic matter and nutrients.

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2 Executive Summary

2.1 Introduction

Kipeto Energy Limited (KEL) proposes to construct a 17km long 220 kV transmission line to evacuate power from their 100MW wind farm to the proposed Kenya Power Isinya switching sub-station as shown in Figure 2-1. The proposed transmission line will be constructed in a 60m wide wayleave to be acquired from local land owners affected by the route. The transmission line will evacuate electrical power from a wind farm sub-station to a proposed switching station owned by the Kenya Power.

It is envisaged that once the transmission line has been commissioned, KEL will hand over the operations and maintenance of the transmission line to the Kenya Power who has signed a Power Purchase Agreement (PPA) with KEL.

Kurrent Technologies Ltd. (KTL) has been appointed by KEL to complete the Environment and Social Impact Assessment (ESIA) Study report for the necessary environmental authorization required in terms of Legal Notice 101 titled Environment (Impact Assessment and Audit) Regulations, 2003 (EIA/EA Regulations) promulgated under the Environment Management and Coordination Act, 1999 (EMCA). KTL is a National Environment Management Authority (NEMA) registered Firm of Experts and is producing this report in accordance with Regulations 18 – 23 of the EIA/EA Regulations.

This ESIA Study has further been undertaken in accordance with the International Finance Corporation (IFC) Performance Standards (PS) 1-8. The proposed transmission line is defined as an “associated facility” to the 100MW wind farm to be developed by KEL.

The objective of the proposed project is to evacuate power generated by a 100MW wind power project owned by KEL and for which environmental authorization was granted by NEMA in 2012. The high level of economic growth experienced in recent years and projections of continued growth point towards capacity of the power generation, transmission and distribution system being outstripped by demand in the short term.

This document is the Non-Technical Executive Summary of the ESIA for the project. It presents an overview of the project and highlights the key impacts identified through the Environmental and Social Impact Assessment (ESIA) process and the mitigation and management measures that have been proposed by KEL to reduce negative impacts and enhance positive impacts.

The ESIA Study describes the detailed environmental assessment of the proposed project including an Environment Management Plan (EMP). The NEMA is the lead agency in Kenya responsible for environmental authorization of the project. The NEMA file reference number for the project is NEMA/PR/5/2/10952.

¹Figure 2-1: Image showing approximate route of the 220kV transmission line



¹ Map data: Cnes/Spot Image, Digital Globe, Europa Technologies, Google

2.2 Project description

The project will comprise construction of an overhead 17km long transmission line for evacuating power generated by a 100MW capacity wind farm. The transmission line will start from a sub-station to be constructed at the wind farm area near the Esilanke Primary School and terminate at the proposed Kenya Power Isinya switching sub-station.

A wayleave agreement is in the process of being negotiated with respective land owners whose land is affected by the proposed transmission line. This wayleave will be used for the construction and operation of the project.

2.2.1 Transmission line and associated infrastructure

The transmission line will be designed to established national and international codes during the detailed design phase. Most of the codes will be derived from the Kenya Electricity Transmission Company Ltd. (KETRACO), International Electrotechnical Commission (IEC), etc. A list of some of the local and international standards that will be used for the design and construction of the proposed transmission line are provided in Section 3.6 of the ESIA Study.

Transmission towers are the most visible component of the bulk power transmission system. Their function is to keep the high-voltage conductors separated from their surroundings and from each other. Higher voltage lines require greater separation. The unintended transfer of power between a conductor and its surroundings, known as a fault to ground, will occur if an energized line comes into direct contact with the surroundings or comes close enough that an arc can jump the remaining separation. A fault can also occur between conductors. Such a fault is known as a phase-to-phase fault. The first design consideration for transmission towers is to separate the conductors from each other, from the tower, and from other structures in the environment in order to prevent faults. This requirement and the electrical potential (voltage) define the basic physical dimensions of a tower, including its height, conductor spacing, and length of insulator required to mount the conductor. Given these basic dimensions, the next design requirement is to provide the structural strength necessary to maintain these distances under loading from the weight of the conductors, wind loads, seismic loads and possible impacts. Of course, the structure must meet these requirements in the most economical possible manner. This has led to the extensive use of variants on a space frame or truss design, which can provide high strength with minimal material requirements. The result is the ubiquitous lattice work towers seen in several parts of the country. The last design requirement is to provide a foundation adequate to support the needed tower under the design loads.

For the proposed transmission line, a tower spotting exercise was carried out based on several factors in order to determine the span length (distance between two towers). While it is not fixed, the towers will be spaced between 250m and 400m apart.

A variety of conductor compositions and constructions are currently in use to meet a variety of specific requirements. In the early years of the industry, copper was used almost exclusively because of its high electrical conductivity, but cable diameters with copper were determined more by the need for mechanical strength than by the need for improved conductivity. The low strength-to-weight ratio of copper limited the acceptable span length (distance between towers). Aluminum, with its higher strength-to-weight ratio, was introduced as an alternative to copper, allowing for greater span lengths. Though copper has higher conductivity than aluminum, the lower density of aluminum gives it a conductivity-to-weight ratio twice that of copper.

The voltage required for economical transmission of electric power exceeds the voltage appropriate for distribution to customers. First, customer equipment generally operates at only a few hundred volts, rather than at the hundreds of thousands of volts used for transmission. Second, if high voltages were maintained up to the point of customer connection, fault protection would be extremely expensive. Therefore, distribution from the transmission line to customers is accomplished at much lower voltages, so transformers are required to reduce voltage before the power is introduced to a distribution or sub-transmission system. These transformers mark the end of the transmission line and are located at substations.

For the proposed transmission line, two new sub-stations will be required; one will be constructed near the proposed 100MW wind farm which will collect and evacuate the power generated to the transmission line and the second one will be at the termination point in Isinya where Kenya Power is proposing to construct a switching station at Isinya. While the dimensions of the Kenya Power sub-station are unknown, the KEL sub-station will be about 140m x 130m or 18 hectares in size.

A wayleave or right-of-way (ROW) is a largely passive but critical component of a transmission line. It provides a safety margin between the high-voltage lines and surrounding structures and vegetation. The ROW also provides a path for ground-based inspections and access to transmission towers and other line components, if repairs are needed. Failure to maintain an adequate ROW can result in dangerous situations, including ground faults.

A ROW generally consists of native vegetation or plants selected for favorable growth patterns (slow growth and low mature heights). However, in some cases, access roads constitute a portion of the ROW and provide more convenient access for repair and inspection vehicles.

For the proposed transmission line, a wayleave of 60m will be required. The wayleave will go through several land owners properties and subsequently KEL is in the process of negotiating agreements with land owners for creation of the 60m wide ROW or wayleave.

As far as possible, existing access routes will be used for construction and maintenance of the proposed transmission line. The access roads/routes will be upgraded in order to meet the loads expected for transmission line construction and maintenance. Roads are also classified as temporary or permanent. A temporary road will be decommissioned after construction is complete, and the ROW will be restored.

The roadway includes the traffic-bearing traveled way, the shoulders, and areas adjacent to the road that have been excavated or filled to provide drainage and support. Beyond the roadway are the clearing width and the outer boundary of the ROW. These features are important for estimating the environmental impact.

Access road widths (traveled way plus shoulders) are commonly from 3.5m to 4.5m. The proposed transmission line access roads/routes will be built or expanded such that they are between 4m and 5m in width. No additional cleared area is needed beyond the ditches.

2.2.2 Construction process

There will be several construction phase activities associated with the proposed transmission line project with some of the key ones being:

- Staging area development;
- Establish access to the transmission line route;
- Tower construction;
- Sub-station construction;
- Conductor stringing; and
- ROW restoration.

A description of the above activities is given herein.

Equipment and materials are stockpiled before and during construction in staging areas, which are normally adjacent to the ROW where they would not interfere with the movement of materials, erection of towers, and line pulling.

The staging areas are used for storage of materials and fuel used during construction, including diesel fuel, gasoline, lubricating oil, and paints. Depending on the location and stage of construction, they may be used for storage of herbicides that are used to maintain clearance along the ROW. Blasting agents may be stored at staging areas, subject to applicable regulations and standards.

For construction of long distance transmission lines, staging areas would typically be located every 13km to 16km. The size would vary, but 1 to 3 acres would accommodate materials and vehicle and equipment parking. Tower assembly areas are accounted for separately.

The proposed transmission line project is relatively short (17km) and subsequently may not require multiple staging areas. The proposed compounds (2 in number) for the 100MW wind farm components may be sufficient to accommodate the transmission line components.

The extent of new access road construction that would be required to service construction and maintenance of a transmission line is very site-specific. Existing roads may serve some of the ROW, and some sections may be accessed only by air.

Note that fill material and road base are likely to be derived from local sources at sites known as borrow pits. Excavation of borrow pits removes material and

possibly habitat from nearby land. These impacts can be minimized by restoration of the surface of the pits.

For the proposed transmission line project, the borrow pit has already been identified by the project manager which is situated adjacent to the proposed location of the wind farm sub-station. KEL is in the process of negotiating with the land owner for the use of the borrow pit.

Specific sites for structures such as towers and substations must be cleared as well as the ROW, staging areas, and areas for tower assembly. Clearing of the ROW can employ a variety of techniques, including the use of heavy equipment, such as dozers and scrapers, or selective hand-clearing. The choice depends upon topography, current growth, land use, and plant species on ROW-adjacent property and the presence of sensitive environments. In sensitive areas, hand-clearing may be used to minimize environmental disturbance. However, even with careful practices, habitat may be changed by ROW clearing, especially if it results in substantial changes to the original vegetation cover. Changes may extend to the area adjacent to the ROW, which is subsequently exposed to increased sunlight or other changes. Changes in drainage patterns may be an important consideration, especially if the ROW is adjacent to a body of water.

Where a crossing is required, there is further risk of impact to the body of water and its aquatic species, since these are dependent on the bordering wetlands that must also be crossed. Erosion at the points of crossing introduce soil particles, increasing sedimentation and the associated clouding of water. The maintenance of a buffer zone between the ROW and the body of water is one strategy used to minimize impacts. Hand-clearing and the removal of slash (cuttings) from the water and the immediately adjacent shore are strategies to reduce construction impacts.

Tower construction will begin by excavating foundations for each of the four legs of the steel lattice tower. In areas of hard rock, use of pneumatic hammers or blasting may be required. Once each foundation hole has been drilled to the required size and depth, an anchor bolt cage with reinforcement is lowered into the hole and concreted. A crane will be used to lift and place the tower base on the anchor bolt cage. In some cases, helicopter cranes may be used to connect tower sections during the assembly.

Substation construction is expected to take 6 to 9 months and will cover approximately 10 acres for the fenced station plus 3 acres for construction support.

The process of attaching conductor wires to the insulators suspended from the towers is called conductor stringing. It generally involves pulling the conductor off of a truck-mounted spool. This process typically will not result in additional land disturbance beyond that required for tower construction. An exception may occur at diversion towers where severe line direction changes occur.

It is general practice to restore the ROW after construction, although the replacement of tall vegetation is not a part of restoration directly within the ROW boundaries. Tall vegetation can create ground-fault hazards, including the risk of fire. Plants consistent with native species are selected, although with consideration of their growth rates and mature plant heights. In some areas, the ROW must remain passable by land vehicles for line inspections.

2.2.3 Operational phase

During normal operation, transmission lines require very little intervention. The only exception is periodic inspections and vegetation management. Inspections are frequently done using tracked or other ground vehicles. In some cases, air inspections may also be carried out where ground vehicles find difficulties accessing the ROW. Ground vehicles are useful where a closer inspection of a potential hazard is required.

ROW maintenance is used to assure safe clearance between conductors and vegetation and to allow passage for inspections on foot or by vehicles. Vegetation management is a critical function which involves mechanical cutting and use of chemical herbicides. In some cases, it involves the replacement of native species with plants that have more favorable growth patterns.

Although normal operation requires minimal intrusion into the ROW, line or tower failures can result in the reintroduction of heavy equipment, work crews, excavation, and materials transport.

2.2.4 Decommissioning phase

It is envisaged that the pipeline will be operational for more than 30 years, and it is likely that this period will be extended. A decommissioning plan will be provided to NEMA three months prior to the decommissioning of the transmission line. The decommissioning plan will take into account the environmental legislation at the time of decommissioning, new technologies for rehabilitation and any residual impacts.

2.3 Need and desirability of the project and consideration of alternatives

Kenya has a specific blueprint for power generation, transmission and distribution referred to as the Least Cost Power Development Plan (LCPDP) 2010 – 2030. This LCPDP identifies the need for various projects in the power sub-sector that need to be developed and implemented during the plan period.

The transmission and distribution system comprises of 1331 Km of 220 KV, 2112 km 132 kV, 649 km 66 kV, 29 km 40 kV, 13,031 km 33kv and 24,334 km of 11 kV. 220 kV forms the system transmission backbone, the main lines being the parallel Kamburu – Dandora 1&2 and Kiambere – Embakasi lines interconnecting Mt. Kenya and Nairobi regions and evacuating hydro generation.

Kiambere-Rabai 220 KV line interconnects Mt Kenya and coast regions. Apart from the low rated 132 kV Rabai-Juja line, Kiambere-Rabai line forms the only other link between Nairobi and Coast regions. This is a very long transmission path to Nairobi and power transfer capability between Mombasa and Nairobi is therefore limited by system stability and overloading of Rabai-Juja line. This interconnection also lacks n-1 reliability with the risk of coast system collapse when Rabai-Kiambere line trips on load.

Olkaria – Dandora 220 kV double circuit lines designed to evacuate geothermal generation at Olkaria form the link between Central Rift and Nairobi regions. The link between Nairobi and West Kenya region is completed by the 132 kV Juja-Lessos-Tororo double circuit line.

The line is old and lowly rated, and lacks sufficient capacity to transmit power from West Kenya to Nairobi especially during contingencies when significant import for generation support is required from Uganda.

Subsequent to the above, Kenya needs to develop a significant amount of transmission line infrastructure to evacuate power generated by various types of power generations sources.

Additionally it is recognized that the 100MW KEL wind power project needs to evacuate power using transmission lines and there are currently no existing transmission lines that can be used to evacuate power from this power plant. Subsequently, the proposed transmission line project is an associated project to the 100MW wind power project being promoted by KEL.

The development of the 100MW wind power project and transmission of electricity to the national grid through the proposed Kenya Power Isinya switching sub-station will assist in bridging the demand side management of power in the country.

2.4 EIA process

2.4.1 Objectives of the EIA

Under the Second Schedule of the EMCA, an EIA is mandatory for all transmission line projects. The purpose of an EIA is to provide information to regulators, the public and other stakeholders to aid the decision-making process. The objectives of an EIA are to:

- Define the scope of the project and the potential interactions of project activities with the environment (natural and social).
- Identify relevant national and international legislation, standards and guidelines and to ensure that they are considered at all stages of project development.
- Provide a description of the proposed project activities and the existing environmental and social conditions that the project activities may interact with.
- Predict, describe and assess impacts that may result from project activities and identify mitigation measures and management actions to avoid, reduce, remedy or compensate for significant adverse effects and, where practicable, to maximize potential positive impacts and opportunities.
- Provide a plan for implementation of mitigation measures and management of residual impacts as well as methods for monitoring the effectiveness of the plan.

2.4.2 Approach to the EIA Study

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 EIA process consists of two phases namely the Environment Project Report (EPR) phase and the detailed Environment and Social Impact Assessment phase. 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 EIA.

2.4.3 Scoping

The proposed project was registered with the NEMA on April 22nd, 2013 with registration number 10952 and it was determined that an EIA was required. A Scoping Report presenting an overview of the project and outlining the key issues to be studied in the EIA was submitted to the NEMA on March 31st, 2013. It was approved by the NEMA on June 12th, 2013 and subsequently an approved TOR for ESIA Study given.

Specifically, the objectives of the EPR phase were to:

- Develop a common understanding of the proposed project with the authorities and stakeholders;
- Identify stakeholders and engage them on the proposed transmission line project and processes;

- Provide stakeholders with the opportunity to participate in the process and identify issues and concerns associated with the proposed project;
- Identify potential environmental impacts that will require further study in the impact assessment phase of the EIA process; and
- Develop a terms of reference (TOR) for conducting the EIA Study.

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 EIA 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
Avifauna Study	Ms. Phillista Malaki	Appendix A
Bat Study	Mr. Bernard Agwanda	Appendix B
Ecology	Mr. Dickens Odeny	Appendix C
Social impact assessment	Mr. Winstone Omondi	Appendix D
Stakeholder Engagement Plan	Mr. Winstone Omondi	Appendix E
Visual Impact Assessment	Mr. Henry Holland	Appendix F

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

- Hosting public consultation meetings, focus group discussions and key informant interviews with land owners, non-land owners and to engage the communities affected by the proposed project on potential environmental and social issues;
- Undertaking baseline data collection of various environmental and social parameters between January and July 2013;
- 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 (EIA) Study Report including incorporation of comments raised by stakeholders, specialist studies and an Environment Management Plan (EMP); and
- Submission of the Final EIA Study Report to the NEMA for onward distribution to other lead agencies associated with the proposed project for consideration.

2.4.4 Baseline Data Collection

For the EIA, baseline data was obtained from the following sources.

- Available data including feasibility reports by Gibb Africa, construction tender pack from Galetech Energy Developments; input from stakeholders; and published sources on the internet; and
- Appropriate baseline surveys conducted between January and July 2013 to characterize the baseline environment.

2.4.5 Public/stakeholder engagement

A Stakeholder Engagement Plan (SEP) for the transmission line project was developed to ensure that stakeholder engagement was undertaken in a systematic and inclusive manner and provided important input to the EIA process. The objective of engagement is to ensure that sources of existing information and expertise are identified, legislative requirements are met and that stakeholder concerns and expectations are addressed.

A series of consultation meetings involving people from the project area and Kajiado County administration were undertaken for the EIA between January and July 2013.

2.4.6 Key issues raised during stakeholder consultations

Public/stakeholder meetings form an integral part of the ESIA process; subsequently various types of meetings were held with respect to the proposed project. These included stakeholder meetings with land owners, non-land owners and other community members, focus group meetings with the youth and women and one-on-one meetings.

Some of the issues raised by the public include:

- Economic issues (employment, economic benefits, etc.);
- Ecological issues (impacts on terrestrial ecology);
- Health, safety and security arising from the operation of the new transmission line; and
- Social issues (conflicts over job opportunities, disruption of infrastructure and services, etc.).

These issues informed the specialist studies and the detailed environmental assessment.

2.4.7 Impact Assessment

The impact assessment process followed four steps namely:

- (1) Identification and prediction of potential environmental and social impacts as a consequence of project activities.

- (2) Evaluation of the importance and significance of the impact using a matrix.
- (3) Development of mitigation measures to manage significant impacts where practicable.
- (4) Evaluation of the significance of the residual impact.

The impact assessment considered both predictable and unpredictable impacts (such as accidents). Impacts were assessed as either significant or not significant. Those that were assessed as significant were further rated as being of minor, moderate or major significance. For significant impacts mitigation measures were developed to reduce the residual impacts to as low as reasonably practicable (ALARP) levels. This approach took into account the technical and financial feasibility of mitigation measures.

2.4.8 Environment management plan (EMP)

The purpose of the EMP is to ensure that social and environmental impacts, risks and liabilities identified during the EIA process are effectively managed during the construction, operations and closure of the proposed transmission line project. The EMP specifies the mitigation and management measures to which KEL is committed, and shows how the Project will mobilize organizational capacity and resources to implement these measures. It also shows how management measures aimed at mitigation and enhancement will be scheduled.

Best practice principles require that every reasonable effort be made to reduce and preferably to prevent negative impacts, while enhancing positive benefits, especially within the communities most directly affected by the proposed project. These principles have guided the EIA process. For the proposed project, potential negative impacts will be avoided through careful design.

The EMP is a key product of the EIA process and is generated based on management and/or mitigation measures that will be taken into consideration to address impacts during the planning and design, pre-construction and construction activities, and operations, as necessary.

The EMP is a living document that will be periodically reviewed and updated. It may be necessary to update the version presented in this EIA Study (See Section 11) during the detailed design phase, prior to the commencement of construction.

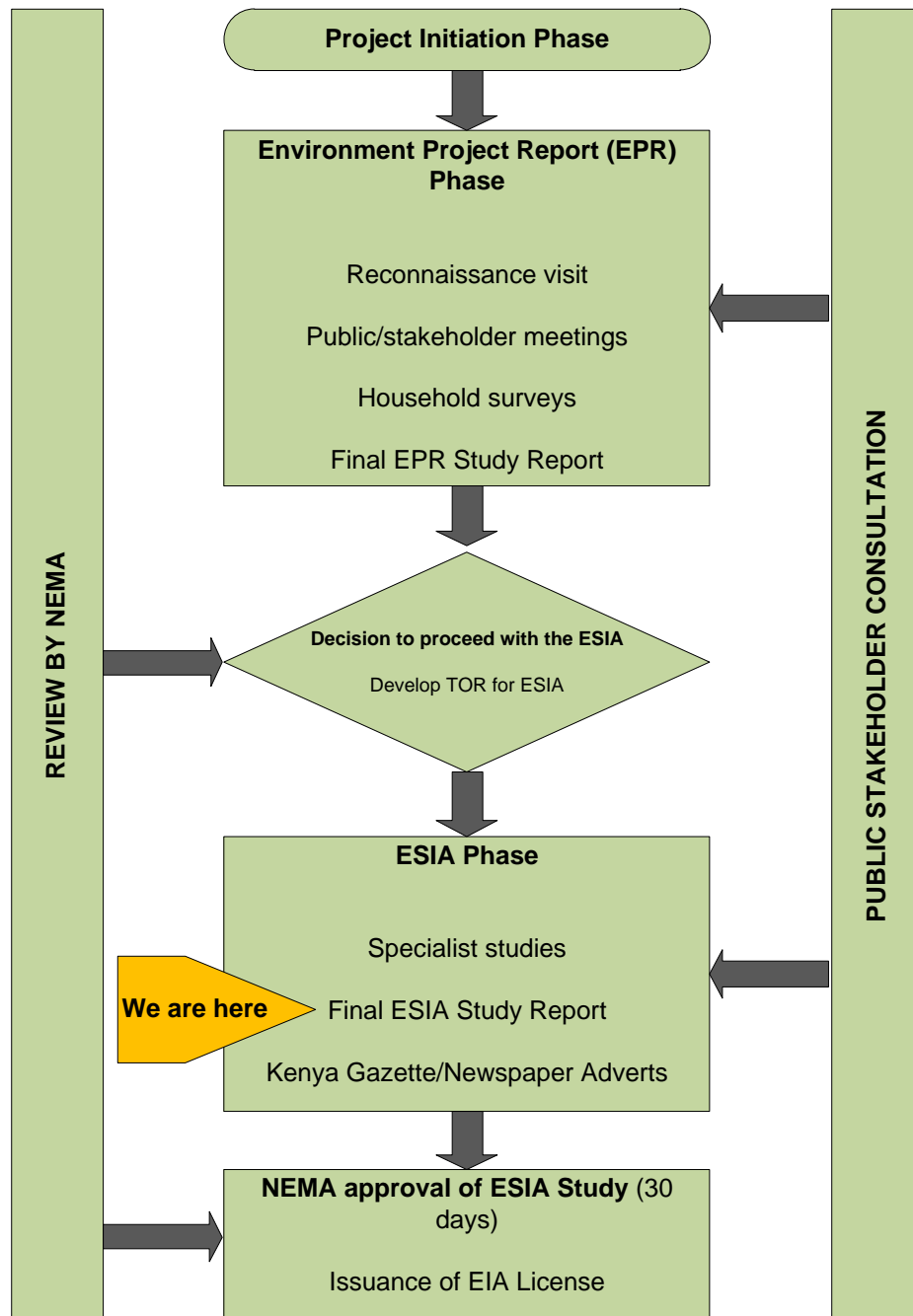
Responsibility for the EMP will reside in the Owner's Engineer for the transmission line project, but there will be links with other functional clusters in areas such as operation and maintenance services.

2.4.9 Reporting and Disclosure

The EIA process and outcomes were drawn together into a draft ESIA which was submitted to NEMA for review. In accordance with Kenya EIA requirements, NEMA will disclose the ESIA Study to the public for review and comment. NEMA will base the decision to grant or deny the EIA License for the project on the outcome of the review process.

Figure 2-1 showed schematically the various elements which comprise the EIA process for the proposed transmission line project and the sequence in which they occur.

Figure 2-2: The Environment Impact Assessment Process



2.5 Key findings of the specialist studies

Specialist studies were undertaken on specific aspects of the environment, with the aim of ascertaining the potential project impacts and making recommendations for measures to avoid and/or mitigate/enhance these effects during the planning and design; preconstruction and construction; operation and closure phases. These recommendations inform the environmental assessment. As the proposed project is a transmission line project, most environmental impacts are envisaged to occur during the construction phase.

2.5.1 Avifauna impact assessment (Appendix A)

Baseline avifauna surveys associated with the proposed 100MW wind farm and transmission line projects began in May 2011 and continue to date. Surveys were based on known migration patterns of birds going through the wind farm and transmission line areas. The survey methods involved vantage point watches and transect surveys. The surveys were carried out in alignment with international guidelines such as the Scottish National Heritage (SNH 2005) *Bird Survey Methods for use in assessing the impacts of onshore wind farms on bird communities*.

Diurnal Vantage Point (VP) Surveys were carried out to estimate spatial and temporal use of the site by resident and migrant raptors and other diurnal passerines. Sampling intensity was designed to document raptor movement throughout the proposed development area.

Ten vantage points were selected along the transmission line. The survey points were selected to provide good visibility in all directions while surveying different habitats, topographic features, and portions of the study area without overlap. VP watches were carried out to assess the likelihood of collision with the transmission line (overlooking the proposed site to assess the usage of the site by overflying birds).

Electrocution is a significant mortality factor among medium-sized and large birds such as Storks, Eagles, Vultures, other Raptors, Owls, Ravens and Bustards. Raptor species potentially at risk in the greater study area include Tawny Eagle, Lesser Kestrels, and White-backed Vulture.

Collisions are another significant threat posed by overhead lines to birds. Those that would be mostly impacted are bustards, storks, cranes and various species of ducks observed. These species are mostly heavy-bodied birds with limited maneuverability, which makes it difficult for them to take the necessary evasive action to avoid colliding with power lines.

Habitat destruction is expected during the construction phase and maintenance of the transmission line and substation. Habitat destruction occurs during the construction of access roads, the clearing of power line servitudes and construction of substations. Servitudes have to be cleared of excess vegetation at regular intervals in order to allow access to the line for maintenance, to prevent vegetation from intruding into the legally prescribed clearance gap between the ground and the conductors and to minimize the risk of fire under the line which can result in electrical flashovers. These activities have an impact on birds

breeding, foraging and roosting in or in close proximity of the servitude through modification of habitat.

2.5.2 Bat study (Appendix B)

A bat study was undertaken to understand the impact of the proposed transmission line on bats that exist within the 100MW wind farm area. Recognized methods were used to identify the bat species prevalent in and around the project footprint area. Mist nets were used to capture bats in habitats under detailed study; an Anabat SD2 bat ultrasonic sound recorder was used to document bat diversity and monitor activities in static positions in selected bat habitats such as fly-ways. A bat box detector was used to record bats in walk transects within target habitats.

Between March and December 2012, fifteen bat species from eight families were recorded in the larger 100MW wind farm area. An additional bat survey specific to the proposed transmission line was carried out between March and May 2013. In each month when the surveys were carried out, two bat specialists were deployed to the field to collect baseline data on bats in the project area. The bat specialists were in the field continuously for five nights each month. Nocturnal bat surveys were conducted up to about 10:00pm at night each night.

The bat specialists conducted a reconnaissance visit along the transmission line route to establish vantage points for undertaking bat surveys. A total of four vantage points were identified and marked for collection of baseline data on bats and to assist in prediction of potential impacts associated with the construction of the transmission line.

Key issues of concern with respect to bats along the proposed transmission line include:

- Bat collisions with the transmission line cables and infrastructure during the operational phase. Based on bat surveys conducted in the Kipeto area, echolocating bats are less likely to collide with transmission line cables and infrastructure. Additionally, fruit bats which could potentially be vulnerable to collisions are rare in Kipeto and often fly lower than the hub height.
- Electrocutation of bats on the transmission lines when a part of their body, normally wing membranes simultaneously get in contact with energized wire and neutral, energized wire and earthed object or touching two energized wires at the same time. The probability of this happening is more likely when cables are close together, given that the size of wing span of a bat (10cm-60cm apart). In order to mitigate this, electrical cables should be spaced sufficiently wide (>60cm) to ensure that the wing span of a bat does not touch two transmission line cables simultaneously.
- Bat habitat alteration and disturbance during the construction phase resulting from the presence and use of construction plant and equipment to clear foraging and roosting areas. Mitigation measures include clearing minimal amounts of existing vegetation along the transmission line route for access tracks and possibly avoiding construction activities during resident bat breeding seasons.

- Contamination of water resources used by bats along the proposed transmission line route from siltation and oil contamination from fugitive construction plant emissions. There are relatively small water points along the transmission line route that are used by resident bats and which could be contaminated by construction phase activities. In order to minimize such contamination, the contractor will be required to have a strict duty of care towards pollution of surface waters which could adversely impact bat resources such as water.
- Herbicides if used to maintain the vegetation along the wayleave could potentially have negative impacts on bats' health as especially if active chemicals within the herbicides leach out into surface waters. It would be prudent to manage the wayleave vegetation using environmentally friendly herbicides or manual means such as slashing.

2.5.3 Terrestrial ecology (Appendix C)

The Kipeto-Isinya landscape is diverse and characterized by different habitats complementing support for wild herbivores and local communities. The diversity of plant species is relatively high in the south eastern area of the proposed transmission line. There are mixed habitats and species. The upper areas have more grassland, which are easily affected by harsh climatic conditions such as drought.

Key issues of concern associated with terrestrial ecology and their mitigation measures include:

- Introduction of alien invasive floral and faunal species. While its origins to the project area may be unknown, it is best to ensure that all construction plant and equipment is thoroughly cleaned of any potential propagules before being introduced to the project area. Additionally, all containers should be checked and fumigated in order to avoid faunal species such as rodents being introduced into the project area.
- Impacts on terrestrial woody plants through clearing the wayleave for the transmission line. The *Acacia* species forms a large part of the woody tree species in Kajiado area. The species is in particularly suitable for growth in the dry land due to its adaptation to season droughts. The *Acacia species* plays an important role in providing habitat for animals such as birds and other mammals. As far as is practical, removal of woody plant species and grasses should be avoided within the 60m wayleave of the transmission line. Further, lattice towers that fall directly over a cluster of wooded plants, should be set back to avoid cutting down the cluster of trees which act as a refuge for reptiles and small mammals.
- Adverse impacts on aquatic habitats along the wayleave. There are no permanent rivers crossing the proposed transmission line route, but there are seasonal riverine habitats and marshes. The construction of the transmission line using heavy construction plant and equipment may potentially cause soils to be susceptible to run-offs. Due to increased susceptibility during rainy seasons, erosion may occur in areas having weak soil strengths thus muddying downstream areas. Secondly, construction plant and equipment may go through riverine areas thus destroying habitats that exist there. Contamination

of water pans with soil could be detrimental as both animals and humans use that water. Mitigation measure to prevent alteration of aquatic habitat included intelligent clearing of the wayleave for construction and operational purposes and prevention of sedimentation activities.

- Temporary obstruction of movement by wild herbivores. The Kipeto landscape contains some wild herbivores such as zebras and Thompson's gazelles. The construction of the transmission line may potentially affect activities and behaviors of some of the wild herbivore species resulting from construction vehicles. The species depend on the area for habitats, foraging grounds and migration during dry season. Some of the mammals prefer woodlands or bush lands, riverine, grasslands and rocky areas. during the construction of the power line there will be movements of vehicles and noise generated by vehicles and construction equipment. The noise would potentially scare animals away from dispersal areas. Speed of the vehicles used in the area would be a concern to lives of Thompson Gazelles. The gazelles normally graze in a group and they tend to follow each other. A vehicle intercepting a group crossing a road runs the risk of hitting individuals which normally try to catch up with the rest. Activities leading to interference of movements by wild herbivores are viewed as adverse to the species. These adverse impacts can be mitigated by enforcing a maximum speed limit for all vehicles of 40km/h; also animals should be given the right of way. Secondly, construction activities should be carried out during daylight hours only to allow nocturnal animals to forage.
- Poaching for bush meat. During the construction phase of the transmission line, there is a potential for poachers to disguise themselves as construction workers and kill wild herbivores for bush meat. Wild herbivores are known to forage in the Kipeto area including the transmission line route. Mitigation measures will include screening of construction workers, using intelligence from the local community to identify potential poachers and engaging the community on how to identify construction workers.
- Impacts on herpetofauna. Construction phase activities may potentially impact the movement of herpetofauna through the wayleave area and access roads. This is anticipated to be a temporary short term adverse impact. As most herpetofauna crawl, chances of crushing the species such as snakes, lizards, geckos, etc. are higher. Mitigation measures include controlling speed limits on access roads to 40km/h, driver alertness to visible species and possibly working during daylight hours only.

2.5.4 Socio-economic impacts (Appendix D)

Public/stakeholder consultations for the proposed 100MW wind power project and 17km long 220kV transmission line began in 2009 and continue to date. There have been numerous meetings that have been held between the affected communities, KEL and the NEMA Firm of Experts to understand, appreciate and manage social and economic impacts arising from the two projects.

A formal Stakeholder Engagement Plan (SEP) has been prepared for the design, construction, operation and decommissioning phases of the project. The key social issues arising from the construction of the proposed transmission line and their mitigation measures include:

- Perception of limitations on land use rights due to land take for the 60m wide wayleave. There appears to be a perception among some land owners along the wayleave that they will have limited land use rights once they sign an agreement with KEL for the wayleave. This is however untrue, as the local communities will continue to practice their animal grazing activities over the wayleave and the only thing they will not be allowed to do is erect semi-permanent or permanent structures within the wayleave. Mitigation measures include engagement of the affected land owners on the contents of the “easement agreement” and provision of timely compensation to each land owner based on market rates.
- Destruction of existing paddock fences and gates that cross the proposed wayleave. During the construction phase, there is a potential for destruction of paddock fences along the wayleave belonging to some land owners resulting in the loss of livestock. Mitigation measures include minimal destruction of paddock fences and in their absence, repairing fences and gates following completion of the construction.
- The construction of the transmission line will not doubt have several potential adverse impacts such as increased vehicular traffic resulting in increased air emissions, generation of various types of wastes, potential accident situations resulting in damage to people, property and the environment, noise, etc. These potential adverse impacts can be mitigated through the development and implementation of a construction HSE Plan by the contractor.
- Impacts related to compensation payments for easement agreements. The compensation to be paid out to each land owner that signs an easement agreement with KEL could potentially have positive and adverse impacts. From a positive perspective, the compensation paid out to the individual land owners could be used to improve the social wellbeing of the land owner and his/her family(ies). Conversely, compensation payments to polygamous land owners could potentially escalate family disputes if monies paid out are not managed properly. Mitigation measures include engagement of the respective land owners on the contents of the easement agreement and its contents.

2.6 Structure of the EIA Study

This report is Volume I of the EIA Study undertaken for the proposed transmission line project and represents the outcome of the EIA phase of the process; it contains the following sections:

Section 1 provides the Project Details associated with the proposed project.

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

Section 3 provides a location and description of the project and its components.

Section 4 provides an overview of the regulatory and legal context for the proposed project and the EIA process.

Section 5 provides an overview of the baseline environment and social setting of the project.

Section 6 discusses the procedures and processes to be used in the implementation of the project.

Section 7 discusses the construction process and materials to be used during the construction and implementation of the project.

Section 8 provides an overview of the products, by-products and wastes to be generated throughout the project life cycle.

Section 9 discusses the methodology used for undertaking the environment and social impact assessment of the proposed project.

Section 10 presents the assessment of environmental and social impacts associated with the project.

Section 11 presents the Environment and Social Management Plan (ESMP) associated with the project.

Section 12 evaluates the project alternatives including the “no-go alternative”.

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

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

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

Section 16 provides the conclusions of the Firm of Experts associated with the proposed project.

Section 17 lists the references that were used to undertake the ESIA Study

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

Appendix	Description of Specialist Study
A	Avifauna Impact Assessment
B	Bat Study
C	Ecological Impact Assessment
D	Social Impact Assessment including Stakeholder Engagement Plan
E	Stakeholder Engagement Plan
F	Landscape and Visual Impact Assessment

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3 Location and description of the project

3.1 Location of the project

As stated earlier, the proposed transmission line will transport electricity from a 100MW wind farm sub-station to the proposed Kenya Power sub-station in Isinya; the transmission line will be constructed within an easement about 60m wide for the entire length of the route which is about 17km. Two alternative routes were evaluated during the feasibility study of the transmission line and Figure 3-1 shows the preferred route that was used for this EIA Study.

3.2 Objectives of the project

The objective of this project is to transport electrical power generated by a 100MW wind farm in the Oloiyoungalani location and feed it into the national electricity grid through the proposed Isinya sub-station.

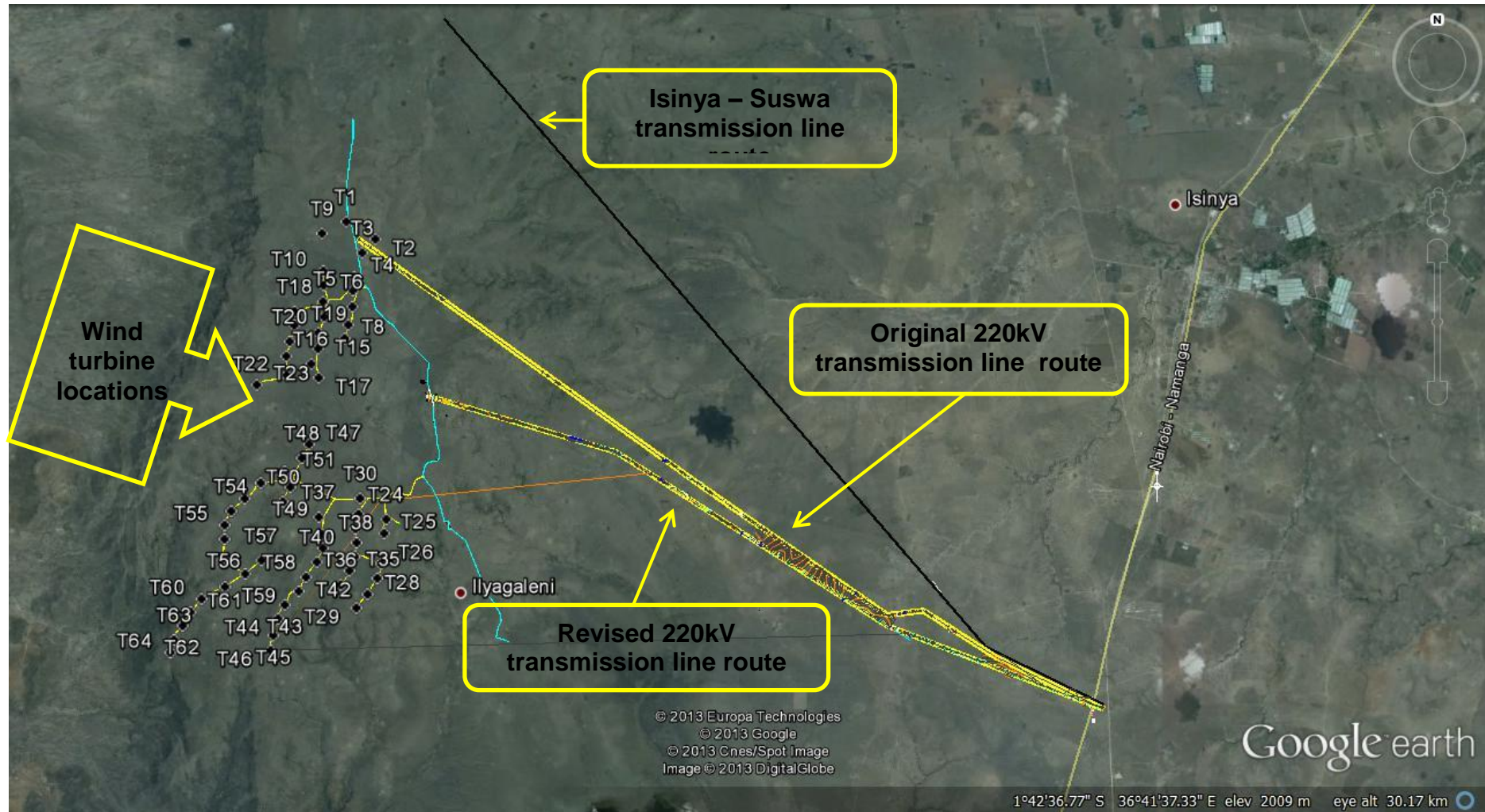
Subsequently, the objectives of the project are given below.

- The transmission line is an associated facility to the 100MW wind farm project for which NEMA has already granted an EIA License;
- The transmission line will transport electrical power from a proposed sub-station within the wind farm area to the proposed Kenya Power Isinya sub-station.

3.3 Description of the project

As electricity cannot be stored, power is generated and delivered over long distances at the very instant that it is needed. In Kenya, thousands of kilometers of high voltage Transmission power lines (i.e. 400kV, 220kV and 132kV power lines) transmit electricity, which is generated at various power stations in the country to Kenya Power's major substations. At these transmission substations, the voltage is stepped down and the electricity is distributed to distribution substations all over the country through distribution power lines (i.e. 66kV, 33kV or 11kV distribution power lines). At the distribution substations the voltage is further reduced and the power is distributed to local users via numerous small power lines referred to as reticulation lines. The power generated by power generation companies can only be utilized from those points of supply which transform the power into a usable voltage.

¹Figure 3-1: Image showing alternative transmission line routes



¹ Map Data: Google, Europa Technologies, Cnes/Spot Image, Digital Globe

3.4 Technical details of the tower and transmission power line design

3.4.1 Towers

Transmission power line conductors are strung on in-line suspension towers and bend (strain) towers. A self-supporting steel lattice tower is proposed for the 220kV transmission line project as shown in Figure 2 below.

Figure 3-2: Image of a typical 220kV transmission tower



For this type of tower, it is envisaged that vegetation will be cleared around an area of 20m x 20m around the position, including de-stumping/cutting stumps to ground level, treating with herbicide and re-compaction of soil. Controlled agricultural practices around the tower will be allowed where feasible.

3.4.2 Easement requirements and clearances

An easement will be registered against the title deeds of the properties that the proposed Transmission power line is to traverse.

The easement width for the proposed 220kV Transmission power line is 60m, i.e. 30m on either side of the center line. The easement is required to ensure the safe construction, maintenance and operation of the power line, and thereby entitles Kenya Power certain rights (e.g. unrestricted access and right of way (ROW)).

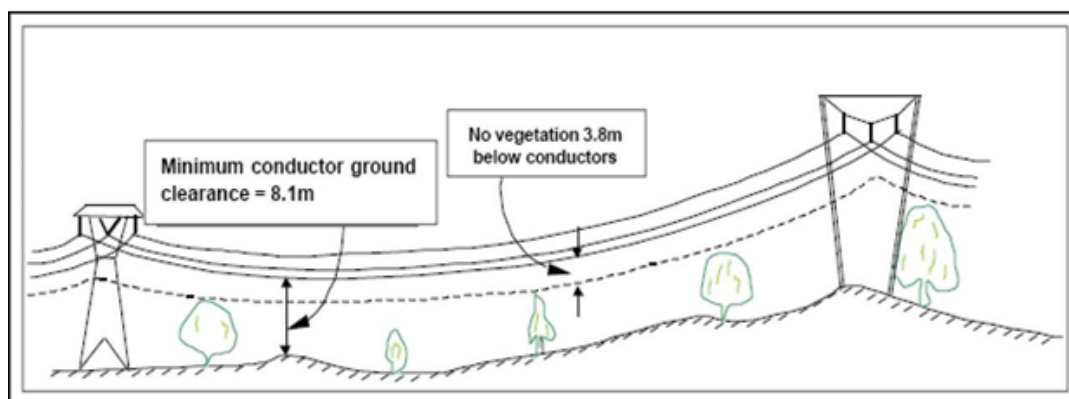
While there is no given standard in Kenya about the separation distances between two high voltage transmission lines, the standard in South Africa is 55m for 400kV transmission lines. Near the Isinya sub-station, construction is currently on going for the 220kV Isinya – Suswa power transmission line as shown in Figure 3-1. Subsequently, it is envisaged that a separation distance of 55m will be maintained between two parallel high voltage transmission lines in order to ensure the reliable operation of both lines. In South Africa, the minimum vertical clearance to buildings, poles and structures not forming part of the Transmission power line must be 5.6m while the conductor ground clearance is generally 8.1m. Figure 3-3 depicts this pictorially. Most farming activities, except for sugar cane and commercial trees, can be practiced under the Transmission power line, provided that safe working clearances and building restrictions are adhered to under all circumstances.

In South Africa, the minimum distance of a 400kV Transmission power line structure from proclaimed public roads is 95 m from the center of the structure to the centerline of the road. The minimum distance between any part of a tree or shrub and any bare phase conductor of a 400 kV Transmission power line must be 5.6m.

A tower spotting exercise was carried out by Gibb Eastern Africa on behalf of KEL to determine the locations of each tower for the transmission line. After negotiating with land owners, the final position of the center line for the transmission line and coordinates of each bend in the line will be determined by the surveyors. Optimal tower sizes and positions will be identified and verified using a ground survey.

For stringing purposes, it is anticipated that a strip of land about 8 – 10m in width will be cleared of all trees and shrubs down the center line of the transmission line easement. Any tree or shrub in other areas that will interfere with the operation and/or reliability of the Transmission power line must be trimmed or completely cleared. Vegetation clearance for the proposed 220kV transmission power line will be minimal due to the characteristic low-growing plant species predominant in the study area. The clearing of vegetation may take place with the aid of a surveyor.

Figure 3-3: Tower illustration indicating minimum conductor ground clearance and vegetation height specifications in South Africa



Once the center line has been cleared, the contractor's surveyor will peg every tower position. Where required, once the tower positions have been marked, the vegetation clearing team will return to every tower position and clear vegetation for assembling and erection purposes.

3.4.3 Foundations

The choice of foundation is usually influenced by the type of terrain encountered and the underlying geotechnical conditions. The actual size and type of foundation to be installed will depend on the soil bearing capacity (actual sub-soil conditions).

Strain structures require more extensive foundations for support than in-line suspension structures, which contribute to the cost of the construction of the transmission line. The typical footprint area required for the construction of the foundation for the transmission line is approximately 1.5m x 1.5m per foundation. Associated with this, the minimum working area required around a structure position is about 20m x 20m for self-supporting towers, with a 5 m radius around anchors.

Foundations may be mechanically excavated where access to the tower position is readily available. The same usually applies to the pouring of concrete required for setting of the foundations. Prior to erecting the towers and filling of the foundations, the excavated foundations are protected in order to protect unsuspecting animals and people from possible injury. All foundations are backfilled, stabilized through compaction, and capped with concrete at ground level.

3.4.4 Stringing of conductors

A guyed wire is used to string the conductors between towers. This can be undertaken mechanically or by hand. The line is generally strung in sections (from bend to bend). Cable drums are placed at 2 km intervals (depending on the length of the conductor) during this stringing process. In order to minimize any potential negative impacts on the surrounding area, these cable drums should be placed within the servitude.

3.4.5 Insulators

Composite insulators are used to connect the conductors to the towers. Glass and porcelain have been used for many years, and are the most common. They are, however, heavy and susceptible to breakage by vandals, as well as contamination by pollution. Composite insulators have a glass-fiber core with silicon sheds for insulation. Composite insulators are lightweight and resistant to both vandalism and pollution.

Composite (Long rod type) insulators with silicone based weather shed material may be used for strain assemblies. Composite horizontal line post insulators may be used for the intermediate structures and on the jumper supports.

3.4.6 Conductors

The conductors are made of aluminium with a steel core for strength. Power transfer is determined by the area of aluminium in the conductors. Conductors are used singularly, in pairs, or in bundles of three, four or six. The choice is determined by factors such as audible noise, corona, and electro-magnetic field mitigation.

Many sizes of conductor are available, the choice being based on the initial and life-cycle costs of different combinations of size and bundles, as well as the required load to be transmitted.

3.4.7 Access

A vehicle access road is usually required to be established to allow access along the entire length of the easement. Access is required during both the construction and operation/maintenance phases of the transmission line life cycle. Any new access roads that are required will be established during the construction phase and are more established by vehicle passage than by grading or blading.

In order to reduce potential impacts associated with the construction of new access roads, existing roads will be used as far as possible where available and new access roads will be constructed by means of driving over the vegetation where possible to avoid permanent removal of the existing vegetation. All access points and roads will be negotiated with landowners, and are to be established during the construction phase.

3.4.8 Construction camps

This construction of the transmission line will require the establishment of a construction camp/s at an appropriate location along the route. The construction camp is estimated to be required to house approximately 100 people. The exact siting of this construction camp is required to be negotiated with the relevant landowner, and must take cognizance of any no-go and sensitive areas identified by the EIA studies.

3.5 Project timing

The timing of the project is envisaged as indicated in the table below.

Activity	Potential Date	Duration
Undertaking the ESIA	Commenced November 2012	9 months
EPR Study Report preparation and submission to NEMA	April, 2013	30 days
Submission of draft ESIA Study for review	August 2013	7 days
Submission of final ESIA Study to NEMA	September 2013	30 days
NEMA decision	October 2013	30 days after submission
Planning and design	Underway	
Construction phase	May/June 2014	12 months
Operational phase	May/June 2015	Expected lifespan of transmission line of more than 30 years

3.6 Technical description

3.6.1 Design and equipment standards

Currently there are minimal Kenyan standards and codes of practice on the design of transmission lines and associated infrastructure. Subsequently, the design and equipment standards for the proposed transmission line and associated infrastructure will comply with international standards and best practices. It is expected that the transmission line will have a lifespan of more than 30 years. Partial lists of the codes and standards that will be used in designing the transmission line are presented in the table below.

Table 1: Design Standards and Codes of Practice

Standard/Code	Description
Manufacturer	DIN ISO 9001
Planning and Design of Overhead Power Lines with rated voltages above 1 kV	IEC 60 826
Quartering wind, angle of 45°	IEC 60 826
Clearances	IEC 60 826
Broken wire conditions	DIN 1054, BS 8004
Coefficient of dynamic wind pressure	IEC 60 826

Standard/Code	Description
Wind pressure on conductors, ground wires and on areas of steel angle members	IEC 60 826
Foundation concrete; compressive strength	DIN 1045
Access roads; maximum size, weight and axle loading of vehicles	DIN 1072
Concrete work, concrete Class 25	DIN 1045
Towers; quality of steel	DIN 17100 EN 10025
Steel; yield stresses	DIN, BS
Tower materials	Euro Norm, DIN ASTM A123/143
Bolts nuts, with metric thread, min. grade 5.6	DIN 267 DIN 555
Spring lock washers	DIN 127
Flat washers	DIN 126
Step bolts	DIN 57105, Part 1
Earthing bolt M 16	DIN 48088, Part 2
Danger plates	DIN 40006
Bolts, locking type; with hot-dip galvanized nuts	DIN 48073 form "S"
Earthing grid	VDE 0141
Conductor reels	DIN 46 391, BS 1559
Line conductors Type, routine, sample tests	IEC 60889, IEC 61089, IEC 61232, ASTM B415, ASTM B416
Conductors and ground wire	DIN 48200, 48201, 48203, 48204
Aluminum clad steel wire	ASTM B 415, B 416
Optical fiber CCITT	ITU-T G652, 655 recommend. IEC 793-1
OPGW	IEC 60794-4-1, IEEE 1138, Annexure A for short circuit tests ITU-T issues for single mode fibers IEC recommendations, IEEE
OPGW tests	IEC 60793-1, 60794-4-1
Fittings for OHTL	IEC, DIN
Material for fittings	DIN 17200, DIN 1725
Fittings for OHTL	DIN/VDE0212 IEC 60383-2
Static mechanical behavior Dynamic mechanical behavior of anti-vibration fittings Electrical contact behavior of current carrying fittings, under normal operating conditions Partial discharge characteristics, tests Thermal	Part 50, Part 5,1 Part 52, Part 53, IEC 60 575, IEC 1211

Standard/Code	Description
mechanical tests Impulse over-voltage puncture test	
Ball and socket connection Clevis Caps for Insulators Hinges (only form "S" to be utilized) Connecting Dimensions for protective fittings Eye links Yokes (only form "S" to be utilized) Connecting Bolts (only form "S" to be utilized) Connecting Dimensions for Eyes and Clevises P.G. Clamps Clevis Straps (only form "S" to be utilized) Compression Dies Earth Clamping Bolts Clamps & joints Turnbuckles Galvanizing	IEC 120, DIN 48062/2, DIN 48066, DIN 48068, DIN 48069, DIN 48070/1, DIN 48073, DIN 48074, DIN 48075, DIN 48078/1, DIN 48083, DIN 48088/2, DIN 48215, DIN 48334, DIN VDE 0210, ASTM A153
Fatigue test, dynamic endurance of the damper	DIN VDE 0212 Part 51 (Issue July 1986)
Glass Insulators	IEC 60305
Polymer Composite Insulators; Design, type, routine, sample tests	IEC 60383, IEC 61109
Insulator strings Type tests	IEC 60383, IEC 60437, IEC 61109, DIN/VDE 0212 p. 53
Insulator-, Conductor-, OPGW fittings and line accessories, type, routine, sample tests	DIN/VDE 0212 p. 50-54
Ball & Socket type insulators Track resistance of the material shall be min. class 1A 3.5	IEC 60587
Resistance of the insulator rod against brittle fracture	IEC 61109
Corrosion protection coating	DIN 55945, 53678, 536220 ISO 4628, 2409

The list of design standards listed in the table above incorporate Health, Safety and Environmental aspects associated with transmission line design. Subsequently by using the above standards and codes, the design engineers are able to minimize potential health, safety and environmental impacts associated with the proposed project.

It is worth noting that health, safety, environment, reliability and quality standards that are incorporated into the codes are designed to meet the requirements of the codes and standards bodies that publish them. The code bodies are normally national, regional or international bodies and the codes and standards then apply to all projects within their jurisdiction and discipline. This is done to ensure that the engineering standards employed are at least above a certain minimum level that has been verified by the national or international body to be safe and reliable to an acceptable level.

Using international standards and codes of practice as a baseline, the design engineers may increase the level of safety in their design of the transmission line in order to take into consideration the local environmental risks and sensitivities.

3.7 Pre-construction and construction processes

3.7.1 Typical process for the construction of transmission lines

Section 7 of this EIA Study discusses the construction phase procedures and processes that will be used for constructing the proposed transmission line. Given below is a brief overview of the construction process used for transmission line construction.

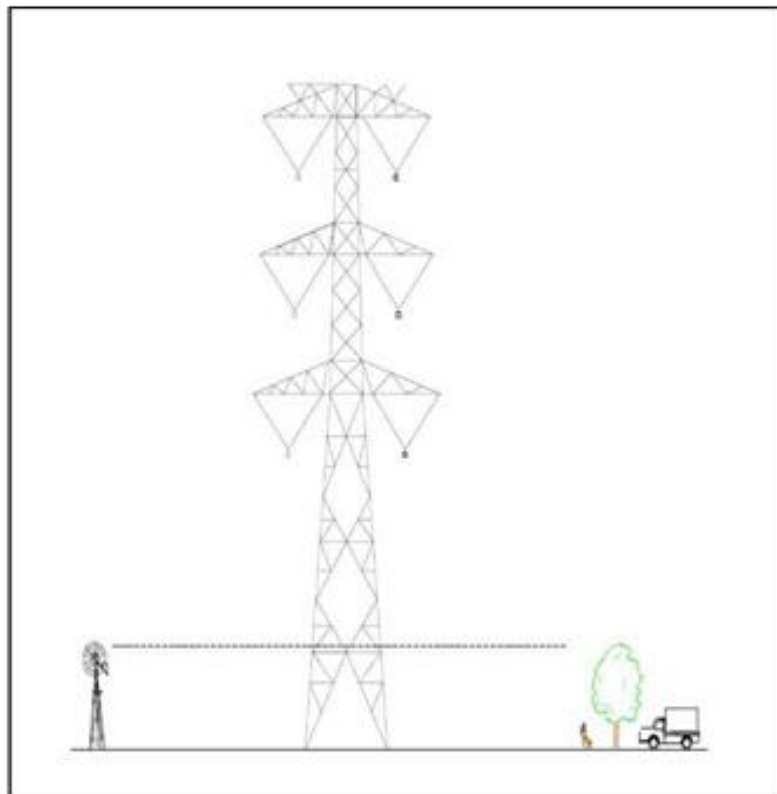
- Aerial survey of the route.
- Determine technically feasible alternative transmission line routes or corridors.
- Investigate the environmental feasibility of alternatives and recommend a preferred route or corridor.
- Environmental authorization with regard to the preferred route or corridor.
- Negotiation of final route corridor within corridor with landowners.
- Selection of best-suited structures and foundations.
- Final design of line and placement of towers.
- Establishment of construction camps and construction of access roads.
- Vegetation clearance.
- Centre line track establishment.
- Construction of foundations.
- Assembly and erection of towers.
- Stringing of conductors.
- Rehabilitation of working areas and protection of areas susceptible to erosion.
- Testing and commissioning of the power line.

3.7.2 Specifications for easement and towers

The proposed transmission line will require an easement 60m wide, i.e. 30m either side of the center line. No permanent residence is allowed within the easement. The easement is required for the safe operation of the power line and reliability of electricity supply to consumers.

Steel lattice towers will be constructed at intervals along the route of the transmission line, at a spacing of approximately 400 – 500m. Each tower is approximately 30 – 40m high as shown in Figure 3-4. Final towers to be used will be determined after surveying and profiling of the line.

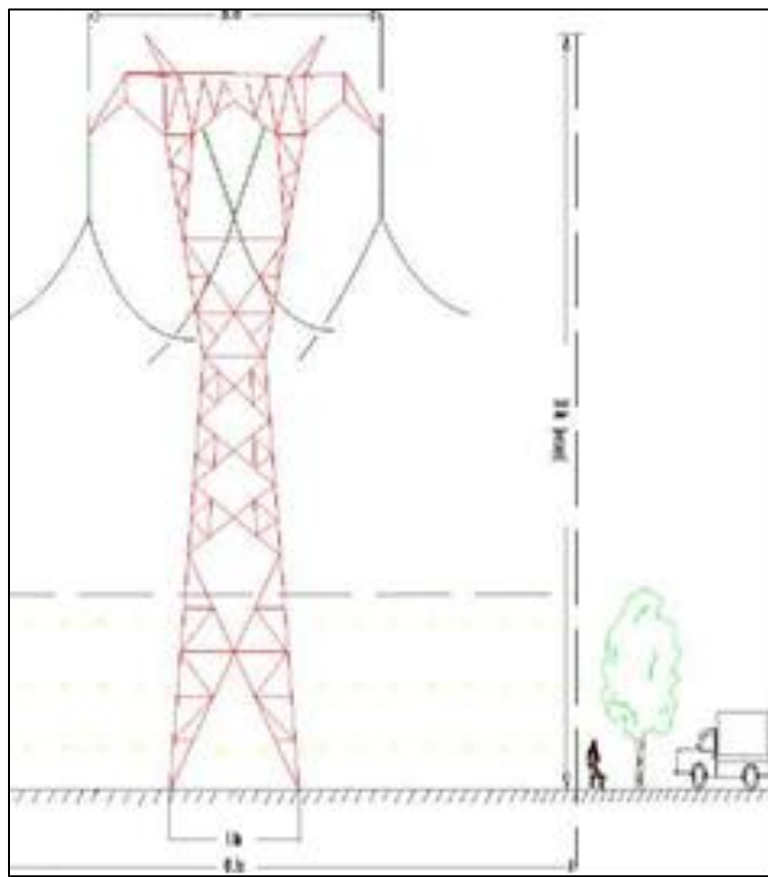
Figure 3-4: Typical multi-circuit tower



For safety reasons, the transmission line requires minimum clearance distances. Some best practices used in countries such as South Africa indicate the following clearance distances:

- The minimum vertical clearance distance between the ground and power line conductors is 8.1m;
- The maximum crop height permitted within the easement is 4.3m;
- The minimum vertical clearance to any fixed structure that does not form part of the power line is 5.6m;
- The minimum distance of a 400kV power line from a proclaimed public road is 95m from the center line of the road;
- The minimum safe distance required from the center of the power line to the edge of a domestic house is 40 - 50 m.

Figure 3-5: typical strain type tower



3.7.3 Easement negotiations and registration

Before construction commences on a transmission line, the Proponent needs to secure easement rights via negotiations with affected landowners.

An easement does not mean that the holder of the easement, viz. Kipeto Energy Limited (KEL) or Kenya Power is the owner of the land, but merely that KEL or Kenya Power has the right of way to convey electricity across the land, subject to conditions agreed between KEL and affected landowners.

An easement provides KEL and Kenya Power certain defined rights for the use of the specific area of land such as:

- Access to erect a transmission line along a specific agreed route.
- Reasonable access to operate and maintain the line inside the easement area.
- The removal of trees and vegetation that will interfere with the operation of the line.

The registration of easements can be a lengthy process, as it requires contractual negotiations with each affected landowner. Once this is complete, an application for registration of the servitude is lodged with the County Lands Office against the property deed.

The actual location of the towers on which the conductors will be strung is determined by a number of different factors, including:

- The outcome of KEL negotiations with landowners, including landowner preferences.
- Environmental features and technical requirements.

As a result of these factors, it is challenging to predict the exact position of the towers within the ESIA process, and final positions are often identified at the stage when the detailed engineering design is compiled, with site-specific input from specialists.

3.8 Operational phase process

During operation, Kenya Power requires access to the easement to enable maintenance of the transmission line. This could require traversing private property. Maintenance is carried out at regular intervals, and will be done by road so that electricity supplies are not disrupted. Maintenance activities are highly specialized and are, therefore, carried out by Kenya Power employees/contractors.

The easement will need to be cleared occasionally to ensure that vegetation does not interfere with the operation of the line.

3.9 Decommissioning

The proposed transmission line is expected to be operational for more than thirty years and it is likely that this period may be extended.

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4 Legal and regulatory context of project

4.1 Constitution of Kenya, 2010

Environment and social sustainability is covered explicitly in the Constitution of Kenya, 2010. Clause 42 under the Bill of Rights of the Constitution of Kenya, 2010 provides *inter alia* that every person has a right to a clean and healthy environment. Clause 43 of the Constitution provides that every person in Kenya has economic and social rights.

Chapter 5 of the Constitution provides for the sustainable management of land and the environment in Kenya. Specifically, Clauses 69 – 72 deal with environmental management in Kenya and the proposed project will be conducted in accordance with these Clauses.

Clause 69(1)(f) of the Constitution requires the State to develop systems for environmental impact assessment. The State already has a system for environmental impact assessment in the form of the Environment Management and Coordination Act, 1999 (EMCA) and its subsidiary legislation titled Legal Notice 101: Environment (Impact Assessment and Audit) Regulations, 2003 (L.N. 101).

4.2 Environment Management and Coordination Act

The proposed project will be undertaken in accordance with relevant sections of the Environment Management and Coordination Act, 1999 (EMCA), specifically Clauses 58 – 63. These sections of the Act are operationalized by subsidiary legislation promulgated under the Act and specifically L.N. 101: Environment (Impact Assessment and Audit) Regulations, 2003.

The EMCA is a framework environmental law in Kenya. This Act was assented to on January 14, 2000 in order to provide a structured approach to environmental management 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.

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

The proposed project is subject to relevant provisions of these regulations and subsequently, this ESIA Study has been undertaken in accordance with the appropriate requirements.

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.

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

These regulations will apply to the proposed project during the construction phase and minimally during the operational phase. The EPC contractor will be required to ensure that all effluent from construction activities is treated in accordance with the above regulations prior to discharge into the environment.

This regulation was promulgated on September 4th 2006 and became effective on July 1st 2007. The 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 effluent 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 county. The regulation contains discharge limits for various environmental parameters into public sewers and the environment.

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

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.

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 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 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.

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

Some sections of the transmission line corridor contain rocky outcrops and it may be necessary to cut them for purposes of constructing tower foundations. If any blasting is to be done, the EPC contractor shall apply for a noise permit from 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.

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. These noise limits will be applicable to the proposed project.

<i>Facility</i>		<i>Maximum noise level permitted (L_{eq}) in dB(A)</i>	
		<i>Day</i>	<i>Night</i>
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)		Noise Rating Level (NR)	
		(Leq, 14h)		(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 (Leq, 14 hours)

Night: 8:01 pm – 6:00 am (Leq, 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 this phase of the project.

4.2.5 Licenses and Permits required under the EMCA

The subsidiary legislation under the EMCA is partially monitored through the use of permits and licenses. Subsequently all licenses and permits required during the construction phase shall be the responsibility of the EPC contractor and their agents. During the operational phase, all permits and licenses required to operate the project will be the responsibility of the Proponent.

The subsidiary legislation under the EMCA requires the following types of permits to be available for inspection:

- Effluent Discharge License under Legal Notice 120: The Environment Management and Coordination (Water Quality) Regulations 2006;
- Waste Transport License under Legal Notice 121: The Environment Management and Coordination (Waste Management) Regulations 2006 for disposal of all types of wastes; and
- Noise Permit under Legal Notice 61: The Environment Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009.

4.3 The Land Act, 2012

The Land Act is intended to be the substantive law governing land in Kenya. It provides for the legal regime that will govern *inter alia*, the administration and management of public land and private land; contracts over land, leases, charges, compulsory acquisition, easements and related rights.

The Wayleaves Act was repealed when the Land Act 2012 came into force and subsequently, the proposed project will need to comply with relevant provisions of the Act as they apply to the easement to be acquired for the transmission line project.

4.4 The Energy Act, 2006

The proposed transmission line project must be compliant with relevant clauses of the Energy Act, 2006. Specifically, a license or permit issued by the ERC is required for transmission of electrical energy. Clause 30 states that in order to grant a transmission license to a Proponent, the ERC will consider:

- The impact of the undertaking on the social, cultural or recreational life of the community;
- The need to protect the environment and conserve the natural resources in accordance with the EMCA;
- The ability of the Proponent to operate in a manner designed to protect the health and safety of users of the service for which the license or permit is required and other members of the public who would be affected by the undertaking.

Clauses 46 – 50 specify the process steps required for construction of transmission lines through any land. The proposed project will have to comply with the requirements of these clauses.

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 projects in the energy sector. These are highlighted below and the Proponent will be required to comply with these provisions during the construction and operational phase of the project.

4.5 Occupational Safety and Health Act, 2007 (OSHA)

The proposed project will be undertaken in compliance with the OSHA especially during the construction phase. During the operational phase, there will be minimal activity along the transmission line corridor.

Specifically, the EPC contractor will be required to fully comply with the requirements of Legal Notice 40 titled: Building Operations and Works of Engineering Construction Rules, 1984 (BOWEC) during the construction phase of the project. The EPC contractor will develop and implement a construction health and safety plan for the entire construction phase duration in alignment with the BOWEC, OSHA and international health and safety best practices.

The OSHA 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 lists 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 proposed project during the construction and operational phases respectively.

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 construction and 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 various fines and penalties associated with non-compliance with 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.

4.5.1 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 OSHA 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.

4.5.2 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 OSHA 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 EPC Contractor to ensure that Material Safety Data Sheets (MSDSs) for chemicals used in the construction phase are studied for toxicological and epidemiological information and workers trained on their safe handling, use and disposal. 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.

4.5.3 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 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.

4.5.4 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 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, Control and Countermeasures plan (SPCC). 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 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.

Regulation 33 requires Proponents to have adequate fire water storage capacity. As a minimum this regulation requires Proponents to have at least 10m³ 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.

4.5.5 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 will expose workers to chemicals that can potentially be hazardous to occupational health.

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.

4.6 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 sections of this part will be applicable to the project during the construction phase of the project.

4.7 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).

4.8 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 project will require water for construction purposes.

4.9 Other important legislation

The above sections highlight some of the principal Acts in Kenya that the proposed project will require to be in compliance with. The outline of legislation provided in the above sections is not exhaustive and it is possible that there may be other laws and regulations that the proposed project may need to comply with. Subsequently, the Proponent and Contractor must err on the safe side by ensuring that a legal risk assessment is carried out before commencement of the project to ensure that any Acts not listed above which are important are complied with and the necessary permits applied for prior to the construction phase of the project.

4.10 IFC Performance Standards

The proposed transmission line project is expected to receive funding from international sources. Subsequently, it will be important for the environment and social assessment process to comply with the relevant requirements of either:

- The International Finance Corporation's (IFC's) Environmental and Social Performance Standards (PSs); or
- The Equator Principles.

There are eight PSs that have been developed by the IFC; of these, PS1 on Assessment and Management of Environmental and Social Risks and Impacts is probably the single most important PS that the proposed project needs to comply with. The other seven PSs will also be applicable as they apply to the proposed transmission line project and have been used to conduct this ESIA Study.

4.11 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
- Energy Act, 2006;
- Land Act 2012
- Public Health Act;
- Water Act, 2002;
- Occupational Safety and Health Act, 2007 and its subsidiary legislation.

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5 Baseline environmental conditions

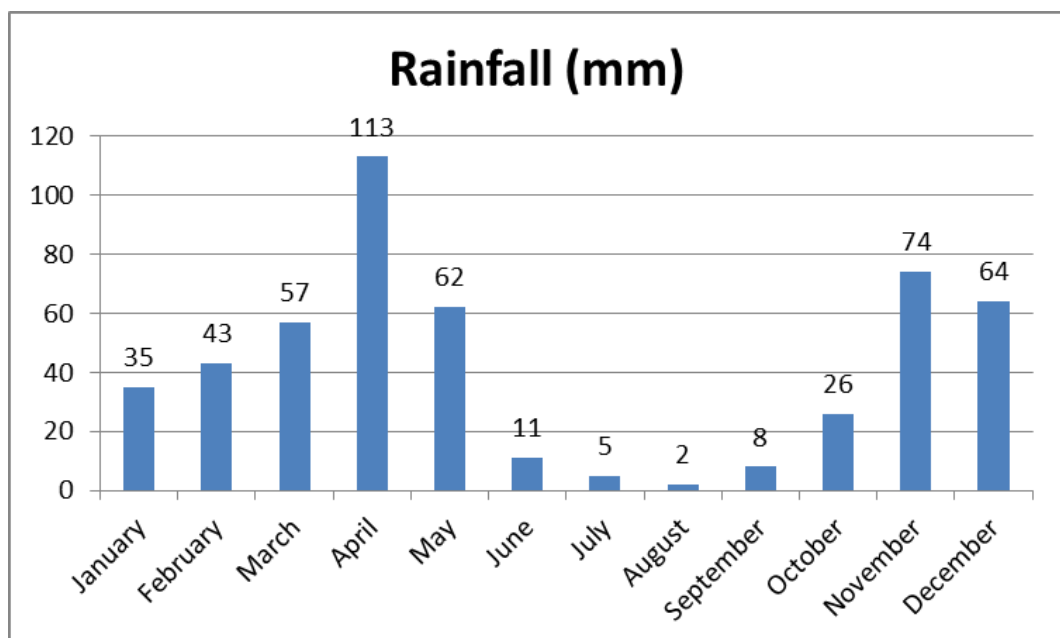
This section provides a description of the project setting and is based on a review of the existing information, site visits undertaken by the project team and discussions with the public/stakeholders.

5.1 Climate and vegetation

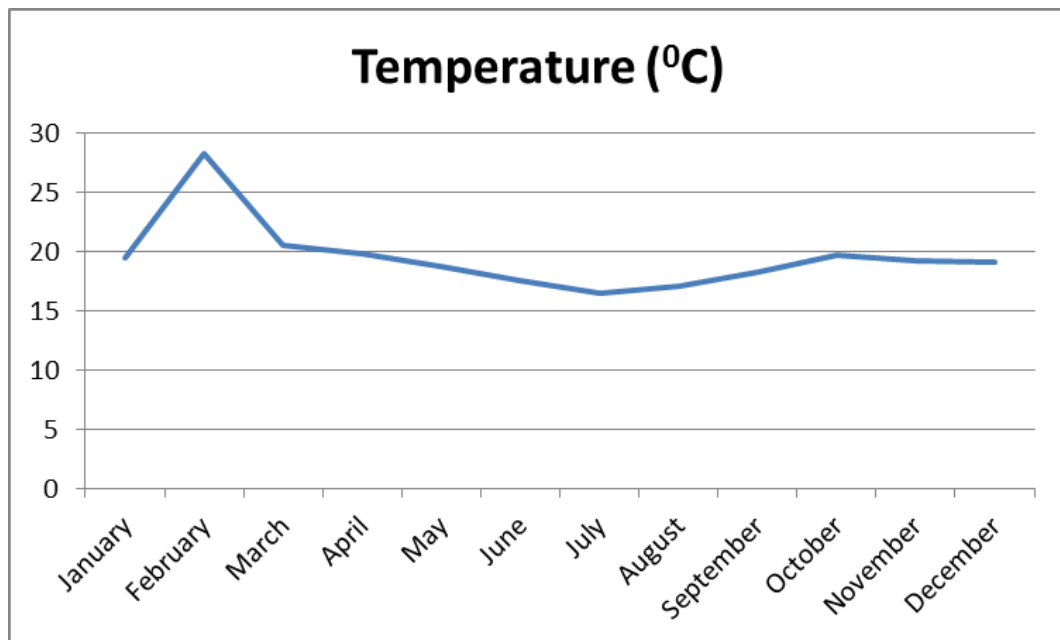
5.1.1 Rainfall

The nearest town to the proposed transmission line route for which weather data records were found happens to be Kajiado. The prevailing climate in Kajiado is known as a local steppe climate. Throughout the year there is little rainfall in Kajiado. Rainfall is concentrated in the months March-May and October-December.

Figure 5-1: Mean monthly rainfall map of Kajiado area



The average annual temperature in Kajiado is 18.9 °C. About 500 mm of precipitation falls annually. The hottest part of the year is from January to March; at other times the temperatures are moderate.

Figure 5-2: Mean monthly temperature graph for Kajiado area

No rivers flow perennially, but water can be obtained by digging in the bed of the Kajiado river. Apart from springs on the Ol Doinyo Narok plateau, the local population is dependent on boreholes and the old pipeline to Magadi, which brings water from the Ngong hills across the Kapiti plains to Kajiado, and then follows the railway.

The vegetation of the Kapiti plains and other volcanic areas consists of rank grass and whistling thorn, but the river-courses are followed by lines of isolated trees. The area of Basement System rocks produces a much thicker growth of thorn trees, and thickets of evergreen forest occur in the valleys. In the Rift Valley vegetation is limited to stunted thorn bushes and small patches of grass. The eastern scarp of the Rift Valley, however, is thickly covered with thorn trees and evergreens.

Cultivation is carried out by the non-indigenous peoples in small areas

5.1.2 Agro-ecological zones

According to the Food and Agricultural Organization (FAO), agro-ecological zones (AEZ) are zones that have similar combinations of soil, landform and climatic characteristics. The particular parameters used in the definition focus attention on the climatic and edaphic requirements of crops and on the management systems under which the crops are grown. Agro-ecological zones are divided into seven zones.

Generally, Zone I is humid areas with annual mean rainfall between 1100 – 2700mm; Zone II is semi-humid with annual mean rainfall between 1000 – 1600mm; Zone III is classified as semi-humid with annual mean rainfall between 800 – 1400 mm; Zone IV is semi-humid to semi-arid with an annual mean rainfall 600 – 1100 mm; Zone V is semi-arid with annual mean rainfall of 450 – 900mm, and; Zone VI is arid with annual mean rainfall between 300 - 550mm.

Most of Kajiado county lies in the semi-arid and arid zones (zones V and VI). Only 8% of the District's land is classified as having some potential for rain fed cropping (zone IV): most of this is in the Athi-Kapiti Plains, close to Nairobi, and in the south of the District, along the Kilimanjaro foothills.

Mean annual rainfall ranges from 300 to 800 mm. Rainfall is bimodal, with "short rains" from October to December and "long rains" from March to May. The distribution of rainfall between the two seasons changes gradually from east to west across Kajiado County.

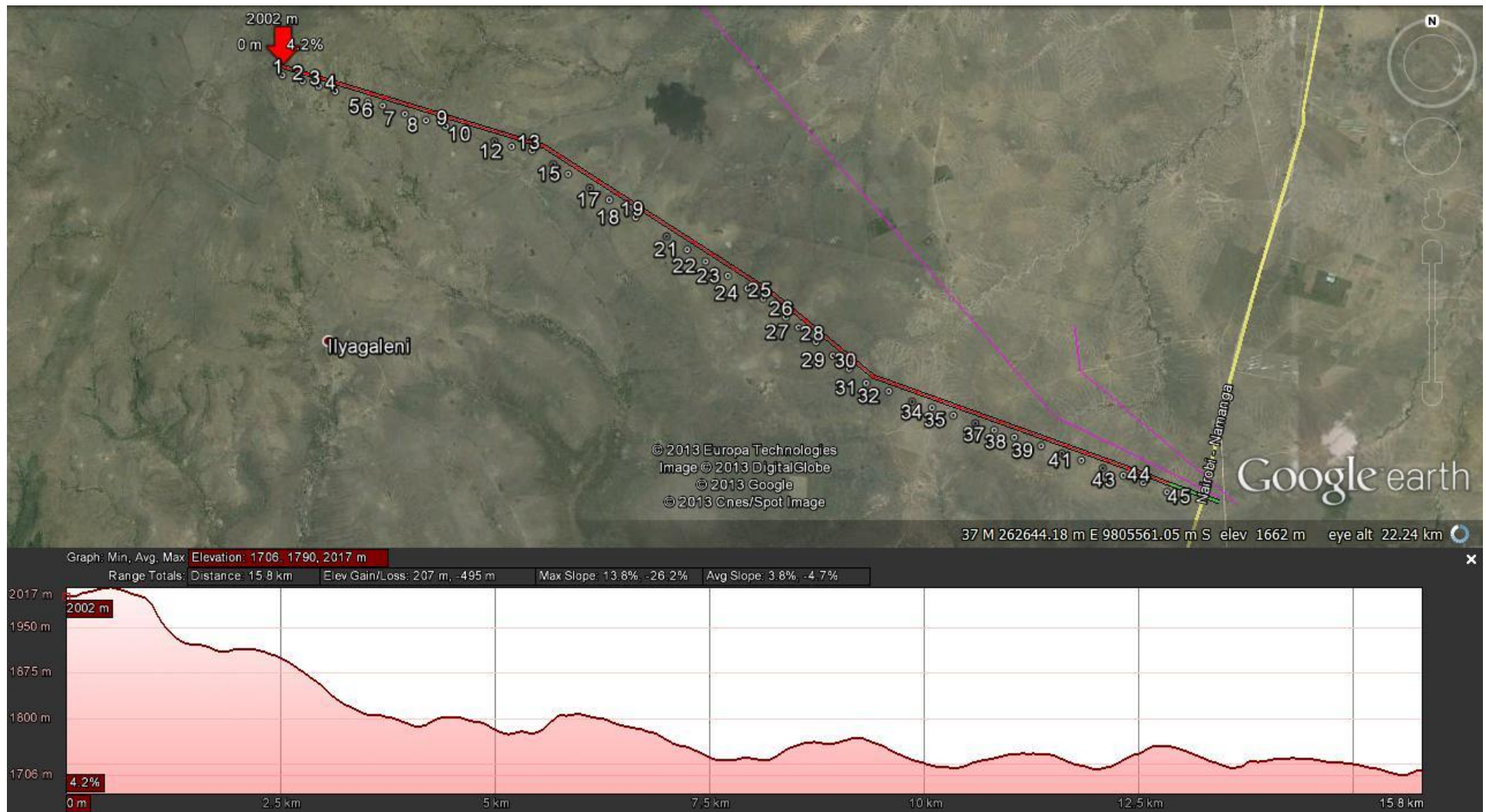
5.2 Topography

The general topography of Kajiado County 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 elevation profile of the proposed transmission line route is shown in Figure 5-3. The elevation at the wind farm sub-station where the transmission line begins is about 2002m above mean sea level while the elevation at the proposed Isinya switching sub-station is about 1705m above mean sea level.

The digits indicated in Figure 5-3 are the locations of the proposed steel lattice towers which are spaced between 250m and 400m along the entire length of the transmission line route.

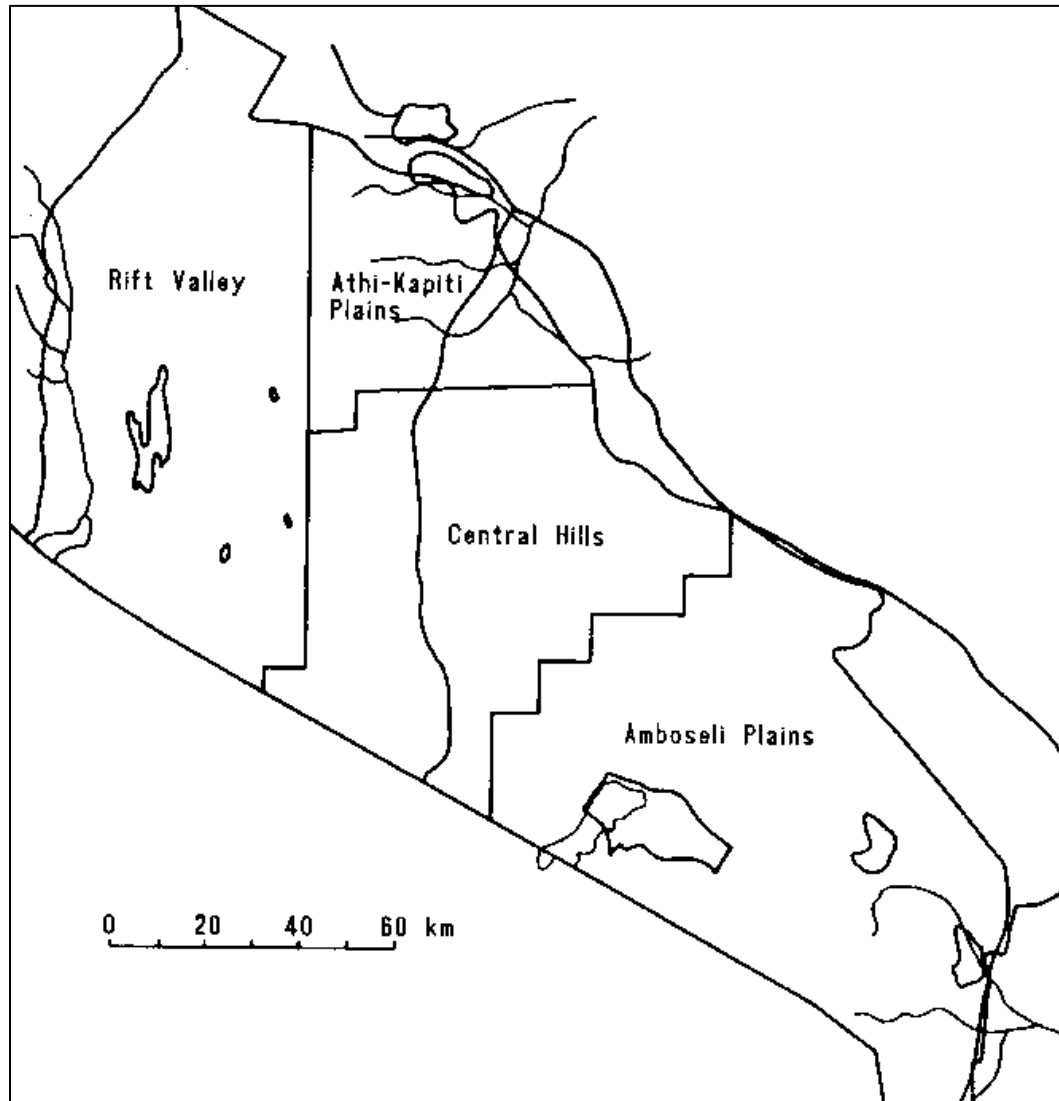
¹Figure 5-3: Image showing the elevation profile of the transmission line route



¹ Image courtesy of Google Earth, 2013

The district can be divided into four topographic areas namely the Rift Valley, Athi Kapiti Plains, Central Broken Ground and the Amboseli Plains as shown in Figure 5-4.

Figure 5-4: Image showing eco-zones in Kajiado County



The proposed transmission line project falls within the Athi Kapiti Plains which 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.

5.3 Geology and soils

The geological succession found in the Kajiado area including the location of the proposed transmission line project routing is:

<i>Age</i>	<i>Formation</i>	<i>Tectonics</i>	
Recent	Soils		
Pleistocene	Olorgesailie Lake Beds	Minor grid faulting	
	Orthophyre-trachyte	Grid faulting	
	Alkali Trachytes		
Pliocene to Miocene	Ol Keju Nero Basalts	Rift Faulting	
	Ol Esayeiti Volcanics		
	Ol Doinyo Narok Agglomerate and Kerichwa Valley Tuff		
	Olorgesailie Volcanic Series		
	Mbagathi Trachyte		
	Upper Athi Tuffs		
	Kapiti Phonolite		
			Erosion and formation of peneplains
	Archaean	Basement System	Folding and metamorphism of Basement System

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.

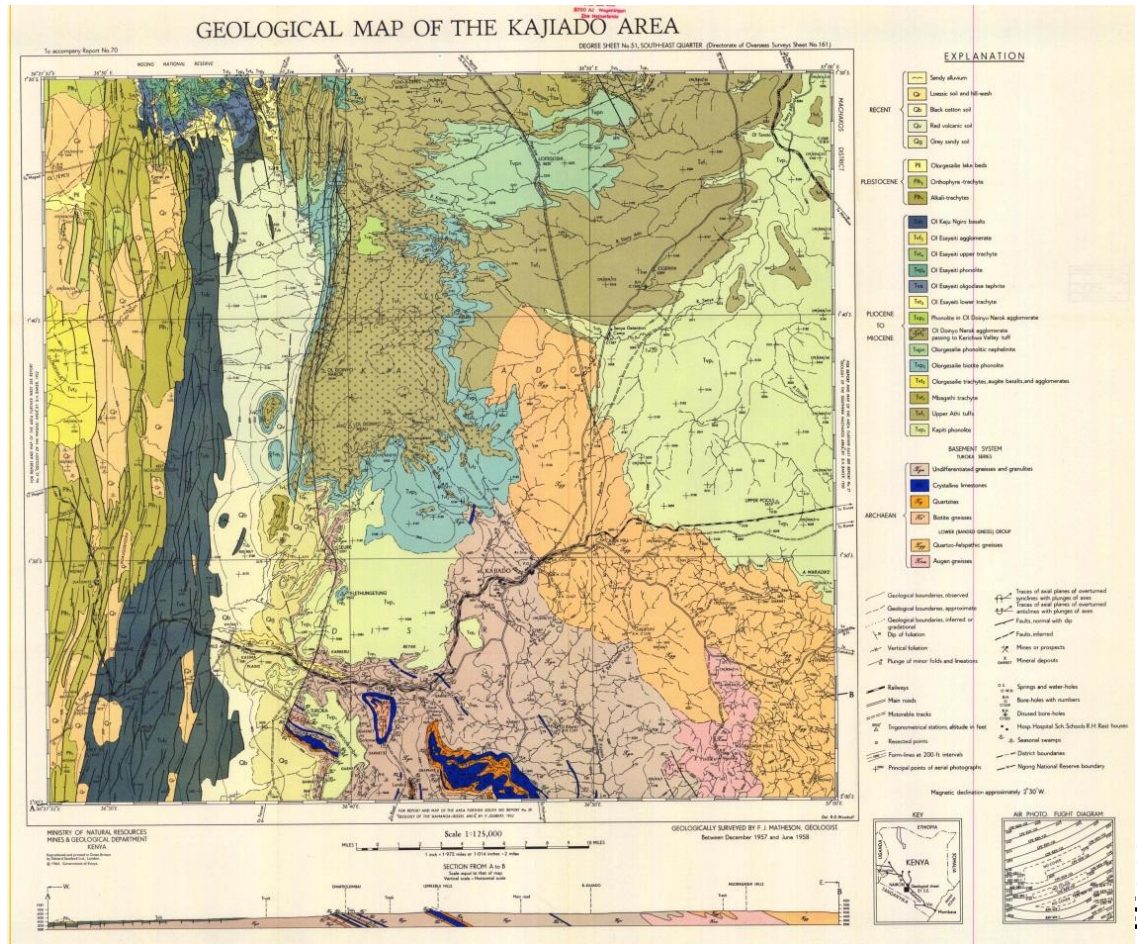
There are also small to medium sized caves found in some of the outcrops of the volcanic rocks spread out in the area.

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.

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 5-4.

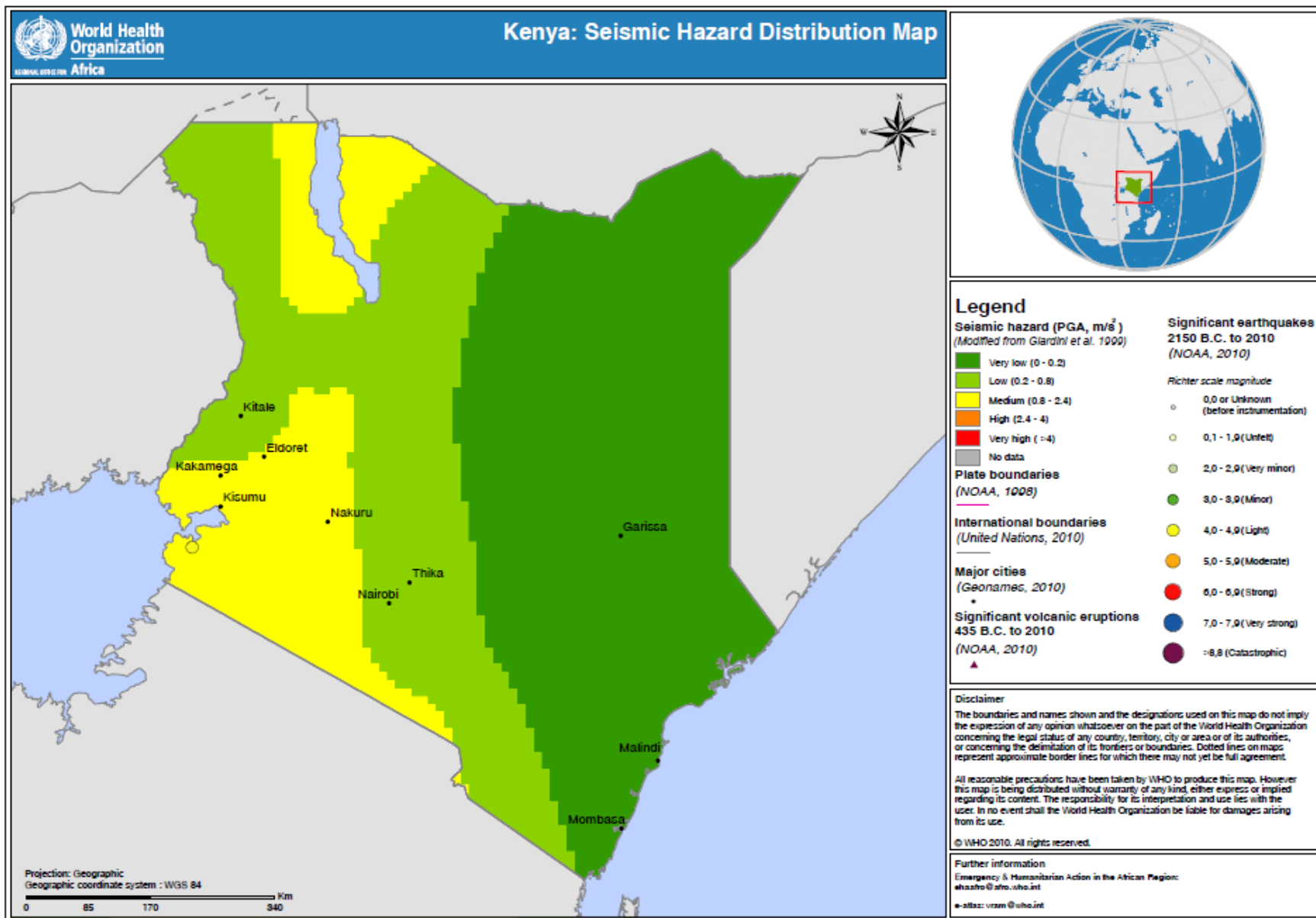
Figure 5-5: Geological map of the Kajiado area



5.3.1 Seismic risk

The location of the proposed transmission line project generally exhibits low seismic hazards as shown in the Figure 5-4. The measure of seismic risk is defined by Probabilistic Ground Acceleration (PGA) which is the maximum acceleration of the ground shaking during an earthquake. The PGA for an earthquake along the transmission line route is in the range of 0.2 – 0.8m/s².

²Figure 5-6: Seismic Hazard Distribution Map - Kenya



² Image courtesy of World Health Organization (WHO)

5.4 Hydrogeology

Groundwater occurs in pores and interstices of various rock formations depending on the geological conditions and physiography of an area. The permeability and porosity of the rock formations, the degree and depth of weathering, the fracturing of the rock and the tectonic historical conditions of the area is used to determine the groundwater potential of a formation. The hydrogeology of an area is therefore determined by the nature of the parent rock, structural features, weathering processes and precipitation patterns.

5.5 Hydrology

No perennial rivers flow in the Kipeto area so water supplies are scarce, and the local population depends largely on water pans (dams). Water can be obtained by digging in the bed of the Kajiado River, and several small dams retain some of the flow.

The few bore-holes in the area are situated in natural drainage basins, obtaining water from permeable bands such as biotite gneisses, within the Basement System. In volcanic areas the best supply comes from the junction of volcanic rocks and the Basement System, the weathered surface of which acts as aquifer.

The geology report for Kajiado indicates that water from a number of boreholes has been chemically analyzed; although most of the water is somewhat hard it is suitable for domestic consumption, but the fluorine content is usually on the high side. Most of the water analyzed is from boreholes in the Basement System, and the fluorine content is appreciably lower than water found in volcanic parts of the country.

5.5.1 Sources of water for the project

During the project period, water will be needed for human use at base camps and for construction. The main possible sources of water are:

- i). Existing boreholes and shallow wells in the proximity of the proposed transmission line route. To access water from existing boreholes, authority will be required from Athi Catchment WRMA regional office; or
- ii). Sinking a new borehole; or
- iii). Purchasing water in bowsers from towns such as Kajiado, Isinya, Kitengela, Athi River, Kiserian or Ongata Rongai.

The proposed project contractor will be required to prepare a water management plan for the project.

5.6 Ecology

A number of field surveys were undertaken to characterize the baseline terrestrial ecology along the proposed transmission line route. The following surveys were undertaken as part of the baseline study:

- Plant/vegetation survey;
- Aquatic survey;
- Mammal survey; and
- Herpetofauna survey.

Additionally the **IUCN red list data of threatened species** was used to determine the conservation status of species covered by the above surveys. The surveys were conducted along the length of the proposed transmission line route and covered a width of about 500m on either side of the center line.

5.6.1 Vegetation characteristics

Grasslands are predominant in the upper parts of the project area. Some areas have mixed herbaceous plants which are opportunistic and a few are invasive species (Figure 5-6). Grasses are normally tall during peak wet seasons. Herbivores disperse to the vast grasslands during wet season to effectively use the landscape.

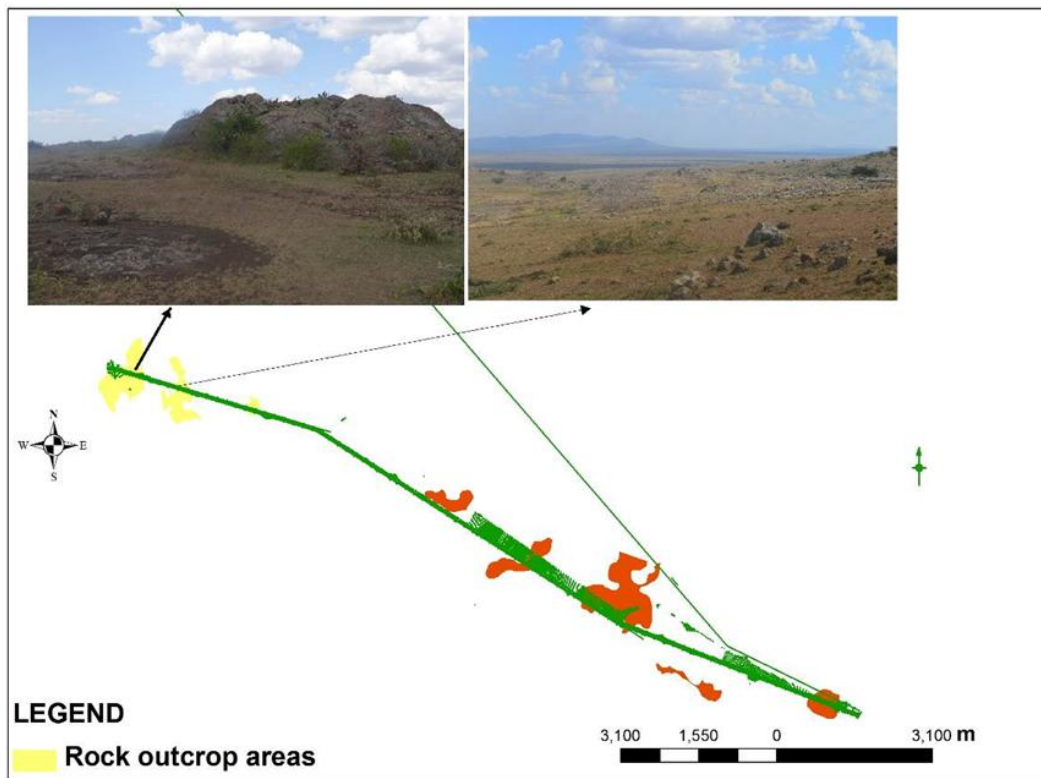
Figure 5-7: Image showing mixed herbaceous plants along the wayleave



5.6.2 Rock outcrops

Rock outcrops occur mostly in the upper area of the proposed transmission line near the wind farm area (Figure 5-7). These are part of volcanic rocks that protrude in the area.

Figure 5-8: Project area showing distribution of rock outcrop areas



Some succulent plants were observed growing on rock crevices and on soils which collect on small depressions (Figure 5-8 and 5-9). The *Aloe sp.* is conspicuous in the outcrop area; some grow on the crevices and others on soils near the rocks.

Figure 5-9: Trees (*Erythrina abyssinica*) growing on soil pans within rock outcrops



Figure 5-10: Succulent herbs growing on rock crevices



5.6.3 Bush lands

Bushes were prominent in the lower areas of the proposed transmission line route. The bushes observed comprise the *Acacia drepanolobium* and *Acacia mellifera* (Figures 5-10 and 5-11). These are generally woody species but short (less than 3m tall) with canopy (branches) spreading near the ground. The species sometimes occur as singles or clusters forming bushy shapes.

Figure 5-11: Image of *Acacia drepanolobium*



Figure 5-12: Image of *Acacia mellifera*



5.6.4 Woodland/shrub land

This group includes woody plants that have a diameter at breast height less than 10 cm and are less than 4 m high. In addition they stand forming low density with open habitats (Figure 5-12 and 5-13). These areas support undergrowth such as grasses and herbs. Woodland or shrub lands are restricted to riverine valleys or runoff restricted areas with exception of one located at the foot of the overhanging rocks in Kipeto area. The latter apparently occur at the foot of the rocks receiving water from the rock catchments and remain there for long time.

Figure 5-13: Mixed trees and shrub like habitat



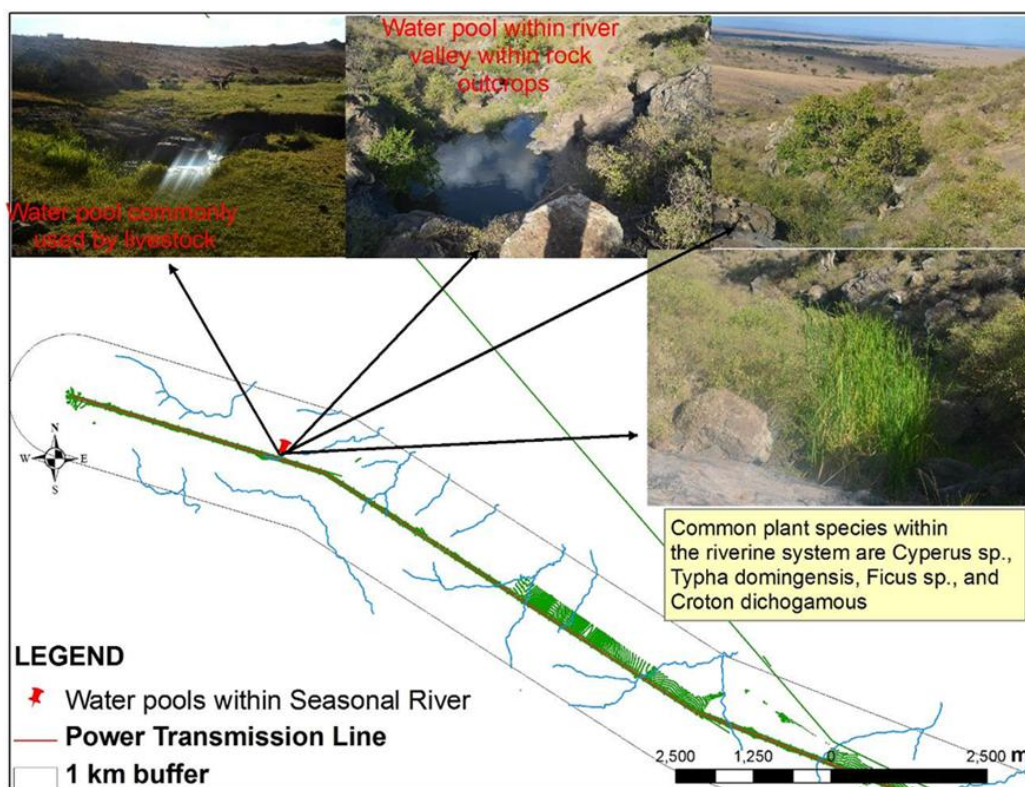
Figure 5-14: Scattered Acacia woodland within valleys



5.6.5 Aquatic habitat

The proposed transmission line route appears to have established drainage valleys intersecting it that collect run-off during the rainy season. However there are no permanent rivers or streams cutting across the transmission line route. The valley receives run-offs during the rainy season and stores water in pools which can then be used during the dry season. An image of the types of pools found along the transmission line route is shown in Figure 5-14.

Figure 5-15: Points along transmission line with aquatic system where aquatic plants and animals



The water pools serve aquatic animals such as frogs serving as breeding sites. Frogs and toads lay their eggs when water currents are relatively calm and hatch tadpoles which grow into full adult before the pools are dry. Thus the pools contribute in maintaining life cycles of frogs and toads in the riverine systems. Wetland plants such as *Typha domingensis* and *Cyperus sp.* are important part of riverine and aquatic systems. They stabilize riverine and stream banks creating suitable habitats for insects and birds. The *Cyperus sp.* are good forage for livestock during dry season thus, the system is valued during dry season in providing service to the locals.

Riverine vegetation which comprises mainly of *Croton dichogamous* and *Carissa edulis* creates bushland cover type within the valley adjacent to the wayleave that forms habitats for birds.

5.6.6 Developed water resources

Water pans are common water resources developed by the Masai community in the Kipeto area. Most of the water pans are constructed for livestock but alternatively serve the wild herbivores with drinking water (Figure 5-15).

Figure 5-16: Water pan used for drinking livestock and visited by wild animals



Wetland birds were observed near some water pans which provide sources of food and water for the animals. The presence of Grey Crown Crane near a water pan indicates the resource serves important ecological roles (Figure 5-16).

Figure 5-17: Water with the Grey Crown Crane in the background



5.6.7 Mammals

The Kipeto-Isinya landscape is characterised by diverse animal species. The conspicuous mammals that were observed during the faunal survey include Zebra and Thompson Gazelles (Figure 5-17).

Figure 5-18: A group of Zebras grazing



Other mammal species are not widespread in the area but occur specifically in mixed grass and bushy landscapes. The species observed were the Harte-beast and Wild-beast (Figure 5-18).

Figure 5-19: Wildebeest and Zebra



Figure 5-20: Harte Beast in the background



Other mammals were identified by their droppings; these include the African hare and warthog. Some mammals were identified by the signs of their activities e.g. rodents and moles which create mounds in grass fields. Also seen were holes created by mammals such as spring hares and aardvarks which are nocturnal creatures.

While not seen, local accounts indicated that the low lying areas of Kipeto are sometimes visited by Elands and Cheetah.

5.6.8 Herpetofauna

Snakes were not physically observed but their presence was noted by mounds that remain in the grasses or on bushes. The common species observed was the spitting cobra (Figure 5-20). This species is common in the Maasai land in the grasslands.

Figure 5-21: Mature cobra molt



The other taxa observed were the lizards and Geckos (red head and yellow head) in the rock outcrop areas (Figure 5-21). They live in the rock crevices or areas with stone where they can hide under them and bask on rocks in the morning sun shine.

Figure 5-22: Gecko on tree stem



5.7 Birds and bats baseline

5.7.1 Avifauna and bird micro-habitats

The landscape within the proposed transmission line is mainly characterized by wooded grassland and rock outcrops that opens up to dwarf *Acacia drepanolobium* habitat towards the proposed Kenya Power switching sub-station at Isinya. It is expected that limited vegetation will be removed along the wayleave, as the construction phase will require the making of a permanent access road, which will provide access for the construction and operational phase activities respectively.

The proposed transmission line falls within pastoral landscape with associated grasslands and scattered acacia woodlands. The majority of this habitat is regarded as suitable for terrestrial bird species for foraging, roosting and as passage for migrating birds. It must be emphasized that birds will, by virtue of their mobility, utilize almost any areas in the landscape from time to time.

The scattered acacia woodlands in the study area support the majority of and a mixed diversity of avifaunal species found in the study area. Unique species found within the woodland include wheaters, pipits, larks etc. The disturbance associated with clearing of woodland and grassland for the transmission line servitude will potentially impact on such species. Acacia encroached grasslands tend to occur towards the southern reaches of the proposed route. Species at risk to collisions in this area include a host of raptors such as, Lesser Kestrels, Verreaux's Eagle, etc. observed at the time of the survey.

Cultivated land represents a significant feeding area for many bird species in any landscape due to readily accessible food for birds and other predators; the crop or pasture plants cultivated are often eaten by birds, or attract insects which are in turn eaten by birds; during the dry season cultivated lands often represent the only green or attractive food sources in an otherwise dry landscape. Cultivated lands are scattered throughout this study area. Relevant bird species that will be attracted to these areas include the Hornbill and Raven species and possibly Storks. However this should not pose significant threat as it's not a widely practiced activity.

Man-made water pans and natural depressions occur in close proximity to the area of the proposed transmission line. These form suitable habitat for duck species and drinking points for other birds. These were mainly observed along the stream. At certain times of the year, they are characterized by slow flowing water and tall emergent vegetation, and provide habitat for water birds.

Avifauna surveys have been going on in the Kipeto wind farm area in 2011, 2012 and 2013 respectively. During the avifaunal survey for the transmission line project, a total of 63 species of birds were recorded; of the species recorded, none were found to be classified as endangered using the IUCN red data list of threatened species.

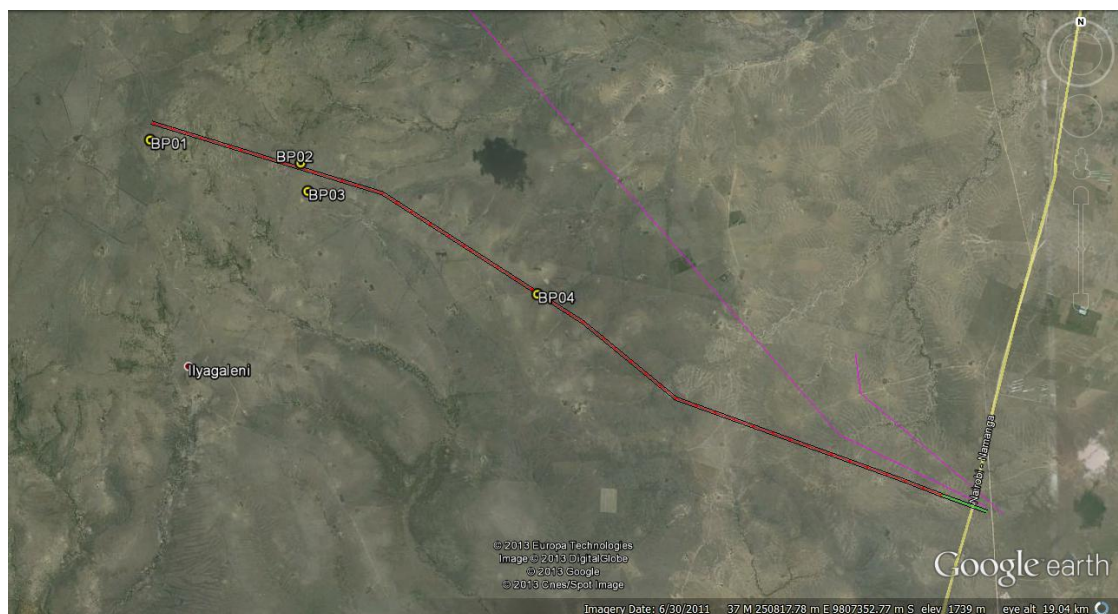
The habitat along the transmission line provide suitable habitats for grassland bird species including pipits, wheatears, Larks etc most of which breed on the ground. Raptors including Kestrels, Kites and eagles were recorded. These are key targets for monitoring with respect to the impacts of the proposed development. Bird movements are possible between these habitats within the proposed development site during different times of the year. The routing of the transmission line could increase this collision risk, particularly near wooded areas or rock outcrops that form cliffs. Storks and herons have also been identified as groups especially prone to collisions with overhead lines (Jenkins *et al.* 2010), and this risk is increased when lines run through suitable habitats like cliffs.

5.7.2 Baseline study on bats

Even though bats have been known to be affected by wind turbines and associated structures since the 1960s, it is only recently when systematic studies mostly in US and Europe have begun to show specific causes and how the bats are affected (Hortker et al 2005).

A bat survey was undertaken at four vantage points (labeled as BP01, BP02, BP03 and BP04) along the transmission line route as indicated in Figure 5-16 below.

³Figure 5-23: Image showing location of bat vantage points



Bats were studied using standard methods as detailed in the Kipeto Wind Farm ESIA Bat Study (Kurrent Technologies 2013). Mistnets were used to capture bats in habitats under detailed study. Anabat SD2 bat ultrasonic sound recorder was used to document bat diversity and monitor activities in static positions in selected bat habitats such as fly-ways. Bat box detector was used to record bats in walk transects within target habitats.

³ Image courtesy of Google Earth, 2013

The characteristics of each of the four bat point surveys are given below.

1. Bat Survey Point 1 (BP01)
 - a. Characterized with large rocky cliff slopping eastward;
 - b. A patch of thick woodland dominated by *Euphobia sp* trees and *Ficus sp*.
 - c. This habitat is unique island; forest like in the middle of open country
 - d. The rocky cliffs are sites for bat roosting, while the fig trees are foraging site for both fruit and insect bats especially when the figs are on fruits.
 - e. Wahlberg's Epauletted fruit bat (*Epomophorus wahlbergi*), *Neoromicia sp.*, Slit-faced bat (*Nycteris hispida*), Horseshoe bat, (*Rhinophus fumigatus*) and False vampire (*Cardioderma cor*) were recorded in this habitat in a single night survey.
2. Bat Survey Point 2 (BP02)
 - a. This point is a confluence where 3 valleys meet and has series of small water spring.
 - b. There is a human made water pond at this site
 - c. Grass is short but green, apparently trimmed by frequent grazing animal
 - d. The bats species recorded here include *Neoromicia sp*, and Little free-tailed bat (*Chaerophon pumila*). The area could be frequented by other foraging bats in the general areas.
3. Bat Survey Point 3 (BP03)
 - a. This is deep river valley
 - b. It has series of seemingly permanent water bodies (pools) on rocky valley bottom mixed with soft ground where human has sunk ponds.
 - c. There were tracks of zebra, Thomson gazelle watering here too.
 - d. Enerau primary school and a church are situated near this point presumably because of this water.
 - e. According to IFC performance standards guidance note 6, it is a potential critical habitat for biodiversity not just bats
 - f. Baseline survey Slit-faced bat (*Nycteris hispida*), Little free-tailed bat (*Chaerophon pumila*), Wrinkle lipped bat, (*Mops condylurus*) and unidentified Pipistrelle.
4. Bat Survey Point 4 (BP04)
 - a. This is bush/woodland more high in height and dense than elsewhere westward
 - b. The wood/bush is dominated by Whistling acacia, *Acacia drepanolobium*.
 - c. It is also a habitat close to buildings near Isinya and could be a foraging where house roosting bats could be an issue.
 - d. Survey of bats in this habitat was conducted near water pan measuring 30m by 20m and following species were registered: *Tadarida sp*, Little

free-tailed bat (*Chaerophon pumila*), Mops condylurus, and Rusty pipistrell (*Pipistrellus rusticus*).

5.7.2.1 Natural vulnerability due to high height flight

High flying bats (above vegetation) typically tend to possess narrow and long wings coupled with high aspect ratio. The high flying bats tend to prefer open spaces where they are able to cruise and catch their prey in-flight. Bats in this category are potentially at a higher risk of collisions with wind turbines than low and slow flying bats.

The Guano bat, *Tadarida ventralis*, is the only species in this category recorded in Kipeto. It prefers open country or low bushland where it feeds above vegetation (Tailor P et al., 2003). It is in the Least Concern category of IUCN Red List of Threatened Species. Whereas records at the National Museums shows it is widespread in Kenya especially in the semi-dry to dry counties, it was one of the least abundant in Kipeto according to the results of this study. *T. ventralis* roosts in houses, feeds on beetles in open spaces high in space. It is one of the least abundant bats in Kipeto, according to the records this study.

5.7.2.2 Natural vulnerability due to medium height flight

Bats in this category do not fly high over bushes and trees but rather low near the ground among bushes and trees. They possess moderately long and broad wings. Several species recorded in this study fall in this category and include Little free-tailed bat, *Chaerophon pumilus*, Angolan free-tailed bat, *Mops condylurus*, Yellow winged bat, *Lavia frons*, Yellow bellied house bat, *Scotophilus dinganii*, and Hildebrandt's horse-shoe bat, *Rhinolophus hildebrandtii*.

A typical example of low flying bats recorded in Kipeto area is the greater long-fingered bat, *Miniopterus inflatus*. Because this bat species is often confused with *M. schreibersii* which is speculated to be migratory (Simmons 2005), a sample caught in mist net at a valley near turbine 26 (T26) was collected and compared with reference collection at NMK to confirm its identity. The species was registered around T26, T34 and T62. Its relative abundance compared to others was on average 17% at T26, 2% at T34 and 10.5% at T62 in November/December 2012 combined data. This species is listed as **Least Concern** in IUCN Red list⁴, and not listed in any regional and national conservation lists. It has been recorded elsewhere in Kenya⁵ in Chyulu, and some coastal Kenya caves.

Echolocation signals recorded on Anabat in Kipeto from this bat is low duty FM at around 48 kHz and is fairly brief 2-4ms. The bat is known to have high wing loading (narrow long wings) and moderate aspect ratio (Monadjem *et al.*, 2010). These three traits: call duration, wing loading and aspect ratio, typifies edge feeders, between or along vegetation (Altringham, 2001) at intermediate height (2-10meters above ground).

⁴ Schlitter, D. 2008. *Miniopterus inflatus*. In: IUCN Red list of Threatened species. Version 2012.2 www.iucnredlist.org downloaded on 02. Feb 2013

⁵ Kuzmin I., et al., 2009. New Species of bat lyssavirus, Shimoni bat virus. Pubmed
Agwanda B. 2011. Bats of Fikirini cave, Shimoni. National Museums of Kenya, Nairobi

Several other species recorded in Kipeto share similar traits with *M. inflatus*. They include the following

- Tiny Pipistrelle, *Pipitrellus nanulus*, was relatively more abundant, 47% around T26. IUCN Red list category: **Least Concern**
- Rusty Pipistrelle, *Pipitrellus rusticus*, was least abundant at T42 and T64 but was the only bat around T13 over water pan. IUCN Red list category: **Least Concern**
- Schlieffen's Twilight bat, *Nycticeinops schlieffeni* but is less abundant, only recorded once around T62. IUCN Red list category: **Least Concern**

Overall, the bats in this category are vulnerable to colliding with turbines made of 50-meter long blades mounted on 80 meter long hub. However, most species in this category were registered in bushes and valleys away from actual turbine sites.

5.7.2.3 Natural vulnerability due to low height flight

Bats in this category possess broad big wings enabling them to fly slowly and even hover and have high frequency calls with broad band or several harmonics to help them 'scan the cluttered environment. This category comprise Slit-faced bat, *Nycteris thebaica* and to lesser extent *Rhinolophus fumigatus*.

There were no recorded species of these bats during the field surveys.

5.8 Socio-economic baseline

The proposed 17km long 220 kV transmission line lies between Kajiado North and Kajiado Central constituencies respectively. The transmission line route commences close to Esilanke Primary School and goes in a south easterly direction towards the A104 (Athi River – Namanga) highway. The transmission line crosses over the A104 highway a few kilometers north of Kajiado town and will be connected to the national grid at the proposed Kenya Power Isinya switching sub-station.

For purposes of the socio-economic study, the baseline is considered as the transmission line route. Socio-economic impacts associated with the construction and operation of the transmission line have been evaluated in Section 10 of this ESIA Study.

5.8.1 Overview of Kajiado County

The county of Kajiado has a population of about 687,312 (2009 census) and is made up of three constituencies namely Kajiado North, Kajiado Central and Kajiado South respectively. The proposed transmission line project falls within two constituencies namely Kajiado North and Kajiado Central.

A vast portion of the county of Kajiado is inhabited by the Maasai, whose **livelihoods** depend on livestock, which in turn rely on the sustainable use of rangeland. While this land was traditionally Group Ranch land in the mid-1980s, the process of sub-division was undertaken with little thought about the negative impacts of the sub-division on the well-being of the land, the Maasai or Wildlife.

The sub-divisions were hastily finalized without a sound framework for further use of common resources, which has greatly decreased the pastoralists' resilience to droughts and other ecological shocks. Recently, the Kajiado County Council developed a Land Use Master Plan (LUMP) for future land use; the Land use Master Plan is an effort to coordinate development within the area. The Kipeto Wind farm lies in Zone D of the Kitengela-Isinya-Kipeto development plan area.

Over the last 30 years, the **human population** of Kajiado County increased four-fold, or by 4.7% a year (Republic of Kenya, 1982). At least half of this increase was due to immigration. In 1979 the population of Kajiado County was estimated at 149,000 or an overall density of 7.6 people/km² while the population density in pastoral areas was approximately 5 people/km² (CBS, 1981).

The economy of Kajiado County is still dominated by the Maasai, who are largely pastoralists, but rain fed farming largely by non-Maasai has taken over as a significant economic activity in higher agricultural potential areas. Irrigated cropping has also been increasing along river valleys and in swampy areas. The main areas for irrigated cropping are along the Ngong Hills, along the Nolturesh River in the Kimana area, in the Kilimanjaro foothills and around Namanga.

5.8.2 Demography

The population of Kajiado is 687,312 (Male 50.2% and Female 49.8%) according to the 2009 Kenya Population and Housing Census Report. Kajiado North constituency has a population of about 193,081 according to the 2005-2010 District Development Plan. Isinya District has a population of about 104,266 as per 2010 estimates from the district plan records.

The current estimated population growth rate is about 4.5 percent per annum and life expectancy at birth is 43 years. While population is predominantly Maasai, the County is also occupied by a growing number of non-Maasai communities such as the Kikuyu, Kamba, Luo, and Somali especially within the urban centres of Ngong, Kiserian, Ongata Rongai, and Isinya. A large proportion of these are immigrants seeking or building residential home as and in search of work opportunities as a result of the strong commercial and construction industry that has driven the county economy over the last recent years.

5.8.3 Land

Land adjudication and subdivision of group ranches dominating land use in the region in the past led to individual land tenure that contributed to land sales to immigrant communities and opened the area previously under strictly livestock farming to other types of economic activities including educational institutions, residential gated communities, and commercial farming using drip water and greenhouses in the more agriculturally potential areas.

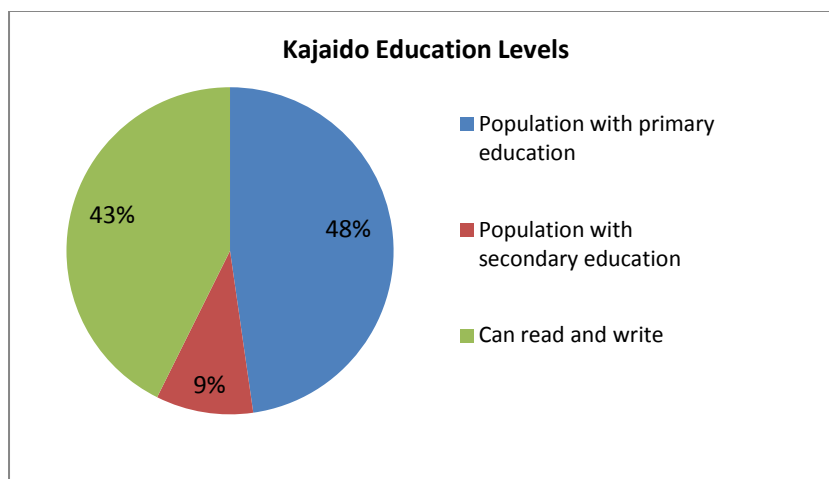
Land Use: The Maasai are a pastoral people with livestock forming the basis of their economic livelihood, the focus of social relations, and a critical element of ethnic self-definition. With most of the area being rangeland, ranching and livestock production form the dominant land-use. As you approach the Nairobi Namanga Road, land use changes with commercial and educational institutions increasing in number. There are a number of primary and secondary schools as well as university institutions being built along the Athi River – Namanga highway (A104) where the transmission line meets the main road.

5.8.4 Employment and Labor force

The key employer in rural Kajiado County is livestock farming and a large number of male adults graze cattle. They protect the homestead, maintain water sources for the community, and protect the livestock from wild animals and theft. Wealth is measured by the amount of land owned by a household and the number of animals they keep. This is as opposed to the increasingly urban immigrant population whose economy in the recent years is driven by construction industry as more build homes and more residential and commercial housing facilities are constructed in the major towns bordering Nairobi.

5.8.5 Health & Education

There are only two (2) district hospitals in the county which is far and limited in staff, medical facilities and drugs. Access and accessibility to good health services is a basic and crucial issue in the County.

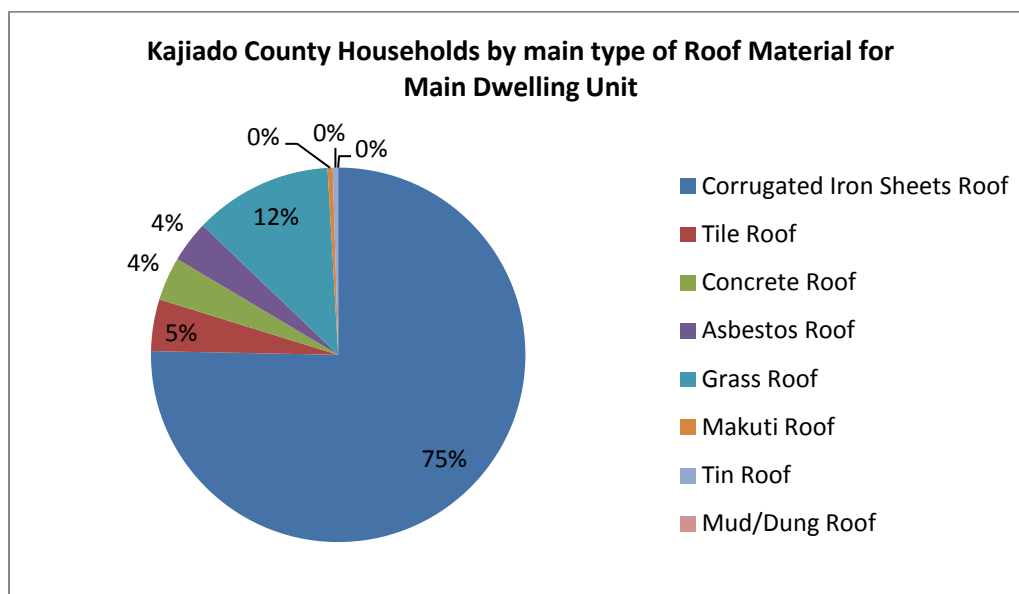


5.8.6 Transport

The prevalent mode of transport is foot. Public transport and public transport are secondary. The County’s road networks are poor and gaining access to health and educational facilities is gruesome.

5.8.7 Housing

Several **households** in rural Kajiado are constructed using galvanized iron sheets (commonly known as *Mabati*). Most homes in the Kipeto area are traditionally built by women, constructed of branches woven together with grass and smeared with cow dung on the walls. The homes are built in a large circle that serves to protect an inner kraal (Commonly referred to as *bomas*). All houses are either owned or self-constructed.



5.8.8 The LUMP and Kipeto Transmission line project

The proposed Kipeto transmission line project will be developed within the Land Use Development Plan (LUMP) framework for Zone D (Kipeto Region) through which the transmission line passes. While the project description and technical components do not go against the premise of the integrated development planning, it calls for strict management of the environment to ascertain certain standards proposed in the integrated development master plan are respected.

According to the LUMP, general the Permitted Land Use for Region D includes:

- a) Livestock production minimum Land size 24 Ha.
- b) Wildlife Production/Promotion – Minimum Land size 24 Ha.
- c) Limited Farming
- d) Restrict Commercial Activities in Oletapes
- e) Promote Eco-Tourism
- f) 10% of the Land to be planted with Environmentally-Friendly Trees.
- g) Prepare Action Plans
- h) Prepare Environmental Action Plans (EAP) for Environmental Sensitive Areas.
- i) Permit Eco-Friendly Development in selected Areas.

- j) Primary access roads size 9m;
- k) Wildlife promotion and Eco-Tourism
- l) Annual Environmental Audits.

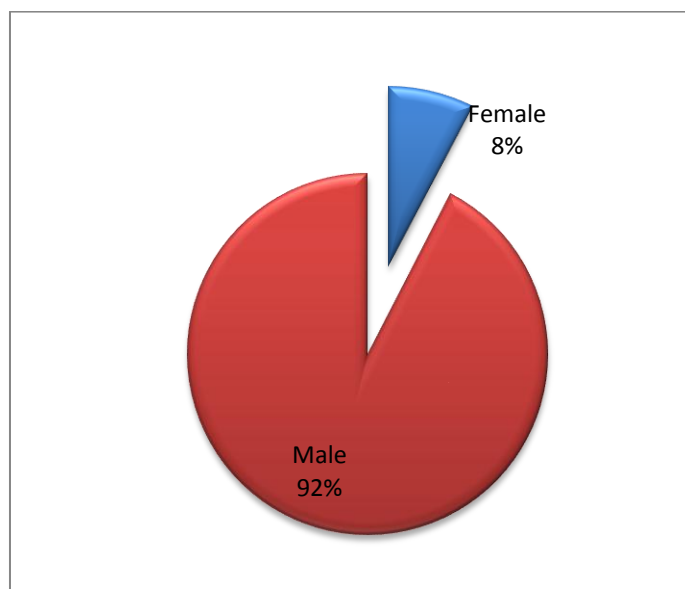
These are to be considered in assessing impact that needs to be assessed in the three phases of construction, operation and decommissioning.

5.8.9 Public/stakeholder consultation

This section provides an overview of the community consultation and participation process for the proposed transmission line project. It is based on field work carried out by the project sociologist, analysis and conclusion drawn from those discussions guided by the IFC's Performance Standards 1, 2, 4, 5 and 7, the constitution of Kenya, national EIA regulations and other relevant legislation and references.

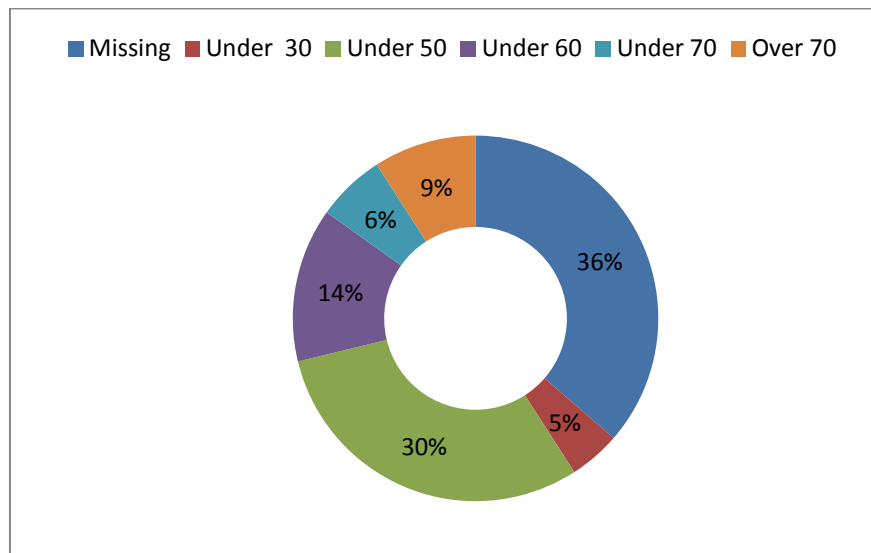
A stakeholder participant survey was carried out and the data entered in a statistical spreadsheet. The following were the outcomes; for the sample taken, the respondents were mainly male 92%.

Figure 5-24: Graph showing respondents by gender



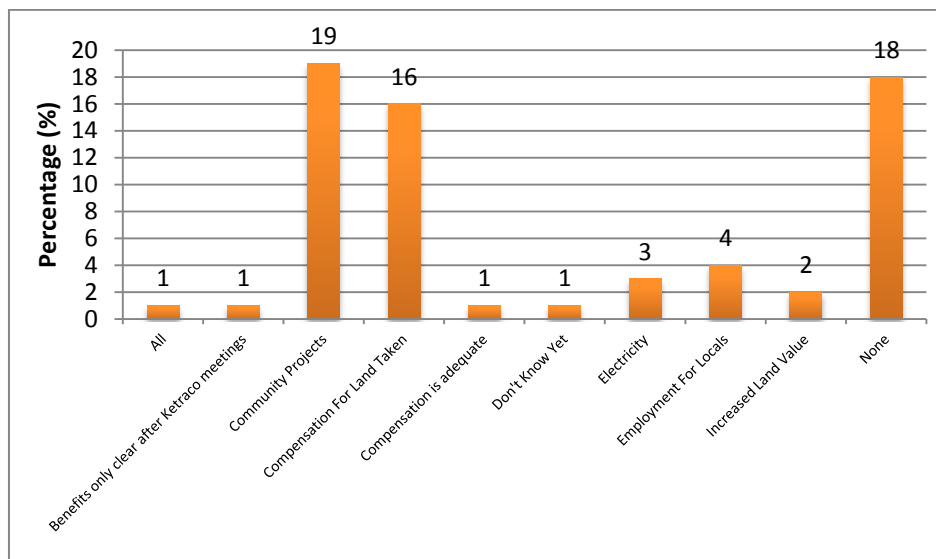
Majority of the respondents said they were Livestock farmers. 40% said they had lived in the area all their lives. 82% of the respondents said they were land owners owning land along the Kipeto transmission line route and only 1% said they were neighbors.

Figure 5-25: Graph showing respondents by age



The age distribution was also defined mainly by parents and elder sons of various families within the household. Most households are polygamous and sons representing various wives were present. The families are relatively large as is the majority of the land in which the transmission line passes. 64% mentioned livestock farming as the only economic activity they are engaged in while 30% said they also had some business activities apart from livestock farming.

Figure 5-26: Graph showing respondents perceived benefits of the project



Majority of the respondents’ participants ranked Community projects as the highest perceived benefit they expected (19%). Majority mentioned community projects like schools, health facilities (the whole project area has only one at Oliyangalani); others mentioned bringing electricity to their community including the schools and church.

17% mentioned compensation for land taken as their highest perceived benefit. Compensation for land taken drew a lot of discussions with inquiries as to how the compensation is calculated, how much land is taken, issues related to one off payment verse annual and or periodical payments.

Figure 5-27: Graph showing respondents perceived adverse impacts of the project

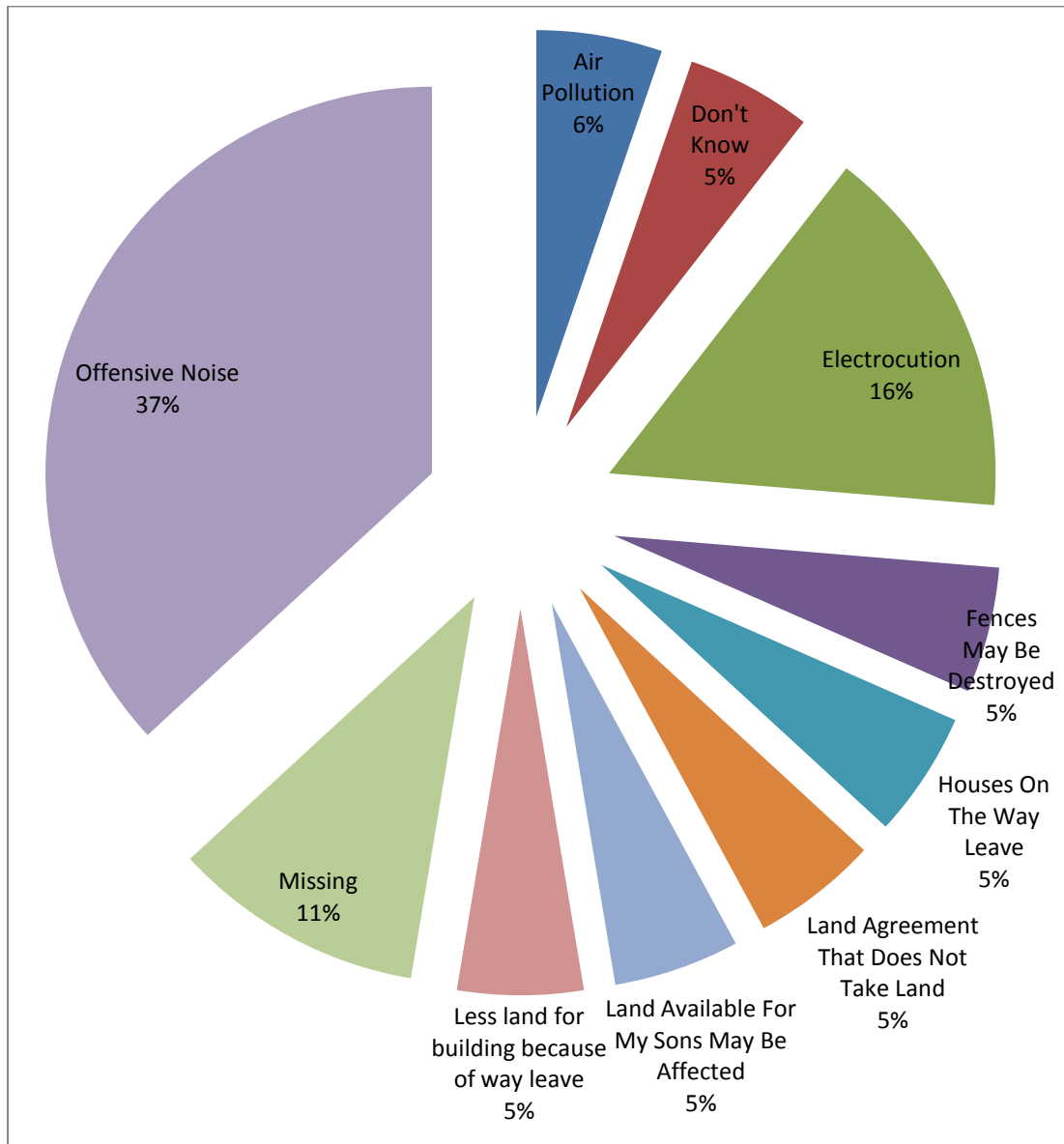


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6 Procedures and processes to be used in the implementation of the project

This section of the EIA Study describes the procedures and processes to be used in implementation of the proposed 220kV transmission line project. The section highlights the processes that will be used for the implementation of the transmission line project 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 proposed transmission line and provides an overview of the various aspects that play a role in its development.

For the proposed project, KEL appointed two professional companies listed below for the design, construction supervision and EIA work including the permitting process associated with the transmission line development project.

Galetech Energy Developments Limited (GED): is an Irish based internationally focused multi-disciplinary renewable energy consultancy.

The company specializes in the delivery of feasibility analysis, project design, project management, GIS mapping, permitting & environmental impact assessment reports, and have the capability to offer a full range of project development services to suit its clients' needs.

Kurrent Technologies Ltd.: is a Kenyan based company specializing in providing complete energy solutions for clients in sub-Saharan Africa. Kurrent Technologies Ltd. is a NEMA registered Firm of Experts undertaking the Environment and Social Impact Assessment (ESIA) Study of the proposed 220kV transmission line project. Kurrent Technologies Ltd. will also be involved as the owners HSE expert.

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

- Technical and commercial considerations: Provides the various technical aspects of the project including accessibility, infrastructure and construction issues.
- Environmental and social considerations: Includes the environmental and social analysis along the proposed transmission line wayleave.
- Public/stakeholder consultation process: Provides the processes that have been adopted for engaging the project affected communities and land owners, lead agencies and other stakeholders associated with the proposed project.

6.1 Kipeto Energy Limited

Kipeto Energy Limited (KEL) is a special purpose vehicle that is promoting a 100MW wind power project which comprises a 17km 220KV transmission line (subject of this ESIA Study). The company's promoters include General Electric of the USA and Craftskills Wind International East Africa Limited.

KEL is the proponent of the proposed project and will be providing the financing necessary for the design, construction and implementation phases.

6.2 Site selection process

The first step in the development of any project is the site selection criteria 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 the technical, commercial or environmental constraints in order that only the most favorable sites are taken forward.

KEL appointed Gibb International (Gibb) to conduct a feasibility study for the proposed transmission line in mid-2012. As part of the feasibility study, Gibb conducted a "Detailed Connection Options Study". This study analyzed three potential routes for the proposed transmission line study namely "Kipeto – Ngong", "Kipeto – Athi River" and "Kipeto – Isinya".

Based on an analysis of the three options, Gibb concluded that the optimum grid connection point should be the proposed Kenya Power Isinya switching sub-station.

6.2.1 Technical/commercial considerations

One double circuit power line is proposed to connect the wind power facility to the electricity distribution grid at the proposed Kenya Power Isinya sub-station. The transmission line towers will be approximately 35m tall and the transmission line way leave will be approximately 60m in width.

Two alignment alternatives were considered for the transmission line one starting close to turbine number 1

6.2.2 Initial environmental considerations

Concurrent with the technical considerations, proponents should consider the environmental and social acceptability of potential sites for a proposed 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 susceptibility of the project.

During the feasibility study of the proposed transmission line, Gibb conducted a site visit along the various routes in order to familiarize themselves with the site conditions.

The proposed Kipeto – Isinya routing of the transmission line will require easement agreements to be signed between KEL and each of the land owners who will be directly impacted by the project. Based on Gibb’s feasibility study of the project, KEL initiated a process of signing easement agreements with each of the land owners affected by the project.

During the environmental scoping process, Kurrent Technologies Ltd. (KTL) undertook desk-top and field studies associated with the following environmental and social aspects:

Terrestrial ecology: In understanding the project, KTL took account of the existing information relating to both ecological designations and any particular protected areas found along the proposed wayleave;

Ornithology assessment: An ornithological impact assessment was undertaken to understand and assess the potential impacts on avifauna related to the proposed transmission line. In particular, the assessment was undertaken to evaluate the collision risk potential of avifauna with the proposed transmission line and mitigation measures identified in order to reduce the risk of such collisions.

Bat study: Similar to the ornithological impact assessment, KTL undertook a bat study to understand and evaluate the potential impacts associated with the design, construction and operations of the proposed transmission line.

Social Impact Assessment: The proposed transmission line project will traverse through properties of landowners between Oloyogalani and Isinya and subsequently there will be potential social impacts associated with the project. Subsequently KTL undertook baseline social data collection studies through public meetings with both land owners and non-land owners in the project footprint area, focus group discussions, etc.

Landscape and visual impact assessment: A 220kV transmission line project could potentially have visual impacts arising from the types and sizes of lattice structures that will be dotted along the landscape within the transmission line route. Subsequently a landscape and visual impact assessment was undertaken to evaluate the sensitivities associated with construction and therefore presence of large steel lattice tower structures and transmission lines along the transmission line route.

6.2.3 Initial public/stakeholder consultation

KEL has from the onset of the EIA process, had engagement sessions with the Ministry of Energy, land owners and non-land owners along the proposed wayleave, Government Ministries and Lead Agencies among others. Formal and informal stakeholder engagement meetings have been held with relevant people engaged in the proposed transmission line project.

The engagement sessions have been fruitful in explaining the proposed project to stakeholders.

6.3 Project feasibility process and procedures

During this phase, the Gibb and KTL undertook further examination of the proposed project including:

- Conducting a tower spotting exercise
- Establishing the revised transmission line corridor route; and
- Developing an Environment Project Report (EPR) Study to identify specific environmental constraints and opportunities prior to undertaking the detailed ESIA.

During the feasibility stage, Kurrent Technologies Ltd. continued engaging the communities in the project area.

6.3.1 Technical/commercial considerations

During the project feasibility stage, the focus of the technical work was on gathering site specific information by visiting and/or surveying the project area to determine existing and future KETRACO/KPLC power transmission line infrastructure in the immediate and wider area.

Technical data provided by KEL: This included coordinates of the wind farm and technical parameters of the turbines and control system.

KP&LC's present and future infrastructure in the Kipeto area: Visits were made to KP&LC offices to establish their current and future transmission line infrastructure operated at a minimum of 66 kV within the Kipeto area.

Data from KETRACO: Data was obtained from KETRACO and included schematic drawings of the proposed transmission systems and sub-stations in the immediate and wider area up to the year 2015, coordinates of sub-stations and construction timelines.

6.3.2 Environment Project Report (EPR)

During the initial site selection process, the scoping process for site selection includes sustainable management of the project. 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 KTL with the report submitted to NEMA for consideration.

6.3.3 Public/stakeholder consultation

Public/stakeholder consultation is a continuous process throughout the project life cycle. During the feasibility stage, KTL and KEL continued to engage the communities along the proposed easement 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, KTL also provided information to the communities along the proposed wayleave about the 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.

6.4 Detailed assessment process and procedures

KEL will undertake a detailed assessment of the project if the site selection process and feasibility studies indicate that the project is commercially and environmentally viable.

6.4.1 Technical/commercial considerations

Throughout the detailed assessment phase, Gibb continued to gather preliminary engineering design information and continued to re-appraise the economic viability of the project.

6.4.2 Environmental considerations

Where the NEMA believes that the proposed project 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 June 19th, 2013 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 and social impacts and propose mitigation measures.

Terrestrial ecological assessment: The flora and fauna found along the proposed easement should be considered in relation to the loss of habitat, to their sensitivity to disturbance and to their importance nationally. Impacts to fauna especially in protected areas and introduction of alien invasive species are components that must be managed throughout the construction phase of the project. As part of the ESIA Study, an ecologist was engaged to undertake a baseline study of the flora and fauna within the project area and to predict impacts associated with the transmission line project.

Socio-economic Impact Assessment: A socio-economic analysis is a requirement in all ESIA Studies undertaken in Kenya. Socio-economic studies are undertaken through literature review of demographic, economic and social data and public/stakeholder consultations. For linear projects such as the proposed transmission line project, formal stakeholder consultation meetings were held with various indigenous Masai communities living on or near the proposed wayleave and having a direct or indirect influence on the outcome of the project. Additionally public *barazas* were organized where the Proponent was present to collect oral and written comments about the project. Focus group discussions were held with specific groups such as the youth. A specialist socio-economic assessment report is appended to this ESIA Study.

Avifauna Impact Assessment: This ESIA Study has considered the direct and cumulative impacts of the proposed transmission line project on birds. The physical impact of the proposed transmission line project has further been examined and a specialist report to this ESIA Study produced.

Bat Study Assessment: The ESIA Study considered the direct and cumulative impacts of the proposed transmission line project on bats. The physical impact of the proposed transmission lines has been assessed and specialist bat study produced.

Landscape and visual impact assessment: For imposing projects on the landscape such as the proposed transmission line, it is important to undertake a landscape and visual impact assessment. The objective of such assessments is to ensure that the project is not visually intrusive and undesirable to local residents. A landscape and visual impact assessment was conducted by a South African company that specializes in this kind of work to evaluate the impacts of visual intrusion caused by the proposed transmission line project.

Health and safety: Health and safety is a critical business support function within an organization and these aspects should be internalized for the most part within the organization through written policies and procedures. The design, construction, supervision and operation of the proposed transmission line will be done in accordance with international electrical industry standards in order to eliminate potential health and safety hazards.

It is envisaged that most health and safety risks from the proposed project will occur during the construction phase. This ESIA Study addresses the construction and operational phase health and safety risks associated with the proposed transmission line.

6.4.3 Public/stakeholder consultation

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

For the proposed project, public/stakeholder consultation has been an on-going process. Public meetings with the provincial administration and local land owners situated along the proposed wayleave 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.

6.5 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 each 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 longer periods 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 so, is issued with an EIA License.

6.6 Construction phase process and procedures

Environmental considerations will continue into the construction phase of the project and KEL and the selected contractor(s) will refer to the ESIA Study and NEMA conditions under which the EIA License is granted.

6.6.1 Technical considerations

In view of the number of separate contractors involved in the construction works for a transmission line project, KEL will identify an individual with responsibility for site management. This individual will have responsibilities for all aspects of the work. The site manager will endeavor to ensure that all contractors are aware of and abide by the requirements of the EIA License and any other planning conditions set by lead agencies or parastatals.

6.6.2 Environmental considerations

Large projects such as the proposed 220kV transmission line project need to be undertaken in strict compliance with Kenyan legislation on Health, Safety and Environment (HSE). The principal legislation governing these aspects is:

- Environment Management and Coordination Act, 1999 (EMCA) and its subsidiary legislation; and
- Occupational Safety and Health Act, 2007 (OSHA) and its subsidiary legislation.

In order to comply with the provisions of these two principal statutes and their subsidiary legislation, this ESIA Study includes a Construction Environment Management Plan (CEMP) and a Construction HSE Plan which must be customized and complied with by the contractors during the construction phase of the project.

During the construction phase, there will be a requirement for construction camp sites which will be spread within the project footprint area and may number between 1 and 3. Each camp site will host several construction workers???. The camp sites will have accommodation and catering facilities for the workers. The camp sites are expected to be located not far from the project area and will generate several types of wastes from the activities.

At the stage of undertaking the ESIA Study, the locations of the camp sites is unknown and the number of workers to be housed in each camp site. However, all wastes generated from such sites will comply with the requirements listed in Legal Notice 121 titled Environment Management and Coordination (Waste Management) Regulations, 2006.

6.6.3 Public/stakeholder consultation

The successful contractors under the supervision of owner's engineer (Galetech Energy Developments) will ensure that on-site and off-site works are undertaken with minimal disruptions to the communities living along the project area.

It is suggested that consideration be given to the formation of a community liaison group providing the opportunity for dialogue between the main contractor and the local communities living in the vicinity of the proposed transmission line wayleave.

In the event of any comments or complaints about the construction works, the owner's engineer or their local representative should be accessible to the local community to deal with such comments and complaints expeditiously.

The successful main contractor 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.

6.7 Operational phase process and procedures

The proposed transmission line is expected to have minimal environmental impacts during the operational phase as the project will be designed and constructed to international electric power standards.

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

6.7.1 Environmental considerations

The potential environmental impacts of a high voltage electrical transmission line project typically relate to effects on radiation and, health and safety impacts. Kenya Power has a robust surveillance system which includes the following components:

- Ground surveillance of the wayleave using local communities; and
- Aerial surveillance of the wayleave.

During the operations phase of the proposed project, Kenya Power will continue to use the above systems to monitor the environment along the transmission line route in order to prevent health and safety impacts arising from their operations.

6.7.2 Public/stakeholder consultation

During the operations phase of the project, Kenya Power will allow local individuals to raise any concerns they may have about the operation of the proposed transmission line project. Kenya Power's head office based staff in conjunction with relevant field staff will be available to local individuals that wish to voice their concerns.

6.8 Decommissioning phase process and procedures

6.8.1 Extent of decommissioning

The extent of decommissioning is as follows:

Decommissioning of the proposed transmission line is estimated to take four to six months to complete, and will involve the following operations.

Transmission line steel towers

The steel lattice towers will be removed entirely from the wayleave. All materials arising from demolition will be disposed of in accordance with relevant Kenyan waste management regulations and international waste management guidelines. The excavated areas will be backfilled, covered in topsoil and seeded with an appropriate local mix.

Conductors and insulators

The conductors will be de-energized, cut, ends removed and reeled for disposal in a steel recycling plant. The insulators will be removed and disposed off in accordance with relevant Kenyan waste management regulations and international waste management guidelines.

6.8.2 Decommissioning process

The decommissioning process will comprise the following tasks:

1. Remove the conductors from steel lattice towers;
2. Remove the insulators and other associated fittings from the lattice towers;
3. Dismantle by unbolting and/or cutting each steel lattice tower component;
4. Using lifting cranes, place steel lattice tower sections in trucks, cover flatbed truck and cart away to NEMA approved waste disposal site;
5. Backfill excavated lattice tower foundation using imported clean soil material.

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7 Construction phase procedures and processes

7.1 Introduction

This section provides a description of the various construction processes that will be used in constructing the proposed 220KV transmission line project. Descriptions of the facilities that make up the footprint of the 220KV transmission line project are described below.

The total length of the proposed transmission line is approximately 17km and will take a construction period of about 12 months to complete. 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 stringing conductors, etc.

Construction of the transmission line will take place within an easement negotiated between Kipeto Energy Limited (KEL) and affected landowners. It is expected that the easement will be about 60m wide (30m on each side of the transmission line centerline).

Construction is envisaged to begin in the third quarter of 2013 if all project approvals have been acquired from relevant lead agencies.

The construction of the proposed transmission line and associated infrastructure will involve a number of activities listed below.

- Limited clearing of the easement where people have settled or conduct business;
- Excavation for the transmission line tower foundations;
- Installation of insulators and stringing of conductors;
- Cleanup and drying the pipeline after testing to prepare it for operation; and
- Reclaiming impacted environmental areas.

Given below are the activities that will take place during the pre-construction, construction and operational phases of the transmission line project.

7.2 Pre-construction Activities

7.2.1 Surveying and mapping

Surveying and mapping operations are essential not only for transmission line construction, but to support various engineering decisions, including calculations for tower spotting, foundation designs, etc. Surveying will also identify unique circumstantial factors that must be accommodated during construction (e.g., nearby utilities, buried or otherwise). It is envisaged that the main contractor will carry out the surveys indicated in Table 7-1.

Table 7-1: Types of Survey required

Survey	Use
Topographic surveys	For providing the location of natural and artificial features and elevations used in mapmaking
Transmission line route surveys	For identifying the most direct paths between control points, which are then amended based on field conditions.

7.2.2 Engineering and Procurement

The design and construction of the transmission line will be undertaken in accordance with international electrical energy industry standards and codes of practices. A preliminary and detailed engineering design of the transmission line will be undertaken by the owner's engineer.

Subsequently, using Best Applicable Engineering standards, the owner's engineer will prepare specifications and bills of quantities. The proponent will go out to tender by inviting contractors of international repute and a good track record in transmission line related projects in the past. On receipt of the bids from the bidders the owner's engineer is expected to evaluate the bids and recommend appropriate contractors for civil and electrical works. The Proponent will then evaluate the recommendations of the owner's engineer and if satisfied will issue purchase orders to the successful bidders. This will end the pre-contract phase of the project.

During the post contract phase the owner's engineer will supervise all contractors to ensure that they complete the works in accordance with the specifications and time.

7.3 Construction

7.3.1 Staging area development

Equipment and materials will be stockpiled before and during construction in staging areas, which are normally adjacent to the wayleave where they would not interfere with the movement of materials, erection of towers, and line pulling.

The staging areas will be used for storage of materials and fuel used during construction, including diesel fuel, gasoline, lubricating oil, and paints. Depending on the location and stage of construction, they may be used for storage of herbicides that are used to maintain clearance along the wayleave. Blasting agents may be stored at staging areas, subject to applicable regulations and standards.

7.3.2 Establishment of access

New Access Road Requirements. The extent of new access road construction that would be required to service construction and maintenance of a transmission line is very site-specific. Existing roads may serve some of the wayleave, and some sections may be accessed only by air. The fill material and road base required for new access roads are likely to be derived from local sources at sites known as borrow pits. Excavation of borrow pits is expected to remove material and possibly habitat from nearby land. The impacts associated with use of borrow pits can be minimized by restoration of the surface of the pits.

Clearing of Sites for Structures. Figure 7-1 shows a site clearing operation during construction of a 500-kV line in hilly terrain.

Figure 7-1: Image showing clearing of vegetation in hilly terrain



Specific sites for structures such as towers and substations (see Figure 7-2) must be cleared as well as the wayleave, staging areas, and areas for tower assembly.

Figure 7-2: Site preparation for construction of typical sub-station



Clearing of the proposed transmission line wayleave could employ a variety of techniques, including the use of heavy equipment such as dozers and scrapers, or selective hand-clearing. The choice will depend upon topography, current growth, land use, and plant species on wayleave-adjacent property and the presence of sensitive environments. In sensitive areas, hand-clearing may be used to minimize environmental disturbance. However, even with careful practices, habitat may be changed by wayleave clearing, especially if it results in substantial changes to the original vegetation cover. Changes may extend to the area adjacent to the wayleave, which is subsequently exposed to increased sunlight or other changes. This is particularly true in the case of an interruption in an otherwise continuous forest cover. Changes in drainage patterns may be an important consideration, especially if the wayleave is adjacent to a body of water.

The brush and slash removed from the wayleave must be disposed of by chipping or leaving it where it falls.

7.3.3 Tower construction

While it is unclear at this stage of the EIA Study what methods will be used for tower construction, Figures 7-3 to 7-8 show various steps of tower construction process used in the developed world.

<p>Figure 7-3: Drilling rock for blasting to set tower foundation</p> 	<p>Figure 7-4: Anchor bolt cage and reinforcing for tower foundation construction</p> 
<p>Figure 7-5: Anchor bolt cage in place</p> 	<p>Figure 7-6: Hole being drilled for footing</p> 
<p>Figure 7-7: Helicopter crane being connected to tower sections during tower assembly</p> 	<p>Figure 7-8: Crane being used to lower tower section onto a tower base</p> 

7.3.4 Sub-station construction

Substation construction is expected to take 6 to 9 months and will cover approximately 5 acres for the fenced station plus 3 acres for construction support. Figure 7-9 shows a representative substation under construction.

Figure 7-9: Sub-station under construction



7.3.5 Conductor stringing

The process of attaching conductor wires to the insulators suspended from the towers is called conductor stringing. It generally involves pulling the conductor off of a truck-mounted spool. This process typically will not result in additional land disturbance beyond that required for tower construction. An exception may occur at diversion towers where severe line direction changes occur.

7.3.6 Wayleave restoration

It is general practice to restore the wayleave after construction, although the replacement of tall vegetation is not a part of restoration directly within the wayleave boundaries. Tall vegetation can create ground-fault hazards, including the risk of fire. Plants consistent with native species are selected, although with consideration of their growth rates and mature plant heights. In some areas, the wayleave must remain passable by land vehicles for line inspections.

7.4 Ancillary services and utilities

7.4.1 Site Compound

During the construction period, a construction camp and material laydown areas will be required. 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. 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 sub-station building depending on the final grid connection and hence substation location.

7.5 Borrow Pit

Borrow pits and/or quarries will be identified during the detailed engineering design stage of the project. Borrow pits may be required for extraction of suitable material for the access road construction to the transmission line wayleave.

In general, borrow pits are usually worked in strips to ensure that only enough material 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.

7.6 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 wayleave.

While the water demand for the project at this stage is unknown, it could be satisfied in one of three ways namely:

- Abstraction of water from the existing boreholes in the local area after getting formal consent from the borehole owner; or
- Use of water bowsers and storage of water in tanks in the laydown area and camp sites; or
- Sinking new boreholes in accordance with the Water Resource Management Authority (WRMA) requirements.

During the construction phase of the project, 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.

7.7 Reinstatement

A detailed Reinstatement Plan will be agreed upon with the selected main contractor. For the purposes of this ESIA Study, the broad restoration measures proposed for the transmission line project are described below.

General restoration will be required along the wayleave, construction camps and material laydown areas. Specific restoration will also be required around water crossings and borrow pits.

As detailed in the various construction activities, the wayleave will be carefully cleared such that the excavated topsoil is neatly stored in windrows. Once the towers have been erected, construction camps have been demobilized and material laydown areas have been cleared, the stockpiled top soil will be used for 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.

Access roads will be dressed off once the ROW reinstatement is 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 reinstated areas will be protected so as to prevent any erosion while vegetation re-establishes.

7.8 Pollution Prevention Measures

7.8.1 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 remedial 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.

7.8.2 Noise quality

Construction phase noise levels will be generated by construction plant and equipment such as excavators, lifting equipment, dumper trucks, compressors, generators, etc. 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.

7.8.3 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.

7.8.4 Site Induction and Training

All employees and sub-contractors will undergo an HSE 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.

7.9 Emergency Response Plan

The main contractor will implement an Emergency Response Plan for credible HSE related scenarios. 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 is 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.

7.10 Prohibited Activities

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

- Entry of construction plant to or trampling of marked sensitive zones;
- Entry of construction plant to areas outside of designated working areas;
- Disposal of waste materials anywhere along the wayleave or indiscriminately in the construction camps and material laydown areas;
- 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 proposed project. Visitors will be escorted at all times by authorized site personnel.

7.11 Working Hours

The construction program working hours will be based on the requirements of the Employment Act, 2007 and its subsidiary legislation. Generally, night time or Sunday work will not be permitted except for security personnel. Any activity that requires working at night or outside daylight hours will require authorization of the relevant community members.

Where work is permitted at night or outside daylight hours, floodlighting will be provided 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.

7.12 Operation and maintenance phase

7.12.1 Normal operation

During normal operation, transmission lines require very little intervention. The only exception is periodic inspections and vegetation management, which are discussed below. Inspections are periodically done using tracked or other ground vehicles.

7.12.2 Wayleave management

Wayleave maintenance is used to assure safe clearance between conductors and vegetation and to allow passage for inspections on foot or by vehicles. Vegetation management is a critical function; failure to manage vegetation can potentially lead to black-outs resulting from a combination of heavy electrical loads, high ambient temperature and low wind speed allowing a critical line to sag close enough to a tree which can cause a ground fault to occur.

7.12.3 Repairs and repair access

Although normal operation requires minimal intrusion into the wayleave, line or tower failures can result in the reintroduction of heavy equipment, work crews, excavation, and materials transport.

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8 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 220 kV transmission line 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.

8.1 Construction Phase

8.1.1 Products

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

- Approximately 47 Steel lattice towers each spaced approximately 350 – 550m apart;
- Stringing of steel transmission line cables mounted on insulators fixed to the lattice towers;
- Appropriate electrical connections from the wind farm sub-station;
- Appropriate electrical connections to the proposed Kenya Power switching sub-station at Isinya; and
- Grounding/earthing system for protection against lightning and stray currents.

8.1.2 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 proposed transmission line 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.

8.1.3 Waste

During the construction phase, domestic and industrial wastes such as, timber skids, sewage, used lube oils and general refuse will be generated. All wastes generated from the project will need to be disposed in accordance with the Environment Management and Coordination (Waste Management) Regulations, 2006 (Legal Notice 121). There shall be a strong emphasis placed on housekeeping and cleanliness at all sites in order to promote safety and minimize environmental impact. The characteristics of the wastes to be generated by the project are described below.

Domestic Wastes

- The construction teams working along the proposed wayleave or staying at the camp site(s) are expected to be supplied with various forms of foodstuffs packed in plastic or other types of containers. This is expected to occur throughout the construction space within the proposed wayleave. The management of such waste will be incorporated by the main 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 wayleave clearing process may potentially generate a considerable amount of dust and other particulates that will be released into the atmosphere. This is expected to be a short-term effect and can be mitigated by using dust suppression methods.

Smoke Emissions

The construction plant, machinery, equipment and trucks brought in by the Contractor are expected to generate gaseous 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.

8.2 Operation Phase

8.2.1 Products

The primary product of the project during the operational phase will be transportation of electricity generated by the 100MW wind farm. This is the product that the Kenya Power will transport from the wind farm sub-station to the proposed Kenya Power Isinya switching sub-station.

8.2.2 By-products

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

8.2.3 Waste

There will be minimal wastes generated by the project during the operational phase.

8.3 Decommissioning phase

8.3.1 Products

Decommissioning is the process of taking structures and/or equipment out of service when it has reached the end of its useful life. From an operational perspective, that point is reached when maintenance and replacement costs for older structures and/or equipment begin to outweigh the value obtained from continued operation.

Prior to the decommissioning, all power from the wind farm and transmission lines will be de-energized. During the decommissioning phase, the primary product is expected to be the scrap metal from the steel lattice structures that needs to be removed from the wayleave and cables strung on the insulators connected to the steel lattice towers.

Insulators which will be found to be in a good state of repair and could potentially be reused, would also be considered a product during the decommissioning phase.

8.3.2 By-products

It is envisaged that there will be minimal by-products generated through the decommissioning of the transmission line.

8.3.3 Waste

During the decommissioning phase, the primary waste will be the scrap metal from the steel lattice towers, insulators and cables. Several trucks will be required to transport wastes generated through the decommissioning phase to appropriate waste disposal sites. These vehicles will consume diesel and produce air emissions as a waste. Secondly, through servicing of these trucks, used oils will be generated which are hazardous wastes. Potentially there may be tires that will be replaced and old tires that come out of the trucks during the decommissioning of the transmission line may also be wastes.

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9 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.

9.1 Description of the ESIA process

The ESIA process has incorporated the following components to date:

- Submission of an Environment Project Report (EPR) to NEMA for consideration. The EPR Study was submitted to NEMA on April 22nd, 2013 who acknowledged receipt and allocated a reference number NEMA/PR/5/2/10952 to the project. NEMA is the lead agency in Kenya that will be requested to issue an EIA License for the proposed project;
- Development of this final ESIA Study report, which has assessed the likelihood, extent and duration of impacts from the proposed development. The EMP has been incorporated into the final ESIA Study report and provides guidelines for the avoidance, minimization and mitigation of impacts for the construction, operation and decommissioning of the project.

It is envisaged that the above steps will be followed by:

- A 30 day public review period of the final ESIA Study report; comments will be incorporated and an edited final ESIA Study report submitted to NEMA;
- The granting of authorization of the development by the NEMA;
- The opportunity for the public or stakeholders to lodge and appeal against authorization of the development by NEMA.

9.2 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. The EPR Study process commenced in November 2012 and provided communities living along the proposed wayleave with the opportunity to receive information regarding the proposed transmission line project, participate in the process and raise issues of concern.

The EPR Study Report identified the following:

- Nature and extent of the proposed 220 kV transmission line project;
- 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 project involving the proponent, specialists and a consultation process involving parastatals and the communities living along the wayleave.

The final EPR Study was submitted to the NEMA on April 22nd, 2013. The NEMA accepted the EPR Study and asked the proponent to initiate the detailed ESIA phase.

9.3 Environment and Social Impact Assessment (ESIA) Study

Through the EPR Study, no environmental fatal flaws were identified to be associated with the proposed transmission line project. However some issues and potentially sensitive areas requiring further study for the proposed project were identified. 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 project;
- 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.

9.4 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 the county administration;
- Undertaking a public/stakeholder consultation process including several meetings with local communities and land and non-land owners living in the vicinity of the proposed wayleave;
- 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.

9.4.1 Public/stakeholder consultation

The public/stakeholder consultation process commenced in February 2013 after the EIA Study team mobilized their resources in the project area. The objectives of the public/stakeholder consultation process were to ensure that:

- Information containing relevant facts with respect to the proposed project was made available to the affected communities living in the vicinity of the wayleave;
- Participation by the local communities along the wayleave 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.

In February 2013, the consultation process involved conducting public meetings with communities living along the wayleave and one-on-one meetings with relevant lead agencies.

This ESIA Study will be submitted to the NEMA for review and consideration. Concurrently it is envisaged that 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.

9.4.2 Specialist studies

Based on the EPR Study, a number of specialist studies were undertaken during the detailed ESIA phase as follows:

- Terrestrial Ecological Impact Assessment;
- Avifauna impact assessment
- Bat specialist study;
- Social Impact Assessment; and
- Visual impact assessment.

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

9.4.3 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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10 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 10.1 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.

10.1 List of potential impacts

- AV: Avifauna
 - AV1: Risk of electrocution
 - AV2: Risk of collision
 - AV3: Disturbance and habitat destruction
- B: Bats
 - B1: Habitat alteration and disturbance
 - B2: Construction site waste generation
 - B3: Hazardous materials impacts
 - B4: Fugitive dust and waste impacts
 - B5: noise from construction plant
 - B6: bat collisions with transmission line
 - B7: Bat electrocution on the transmission line
 - B8: Electric and magnetic fields: coupling effects
- E: Ecology
 - E1: Terrestrial woody plant alteration
 - E2: Introduction of Alien Invasive Plant Species
 - E3: Aquatic Habitat Alteration
 - E4: Temporary obstruction of movement of wild-herbivores
 - E5: Poaching for bush meat
 - E6: Destruction of habitats for herpetofauna
 - E7: Exposure of wild herbivore to electric and magnetic fields
 - E8: Temporary interference of ecosystem service: Pastoral

- SE: Socioeconomic
 - SE01: Destruction of fences and gates crossing the way leave
 - SE02: Impacts associated with construction disturbance
 - SE03: Improved utilization of compensation payments
 - SE04: Exposure to Electromagnetic Field (EMF) Exposure
 - SE05: Community participation in maintenance of way leave
 - SE06: Impacts associated with proposed benefit sharing mechanisms
 - SE07: Lack of employment opportunities for indigenous workers
- C: Cumulative impacts
 - C1: Ecology
 - C2: Land use
 - C3: Socio-economics
 - C4: Air quality and noise

10.2 ESIA methodology

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

EXTENT

Localized (At localized scale and a few hectares in extent)	1
Study area (The proposed site and its immediate environs)	2
Regional (County level)	3
National (Country)	4
International (Beyond Kenya)	5

MAGNITUDE

Small and will have no effect on the environment	0
Minor and will not result in an impact on the processes	2
Low and will cause a slight impact on the processes	4
Moderate and will result in process continuing but in a modified way	6
High (processes are altered to the extent that they temporarily cease)	8
Very high and results in complete destruction of patterns and permanent cessation of the processes	10

DURATION

Very short (0 – 1 Years)	1
Short (1 – 5 Years)	2
Medium term (5 – 15 years)	3
Long term (>15 years)	4
Permanent	5

PROBABILITY

Highly improbable (<20% chance of occurring)	1
Improbable (20 – 40% chance of occurring)	2
Probable (40% - 70% chance of occurring)	3
Highly probable (>70% - 90% chance of occurring)	4
Definite (>90% chance of occurring)	5

Method used to determine the environmental risk

Risk = (Extent + Duration + Magnitude) x Probability

		CONSEQUENCE (Extent+Duration+Magnitude)																			
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
PROBABILITY	1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	2	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40
	3	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60
	4	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80
	5	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100

Low	<30	Where this impact would not have a direct influence on the decision to develop in the area
Medium	30-60	Where the impact could influence the decision to develop in the area unless it is effectively mitigated
High	>60	Where the impact must have an influence on the decision process to develop in the area

Confidence of assessment

The degree of confidence in predictions based on available information, Kurrent Technologies Ltd. judgment and/or specialist knowledge	Low
	Medium
	High

10.3 Subjectivity in assigning significance

Despite attempts at providing a completely objective and impartial assessment of the environmental and social 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 and social 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 EIA 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 EIA 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 defensible system.

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

10.4 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.

10.4.1 Avifauna Impacts (AV)

10.4.1.1 Risk of Electrocutation (AV1)

Electrocution of birds is caused when a bird bridges the gap between either a live phase or an earth component (phase-earth electrocution) or two live phases (phase-phase electrocutions). A number of species of large birds suffer losses resulting from electrocution. This would mainly affect birds associated with the site; and electrocutions on power supply structures by raptors and other medium sized birds on passage.

Birds sitting on power poles and /or conductors could cause short circuits between energized wires or short to ground especially numerous medium and large sized birds using the power poles as perching, roosting and even nesting sites. Birds are able to cause electrical faults (short circuits on power lines through Bird pollution). A flashover occurs when an insulator string gets coated with pollutant, which compromises the insulation properties of the string. When the pollutant is wetted, the coating becomes conductive, insulation breakdown occurs and a flashover results. Nests may also cause faults through nest material protruding and constituting an air gap intrusion. Crows in particular often incorporate wire and other conductive material into their nests.

The bird species at risk of electrocution within the project footprint area would be the vultures. After applying the impact assessment methodology, the assessment shows a High significance, (since species could be killed) but low impact after mitigation.

Operational phase

Unmitigated Impact: Risk of Electrocutation			
Extent	Duration	Magnitude	Probability
2	4	6	2
Result: Low (-24)			
Comments/Mitigation:			
<ul style="list-style-type: none"> • Provide artificial bird safe perches and nesting platforms placed at a safe distance from the energized parts • Cross-arms, insulators and other parts of the power lines can be constructed so that there is no space for birds to perch where they can be proximate to energized wires. • All terminal structures (transformers) should be constructed with sufficient insulation on jumper wires and surge arrestors 			
Mitigated Impact: Risk of Electrocutation			
Extent	Duration	Magnitude	Probability

1	1	2	1
Result: Low (-4)			
Confidence of assessment: High			

10.4.1.2 Risk of collision (AV2)

Collisions are a significant threat posed by overhead lines to birds. Those that would be mostly impacted are bustards, storks, cranes and various species of ducks observed. These species are mostly heavy-bodied birds with limited maneuverability, which makes it difficult for them to take the necessary evasive action to avoid colliding with power lines.

Collision with power lines is a lesser-known problem than electrocution and is harder to detect because it can occur at any point along the transmission line. Collision risk is influenced by the topography of surrounding terrain and the proximity of lines and pylons to nests and other areas used frequently by local species.

Potential impact through collision could occur along river valleys that are mostly utilized by birds especially during the dry season. In most cases the impact of collision would lead to immediate death or fatal injuries.

This was identified as a significant impact on avifauna due to the abundance of medium size winged species and raptors that are present in the area which are vulnerable to collisions. Mitigation in the form of earth wire marking will assist to reduce the impact. The transmission line passes through riverine habitat, valleys and grasslands which are all sensitive areas from an avifauna perspective.

The open patches of grassland may attract species such as storks which could be at risk of collisions however these patches of grassland are small and any impact should be minimal.

Construction and Operational phase

Unmitigated Impact: Risk of collision			
Extent	Duration	Magnitude	Probability
2	4	6	3
Result: Medium (-36)			
Comments/Mitigation:			
<ul style="list-style-type: none"> Contractor should consider installing line marking to increase the visibility of the line. There are three general types of line marking devices: aerial marker spheres, spirals, and suspended devices Consider transmission line placement that takes migratory patterns and high bird-use areas into account. Consider line orientation that considers biological and environmental factors such as bird flight paths, prevailing winds, and topographical features 			
Mitigated Impact: Risk of collision			
Extent	Duration	Magnitude	Probability

2	4	4	2
Result: Low (-20)			
Confidence of assessment: Medium			

10.4.1.3 Disturbance and habitat destruction (AV3)

During the construction phase, sections of natural habitat will be destroyed through clearing activities associated with the transmission line wayleave, creation of access roads and the substation. There could be a potential loss of habitat for woodland avifauna as a result of clearing activities.

Disturbance will potentially occur to avifauna during the construction phase and intermittently in the operations phase. If best practices are followed, disturbances can be kept to a minimum by for example, driving within speed limits. Sensitive areas include the valleys and open grasslands and care should be taken not to disturb avifauna nesting in and around these areas.

Pre-construction and Construction phase

Unmitigated Impact: Disturbance and habitat destruction			
Extent	Duration	Magnitude	Probability
2	4	6	2
Result: Low (-24)			
Comments/Mitigation:			
<ul style="list-style-type: none"> • <i>Destruction of woody grassland during construction should be minimized.</i> • <i>Destruction of riparian habitats and water pans during construction and operation should not be allowed</i> • <i>The activities of the construction and operations staff must be restricted to the wayleave and immediate surrounds.</i> • <i>Birds should not be exposed to more disturbance than is inevitably brought about by construction and operations activities.</i> • <i>Care should be taken in sensitive areas such as grassland, wetland and valleys not to create more disturbance than is necessary. Access of machinery and vehicles to these areas should be carefully controlled and maintenance and construction activities must be restricted to the wayleave where practical</i> 			
Mitigated Impact: Disturbance and habitat destruction			
Extent	Duration	Magnitude	Probability
2	2	2	2
Result: Low (-12)			
Confidence of assessment: High			

10.4.2 Bats (B)

10.4.2.1 Habitat alteration and disturbance (B1)

During the construction of concrete foundations to hold the power pylons considerable use of machines, trucks and other vehicles is envisaged. This will result in the removal of surface vegetation, trampling, and even clearance culminating into the alteration of natural habitat presently used by bats as foraging and roosting, especially foliage roosting bats.

Trees or shrubs used as roost by resident bats on the wayleave may be removed to give way for pylon foundation. That could lead to the loss of roosting habitat for bats. The sheer presence of heavy construction machines and vehicles in habitats used by bats may also affect bats through visual and auditory scare in the area. In general terms individual bats presently using the proposed site for foraging, breeding or roosting could potentially be impacted as construction proceeds through clearing vegetation at pylon sites, access tracks and involves noisy heavy engines.

Pre-construction and Construction phase

Unmitigated Impact: Habitat alteration and disturbance			
Extent	Duration	Magnitude	Probability
2	4	4	3
Result: Medium (-30)			
Comments/Mitigation:			
<ul style="list-style-type: none"> • Use of existing tracks and roads in the general as far as possible will help minimize construction of access roads to deliver materials. • Clearance of plants (trees and shrubs especially) should be minimized unless necessary. This should be easy to observe as trees and shrubs in the area are already short below overhead cables. • Pylons positions should be aligned to avoid water points identified in above section. 			
Mitigated Impact: Habitat alteration and disturbance			
Extent	Duration	Magnitude	Probability
1	2	4	3
Result: Low (-21)			
Confidence of assessment: High			

Operations Phase

Unmitigated Impact: Habitat alteration and disturbance			
Extent	Duration	Magnitude	Probability
2	4	4	3
Result: Medium (-30)			

Comments/Mitigation:			
<ul style="list-style-type: none"> • <i>Frequent and regular maintenance of vegetation on the wayleave may help resident bats get used to routine changes.</i> • <i>The clearance (should not be total) and the activity should be done outside breeding season of most resident bat species</i> 			
Mitigated Impact: Habitat alteration and disturbance			
Extent	Duration	Magnitude	Probability
2	4	2	2
Result: Low (-16)			
Confidence of assessment: High			

10.4.2.2 Construction site waste generation (B2)

Construction activities that lead to the erection of power pylons, substations at either end involve moving soil and vegetation to and from the sites. For instance, is expected that soil and surface rocks will be removed to create concrete foundation for the pylons. How this top soil is disposed off could potentially have impact on habitats of bats in and around the wayleave. The top soils may affect bats by silting surface waters used by resident bats. Because of the small sizes of water points observed in the proposed right-of-way, the soils generated may actually fill the water points. Oil spill from construction engines transformer coolants could also spread to surface waters used by foraging bats thereby poisoning them

Pre-construction and Construction phase

Unmitigated Impact: Construction site waste generation			
Extent	Duration	Magnitude	Probability
2	2	2	4
Result: Low (-24)			
Comments/Mitigation:			
<ul style="list-style-type: none"> • <i>Comprehensive waste management should help in minimizing waste accumulation on site.</i> • <i>Oil spill handling strategy especially mopping up oil immediately after spill, engine maintenance particularly oil change off site plan should help avoid pollution due to oils</i> 			
Mitigated Impact: Construction site waste generation			
Extent	Duration	Magnitude	Probability
2	1	2	2
Result: Low (-10)			
Confidence of assessment: High			

10.4.2.3 Hazardous materials impacts (B3)

Transformers which may be used as part of the transmission line project could potentially be sources of contamination arising from leaked used transformer oils. Vegetation maintenance along the wayleave can either be done manually using slashers or using herbicides.

The above types of chemicals which may be used as coolants and herbicides could be potential pollutants or hazardous to bats and other organisms. They may end up as spills or wastes in bat habitats.

Transformer oils while in use, generate hazardous chemicals such as Polychlorinated Biphenyls (PCB) and Sulfur Hexafluoride (SF₆). The latter is a greenhouse gas whose effect may span beyond project footprint and affect more species beyond bats. Used transformer oil spills in the environment may find its way to surface waters, food resources (fruits, insects) for bats with detrimental health effects. Herbicides used for wayleave vegetation maintenance may also have health risks to resident bats. If this is the recommended means of maintaining vegetation then a clear plan of handling, storage and preventing spills should be developed and discussed with stakeholders before construction. Overall, comprehensive hazard chemical handling strategy is therefore emphasized throughout the stretch of the transmission line.

Pre-construction and Construction phase

Unmitigated Impact: Hazardous materials impacts			
Extent	Duration	Magnitude	Probability
2	4	4	3
Result: Medium (-30)			
Comments/Mitigation:			
<ul style="list-style-type: none"> • <i>SF₆ use should be minimized and if used in high voltage circuitry such as >350Kv then equipment with low leakage rate (<99%) .</i> • <i>PCB use should be accompanied by comprehensive handling, response strategy in case of spill.</i> • <i>Old transformers should be changed on time to minimize leakages. They should be stored in concrete floors and rooms with roofs to avoid precipitation</i> 			
Mitigated Impact: Hazardous materials impacts			
Extent	Duration	Magnitude	Probability
2	4	2	2
Result: Low (-16)			
Confidence of assessment: High			

10.4.2.4 Fugitive dust and waste impacts (B4)

Dust generated during the construction of foundations and heavy vehicles movements on access tracks can also affect the foraging success of resident bats especially at night when they are active. There is therefore a need to assess the risk of resident bats starving due to dust-induced poor visibility of prey. Dust control measures are necessary during construction to avoid accumulation of dust on fruits, vegetation used by bats as food, prey and roosting sites.

Pre-construction and Construction phase

Unmitigated Impact: Fugitive dust and waste impacts			
Extent	Duration	Magnitude	Probability
2	1	2	3
Result: Low (-15)			
Comments/Mitigation:			
<ul style="list-style-type: none"> <i>This impact is low but can be made less in magnitude and extent when dust mufflers are used and watering is done on the construction sites where dust more likely to be an issue.</i> <i>Construction can be timed when the ground is not too dry and dusty and bats are not desperate</i> 			
Mitigated Impact: Fugitive dust and waste impacts			
Extent	Duration	Magnitude	Probability
1	1	2	3
Result: Low (-12)			
Confidence of assessment: High			

10.4.2.5 Noise from construction plant (B5)

Resident bats moving over the proposed transmission line live in natural habitats and perhaps village *manayattas* away from loud noise from heavy machines and vehicles. The use of these loud-noise producing vehicles in an otherwise quiet environment present both audible and visual scare which may affect foraging, mating and roosting habits of the resident bats.

Pre-construction and Construction phase

Unmitigated Impact: Noise from construction plant			
Extent	Duration	Magnitude	Probability
2	1	4	4
Result: Low (-28)			
Comments/Mitigation:			
<ul style="list-style-type: none"> <i>Silencers fitted to the engines could significantly reduce impact of noise to bats.</i> 			

<ul style="list-style-type: none"> Switching off engines not in use can also reduce noise duration and intensity 			
Mitigated Impact: Noise from construction plant			
Extent	Duration	Magnitude	Probability
2	1	2	2
Result: Low (-10)			
Confidence of assessment: High			

10.4.2.6 Bat collisions with transmission line (B6)

Overhead power transmission cables, steel lattice towers supporting the power transmission cables, etc. rise high enough in space to pose risks of collision with flying animals. There is therefore concern that cumulatively there could be risk of bats crashing into the lattice towers especially when they are erected in migratory paths and congregatory habitats such as roosts.¹ There could also be potential positive impacts of towers acting as roosts to some bats.

Construction and Operational phase

Unmitigated Impact: Bat collisions with transmission line			
Extent	Duration	Magnitude	Probability
2	2	2	3
Result: Low (-18)			
Comments/Mitigation:			
<ul style="list-style-type: none"> Echolocating bats are less likely to fall victim of crushing into overhead cables. According to study results, fruit bats which could be vulnerable are rare and often fly lower than proposed height 			
Mitigated Impact: Bat collisions with transmission line			
Extent	Duration	Magnitude	Probability
2	2	2	3
Result: Low (-18)			
Confidence of assessment: High			

10.4.2.7 Bat electrocution on the transmission line (B7)

Bats may be electrocuted by electric power lines when a part of their body, normally wing membranes simultaneously get in contact with energized wire and neutral, energized wire and earthed object or touching two energized wires same time. The probability of this happening is more likely when wires are close together, the size of wing span of a bat (10cm-60cm apart). Bats will not be electrocuted when they get in contact with a single wire, energized or otherwise.

¹ IFC., 2007. Environmental Health and Safety Guidelines page 5.

Operational phase

Unmitigated Impact: Bat electrocution on the transmission line			
Extent	Duration	Magnitude	Probability
2	5	4	3
Result: Medium (-33)			
Comments/Mitigation:			
<ul style="list-style-type: none"> • <i>This risk is real and can be huge if the cables are close to each other. Many bat species recorded in this area include curious species capable of inspecting, and feeding close to cables and could be at risk when their wings touch two cables as explained above. Young bats may be more at risk as they often fly close to potential perches.</i> • <i>Keeping cables far apart >60cm, will certainly minimize or eliminate this risk of electrocution along the lines.</i> • <i>Where wide spacing of electric cables is not practical then insulation is recommended</i> 			
Mitigated Impact: Bat electrocution on the transmission line			
Extent	Duration	Magnitude	Probability
2	4	2	2
Result: Low (-16)			
Confidence of assessment: High			

10.4.2.8 Electric and magnetic fields: coupling effects (B8)

Electric and magnetic fields are invisible lines of force emitted by electric devices such as electric wires/cables². They may affect the living body if exposed, by interfering with electric or magnetic conditions of cell, tissue or organ or system.

Importantly though, a lot of in vitro tests on short-term exposure to electromagnetic fields (EMF), especially cellular and tissues responses have been observed but with no clear exposure-response³. However caution is emphasized in the guidelines provided in ICNIRP, UNEP/WHO 1993) and limits of 100 kHz for human exposure, leaving other living organisms to professional judgment.

Since ICNIRP suggests that effects are inversely proportional to body size and age⁴, (table 2 on page 11), smaller animals such as bats could be more at risk if they have prolonged exposure to time varying low-frequency EMFs. The limit is set to 100kHz -30 GHz for humans.

² IFC., 2007. Environmental Health and Safety Guidelines page 5.

³ Same as above (ICNIRP, 1998)

⁴ ICNIRP 1998. ICNIRP Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic Fields. Health Physics 74(4): 494-522

Operational phase

Unmitigated Impact: Electric and magnetic fields: coupling effects			
Extent	Duration	Magnitude	Probability
2	4	2	2
Result: Low (-16)			
Comments/Mitigation:			
<ul style="list-style-type: none"> • <i>Bat studies show low densities even at the watering points. Only few individuals are therefore exposed and could be at risk.</i> • <i>Re-aligning the transmission off the watering points will certainly reduce this risk further. It is hard to eliminate this risk as bats will still wander near the electric cables</i> 			
Mitigated Impact: Electric and magnetic fields: coupling effects			
Extent	Duration	Magnitude	Probability
2	4	2	1
Result: Low (-8)			
Confidence of assessment: High			

10.4.3 Ecology (E)**10.4.3.1 Terrestrial woody plant alteration (E1)**

Terrestrial woody plants could be adversely affected by the wayleave construction activities. The proposed transmission line passes over landscape that has isolated sparse woodland especially occurring in the seasonal river (stream) valley. Construction of the wayleave therefore would have a negative impact on the system such as creating disconnection of the small habitats (isolated woodland), the riverine woodland, for instance, at causing fragmentations; where habitat is small it can be reduced significantly to the size of the habitat.

Pre-construction and Construction phase

Unmitigated Impact: Terrestrial woody plant alteration			
Extent	Duration	Magnitude	Probability
3	4	4	3
Result: Medium (-33)			
Comments/Mitigation:			
<ul style="list-style-type: none"> • <i>The impact could influence the decision to develop in the area unless it is effectively mitigated.</i> • <i>Traditional construction of a wayleave that involves grading of the belt should be avoided. This causes damage to vegetation and habitats that they provide to animals.</i> 			

<ul style="list-style-type: none"> • <i>Avoid grading in areas with high slope angles to avoid future possible erosion</i> • <i>Minimize grading of rugged areas by looking for alternative passage within the 60 m wayleave.</i> • <i>Avoid cutting of short trees that heights are lower than the power line. Height difference should be maintained at least 15 m.</i> • <i>When points of erecting pylons is exactly on cluster of bushes, offset backwards or forward within the proposed line to avoid destruction of the potential habitats or refugia for reptiles and small mammals</i> 			
Mitigated Impact: Terrestrial woody plant alteration			
Extent	Duration	Magnitude	Probability
3	2	2	1
Result: Low (-7)			
Confidence of assessment: High			

10.4.3.2 Introduction of Alien Invasive Plant Species (E2)

The means of introduction of an Alien Invasive Plant Species (AIPS) in an area is not easy to determine. It is normally essential to know in order to strategize how to control the introduction and spread of AIPS in an area. Fear of AIPS is that they displace indigenous plant species and the area does not provide good habitat and forage to animal species. In areas where AIPS is introduced, the landscape for terrestrial habitat changes significantly with other plant species displaced or suppressed.

Most environmental managers are challenged by the AIPS because they pose unusual characteristics which lack management measures. For instance, some AIPS could be poisonous when eaten by wild herbivores.

AIPS are normally detected after construction activities of the project are over. Introduction of AIPS would be accidental through the gravels used for leveling roads and/or equipment that has soils with propagules of AIPS.

Pre-construction and Construction phase

Unmitigated Impact: Introduction of Alien Invasive Plant Species			
Extent	Duration	Magnitude	Probability
3	5	4	4
Result: Medium (-48)			
Comments/Mitigation:			
<ul style="list-style-type: none"> • <i>Equipment to be used should be decontaminated e.g. washing equipment to remove soil potentially carrying AIPS propagules</i> • <i>Avoid importing soils/gravels to use for level grounds for vehicles to pass in ROW. If brought from outside, the surface of the soil should be removed to avoid mixing of soils potentially harboring AIPS propagules with the lower soil profiles.</i> 			

<ul style="list-style-type: none"> Since AIPS appears later after soil disturbance, aftermath proliferation of AIPS should be controlled by reducing their population and recruitment 			
Mitigated Impact: Introduction of Alien Invasive Plant Species			
Extent	Duration	Magnitude	Probability
1	4	2	2
Result: Low (-14)			
Confidence of assessment: High			

10.4.3.3 Aquatic Habitat Alteration (E3)

The clearing of the wayleave for construction related activities of the transmission line may include passage through riverine habitat, marshes and rivers (permanent or seasonal). The removal of riverine woodland would be inevitable in order to create the wayleave. The Kipeto-Isinya area does not have permanent rivers but has seasonal stream valleys crossed by the proposed transmission line, water pools on seasonal rivers and water-pans on the side of the proposed wayleave.

The construction activities of plant and equipment may potentially cause the soil to be susceptible to runoffs. During rainy season, downstream areas are normally affected by sediment loads from upstream areas. Erosion may occur on areas with weak soil during rainy season. Construction activities might demand water and any attempts of water extraction from the resources could probably drain water that serves an ecological role in the area. The water pools also serve livestock and domestic uses.

Pre-construction and Construction phase

Unmitigated Impact: Aquatic Habitat Alteration			
Extent	Duration	Magnitude	Probability
2	2	4	4
Result: Medium (-32)			
Comments/Mitigation:			
<ul style="list-style-type: none"> There is need to ensure sedimentation is not caused in the drainage system. Minimization of activities that disturb soil layer near the river valley would contribute to the conservation of the system 			
Mitigated Impact: Aquatic Habitat Alteration			
Extent	Duration	Magnitude	Probability
1	1	2	2
Result: Low (-8)			
Confidence of assessment: High			

10.4.3.4 Temporary obstruction of movement of wild-herbivores (E4)

The Kipeto-Isinya landscape is within the Athi-Kapiti plains and provides dispersal areas for wildlife during wet seasons. During dry season, wild animals move towards the Nairobi National Park. The forage conditions for the wild herbivores are adversely affected during this season, depriving them of food. Only the isolation of woodland remains serving small mammals, reptiles and birds as refugia.

Project development will potentially affect activities and behaviors 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 bush lands, riverine, grasslands and rocky areas. Activities leading to interference of movements of the animal are viewed as adverse to the species.

Generally, during the construction of the power line, there will be movements of vehicles and noise generated by vehicles and construction equipment. The noise would potentially scare animals away from dispersal areas. Speed of the vehicles used in the area would be a concern to lives of Thompson Gazelles. The gazelles normally graze in a group and they tend to follow each other. A vehicle intercepting a group crossing road runs a risk of hitting individuals which normally tries to catch up with the rest.

Pre-construction and Construction phase

Unmitigated Impact: Temporary obstruction of movement of wild-herbivores			
Extent	Duration	Magnitude	Probability
2	2	4	4
Result: Medium (-32)			
Comments/Mitigation:			
<ul style="list-style-type: none"> • <i>Speed of vehicles should be controlled at a maximum limit of 40 km/h. Once a driver notices a herd of gazelles is crossing s/he should wait until all have crossed or slow down to avoid hitting individuals</i> • <i>Avoid grading or clearing of vegetation where the mounds of moles and Aardvark holes occur. These are probably their hidings from predators and severe climate conditions.</i> • <i>Construction activities should be restricted to day time from 6am to 6pm. This provides time for foraging for nocturnal animals. This group is normally sensitive to presence of human activities and flood lights at night.</i> • <i>During dry season the upland is dry of grasses but the lowland still has grass, herbs and shrub reserves. Most of herbivores migrate to this area thus construction activities during dry season can affect utilization of this area. Construction should therefore be scheduled after the onset of rainfall. Generally, vegetation in the area responds quickly to rainfall hence herbivores will disperse to avoid any adverse impacts.</i> 			

Mitigated Impact: Temporary obstruction of movement of wild-herbivores			
Extent	Duration	Magnitude	Probability
1	1	2	2
Result: Low (-8)			
Confidence of assessment: High			

10.4.3.5 Poaching for bush meat (E5)

During the construction phase, there is a potential of poaching wild herbivores for bush meat. This could be an adverse impact of the project depending on the discipline of the selected contractor(s). The location of the project footprint area is convenient for quick transportation of bush meat to Nairobi market.

Pre-construction and Construction phase

Unmitigated Impact: Poaching for bush meat			
Extent	Duration	Magnitude	Probability
3	1	4	3
Result: Low (-24)			
Comments/Mitigation:			
<ul style="list-style-type: none"> • <i>Personnel should be screened when entering and leaving construction sites.</i> • <i>Enhance screening of local contract workers using local community</i> • <i>Local people should be alerted by the contractor to be able to detect visitors potential of poaching</i> 			
Mitigated Impact: Poaching for bush meat			
Extent	Duration	Magnitude	Probability
1	1	1	2
Result: Low (-6)			
Confidence of assessment: High			

10.4.3.6 Destruction of habitats for herpetofauna (E6)

The construction activities could potentially affect movement of the herpetofauna species within the wayleave area. Most herpetofauna species hide in holes, under stones and rock crevices. Disturbance during construction by excavation and grading by earth movers might destroy habitats of this species.

The speed at which vehicles move in the area will determine occasions of road kill accidents. Normally the herpetiles crawl and they are prone to road kills by vehicles. Species normally affected are snakes, lizards and geckos.

Pre-construction and Construction phase

Unmitigated Impact: Destruction of habitats for herpetofauna			
Extent	Duration	Magnitude	Probability
2	2	4	3
Result: Low (-24)			
Comments/Mitigation:			
<ul style="list-style-type: none"> • <i>Impact on the species will be localized. Disturbance of their habitats would affect negatively the hidings of geckos and lizards in the rock outcrop area.</i> • <i>Implementation of operation times, speed limit and driver's keenness can potentially reduce this impact.</i> 			
Mitigated Impact: Destruction of habitats for herpetofauna			
Extent	Duration	Magnitude	Probability
2	1	2	2
Result: Low (-10)			
Confidence of assessment: High			

10.4.3.7 Exposure of wild herbivore to electric and magnetic fields (E7)

EMF is associated with the power transmission lines. EMF is invisible lines of force emitted by and surrounding any electrical device. Electric fields are shielded by materials that conduct electricity, and other materials, such as trees and building. Magnetic fields pass through most materials and are difficult to shield. Both electric and magnetic fields however, decrease with distance. There is concern over risks of electrocution and potential health associated with the exposure to EMF on human than wild animals though the evidence on the latter is weak.

Normally areas cleared for ROW experience dominance of grasses. The extensive area also provides wild herbivores with an open area safe from predators. The amount of time the herbivore spent under the pylon cables will determine how much they will be exposed. It is not clear how the EMF would affect wild mammals but a general fear is expressed on the unknown magnitude of impact.

Some locals have expressed fear of possible electrocution through the wire fences that crosses the landscape. This also includes fear for the lives of their livestock and wild herbivores. Accounts from people from different places where pylons and powerful transformers are located indicate that people normally feel dizzy when they stay near the utilities for few hours. In addition, metallic object conduct electricity during rainfalls. This accounts and experience has not been scientifically validated but is considered in this review to address opinions.

Operations phase

Unmitigated Impact: Exposure of wild herbivore to electric and magnetic fields			
Extent	Duration	Magnitude	Probability
1	5	2	2
Result: Low (-16)			
Comments/Mitigation:			
<ul style="list-style-type: none"> • <i>Excessive clearing of vegetation should be avoided to prevent incidences of wild herbivores congregating along the wayleave.</i> • <i>In case there will be possible electric inductions on wire fences, rubber breaks should be introduced on wires to avoid possible conduction of electric domains.</i> 			
Mitigated Impact: Exposure of wild herbivore to electric and magnetic fields			
Extent	Duration	Magnitude	Probability
1	5	1	2
Result: Low (-14)			
Confidence of assessment: High			

10.4.3.8 Temporary interference of ecosystem service: Pastoral (E8)

The Kipeto-Isinya landscape is utilized by both livestock and wild herbivores, which interact in grazing areas as observed during the field study. Unlike the wild herbivores, livestock are led to grazing areas and thus where they go is determined by the pastoralists. Moreover, presence of human and the activities does not prevent them from utilizing pastors.

During the construction phase, livestock herds may be adversely affected by the movement of vehicles. Since livestock would easily move out of way compared to wild herbivores, they run a risk of accidents with the vehicles.

Just like the wild herbivores, changing the vegetation types along the ROW would also affect them. The lowlands which apparently reserve grasses for long during the dry season are also used by pastoralists from the area. The construction activities would cause interference; however, the impact is envisaged to be temporary.

Pre-construction and Construction phase

Unmitigated Impact: Temporary interference of ecosystem service			
Extent	Duration	Magnitude	Probability
2	1	4	2
Result: Low (-14)			
Comments/Mitigation:			
<ul style="list-style-type: none"> • <i>This mitigation controls behavior in the field during construction.</i> • <i>Speed of vehicles should be controlled at a maximum limit of 40 km/h. Once a</i> 			

<i>driver note livestock herds nearby or crossing s/he should wait until all have crossed or slow down to avoid hitting individuals</i>			
Mitigated Impact: Temporary interference of ecosystem service			
Extent	Duration	Magnitude	Probability
1	1	1	1
Result: Low (-3)			
Confidence of assessment: High			

10.4.4 Socio-economic (SE)

10.4.4.1 Destruction of fences and gates (SE01)

Some land owners have erected paddock fences and gates to retain their livestock and for security purposes. During the construction phase, the contractor(s) may destroy some of the fencing/gates in order to gain access to the wayleave, causing potential adverse impacts to livestock in fenced areas.

During the operational phase, Kenya Power will need access to the wayleave for operations and maintenance purposes and may potentially destroy such fences if access is not easily gotten.

Pre-construction and Construction phase

Unmitigated Impact: Destruction of fences and gates			
Extent	Duration	Magnitude	Probability
2	2	2	4
Result: Low (-24)			
Comments/Mitigation:			
<ul style="list-style-type: none"> <i>The Contractor should mind the fences and gates during construction and return them after accessing the wayleave</i> <i>As an alternative, the contractor could erect new fences and gates across the transmission line wayleave. Land owners can then continue construction of their fences to keep the integrity of individual paddocks</i> 			
Mitigated Impact: Destruction of fences and gates			
Extent	Duration	Magnitude	Probability
1	1	2	2
Result: Low (-8)			
Confidence of assessment: Medium			

10.4.4.2 Impacts associated with construction disturbance (SE02)

Construction phase activities will include clearing the wayleave, excavation for foundations of the towers, construction noise, traffic associated with construction plant and equipment, dust emissions, etc.

These activities could have potential adverse impacts on the existing serene environment within the project footprint area and its environs if not suitably mitigated.

There will be minimal impacts associated with disturbance during the operational phase of the project.

Pre-construction and Construction phase

Unmitigated Impact: Impacts associated with construction disturbance			
Extent	Duration	Magnitude	Probability
1	2	4	4
Result: Low (-28)			
Comments/Mitigation:			
<ul style="list-style-type: none"> • <i>The Contractor should develop and implement a construction HSE management plan to manage the impact of construction disturbances on the environment.</i> • <i>Contractor should manage construction traffic especially its impact on grassland resources.</i> 			
Mitigated Impact: Impacts associated with construction disturbance			
Extent	Duration	Magnitude	Probability
1	1	2	2
Result: Low (-8)			
Confidence of assessment: High			

10.4.4.3 Improved utilization of compensation payments (SE03)

Compensation will be paid to land owners based on easement agreements signed between each one and KEL. Currently, several land owners owning land along the wayleave have intermittent income streams. The compensation amounts are expected to be significant; most Masai land owners are pastoralists and it is anticipated that the proceeds from the easement agreements will be used to advance their pre-occupation and wealth through acquisition of more livestock, better housing, access to clean water, etc.

Pre-construction, Construction and Operational phase

Unmitigated Impact: Improved utilization of compensation payments			
Extent	Duration	Magnitude	Probability
2	2	2	2
Result: Low (+12)			
Comments/Mitigation:			
<ul style="list-style-type: none"> • <i>Land owners that receive compensation would get a better return on their investment through basic financial management training that could be offered through vocational colleges</i> 			

<ul style="list-style-type: none"> The proposed community trust should consider assisting affected land owners with legal advice related to financial management of their newly acquired resources. 			
Mitigated Impact: Improved utilization of compensation payments			
Extent	Duration	Magnitude	Probability
2	4	2	4
Result: Medium (+32)			
Confidence of assessment: Medium			

10.4.4.4 Exposure to Electromagnetic Field (SE04)

During the public/stakeholder consultations, it was felt that there may be an adverse occupational health impact to humans and animals arising from exposure to electro-magnetic fields (EMF) generated by the high tension transmission lines.

From a literature review on the subject, it was established that scientific research is inconclusive on the adverse impacts of EMF from conventional 30-40 meters high transmission lines on humans and animals. Some studies suggest that the field strength on a 132 kV line at a height exposure of 30-40m is less than what one would ordinarily be exposed to in a domestic setup.

Operational phase

Unmitigated Impact: Exposure to Electromagnetic Field (EMF)			
Extent	Duration	Magnitude	Probability
2	5	4	2
Result: Medium (-22)			
Comments/Mitigation:			
<ul style="list-style-type: none"> No permanent structures will be allowed within the 60m wide wayleave; this will be enforced by Kenya Power Residents should limit their exposure by staying away from the 60m wayleave 			
Mitigated Impact: Exposure to Electromagnetic Field (EMF)			
Extent	Duration	Magnitude	Probability
2	1	2	2
Result: Low (-10)			
Confidence of assessment: High			

10.4.4.5 Maintenance of transmission line way leave (SE05)

The proposed transmission line wayleave will require periodic maintenance to ensure that vegetation does not grow too tall that vehicle movements are restricted along it. The maintenance activities will include slashing overgrown grass to manageable levels and ensuring that there is a semblance of a track that can be traversed by appropriate Kenya Power vehicles.

Additionally, the maintenance of the wayleave will include making sure that fences and gates erected across the wayleave are in a good state of repair. This will ensure that paddock fences and gates as well as general security are maintained along the wayleave.

During the public/stakeholder consultation meetings, the community expressed interest in being provided with employment opportunities by Kenya Power to maintain the wayleave. This is seen as a positive social impact which will enhance maintenance, security and good relationships between Kenya Power and the local community along the transmission line corridor.

Operational phase

Unmitigated Impact: Maintenance of transmission line way leave			
Extent	Duration	Magnitude	Probability
2	4	4	2
Result: Low (+22)			
Comments/Mitigation:			
<ul style="list-style-type: none"> • Kenya Power should consider providing employment opportunities for maintenance and surveillance of the transmission line wayleave to the local communities living along the route • Kenya Power should have periodic engagement sessions with the local community on the hazards associated with the 220kV transmission line • If Kenya Power provides employment to the local community, they should consider providing motor bikes for the surveillance of the transmission line corridor 			
Mitigated Impact: Maintenance of transmission line way leave			
Extent	Duration	Magnitude	Probability
2	4	6	4
Result: Medium (+48)			
Confidence of assessment: High			

10.4.4.6 Impacts associated with proposed benefit sharing mechanisms (SE06)

The potential benefits of community projects that arise from being part of the proposed Community Trust significantly improves the living status of the Maasai within the transmission line footprint area and the larger community.

Once the community trust is in operation, it is expected that social infrastructure will be improved in the Kipeto area e.g. schools, water boreholes, health facilities, electricity, etc. While the details related to the relationship between the transmission line land owners and land owners in the wind energy project are to be detailed in the community trust document, the expectations arising from the transmission line project potentially improves the social wellbeing of the communities living in the wind farm and transmission line project footprint areas respectively. This is seen as a positive impact in the operational phase.

Operational phase

Unmitigated Impact: Impacts associated with proposed benefit sharing mechanisms			
Extent	Duration	Magnitude	Probability
2	4	2	2
Result: Low (+16)			
Comments/Mitigation:			
<ul style="list-style-type: none"> The proponent should consider including the Kipeto transmission line community in the Kipeto Wind Energy Community Trust mechanism and access funds for community projects within a benefit sharing plan. The contractor should consider local youth in unskilled jobs available both during construction and way leave maintenance during operations phase 			
Mitigated Impact: Impacts associated with proposed benefit sharing mechanisms			
Extent	Duration	Magnitude	Probability
2	4	6	3
Result: Medium (+36)			
Confidence of assessment: Medium			

10.4.4.7 Lack of employment opportunities for indigenous workers (SE11)

In order to build a skills base, provide employment opportunities and transfer knowledge to the local communities, it is essential to create organizational capacity among the local Masai community. The type of organizational capacity required for the proposed project during the construction and operational phase is skilled, semi-skilled and unskilled; however the local community may only have unskilled labor thus locking them out of potential semi-skilled and skilled opportunities.

During the construction and operations phases, there will be a requirement for skilled, semi-skilled and unskilled jobs. Presently, there is a lack of sufficiently trained skilled and semi-skilled workers available in the community.

During the construction phase, if the main contractor does not give priority to sourcing labor from the local Masai communities, there could be potential conflicts which could arise. During the operational phase, potential conflicts could arise if the Operations and Maintenance company does not provide priority for jobs to the local Masai community.

Construction and Operational phase

Unmitigated Impact: Lack of employment opportunities indigenous workers			
Extent	Duration	Magnitude	Probability
2	4	6	3
Result: Medium (-36)			

Comments/Mitigation:			
<ul style="list-style-type: none"> • <i>During the construction phase, the contractor should give first priority for skilled, semi-skilled and unskilled jobs to the local Masai communities. In the absence of suitably competent persons, the contractor should develop and implement a skills based program to develop the local Masai communities.</i> • <i>During the operational phase, the proponent should develop and implement skills based organizational capacity development plans that include development of local Masai communities to provide semi-skilled and skilled labor for maintenance and surveillance of the wayleave.</i> • <i>The organizational capacity development plan should include a Human Resource Management plan that has a Training system for implementation to achieve the objectives of the Plan.</i> • <i>The community should be encouraged to participate in the proponent's organizational capacity monitoring and review process</i> 			
Mitigated Impact: Lack of employment opportunities indigenous workers			
Extent	Duration	Magnitude	Probability
2	4	2	2
Result: Low (-16)			
Confidence of assessment: Medium			

10.5 Cumulative Impacts (C)

Cumulative impacts may result when the environmental effects associated with a proposed project are superimposed on, or added to, either temporary (construction related) or permanent (operation related) impacts associated with past, present, or reasonably foreseeable future projects. Although the individual impact of each separate project may be minor, the additive or synergistic effects of multiple projects could be significant.

Existing conditions in the vicinity of the proposed transmission line project reflect the minimal past changes brought about by long-term human occupancy and use of the project area.

Currently, the transmission line project is in the procurement phase; the environmental mitigation measures will be incorporated into the project by the successful contractor. Subsequent to this, the construction of the proposed project will commence. At the time of undertaking the EIA Study, it is envisaged that construction of the proposed transmission line project will commence in the second or third quarter of 2014 and take about 12 months to complete.

As Kenya moves towards implementation of its Vision 2030 economic blueprint, there are a number of linear transmission line projects that are envisioned to be implemented. Some or all of these projects may be constructed during the same period as the proposed transmission line project which would thus have cumulative environmental and social impacts. Some of the projects envisaged under the Vision 2030 economic blueprint include:

- The Ethiopia – Kenya interconnection transmission line;
- The on-going upgrading of the 400kV high tension transmission lines between Rabai and Isinya;
- The proposed Isinya – Suswa transmission line; and
- The 400kV Loyongolani – Suswa transmission line.

With the exception of the on-going Rabai – Isinya 400kV high tension transmission lines project, the other projects currently do not have specific time frames for commencement; however these projects may cumulatively or additively impact resources that would be affected by construction and operation of the proposed transmission line project. Construction schedules of the future projects depend on factors such as economics, funding, and politics. Projects and activities included in this analysis are generally those of comparable magnitude and nature of impact. More geographically distant projects are not assessed because their impact would generally be localized and, therefore, would not contribute significantly to cumulative impacts in the proposed project area.

10.5.1 Ecology (C1)

When projects are constructed at the same time or close to the same time, they would have a cumulative impact on vegetation and wildlife occurring in the area where the projects would be built.

The transmission line wayleave clearing and grading and other construction associated activities along with other envisioned transmission line projects 400kV Rabai – Nairobi transmission line, the Isinya – Embakasi transmission line, etc. would result in the removal of vegetation, alteration of existing herbivore habitats and other secondary effects such as increased population stress, predation, and establishment of invasive plant species. The loss of vegetation could also indirectly affect vegetation remaining adjacent to the wayleave. These effects would be greatest where other projects are constructed within the same time frame and area as the proposed project.

The proposed transmission line passes through undulating terrain comprised of short grasses and a few trees. The cumulative impact of the proposed project on vegetation in the area would be minimal because most of the vegetation cover types crossed by the proposed transmission line would be allowed to return to preconstruction conditions.

While the Vision 2030 projects mentioned in 10.6 could potentially fragment wildlife habitat, this effect would be minimal because many of the proposed projects are linear projects that, similar to the line proposed transmission line project, would primarily occur within a wayleave or right-of-way. It is envisaged that the Vision 2030 linear projects would implement mitigation measures during the ESIA stage designed to minimize the potential for long-term erosion, increase the stability of site conditions, and in many cases control the spread of noxious weeds, thereby minimizing the degree and duration of the cumulative impacts of these projects.

10.5.2 Land use (C2)

The proposed transmission line project and other similar foreseeable linear projects would result in both temporary and permanent changes to current land uses. Much of the land along the wayleaves that would be disturbed by construction of the proposed transmission line is presently zoned as agricultural land.

While most of these projects would have permanent impacts on land uses, the majority of land use impacts associated with transmission lines would be temporary, as most land owners and land users would be allowed to revert to prior uses following construction.

10.5.3 Socioeconomics (C3)

Present and reasonably foreseeable future projects and activities could cumulatively impact socioeconomic conditions in the project area. Employment, housing, infrastructure, and public services could experience both beneficial and detrimental impacts.

Economy and employment

The linear and other transmission line projects considered in this section would have cumulative effects on employment during construction if more than one project is built at the same time. The proposed transmission line project expects to employ several workers during the peak construction months. While there is no rule of thumb, it is estimated that 30 percent of the construction workforce would be local hires. If the larger projects such as the major transmission line projects are built simultaneously, the demand for workers could exceed the local supply of appropriately skilled labor. It is assumed that the remainder of the employment positions would be filled by non-local hires.

In addition to impacts on local employment, these projects would provide an increase in tax revenue for county governments, central government and other local economies through the payment of payroll tax, sales tax, property tax, and other taxes and fees.

Temporary housing

Temporary housing for the construction workers would be needed for the portion of the workforce not drawn from the local area. Given the potential number of rental housing units that may be available in the area, construction camp sites for the project, and the number of lodgings available in the urban centers in the vicinity of the project, construction crews should not encounter difficulty in finding temporary housing. If construction occurs concurrently with other projects, temporary housing would still be available but may be slightly more difficult to find and/or more expensive to secure. Regardless, these effects would be temporary, lasting only for the duration of construction, and there would be no long-term cumulative effect on housing.

Public services

The cumulative impact of the proposed transmission line project and the other transmission line projects on infrastructure and public services would depend on the number of projects under construction at one time. The small incremental demands of several projects occurring at the same time could become difficult for police, fire, and emergency service personnel to address. This problem would be temporary, occur only for the length of construction, and could be mitigated by the various project sponsors providing their own personnel to augment the local capability or by providing additional funds or training for local personnel. No long-term cumulative effect on infrastructure and public services is anticipated.

10.5.4 Air Quality and Noise (C4)

Construction of most of the reasonably foreseeable transmission line projects and activities would involve the use of heavy equipment that would produce noise, air contaminants, and dust. Construction and operation of the proposed transmission line would contribute cumulatively to both air quality and noise. These effects could add to the ongoing air and noise impacts in the project area.

Noise impacts are particularly localized and attenuate quickly as the distance from the noise source increases. Therefore, cumulative noise impacts associated with construction and operation would be unlikely. Air impacts, although less localized than noise impacts, would also tend to be regional and confined primarily to the airsheds in which the projects occur.

Cumulative impact on air quality, therefore, would be limited primarily to areas where more than one project is proposed within the same airshed. Because the proposed transmission line projects are linear and thus located over a large distances, have varying construction schedules and must adhere to EMCA and its subsidiary legislation for the protection of ambient air quality, cumulative impacts on air quality are not anticipated.

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11 Environment Management Plan (EMP)

This EMP seeks to manage and keep to a minimum the negative impacts of the proposed 220kV transmission line project and at the same time, enhance the positive and beneficial impacts.

11.1 Objectives of the EMP

The objectives of the EMP are to:

- Identify a range of mitigation measures which could reduce and mitigate the potential impacts to minimal or insignificant levels;
- To identify measures that could optimize beneficial impacts;
- To create management structures that address the concerns and complaints of stakeholders with regards to the development;
- To establish a method of monitoring and auditing environmental management practices during all phases of development;
- Ensure that the construction and operational phases of the project continues within the principles of Integrated Environmental Management;
- Detail specific actions deemed necessary to assist in mitigating the environmental impact of the project;
- Ensure that the safety recommendations are complied with;
- Propose mechanisms for monitoring compliance with the EMP and reporting thereon; and
- Specify time periods within which the measures contemplated in the final environmental management plan must be implemented, where appropriate.

11.2 EMP roles and responsibilities

Several professionals will form part of the construction team. The most important from an environmental perspective are the Project Manager (Galetech Energy Developments of Ireland), the Project HSE Officer, the EPC Contractor, and the developer (Kipeto Energy Limited).

The Project Manager is responsible for ensuring that the EMP is implemented during the **pre-construction** and **construction** phases of the project.

The Project HSE Officer is responsible for monitoring the implementation of the EMP during the design, **pre-construction** and **construction** phases of the project.

The EPC contractor is responsible for abiding by the mitigation measures of the EMP which are implemented by the Project Manager during the **construction** phase.

The Project Manager is responsible for ensuring that the EPC contractor complies with the mitigation measures and EMP requirements during the **design, pre-construction** and **construction** phases of the project.

An Operations and Maintenance (O&M) company will be responsible for implementation of the EMP during the **operational** and **decommissioning** phases of the project. Decommissioning will however entail the appointment of a new professional team and responsibilities will be similar to those during the design, pre-construction and construction phases. It is unlikely that the transmission line will be decommissioned for several years.

11.2.1 Project Manager

The Project Manager is responsible for overall management of the project and EMP implementation. The following tasks will fall within his/her responsibilities:

- Be aware of the findings and conclusions of the Environmental Impact Assessment and the conditions stated within the EIA License issued by NEMA;
- Be familiar with the recommendations and mitigation measures of this EMP, and implement these measures;
- Monitor site activities on a daily basis for compliance;
- Conduct internal audits of the construction site against the EMP;
- Confine the construction site to the demarcated area; and
- Rectify transgressions through the implementation of corrective action.

11.2.2 Project HSE Officer

The Project HSE Officer is responsible for the implementation of the EMP during the construction phase as well as liaison and reporting to the Developer, Contractor, Landowners and Authorities. The following tasks will fall within his/her responsibilities:

- Be aware of the findings and conclusions of the Environmental Impact Assessment and the conditions stated within the EIA License;
- Be familiar with the recommendations and mitigation measures of this EMP;
- Conduct weekly/monthly audits of the construction site according to the EMP and EIA License conditions;
- Educate the construction team about the management measures of the EMP and EIA License conditions;
- Regularly liaise with the construction team and the project leader;
- Recommend corrective action for any environmental non-compliance incidents on the construction site; and
- Compile a regular report highlighting any non-compliance issues as well as good compliance with the EMP.

11.2.3 EPC Contractor

The EPC contractor is responsible for the implementation and compliance with recommendations and conditions of the EMP.

- Ensure compliance with the EMP at all times during construction
- Maintain an environmental register which keeps a record of all incidents which occur on the site during construction. These incidents include:
 - Public involvement / complaints
 - Health and safety incidents
 - Incidents involving Hazardous materials stored on site
 - Noncompliance incidents

Most Landowners will see the construction period as interference with their daily activities. There could potentially be a negative attitude towards the whole construction process.

Landowners are always apprehensive toward changes they do not control and strangers on their properties. If and where the transmission line is close to any inhabited area, the necessary precautions shall be taken by the Contractor to safeguard the lives and property of the inhabitants. The Contractor shall under no circumstances interfere with the property of Landowners or nearby Communities.

11.2.4 Contractor HSE Officer

The Contractor HSE Officer will be appointed by the EPC contractor to monitor activities on site on a daily basis. The Contractor HSE Officer will be the HSE Officer's representative on the site and will report back on all audit trips. The Contractor HSE Officer must report any major incidents immediately to the Project HSE Officer.

11.2.5 Independent HSE Auditor

The independent HSE auditor will conduct an environmental audit during the construction phase of the project on a six-monthly basis according to the provisions of the Environmental Management Plan. The independent auditor will:

- Conduct independent environmental audits;
- Submit audit reports to the Project HSE Officer and if required, relevant authority;
- Engage specialist sub-consultants when required.

11.2.6 Environmental management responsibilities

The following are the environmental management responsibilities of the various parties during construction and operational phases. Unless otherwise stated the EMP will be adhered to as follows:

- The Contractor's HSE Officer will be the responsible party for compliance with this EMP during the construction phase;
- The monitoring party will be the Project HSE Officer;
- Method of record keeping will be weekly to two weekly inspections depending on the stage of the project;
- The inspection technique will include a review of records that will be kept on site by the Contractor HSE Officer and/or site inspections;
- The Client will bear ultimate responsibility for environmental management.

11.3 Environmental monitoring

A monitoring program will be implemented for the duration of the construction phase of the project. This program will include:

- Monthly environmental inspections to confirm compliance with the EMP and EIA License conditions. These inspections can be conducted randomly and do not require prior arrangement with the project manager;
- Compilation of an inspection report complete with corrective actions for implementation;
- Monthly HSE committee meetings to be held to ensure compliance with the OSHA and its subsidiary legislation.

The HSE Officer shall keep a photographic record of any damage to areas outside the demarcated site area. The date, time of damage, type of damage and reason for the damage shall be recorded in full to ensure the responsible party is held liable.

All claims for compensation emanating from damage should be directed to the Project HSE Officer for appraisal. The Contractor shall be held liable for all unnecessary damage to the environment. A register shall be kept of all complaints from the Landowner or community. All complaints/claims shall be handled in a timely manner to ensure timeous rectification/payment by the responsible party.

It should be noted that it is difficult to outline a formal monitoring protocol for specific environmental parameters and key impacts until detailed transmission line design have been completed. A formal monitoring protocol will be included within the revised EMP once the detailed transmission line design has been completed, and once recommendations and conditions from the reviewing authority have been received. It should further be noted that for the same reasons mentioned above, it is difficult to delineate the cost of the EMP for specific mitigation measures and therefore this has been excluded from the EMP tables.

The EPC contractor shall be responsible for acquiring all necessary permits during the construction phase of the project. Such licenses include any abstraction of water permits, local authority approvals for camp site locations and operations, extraction of aggregates from borrow pits and their rehabilitation, etc.

11.3.1 Compliance with the EMP and associated documentation

A copy of the EMP must be kept on site during the construction period at all times. The EMP will be made binding on all contractors operating on the site and must be included within the Contractual Clauses. It should be noted that in terms of the principles of environmental management espoused through the EMCA, those responsible for environmental damage must pay the repair costs both to the environment and human health measures to reduce or prevent further pollution and/or environmental damage (the polluter pays principle).

The Contractor is deemed not to have complied with the EMP if:

- Within the boundaries of the site, site extensions and haul/access roads there is evidence of contravention of clauses; or
- If environmental damage arises due to negligence; or
- The contractor fails to comply with corrective or other instructions issued by the Project HSE Officer or Authorities within a specified time; or
- The Contractor fails to respond adequately to complaints from the public.

The Proponent is deemed to be out of compliance with the EMP if:

- Within the boundaries of the site there is evidence of contravention of clauses;
- If environmental damage arises due to negligence;
- The Proponent fails to respond adequately to complaints from the public.

11.3.2 Training and Awareness

11.3.2.1 Training of Construction Workers

The Construction Workers must receive basic training in environmental awareness, including the storage and handling of hazardous substances, minimization of disturbance to sensitive areas, management of waste, and prevention of water pollution. They must also be appraised of the EMP's requirements.

11.3.2.2 Contractor Performance

The Contractor must ensure that the conditions of the EMP are adhered to. Should the Contractor require clarity on any aspect of the EMP, the Contractor must contact the Project HSE Officer for advice.

11.4 EMP requirements for pre-construction phase

The requirements that need to be fulfilled during the pre-construction phase of the project are as follows:

- There should be continuous liaison between the Proponent, the EPC contractor and Landowners along the wayleave to ensure all parties are appropriately informed of construction phase activities at all times;
- The Landowners should be informed of the starting date of construction as well as the phases in which the construction will take place;
- The EPC contractor must adhere to all conditions of contract including the Environmental Management Plan;
- The EPC contractor should plan the construction program taking cognizance of climatic conditions along the wayleave especially wet seasons and disruptions that can be caused by heavy rains;
- Where existing private roads are in a bad state of repair, such roads' condition shall be documented before they are used for construction purposes. This will allow for easy assessment of any damage to the roads which may result from the construction process. If necessary some repairs should be done to prevent damage to equipment;
- The construction site office must keep a proper record of all complaints received and actions taken to resolve the complaints;
- A Project HSE Officer should be appointed by the Proponent and Contractor HSE officer should be appointed by the EPC contractor to implement this EMP as well as deal with Landowner related matters;
- Internal and external environmental inspections and audits should be undertaken during and upon completion of construction. The frequency of these audits should be quarterly;
- The Project HSE Officer should conduct regular inspections along the wayleave in order to maintain good control over the construction process during the construction phase;
- A formal communications protocol should be set up during this phase. The aim of the protocol should be to ensure that effective communication on key issues that may arise during construction be maintained between key parties such as the Project HSE Officer, project manager and EPC contractor. The protocol should ensure that concerns/issues raised by stakeholders are formally recorded and considered and where necessary acted upon. If necessary, a forum for communicating with key stakeholders on a regular basis may need to be set up. This could be done through the EPC contractor's site office that would meet on a regular basis. The communications protocol should be maintained throughout the construction phase.

Table 11-1: Environment Management Plan-Pre-construction Phase

Impact	Environmental Mitigation Measure/Monitoring Plan	Responsibility	Frequency/ Monitoring requirement
Pre-construction phase impacts	<ol style="list-style-type: none"> 1) The Proponent should appoint a project HSE Officer while the EPC Contractor should appoint his/her HSE officer; 2) Demarcate clearly (e.g. using fencing) all areas to be developed before construction commences; 3) The EPC contractor to comply with the conditions of the EIA License for the project; 4) Maintain records of environmental incidents and avail a copy of these records to relevant lead agencies on request throughout the construction phase; 5) Identify and confirm suitable sites for the construction camps and storage areas for materials; 6) Store construction equipment in construction camps. Ensure oil changes take place on an impermeable surface such as reinforced concrete slab; 7) Provide as much as possible opportunities for employment to persons from the local areas along the wayleave; 8) Train site staff on the following areas of environmental management; <ol style="list-style-type: none"> a) Environmental awareness training for construction staff, concerning the prevention of accidental spillage of hazardous chemicals and oil; pollution of water resources (both surface and groundwater), air pollution and litter control and identification of archaeological artifacts; b) Project Manager shall ensure that the training and capabilities of the Contractor's site staff are adequate to carry out the designated tasks; 	KEL, Project HSE Officer	Bi-monthly

Impact	Environmental Mitigation Measure/Monitoring Plan	Responsibility	Frequency/ Monitoring requirement
	<ul style="list-style-type: none"> c) Operators of construction equipment (such as excavators, loaders, etc.) shall be adequately trained and sensitized to any potential hazards associated with their tasks; d) No operator shall be permitted to operate critical items of mechanical equipment without having been trained by the EPC Contractor and certified competent by the Project Manager; e) Staff should be educated as to the need to refrain from indiscriminate waste disposal and/or pollution of local soil and water resources and receive the necessary safety training. 		

11.5 EMP requirements for construction phase

11.5.1 Site preparation

Site clearing along the wayleave will be limited to the width of the proposed wayleave which is about 60m. Site clearing must take place in a phased manner, as and when required. Areas which are not to be constructed on within say one month of time must not be cleared to reduce erosion risks. The area to be cleared must be clearly demarcated and this footprint strictly maintained. Topsoil from the must be neatly stockpiled at the edge of the wayleave ready for backfill when required.

11.5.2 Establishment of Construction Camps and Materials yards

The proposed 100MW wind farm and 220kV transmission line project will utilize approximately two construction camps and laydown areas. The construction camp locations have been identified based on the ease of access to the wind farm area as well as the transmission line.

Site establishment shall take place in an orderly manner and all required amenities shall be installed at Camp sites before the main workforce move onto site. The Construction camp shall have the necessary ablution facilities with chemical toilets at commencement of construction. The EPC Contractor shall inform all site staff to make use of supplied ablution facilities and under no circumstances shall indiscriminate sanitary activities be allowed other than in supplied facilities.

The Contractor shall supply waste collection bins where such is not available and all solid waste collected shall be disposed of using NEMA approved waste handlers. A Waste Tracking Sheet required by Legal Notice 121: Waste Management Regulations, 2006 will be obtained by the EPC contractor and kept on file. The disposal of waste shall be in accordance with the Waste Management Regulations, 2006. Under no circumstances may any form of waste be burnt on site.

Table 11-2: Environment Management Plan-Construction Phase

Impact	Environmental Mitigation Measure/Monitoring Plan	Responsibility	Frequency/ Monitoring requirement
<p>Poor traffic and access management during construction</p>	<p>Construction traffic</p> <ol style="list-style-type: none"> 1. Clearly define construction routes and required access roads; 2. Use the minimum number of trips for delivering construction plant and equipment along the wayleave; 3. Strictly control the access of all construction and material delivery vehicles especially during wet weather to avoid compaction and damage to the topsoil structure; 4. Schedule the delivery hours to avoid peak hour traffic, weekends and evenings; 5. Implement wheel washing and damping down of un-surfaced roads to reduce dust and nuisance; 6. Service vehicles and equipment regularly to avoid the contamination of soil from oil and hydraulic fluid leaks, etc. Servicing of vehicles and equipment must be done off-site and on an impermeable surface such as concrete; 7. Soils compacted by construction equipment along the wayleave should be ripped and regarded. <p>Access</p> <ol style="list-style-type: none"> 8. Rehabilitate temporary access roads prior to the EPC contractor leaving the site; 9. Position entry and exit points strategically to ensure minimal effects on traffic; 10. Clearly signpost primary routes to the site and issue to all suppliers and Sub-Contractors. 	<p>EPC contractor, Project HSE Officer</p>	<p>Bi-weekly</p>

Impact	Environmental Mitigation Measure/Monitoring Plan	Responsibility	Frequency/ Monitoring requirement
	<p>11. Plan access routes to the site for construction purposes in conjunction with the EPC contractor and affected Landowners. All agreements reached should be documented and no verbal agreements should be made. The EPC contractor shall clearly mark all access roads.</p> <p>12. Where new access roads are constructed, this must be done according to design and contract specifications. Drainage channels shall be suitably designed to ensure erosion does not occur, especially at the outflow points. The new access road shall be designed to allow for the natural flow of water where required. Crossing of eroded areas on access routes to new sites shall be thoroughly planned and installed according to design and contract specifications. All areas susceptible to erosion shall be protected with suitable erosion control measures from the onset of the project. Prevention is the ultimate aim, as restoration is normally difficult and costly.</p> <p>Road maintenance</p> <p>13. All damaged roads shall be rehabilitated using suitable measures. In the event of rehabilitation work being required on private roads, such work will be done to the original specifications of the private road;</p> <p>14. Access roads should be maintained in good condition by attending to potholes, corrugations and stormwater damage as soon as these develop.</p> <p>General</p> <p>15. Safety requirements shall be complied with at all times during the construction phase. All equipment transported shall be clearly labeled as to their potential hazards according to specifications. All the required safety labeling on the containers and trucks used shall be in place;</p>		

Impact	Environmental Mitigation Measure/Monitoring Plan	Responsibility	Frequency/ Monitoring requirement
	16. The Contractor shall ensure that all the necessary precautions against damage to the environment and injury to persons are taken.		
Improper setup and operation of Construction camps	<p>Site of construction camp</p> <ol style="list-style-type: none"> 1. The EPC contractor to seek approval from the relevant local authority for the location of the construction camp. Factors to consider during siting of construction camps include location of local residents and/or ecologically sensitive areas, including flood zones and slip/unstable zones. If the EPC contractor chooses to locate the camp site on private land, he must get prior permission from both the Project Manager and respective landowner; 2. Minimize the size of the construction camp (especially where natural vegetation or grassland has had to be cleared for its construction); 3. Provide adequate parking for site staff and visitors. This should not inconvenience or serve as a nuisance for neighbors; 4. Provide adequate drainage around the camp site to avoid standing water and/or sheet erosion. <p>Storage of materials (including hazardous materials)</p> <ol style="list-style-type: none"> 5. Choose storage area location by considering prevailing winds, distances to water bodies, general onsite topography and water erosion potential of the soil. Impervious surfaces must be provided where necessary; 6. Designate, demarcate, fence off and secure all storage areas to minimize the risk of crime; storage areas should be safe from access by unauthorized persons; 7. Provide fire prevention facilities at all storage facilities; 	EPC contractor, Project HSE Officer, Contractor HSE Officer	Bi-weekly

Impact	Environmental Mitigation Measure/Monitoring Plan	Responsibility	Frequency/ Monitoring requirement
	<p>8. Store all hazardous materials such as oils, paints, thinners, fuels, chemicals, etc. in properly constructed and impermeable bunded areas. Hazardous materials must not be allowed to contaminate the subsurface or enter into drainage systems. Siting of hazardous material storage areas must be approved by the Project Manager.</p> <p>9. The EPC contractor to acquire MSDSs for all chemicals and hazardous substances used on site. Training on environmental impacts of chemicals and hazardous substances and PPE required to worn must be provided to the users.</p> <p>10. Hazardous material storage areas must be signposted clearly</p> <p>11. Use a NEMA licensed waste handler for disposal of all used oils from the camp sites. A waste tracking sheet must be completed as required by L.N. 121: Waste Management Regulations 2006 whenever used oils are being disposed.</p> <p>12. Dispose off any excess concrete mixes in consultation with the Project Manager.</p> <p>13. Immediately contain, recover and cleanup any spillages that may occur during the construction phase. All spillages must be reported to the HSE Officer and Project Manager.</p> <p>Drainage of construction camp</p> <p>14. Ensure that all potentially contaminated run-offs from the construction camp meets the discharge limits set under Legal Notice 120: Water Quality Regulations. Run-off from the camp site must NOT discharge into neighbors' properties or into adjacent wetlands, rivers or streams.</p>		

Impact	Environmental Mitigation Measure/Monitoring Plan	Responsibility	Frequency/ Monitoring requirement
	<p>End of construction</p> <p>15. Rehabilitate all storage areas after construction has been completed on site and all excess material has been removed. Such areas shall be rehabilitated to their natural state. Any spilled concrete shall be removed and soil compacted during construction shall be ripped, leveled and re-vegetated;</p> <p>16. Store construction materials, soil stockpiles, machinery and other equipment in designated areas;</p> <p>17. The construction camp must be kept clear of litter at all times. Spillages within the construction camp need to be cleaned up immediately and disposed of in the hazardous skip bin for correct disposal. No open fires are allowed within the construction camp and no wood from surrounding vegetation may be used to create a fire.</p>		
<p>Lack of HSE training for construction staff</p>	<p>Environmental training</p> <p>1. Ensure that all site personnel have a basic level of environmental awareness training. The EPC contractor must submit a proposal for this training to the Project HSE Officer for approval.</p> <p>Topics covered should include;</p> <ul style="list-style-type: none"> • What is meant by “Environment”; • Why the environment needs to be protected and conserved; • How construction activities can impact on the environment; • What can be done to mitigate against such impacts; • Awareness of emergency and spills response provisions; and • Social responsibility during construction e.g. being considerate to local 	<p>EPC contractor, Project HSE Officer</p>	<p>Monthly</p>

Impact	Environmental Mitigation Measure/Monitoring Plan	Responsibility	Frequency/ Monitoring requirement
	<p>residents.</p> <ol style="list-style-type: none"> 2. It is the Contractor’s responsibility to provide the site foreman with no less that 1 hour’s environmental training and to ensure that the foreman has sufficient understanding to pass this information onto the construction staff; 3. Training should be provided to the staff members on the use of the appropriate fire-fighting equipment. Translators are to be used where necessary; 4. Use should be made of environmental awareness posters on site; 5. The need for a “clean site” policy also needs to be explained to the workers; 6. Staff operating equipment (such as excavators, loaders, etc.) shall be adequately trained and sensitized to any potential hazards associated with their tasks. <p>Monitoring of environmental training</p> <ol style="list-style-type: none"> 7. The Contractor must monitor the performance of construction workers to ensure that the points relayed during their induction have been properly understood and are being followed. If necessary, the Contractor HSE Officer and/or a translator should be called to the site to further explain aspects of environmental or social behavior that are unclear. Toolbox talks are recommended. 		
Improper use and management of borrow pits	<p>Location of borrow pits</p> <ol style="list-style-type: none"> 1. Borrow pit localities must be negotiated with the relevant local authority to ensure consensus of their location; <p>Management of borrow pits</p> <ol style="list-style-type: none"> 2. The EPC contractor must also compile an information document which states the methods which will be utilized when creating borrow pits. This document must include, but not be limited to the following: 	EPC contractor, Project HSE Officer, Contractor HSE Officer	Monthly

Impact	Environmental Mitigation Measure/Monitoring Plan	Responsibility	Frequency/ Monitoring requirement
	<ul style="list-style-type: none"> • Plans which detail the expected quantity of excavation that will be required; • Temporary and permanent stormwater control; • The final contouring of the borrow pit and the proposed method of rehabilitation; • The current status and land use of the borrow pit; • Topsoil management strategy (preservation of topsoil for reinstatement); • Proposed management of dangerous conditions (e.g. steep slopes, loose and unstable material, holes). 		
Impacts relating to construction of the transmission line	<p>General construction</p> <ol style="list-style-type: none"> 1. Limit construction time to daylight hours in sensitive areas such as residential areas. Where construction is required after hours in order to avoid traffic interruptions, notification is to be sent out to all potentially affected land owners. 2. Send out prior notifications to relevant lead agencies, parastatals, etc. when essential services such as water or electricity are to be affected by the construction process. <p>Clearing and grading</p> <ol style="list-style-type: none"> 3. Refer to paragraph 11.5.1 above. <p>Construction of lattice towers</p> <ol style="list-style-type: none"> 4. The design of the towers should be done in accordance with applicable international standards. 5. The tower foundations will be constructed out of reinforced concrete in accordance with appropriate design standards 6. Contractors experienced in the erection of towers will be engaged 	EPC contractor, Project Manager	Bi-weekly

Impact	Environmental Mitigation Measure/Monitoring Plan	Responsibility	Frequency/ Monitoring requirement
	<p>7. The contractor will clean up the tower foundation area after erection of each tower and all wastes handled in accordance with L.N. 121: Waste Management Regulations, 2006.</p> <p>Stringing cables on insulators</p> <p>8. The correct insulators as provided in the Project Manager’s specifications will be used.</p> <p>9. Carefully inspect the transmission cables for defects as they are strung from the drums.</p> <p>10. Use the correct cable sizes according to appropriate transmission line standards and codes of practice for a 220kV transmission line.</p> <p>Foundations for towers</p> <p>11. Clear as little as possible the four holes required for the steel tower foundation legs.</p> <p>12. Place the top soil on one side of the excavated hole for use during reinstatement</p> <p>13. Excavate and cart away to an approved land fill site the soil removed below the top soil level to the final depth of each hole</p> <p>Reinstatement</p> <p>14. Rip the compacted areas along the wayleave to loosen the soil and then rehabilitate it.</p>		
Impacts related to soils and geology	<p>Soil erosion</p> <p>1. Provide wind screening and stormwater control to prevent soil loss from the site;</p> <p>2. Use silt fences and/or sand bags in areas that are susceptible to erosion;</p> <p>3. Sensitive areas need to be identified prior to construction so that the necessary</p>	EPC contractor, Project HSE Officer	Monthly

Impact	Environmental Mitigation Measure/Monitoring Plan	Responsibility	Frequency/ Monitoring requirement
	<p>precautions can be implemented.</p> <ol style="list-style-type: none"> 4. Regularly maintain all erosion control mechanisms; 5. Retain vegetation where possible to avoid soil erosion. Vegetation clearance should be phased to ensure that the least area of soil is exposed to potential erosion at any one time; 6. Re-vegetate disturbed surfaces immediately after construction activities are completed; <p>Soil compaction</p> <ol style="list-style-type: none"> 7. Construction vehicles must only be allowed to utilize existing tracks or pre-planned access routes. 8. Soils compacted during construction should be deeply ripped to loosen compacted layers and re-graded to even running levels. Topsoil should be re-spread over landscaped areas. <p>Soil contamination</p> <ol style="list-style-type: none"> 9. The EPC contractor will arrange to remove all construction related contaminated topsoil to the full depth of pollution and replace it at his own expense with approved topsoil; 10. The EPC contractor will be responsible for remediating any polluted topsoil. 		
Impacts related to surface water and groundwater	<p>Sanitation</p> <ol style="list-style-type: none"> 1. Provide adequate sanitary facilities for male and female construction workers in accordance with the Public Health Act requirements; 2. Ensure that sanitary facilities are regularly serviced and emptied to reduce the risk of surface or groundwater pollution. 	EPC contractor, Project HSE Officer	Weekly

Impact	Environmental Mitigation Measure/Monitoring Plan	Responsibility	Frequency/ Monitoring requirement
	<p>Hazardous materials</p> <ol style="list-style-type: none"> 3. Place all hazardous materials in bunded containment areas with sealed surfaces; 4. All hazardous substances must be stored at least 50m from any water body on site; 5. Contaminated wastewater must be managed by the Contractor to ensure existing water resources on the site are not contaminated. All wastewater from general activities in the camp shall be collected, treated and removed from the site for appropriate disposal. <p>Public areas</p> <ol style="list-style-type: none"> 6. Food preparation areas should be provided with adequate washing facilities and food refuse should be stored in sealed refuse bins which should be removed from site on a regular basis; 7. The EPC contractor should take steps to ensure that littering by construction workers does not occur and persons should be employed on site to collect litter from the site and immediate surroundings, including litter accumulating at fence lines; 8. No washing or servicing of vehicles will be allowed on permeable surfaces. <p>Water resources</p> <ol style="list-style-type: none"> 9. Site staff shall not be permitted to use any other open water body or natural water source adjacent to or within the designated site for the purposes of bathing or washing of clothing; 10. Treated water (or another source approved by the Project HSE Officer) should instead be used for all activities such as washing of equipment or disposal of any type of waste, dust suppression, compacting, etc. 11. An Effluent Discharge License shall be acquired from NEMA for the camp site to 		

Impact	Environmental Mitigation Measure/Monitoring Plan	Responsibility	Frequency/ Monitoring requirement
	ensure effluent discharge compliance in accordance with the discharge limits stated in L.N. 120: Water Quality Regulations, 2006.		
Impacts of air quality	<p>Dust control</p> <ol style="list-style-type: none"> 1. The EPC contractor will dampen un-surfaced and un-vegetated areas with a water bowser or sprinklers when necessary to reduce dust; 2. Excavations and other clearing activities must only be done during agreed working times and permitting weather conditions to avoid drifting of dust into neighboring areas; 3. The Contractor shall be responsible for dust control on site to ensure no nuisance is caused to a Landowner or neighboring communities; 4. A speed limit of 40km/h must not be exceeded; 5. Any complaints emanating from the lack of dust control shall be attended to immediately by the EPC contractor. <p>Rehabilitation</p> <ol style="list-style-type: none"> 6. The EPC contractor will commence rehabilitation of exposed soil surfaces as soon as practical after completion of earthworks. <p>Fire prevention</p> <ol style="list-style-type: none"> 7. No open fires shall be allowed on site under any circumstance. All cooking shall be done in demarcated areas that are safe and cannot cause runaway fires; 8. The Contractor shall have operational fire-fighting equipment available on site at all times. The level of fire fighting equipment must be assessed and evaluated thorough a fire risk assessment process. 	EPC contractor, Contractor HSE Officer	Daily

Impact	Environmental Mitigation Measure/Monitoring Plan	Responsibility	Frequency/ Monitoring requirement
Impacts of noise on surrounding areas	<ol style="list-style-type: none"> 1. The EPC contractor should comply with applicable sections of Legal Notice 61: Noise and Vibration Pollution Control Regulations, 2009 for environmental noise and Legal Notice 25: Noise Prevention and Control Regulations, 2005 for occupational noise; where necessary hearing protection should be worn; 2. Construction site yards, workshops and other noisy fixed facilities should be located well away from noise sensitive areas. Truck traffic should be routed away from noise sensitive areas, where possible; 3. Construction activities are to be contained to reasonable hours during the day and early evening. Night-time activities near noise sensitive areas should not be allowed; 4. With regard to unavoidable very noisy construction activities in the vicinity of noise sensitive areas, the contractor and his HSE Officer should liaise with local residents on how best to minimize impact, and the local population should be kept informed of the nature and duration of intended activities; 5. Noise from laborers must be controlled; 6. Noise suppression measures must be applied to all construction equipment. Construction equipment must be kept in good working order and where appropriate fitted with silencers which are kept in good working order. Should the vehicles or equipment not be in good working order, the contractor may be instructed to remove the offending vehicle or machinery from site; 7. The contractor must take measures to discourage laborers from loitering in the area and causing noise disturbance. Where possible labor shall be transported to and from the site by the contractor or his Sub-Contractors. 	EPC contractor, Contractor HSE Officer	Daily

Impact	Environmental Mitigation Measure/Monitoring Plan	Responsibility	Frequency/ Monitoring requirement
Impacts on ecology along the wayleave	<p>Existing vegetation</p> <ol style="list-style-type: none"> Existing indigenous vegetation must be retained where possible. A follow up vegetation survey should be conducted before site clearing to demarcate vegetation that should remain and remove and relocate any plants of botanical or ecological significance. Vegetation will be removed as it becomes necessary; Materials should not be delivered to the site prematurely which could result in additional areas being cleared or affected; No vegetation to be used for firewood. <p>Rehabilitation</p> <ol style="list-style-type: none"> All damaged areas shall be rehabilitated upon completion of the contract to as near pre-construction conditions; All natural areas impacted during construction must be rehabilitated with locally indigenous grasses typical of the representative botanical unit; Rehabilitation must take place as soon as construction is complete to avoid the edge effect, the infiltration of alien species and soil erosion within the wayleave; <p>Permits</p> <ol style="list-style-type: none"> Permits for removal of any protected species must be obtained from KWS or KFS or other relevant lead agency should such species be affected. All plants not interfering with the operation of the transmission line construction shall be left undisturbed, clearly marked and indicated on the site plan; The construction workspace must be well demarcated and no construction activities must be allowed outside of this demarcated footprint; Only vegetation within the trench area to be excavated must be removed. 	Project HSE Officer, Contractor HSE Officer	Weekly

Impact	Environmental Mitigation Measure/Monitoring Plan	Responsibility	Frequency/ Monitoring requirement
	<p>Vegetation removal must be phased in order to reduce impact of construction;</p> <p>11. Construction site office and laydown areas must be clearly demarcated and no encroachment must occur beyond demarcated areas.</p> <p>12. Construction areas must be well demarcated and these areas strictly adhered to.</p> <p>13. Soils must be kept free of petrochemical solutions that may be kept on site during construction. Spillage can result in a loss of soil functionality thus limiting the re-establishment of flora.</p> <p>Utilization of resources</p> <p>14. Gathering of firewood or any other natural material onsite or in areas adjacent to the site is prohibited unless with prior approval of the Project HSE Officer.</p>		
Impacts arising from inconsistent waste management	<p>Construction rubble</p> <p>1. All rubble from demolition activities must either be used on site as part of the existing development, or must be taken away from the project site and disposed off appropriately;</p> <p>2. Rubble must not be dumped on site but must be placed within a receptacle for regular removal;</p> <p>3. Construction rubble shall be disposed of in pre-agreed, demarcated spoil dumps that have been approved by the Kajiado County Council.</p> <p>Litter management</p> <p>4. Refuse bins must be placed at strategic positions to ensure that litter does not accumulate within the construction site;</p> <p>5. A housekeeping team should be appointed to regularly maintain the litter and rubble situation on the construction site;</p>	EPC contractor, Project HSE Officer, Contractor HSE Officer	Weekly

Impact	Environmental Mitigation Measure/Monitoring Plan	Responsibility	Frequency/ Monitoring requirement
	<p>6. Waste disposal will need to take place in accordance with Legal Notice 121: Waste Management Regulations, 2006;</p> <p>7. Littering by the employees of the Contractor shall not be allowed under any circumstances. The Contractor HSE Officer shall monitor the neatness of the work sites as well as the Contractor campsite;</p> <p>8. Receptacle containers should be maintained on site. These should be kept covered and arrangements made for them to be disposed regularly from the site;</p> <p>9. Waste Tracking Sheets providing disposal shall be provided for the Project HSE Officer's inspection.</p> <p>Hazardous waste</p> <p>10. All hazardous materials must be carefully stored as advised by the Project HSE Officer, and then disposed offsite using NEMA approved waste handlers;</p> <p>11. Contaminants will be stored safely to avoid spillage;</p> <p>12. Machinery must be properly maintained to keep oil leaks in check.</p> <p>Sanitation</p> <p>13. The Contractor shall install mobile chemical toilets on the site;</p> <p>14. Staff shall be sensitized to the fact that they should use these facilities at all times. No indiscriminate sanitary activities on site shall be allowed;</p> <p>15. There should be enough toilets available to accommodate the workforce in accordance with the Public Health Act requirements. Male and females must be accommodated separately where possible;</p> <p>16. Toilets shall be serviced regularly and the contractor HSE Officer shall inspect toilets;</p>		

Impact	Environmental Mitigation Measure/Monitoring Plan	Responsibility	Frequency/ Monitoring requirement
	<p>17. Under no circumstances may open areas, neighbors fences or the surrounding bush be used as a toilet facility;</p> <p>18. Potable water must be provided for all construction staff.</p> <p>Remedial actions</p> <p>19. Depending on the nature and extent of the spill, contaminated soil must be either excavated or treated on-site;</p> <p>20. Excavation of contaminated soil will involve careful removal of soil using appropriate tools/machinery to storage containers until disposed of using NEMA approved waste handlers;</p> <p>21. If a spill occurs on an impermeable surface such as cement or concrete, the surface spill must be contained using oil absorbent materials;</p> <p>22. If necessary, oil absorbent sheets or pads must be attached to leaky machinery or infrastructure.</p> <p>23. Materials used for the remediation of petrochemical spills must be used according to product specifications and guidance for use.</p> <p>24. Contaminated remediation materials must be carefully removed from the area of the spill so as to prevent further release of petrochemicals to the environment, and stored in adequate containers until appropriately disposed off.</p>		

Table 11-3: Environment Management Plan-Operations Phase

Impact	Environmental Mitigation Measure/Monitoring Plan	Responsibility	Frequency/ Monitoring requirement
Impacts associated with construction site decommissioning	<p>Removal of equipment</p> <ol style="list-style-type: none"> 1. Remove all structures comprising the construction camp. Check for any previous construction related chemical soil contamination and cleanup. Return the ground conditions within the camp sites to their near original state by undertaking the necessary landscaping. <p>Associated infrastructure</p> <ol style="list-style-type: none"> 2. All rubble is to be removed from the site to an approved disposal site as approved by the Project Manager. Burying of rubble on site is prohibited. 3. The site is to be cleared of all litter. 4. The Contractor is to check that all watercourses are free from building rubble, spoil materials and waste materials. 5. Fences, barriers and demarcations associated with the construction phase are to be removed from the site unless stipulated otherwise by the Engineer. 6. All residual stockpiles must be removed or spread on site as directed by the Engineer. 	EPC Contractor, Proponent, Project Manager, Project HSE Officer, Contractor HSE Officer	Weekly
Impacts associated with transmission line operations and maintenance	<p>Maintenance</p> <ol style="list-style-type: none"> 1. All applicable standards, legislation, policies and procedures must be adhered to during operation; 2. Periodic inspection of the wayleave must take place to monitor the status of the transmission line; 	Proponent	Monthly

Impact	Environmental Mitigation Measure/Monitoring Plan	Responsibility	Frequency/ Monitoring requirement
	<p>Public awareness</p> <p>3. The Proponent should conduct an HSE awareness campaign to landowners/residents affected by the transmission line;</p> <p>4. The emergency preparedness plan must be ready for implementation at all times should an emergency situation arise.</p>		
Impacts on biodiversity	<p>1. Indigenous vegetation must be maintained along the wayleave and all exotic species removed as they appear and disposed off appropriately.</p> <p>2. Vegetative re-establishment shall, as far as possible, make use of indigenous or locally occurring plant varieties</p> <p>3. No faunal species must be harmed by maintenance staff during any routine maintenance at the transmission line.</p>	Proponent	Monthly
Impacts on health and safety	<p>Emergency response plan</p> <p>1. Upon completion of the construction phase, an emergency response risk assessment should be undertaken and specific contingency plans incorporated in the transmission line crisis management plan to ensure the safety of the staff and surrounding land owners and users in case of an emergency.</p>	Proponent	Monthly

Table 11-4: Social Management Plan

Impact	Social Mitigation Measure/Monitoring Plan	Responsibility	Frequency/ Monitoring requirement
Impacts due to increased employment in the project area	<ol style="list-style-type: none"> 1. The use of labor intensive construction measures should be used where appropriate; 2. Training of labor to benefit individuals beyond completion of the project 3. Labor to be sourced from the local community where possible 4. Local suppliers to be used where possible 5. The Project Manager must ensure that all staff working on the proposed project must be in possession of a Kenyan Identity Document or a relevant work permit. 	EPC contactor, Project HSE Officer, Contractor HSE Officer	Weekly
Impacts related to health and safety on workers and the public exposed to construction hazards	<p>Worker safety</p> <ol style="list-style-type: none"> 1. Implement safety measures, work procedures and first aid on site. Workers have the right to refuse work in unsafe conditions; 2. Develop and implement a construction health and safety plan which must be approved by the Project Manager. 3. Comply with the relevant requirements of OSHA during the construction phase and especially Legal Notice 40: Building Operations and Works of Engineering Construction Rules, 1984 (BOWEC); 4. Train workers thoroughly in the safe use of potentially dangerous equipment; 5. Contractors must ensure that all equipment is maintained in a safe operating condition; 6. Record all incidents in a “General Register” as required by OSHA and maintain an updated copy of the Register in the site office for inspection. Any health and safety incident must be reported to the project manager immediately and a DOSH1 form filled out and forwarded to the nearest County DOSHS Officer; 7. Provide first aid facilities on site at all times as required by Legal Notice 160: First 	Proponent, EPC Contractor, Project HSE Officer, Contractor HSE Officer	Daily

Impact	Social Mitigation Measure/Monitoring Plan	Responsibility	Frequency/ Monitoring requirement
	<p>Aid Rules, 1977;</p> <p>8. The Contractor shall take all the necessary precautions against the spreading of disease such as measles, foot and mouth, etc. especially under livestock;</p> <p>9. The contractor must ensure that all construction workers are made aware about HIV/AIDS and the risks surrounding this disease. The location of the local clinic where more information and counseling is offered must be indicated to workers;</p> <p>10. Material stockpiles or stacks, such as, cable drums, tower components, etc. must be stable and well secured to avoid collapse and possible injury to site workers/local residents.</p> <p>Welfare facilities</p> <p>11. Eating areas should be regularly serviced and cleaned to ensure the highest possible standards of hygiene and cleanliness;</p> <p>12. Fires are not to be allowed for cooking or heating purposes anywhere along or near the construction areas.</p> <p>Protective gear</p> <p>13. Construction staff and visitors without exception must always wear appropriate Personal Protective Equipment (PPE) while working. Access to any part of the construction site will be forbidden to anyone not donning the correct PPE;</p> <p>14. The EPC contractor will adhere to the “Protection of Eyes” Schedule within the OSHA.</p>		

Impact	Social Mitigation Measure/Monitoring Plan	Responsibility	Frequency/ Monitoring requirement
	<p>Site safety</p> <p>15. The construction camp must remain fenced for the entire construction period;</p> <p>16. Potentially hazardous areas such as trenches are to be demarcated and clearly marked;</p> <p>17. The EPC contractor will place adequate warning signs in all hazardous working areas;</p> <p>18. Uncovered manholes and excavations must be clearly demarcated;</p> <p>19. Emergency numbers for local police and rescue services etc. must be placed in a prominent area;</p> <p>20. Firefighting equipment must be placed in prominent positions across the site where it is easily accessible. This includes fire extinguishers, a fire blanket as well as a water tank;</p> <p>21. Suitable conspicuous warning signs in English and all other applicable languages must be placed at all entrances to the site;</p> <p>22. All speed limits must be adhered to.</p> <p>Construction equipment safety</p> <p>23. All construction plant and equipment must be properly guarded to prevent injuries to workers;</p> <p>24. All equipment used for construction must be in good working order with up to date maintenance records.</p> <p>Hazardous Material Storage</p> <p>25. Staff that will handle hazardous materials must be trained on the health and safety aspects of storage, handling and distribution;</p>		

Impact	Social Mitigation Measure/Monitoring Plan	Responsibility	Frequency/ Monitoring requirement
	<p>26. Any hazardous materials (apart from fuel) must be stored within a lockable store with a sealed floor;</p> <p>27. All storage tanks containing hazardous materials must be placed in bunded containment areas with sealed surfaces. The bund walls must be high enough to contain 110% of the total volume of the stored hazardous material;</p> <p>28. Material Safety Data Sheets (MSDS) which contain the necessary information pertaining to a specific hazardous substance must be present for all hazardous materials stored on the site;</p> <p>29. The provisions of Legal Notice 60: Hazardous Substances Regulations, 2007 promulgated in terms of the OSHA must be adhered to. This applies to solvents and other chemicals possibly used in the construction phase.</p> <p>Procedure in the event of a petrochemical spill</p> <p>30. The individual responsible for or who discovers the petrochemical spill must report the incident to the Project Manager, contractor HSE officer or EPC Contractor. The problem must be assessed and the necessary actions required will be undertaken;</p> <p>31. The immediate response must be to contain the spill;</p> <p>32. The source of the spill must be identified, controlled, treated or removed.</p> <p>Fire management</p> <p>33. Firefighting equipment should be present on site at all times as per Legal Notice 59: Fire Risk Reduction Rules, 2007;</p> <p>34. All construction staff must be trained in fire hazard control and firefighting techniques;</p>		

Impact	Social Mitigation Measure/Monitoring Plan	Responsibility	Frequency/ Monitoring requirement
	<p>35. All flammable substances must be stored in dry areas which do not pose an ignition risk to the said substances;</p> <p>36. No open fires will be allowed on site;</p> <p>37. Smoking may only be conducted in demarcated areas.</p> <p>Safety of surrounding residents</p> <p>38. All residents affected by the construction of the transmission line should be notified in advance of any known potential risks associated with the construction site and the activities on it. Examples of these are:</p> <ul style="list-style-type: none"> • Earthworks/earthmoving machinery on steep slopes above houses/ infrastructure; • Risk to residence along haulage roads/access routes. 		
<p>General social impacts along the wayleave and its vicinity</p>	<ol style="list-style-type: none"> 1. EPC contractor to ensure that communications with affected persons along the wayleave is always courteous; 2. No interruptions other than those negotiated shall be allowed to any essential services. Damage to infrastructure shall not be tolerated and any damage shall be rectified immediately by the Contractor. A record of all damage and remedial actions shall be kept on site; 3. All existing private access roads used for construction purposes, shall be maintained at all times to ensure that the local people have free access to and from their properties. Speed limits shall be enforced in such areas and all drivers shall be sensitized to this effect; 4. Any possible disruptions to essential services must be kept to a minimum and should be well advertised and communicated to the Landowners and surrounding Communities. The position of all underground utilities in the vicinity of a site must 	<p>EPC Contractor Project HSE Officer, Contractor HSE Officer, Proponent</p>	<p>Bi-monthly</p>

Impact	Social Mitigation Measure/Monitoring Plan	Responsibility	Frequency/ Monitoring requirement
	be obtained from the Landowners or local Community and clearly marked. Where required such lines shall be deviated.		
Impacts on grazing land	<ol style="list-style-type: none"> 1. The EPC contractor will not fence off the construction area thus preventing livestock from grazing; 2. Rehabilitate all disturbed grazing areas within the wayleave and construction workspace to near original condition to enable livestock continue to graze; 3. Fence off exposed areas for maintenance to prevent livestock from moving through the area; 4. Compensation to landowners will be provided if livestock gets hurt as a direct result of negligence on the maintenance team's part; 5. The area should be rehabilitated upon completion of the maintenance activities to ensure that the land is returned in the same condition as prior to the maintenance activities. 	EPC Contractor Project HSE Officer, Contractor HSE Officer, Proponent	Monthly
Impacts associated with influx of construction workers	<ol style="list-style-type: none"> 1. For workers not indigenous to the wayleave area, awareness will be created among construction workers about local traditions and practices; 2. Communities living in close proximity to the wayleave should be given an opportunity through the local area chief's office to communicate their expectations of construction workers' behavior; 3. Implement methods (posters, talks, etc.) to create HIV and STI awareness amongst construction workers; 4. Payment to Kenyan construction workers should comply with applicable Kenyan Labor Laws in terms of minimum wages; 5. Where local laborers are employed on a more permanent basis, the EPC contractor shall mandatorily register such workers with statutory bodies such as the KRA, 	EPC Contractor Project HSE Officer, Contractor HSE Officer, Proponent	Bi-monthly

Impact	Social Mitigation Measure/Monitoring Plan	Responsibility	Frequency/ Monitoring requirement
	NHIF and NSSF and make the necessary deductions from the worker's wages for onward transmission to the statutory bodies.		
Impacts associated with job seekers	<ol style="list-style-type: none"> 1. The EPC contractor will notify the local District Officer of the employment procedures of the company; 2. No loitering will be allowed in the vicinity of the camp sites. The EPC contractor to work with relevant security agencies to evict any loiterers. 3. Construction workers should be clearly identifiable by wearing proper construction uniforms displaying the logo of the construction company. Construction workers could also be issued with identification tags. 	EPC Contractor Project HSE Officer, Contractor HSE Officer, Proponent	Bi-monthly
Impacts associated with attitude formation against the project	<ol style="list-style-type: none"> 1. Engage the local community early on and throughout the construction phase about the construction activities to get their buy-in. 2. Employment opportunities should first be offered to the local community if the skills are available within the community. 3. The undertakings in the EMP should also be implemented effectively and with due diligence. 	EPC Contractor Project HSE Officer, Contractor HSE Officer, Proponent	Bi-monthly
Impacts of additional demand on existing utilities	<ol style="list-style-type: none"> 1. Water is a scarce resource along the wayleave and subsequently construction workers should be made aware of the limited availability and conservation measures; 2. Construction camps should be located away from areas of concern to avoid pollution of water bodies. 	EPC Contractor Project HSE Officer, Contractor HSE Officer, Proponent	Bi-monthly
Impacts on sanitation	<ol style="list-style-type: none"> 1. Construction workers should receive medical advice regarding correct sanitation and receive correct medical attention where required; 2. Adequate water facilities should be provided; 	EPC Contractor Project HSE Officer, Contractor HSE	Bi-monthly

Impact	Social Mitigation Measure/Monitoring Plan	Responsibility	Frequency/ Monitoring requirement
	<ol style="list-style-type: none"> 3. Sufficient portable chemical toilets on site and at the construction camps should be provided; 4. Adequate sanitation services (e.g. showers) at the construction camp should be provided with effective drainage facilities to ensure that used water is carried away from the site. 	Officer, Proponent	
Impacts on integration with local communities	<ol style="list-style-type: none"> 1. An aggressive STI and HIV/AIDS awareness campaign should be launched, which is not only directed at construction workers but also at the community as a whole; 2. Contraceptives (such as condoms) should be distributed by placing them at centrally located points and by ensuring that construction workers and community members are aware of the availability and location of contraceptives. The distribution of contraceptives should be approached with the necessary cultural sensitivity; 3. Access at the construction site should be controlled to prevent commercial sex workers from either visiting and/or loitering at the construction village; 4. Local women should be empowered. This could be achieved by employing them to work on the project, which in turn would decrease their (financial) vulnerability. 	EPC Contractor Project HSE Officer, Contractor HSE Officer, Proponent	Bi-monthly
Impacts associated with archeology and cultural heritage	<ol style="list-style-type: none"> 1. Develop and implement appropriate measures for artifacts of archeological and cultural significance unearthed during the construction phase; 2. The workforce should be made aware of reporting any possible historical or archaeological finds to the HSE Officer so that appropriate action can be taken; 3. Any discovered artifacts shall not be removed under any circumstances; 4. Report any archaeological sites and/or graves uncovered during construction to the Project Manager; 5. Implement measures to ensure that behavior and practices of construction workers 	EPC Contractor Project HSE Officer, Contractor HSE Officer, KEL	Bi-monthly

Impact	Social Mitigation Measure/Monitoring Plan	Responsibility	Frequency/ Monitoring requirement
	do not cause offence to local communities and land owners.		

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12 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.

Alternatives are the different ways in which the project can be executed to ultimately achieve its objectives. Examples could include carrying out a different type of action, choosing an alternative location or adopting a different technology or design for the project. This section explores the evolution in the identification and refinement of alternatives that occurred during the execution of the EIA process.

12.1 Route alternatives

Gibb Africa (Gibb) was contracted by Kipeto Energy Limited (KEL) to conduct a grid connection feasibility study. As part of the study, Gibb conducted a Connection Options Study to identify various corridor alternatives for the transmission line.

Following completion of the Data Analysis Stage of the study, a more detailed study of the options identified during the analysis stage was undertaken in order to arrive at the optimum connection point. Among the parameters considered for each of the options were the following:

- (a) Position of the final Kipeto take-off substation;
- (b) Locations (distances) of the possible connection points;
- (c) Availability of spare capacity at the possible connection points;
- (d) Voltage levels at the possible connection points; and
- (e) The expected commissioning dates of the planned KETRACO expansion works that have been identified as possible connection points.

Load flow studies between Kipeto and the possible connection points were also undertaken in order to establish voltage profiles and projected system losses in the transmission lines between Kipeto and the connection point options.

The connection options identified from the previous Data Analysis Stage are as follows:

- (a) Option 1: Construction of a 39 km long 66kV overhead sub-transmission line(s) from Kipeto substation to Ngong 220/66kV substation;
- (b) Option 2: Construction of a 45 km long 66kV overhead sub-transmission line(s) from Kipeto substation to Athi River 220/66kV substation;
- (c) Option 3: Construction of a 17 km long 220 kV overhead transmission line(s) from Kipeto substation to Isinya 220/220 kV switching station (future 400/220kV 2x500MVA substation).

During this option study, continual consultations were held with both KETRACO and Kenya Power. Comments received were considered during the study.

The detailed study included Load flow, stability and short circuit analyses of the three evacuation options which were done jointly with KPLC using PSS/E power system simulation and analysis software in order to obtain their concurrence on the results. This was done for each of the connection options in order to determine the effect of connection on the national grid and to check the technical viability of each of the options. The results obtained would also assist in the selection of the optimum option and in informing the appropriate measures that will need to be taken during the later detailed design of the proposed transmission system.

For the Isinya 220kV system as the connection point, load flow studies, short circuit analyses and voltage level stability analyses were undertaken at national transmission level using national power stations parameters, KPLC transmission system and the 100 MW from the proposed Kipeto Power Station lumped together at 220kV voltage system.

For the Ngong and Athi River 220/66kV substations as the connection points, load flow studies, short circuit and stability analyses were done at national transmission level using national data of national power stations parameters, KPLC transmission system parameters and the 100 MW from the Kipeto Power Station lumped on their respective 66kV bus bars.

The analysis summary documented below focuses on the connection point at the 220kV bus bar at Isinya, which was studied in more detail as the results showed it to be the best connection option.

A summary and conclusions of the Detailed Study is given below.

12.1.1 Option 1: Kipeto - Ngong 66kV Sub - Transmission System

This system would require that the voltage level of the final substation at Kipeto Wind Power Station be at 66kV. Load flow studies conducted showed that transmitting 100 MW on this line would result in a poor voltage profile and high transmission losses. The timeline for commissioning the Ngong 220/66kV 2x100 MVA substation has been set by KETRACO at year 2013. It is not recommended to select this option because of the poor voltage profile and high transmission losses.

12.1.2 Option 2: Kipeto - Athi River 66kV Sub - Transmission System

This system would also require that the voltage level of the final substation at Kipeto Wind Power Station be at 66kV. Load flow studies conducted showed that transmitting 100 MW on this line would also result in a poor voltage profile and high line losses. The timeline for commissioning the Athi River 220/66kV 2x100 MVA substation has been set at year 2013. It is not recommended to select this option because of the poor voltage profile and high transmission losses.

12.1.3 Option 3: Kipeto - Isinya 220kV Overhead Transmission System

This system would require that the voltage level of the final substation at Kipeto Wind Power Station be at 220kV. Load flow studies undertaken using a single and twin canary conductor showed a good voltage profile and low system losses. A double circuit line yielded an even better voltage profile and lower system losses. A twin canary conductor with a rating of 250MVA would guarantee future expansion of Kipeto Power station and minimise corona losses. A double circuit at 220kV voltage level would fulfil N-1 redundancy requirements by network operators. The timeline for commissioning the Isinya Switching Station is set at late year 2013.

This option is therefore highly recommended.

12.2 Design alternatives

From the previous section of the report, the proposed Isinya 220/220kV switching station (Option 3) was identified as the best option for connection of the power generated at the Kipeto Wind Power station to KETRACO's transmission system. A preliminary examination of design considerations for this option was undertaken during Detailed Study. The considerations examined included the following:

- Substation configuration at the proposed Isinya 220/220kV switching station;
- The requirements for transmission lines that would connect Kipeto Wind Power Station to the proposed Isinya switching station;
- The voltage level of the high side of Kipeto substation;
- The configuration of the final / take-off substation at the Kipeto Wind Power Station.

12.2.1 Isinya 220/220kV Switching Station Configuration

The preliminary designs of the Isinya 220/220kV switching station obtained from KETRACO show that its two diameters are full. Incoming lines from Kipeto will have to be at 220kV voltage level and will therefore take an extra diameter in a breaker and a third configuration.

12.2.2 Transmission Lines Connecting Kipeto to Isinya 220/220kV Switching Station

The major subcomponents of the transmission lines will be:

- (a) 220kV line support structures;
- (b) Conductors.

12.2.2.1 220kV Transmission Line Support Structures

In a countryside location such as Kipeto, it is recommended to construct a double circuit overhead transmission line on steel lattice towers.

12.2.2.2 220kV Line Conductor

The choice of the conductor will be influenced by its electric current carrying capacity and the prevailing environmental conditions in the Kipeto area.

12.2.3 Voltage Level of High Voltage side of Kipeto' s Final Substation

This voltage level will be dictated by the transmission system. Since the transmission line voltage will be at 220kV voltage level, it is recommended that the high voltage side of the substation be set at 220kV voltage level.

12.2.4 Kipeto Substation Configuration

The final take-off substation at Kipeto can take the form of a breaker and a half, or a breaker and a third or a double bus bar configuration. These forms all fulfill the N-1 criteria needed for security of supply. A double bus bar configuration is the least expensive of the three configurations and it is recommended to adopt it.

12.2.5 Transmission Line Route

The preliminary transmission line route identified assumes at this stage that there are no major obstacles along the way and that the transmission line will run in a fairly straight line between Kipeto' s final take-off substation to the Isinya 220kV switching station. The length of the line is estimated to be approximately 20 km. A detailed route design for construction purposes will be undertaken once the detailed route survey is done.

12.3 No-development alternative

This alternative simply means that the Proponent does nothing to address the purpose and need for the transmission line. The most significant outcome of this approach would be a negative impact on current and future electricity supply networks, and the possibility of complete blackouts at times of high and peak demand. Against the background of load shedding events, not strengthening electricity supply to the national grid could have potentially negative effects, such as a continual lack of supply electricity for many communities and a reduction of economic growth in Kenya as a whole.

Positive outcomes associated with the no-development option include the maintenance of the current aesthetic landscape with no negative impacts on the social and socio-economic environment, the primary economy (grazing of livestock) and the biophysical environment (wetlands, rivers, flora and fauna).

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13 Prevention and management of foreseeable accidents and hazardous activities

13.1 Introduction

Clients and transmission line project proponents have a vital role in the establishment and ongoing management of Project construction health and safety standards. They inevitably influence and impact on how Projects are structured, the amount of detail provided in the tendering process, the time allowed for Project planning, licensing and approvals timetables, the time of year of the Project, the time allowed to complete the Project, the specification of Project health and safety standards, the selection of the Construction Contractor and the degree of Project surveillance and involvement.

The proposed project will involve the construction of a 220KV overhead transmission line approximately 17km in length emanating from a wind power project sub-station to the proposed Isinya sub-station. Such a project will employ several people in construction.

In order to prevent accidents or hazardous activities throughout the pre-construction and construction phases, the EPC contractor will be required to develop a specific construction health and safety (H&S) plan. A H&S Plan is a formal, structured and systematic method for preventing accidents and hazardous activities at a construction site. This section of the EIA Study provides a framework for an H&S plan that the EPC contractor will be required to develop and implement in preventing accidents and hazardous activities during the construction phase.

13.2 Planning for compliance

The EPC contractor will have a full understanding of the health, safety and environmental legislative and statutory duty requirements of the jurisdiction in which the transmission line is to be constructed.

As part of the Project planning process the EPC contractor will:

- Acquire applicable H&S legislation and other legal requirements (including EIA License Conditions, etc.);
- Have access to copies of all relevant H&S legislation (hard or electronic format) prior to and on site;
- Ensure appropriate personnel have an adequate understanding of their H&S legal responsibilities;
- Provide a system to identify changes and amendments to applicable legislation during the construction phase and assess the impact of such changes in a timely manner. A H&S Legal Register should be established and maintained for the duration of the project to ensure legislative changes are monitored, assessed, implemented and communicated; and

- Review relevant legislation and other legal requirements to assess specific application and develop an appropriate compliance strategy.

13.3 Preparation of the H&S plan

Immediately after the award of the contract for construction works, the EPC contractor will develop a construction H&S plan using a suitably qualified and experienced person. It should be prepared with sufficient time to submit to the Project Engineer (Galetech Energy Developments Limited, Ireland) and allow for comments.

Where possible, involvement by personnel and stakeholders in the development of the Plan should be sought. The Plan shall describe the duties, responsibilities, authorities and accountabilities with respect to the development and implementation of the Plan.

The Construction Health and Safety Plan will often work in parallel with the Construction Environmental Management Plan (CEMP). Opportunities for co-management of, and integrated management systems for safety and environmental issues should be considered.

13.4 Use of sub-contractors

There may be a number of sub-contractors that will be used for the proposed project. These may include contractors specializing in mechanical works, civil and structural works, electrical works, instrumentation and control, etc. The specific H&S plan to be developed by the EPC contractor will be developed so as to provide sub-contractors with enough detail on the expected H&S standards for the Project.

Sub-contractors may provide their own H&S Plans under the umbrella of the Construction H&S Management Plan.

13.5 Review of the plan

The construction H&S plan may be reviewed from time to time to reflect changing circumstances during the construction phase. The EPC contractor will include a section outlining the circumstances that would trigger a review of the construction H&S plan and resubmission of it to the Project Engineer for review and approval (design or route changes etc.).

13.6 Construction H&S Plan for the proposed project

The following sections provide the content and structure of a construction phase H&S plan for the proposed project which the EPC contractor will develop and implement.

13.7 Leadership and Commitment

Health and safety management throughout the construction phase will be led by the Project Manager working for the EPC contractor. It is the overall responsibility of the top leadership to internalize H&S in all aspects of the construction phase processes.

The Project Management Team will develop a Project Specific Health and Safety Policy or Statement of Commitment, consistent with the Health and Safety Policies of the parent organization.

The Project Health and Safety Policy will be communicated to all employees and interested parties through training, induction and consultation.

The Project Management Team will implement processes to raise awareness and promote a health and safety culture of active involvement in achieving the objectives of the Health and Safety Policy.

The project specific H&S Policy will be displayed at the construction site and be disseminated to interested parties such as regulatory authorities, emergency services, support personnel, contractors, caterers, land owners, etc. Interested parties also include visitors and the local community.

13.7.1 Organization and responsibilities

The EPC contractor will provide a project organization chart to the Project Engineer. The organization chart will be used to establish an effective organization structure with defined roles, responsibilities and accountabilities for implementation and maintenance of the project H&S policy and management system.

At this stage of the project, the organization chart has not been formalized but given below is a typical EPC contractor matrix indicating the roles and responsibilities for various key players in construction H&S management.

Position	HSE Roles and Responsibilities
Construction Manager	<ul style="list-style-type: none"> • Overall EPC contractor representative and retains HSE monitoring role over the project; • Ensures compliance with EIA conditions set by the EMCA and other HSE related laws associated with project construction; • Has overall accountability and responsibility for HSE associated with the project; • Promotes HSE awareness by example (role model behavior); • Ensures sub-contractors comply with HSE rules and are trained in HSE; • Ensures that the project HSE plan is continuously maintained and updated.

Position	HSE Roles and Responsibilities
Other supervisors and engineers	<ul style="list-style-type: none"> • They report to the Construction Manager; • Demonstrate their concerns for HSE compliance by good role model behavior; • Ensure that subordinates are aware of HSE hazards involved in their respective work tasks through training and work experience; • Ensure compliance with HSE legislation including conducting regular HSE inspections at the work site; • Ensure that construction plant and equipment is in a good state of repair and made available to the construction workers; • Reporting of any unsafe acts or conditions to the Construction Manager's attention for remedial action; • Ensuring that all accidents/incidents are reported immediately and appropriate investigations undertaken; • Plan, coordinate and participate in HSE toolbox meetings for construction workers.
Employees	<ul style="list-style-type: none"> • Carry out their routine construction activities in a healthy, safe and environmentally friendly manner; • Use appropriate PPE provided to them by the contractor; • Ensure compliance with the EPC contractor's HSE rules; • Be aware of the HSE hazards associated with the construction plant and equipment they will use; • Bring to the notice of their immediate management any HSE hazards identified during the construction phase.
HSE manager	<ul style="list-style-type: none"> • Reports to the Construction Manager and is the primary advisor to the EPC contractor on all HSE issues associated with the construction site; • Is empowered to halt construction operations if any unsafe acts or conditions are witnessed; • Ensures all supervisors and employees are aware of their HSE responsibilities; • Facilitates HSE risk assessments and JSAs;

Position	HSE Roles and Responsibilities
	<ul style="list-style-type: none"> • Undertakes regular HSE inspections of the construction site in accordance with the EPC contractor's HSE policy; • Provides HSE training for the EPC contractor's employees and nominated sub-contractors; • Undertakes accident/incident investigation to establish root causes of accidents/incidents; • Ensures statutory HSE audits and inspections are undertaken and reports filed appropriately; • Issues a construction HSE project report monthly; • Provides HSE documents requested by the Proponent or any HSE related lead agency.
HSE representatives	<ul style="list-style-type: none"> • Responsible for ensuring that relevant HSE work instructions are understood and fully implemented by fellow workers; • Reporting any accidents/incidents, unsafe acts or conditions to the HSE manager; • Reinforcing and encouraging the concept of individual HSE responsibility within their work teams; • Attend all HSE meetings and share proceedings with the rest of the work teams.
Sub-contractors	<ul style="list-style-type: none"> • Will be subjected to the EPC contractor's HSE appraisal; • Compliance with HSE laws and regulations and EPC contractor's HSE policies.
Suppliers	<ul style="list-style-type: none"> • Comply with the EPC contractor's HSE policy which will be forwarded to them by the HSE Manager; • Provide relevant HSE information to the HSE Manager associated with storage, use and disposal of supplies.

All personnel will be notified of their health and safety roles, responsibilities and accountabilities through communication of the Construction Health and Safety Management Plan and induction.

Personnel with defined Health and Safety responsibilities and accountabilities will acknowledge their understanding and acceptance of their roles and responsibilities through position specifications for key roles and verified by signature and induction records.

The Project Management Team will ensure that sufficient personnel with appropriate skills are appointed commensurate with the level of risk associated with construction activities and work and shift patterns during normal and emergency situations.

13.7.2 Employee involvement and communication

During the construction phase, employees will be involved in establishing and maintaining effective mechanisms to promote active consultation, communication and involvement in the management of health and safety and the control of workplace hazards. These will be undertaken through hazard identification workshops, job hazard analysis preparation and Health and Safety management system reviews.

As the proposed project will employ more than 20 persons, the EPC contractor will be required to comply with Legal Notice 31: Factories and Other Places of Work (Safety and Health) Committees Rules, 2004 by establishing a working H&S committee in each construction spread. The H&S committee will be formed according to the procedures listed in Legal Notice 31 and will meet at least quarterly.

The EPC contractor will develop a positive H&S culture on the project through active participation of involved parties. Methods to promote participation in achieving the project will include “Toolbox” and “Job Start” meetings, involvement in hazard identification workshops and Job Hazard Analysis preparation, induction and ongoing training, incident investigations and procedure reviews.

Acceptable methods and accessible packages for communicating Health and Safety information include health and safety alerts, posters and notice boards, minutes of meetings, performance reports, health and safety plans, procedures, legislation and technical operating manuals, and material safety data sheets.

Communication between the Proponent and the Project Management Team is a critical element in managing health and safety. Regular scheduled meetings and where necessary unscheduled meetings will be held to communicate H&S issues to all levels of the workforce throughout the Project.

13.7.3 H&S resources

Sufficient resources are necessary to develop, implement and maintain the Health and Safety Management System to achieve the Health and Safety objectives for the project.

The Project Management Team through project planning process will define and allocate sufficient resources in terms of finance, human and specialist advisers to implement the project H&S Policy and Safety Management System.

The project budget will specifically provide for the management of H&S on the project and to fund implementation of Safety Management System.

The Project Management Team will ensure management personnel are assigned sufficient authority to commit additional resources if required, to ensure H&S objectives are achieved.

The Project Management Team will appoint suitably qualified and experienced H&S personnel to facilitate the implementation of the safety management system.

The project planning process will include an assessment of the need for direct and indirect H&S resources i.e. first aid training and first aid trained personnel (paramedics and OHS nurses), field inspectors or specialist risk and safety management consultants to assist with risk assessment, auditing activities and rehabilitation providers.

13.8 Planning

13.8.1 Hazard identification and risk assessment

Hazard identification and risk assessment are critical in establishing a systematic approach to the management of hazards and risks associated with pipeline project activities.

The EPC contractor will use a systematic process to identify hazards, to assess the likelihood and consequences of risk and to agree on the implementation of controls to ensure risks associated with construction activities are reduced to As Low As Reasonably Practicable (ALARP).

These studies will be carried out early and a Project Risk Register developed before construction commences. The Risk Register will identify the need for the preparation of JHAs for work-crews, manual task assessments, specific plans, procedures, training to be conducted, personnel experience and qualifications, etc.

The construction hazard identification and risk assessment process will consider:

- Documented standards and procedures for systematic identification, assessment, control and review of risk;
- Agreed and documented Risk Acceptance Criteria;
- Competent and experienced personnel involved in hazard identification and risk assessment and control process;
- Construction methodology;
- Design specifications for construction;
- Safety in Design; and
- Consideration of continual review and analysis of the effectiveness of risk assessment and control processes.

13.8.2 Hazard and risk communication

The objective of hazard and risk communication is to establish systems and techniques for communicating hazard and risk information to relevant stakeholders and monitor feedback on the effectiveness of controls.

For the proposed project, the primary strategy for hazard and risk communication on site will be through the Job Hazard Analysis (JHA) process (also referred to as Job Safety Analysis, Job Risk Analysis, Job Safety and Environment Analysis, or Safe Work Method Statement). The process requires that supervisors actively involve all members of the work crew and other stakeholders in the development of the JHA through identification and control of hazards and risk on site. The JHA process will link into the formal hazard and risk identification process and Project Hazard Register.

Hazards, risks and their controls will form a significant part of the project training and induction program.

13.8.3 H&S Objectives, Plans and Performance Standards

Prior to the pre-construction and construction phase, the EPC contractor will define verifiable health and safety objectives, plans and standards for the project which reflect responsibilities, legislative requirements and project health and safety policy commitments. Typical objectives may include:

- Prevention of incidents;
- Control of hazards;
- Stakeholder consultation;
- Compliance with applicable legislative requirements;
- Compliance with approved industry standards and codes; and
- A platform for continuous improvement.

The Plan will incorporate agreed and measurable H&S performance objectives including both leading and lagging H&S performance indicators.

Project H&S objectives, plans and standards will be communicated to all personnel during induction and toolbox meetings to ensure an understanding of and participation in achieving the project health and safety objectives. Typical performance standards include:

Lagging Indicators	Leading Indicators
<ul style="list-style-type: none"> • Lost Time Incidents • Lost Time Incident Frequency Rate • Restricted Work Injuries • Medical Treatment Cases • First Aid Treatments • Near Misses • Vehicle Incidents 	<ul style="list-style-type: none"> • Planned Job Observations • Hazard Reports • Corrective Actions • Tool-box Talks • H&S Induction • H&S Inspections • H&S Audit Compliance

13.8.4 H&S management system documentation

The EPC contractor that will undertake the proposed project will be expected to be a company of high repute on H&S. Such EPC contractors understand the importance of having documented management systems. Subsequently, Project H&S documentation including revisions to the Safety Management System and Construction Safety Plan will be maintained in hard and electronic format on site. A revision to the key project H&S documentation i.e. plans, procedures, hazard identification and risk assessment records (i.e. JHAs) will be controlled through a formal Document Control process.

Documentation requirements such as safe operating procedures, work method statements, forms and records etc. will be consistent with any parent company documentation and as identified in any formal safety assessment.

13.8.5 Purchasing, contractors and importers

The proposed project will require several goods and services for successful implementation. Some of the goods and services will be imported by the EPC contractor. In procuring any goods and services for the proposed project, the EPC contractor will ensure that products and services for the construction phase have been assessed for health and safety impacts to ensure that once construction commences, all information is available and known.

Examples may be the purchase of PPE, construction equipment, chemicals, etc. The Project Management Team should ensure that contractors and suppliers are provided with the Project's health and safety requirements.

13.9 H&S Implementation

13.9.1 Design, construction and commissioning

In order to prevent accidents and hazardous activities, the EPC contractor will need to demonstrate that hazards and risk associated with design, construction and commissioning of the transmission line are eliminated or reduced to ALARP.

A Design Basis Memorandum will be prepared to ensure specified design requirements and safety performance standards are achieved. The design process will follow a systematic approach to planning, controlling, and verifying the design by appropriately qualified and experienced personnel in the industry.

Traceable records of design will assist to validate conformance with regulatory requirements, industry standards and sound engineering practice.

Key techniques to eliminate or reduce design, construction and commissioning risks include:

- Conceptual and Construction Hazard Identification meetings; and
- Commissioning Hazard Identification and Planning meetings.

The EPC contractor in consultation with the Project Engineer and Proponent will perform pre-commissioning.

A specific commissioning program for the transmission line will be prepared by the EPC contractor and Project Engineer to ensure the safety of personnel and the public during all commissioning activities.

Hand-over and approval for the transmission line during commissioning will be with the approval of the KETRACO, Kenya Power, Proponent and regulatory authorities following completion of construction activities.

13.9.2 Management Of Change (MOC)

Management of Change (MOC) is an important aspect of construction of the proposed project as it ensures that changes and modifications are reviewed for hazards and risk prior to implementation and information on change requirements are communicated to relevant personnel and stakeholders.

The EPC contractor will develop and implement an MOC process for changes to design, procedures, personnel, equipment, or construction methods that may have the potential to adversely affect H&S associated with the project. Changes will be managed through an approved Change Management Procedure where the potential impact and the significance of the change can be assessed. Significant changes including design changes will be documented where an assessment of the risk and safety implications are recorded, approved and sign-off by or on behalf of the Proponent.

Key personnel on the project will carry out a formal hand-over of responsibilities resulting from organizational changes, changes in reporting relationships and scheduled work absences.

Prior to implementation of changes to work processes, plant or equipment the proposed change will be communicated to relevant personnel during toolbox or H&S committee meetings.

13.9.3 Procurement and control of materials and services

The objective of including H&S in procurement and control of materials and services is to develop and maintain systems for the control of purchased services and materials to ensure additional hazards are minimized.

If any major specialist contractors are engaged on the project, they will be required to submit a Project Specific H&S Plan for the scope of their work. Alternatively the contractor will sign a formal statement of commitment for implementation of the EPC contractor's Construction H&S Management Plan.

Contractors and service providers will be managed in accordance with agreed management procedures that include:

- Selection of contractors based on experience, safety record and management systems;
- Selection of processes based on safety (quality and environmental) outcomes;

- Communication of the Project Safety Management System through contractual arrangements, planning meetings and induction etc.;
- Direct and ongoing monitoring of H&S performance through inspection and audits; and
- Selection of plant and equipment to ensure H&S considerations have been taken into account.

The EPC contractor will establish processes to ensure that materials are delivered and installed in a manner fit for purpose. These processes will include arrangements for monitoring of goods and services to ensure technical, quality, safety and environmental specifications are complied with.

Arrangements will be made for materials hand-over, traceability and reconciliation during load out. These arrangements will provide for quarantining of out of specification materials and plant.

All materials will be appropriately packaged, labeled and documented. Material Safety Data Sheets will be retained for any chemicals used in the project.

Vehicles and construction equipment including hired in plant and equipment will be selected with H&S considerations, and be delivered fit for purpose. Key provisions to ensure safety of plant will include:

- Supply of operating instructions and manuals,
- Supply of valid certificates from DOSHS approved persons for lifting equipment;
- Documented assessment of plant safety prior to releasing for use,
- Recording daily inspection/maintenance reports.

13.9.4 Safe Operating Procedures

Safe operating procedures (SOPs) are necessary in managing hazards and risk arising from project activities. SOPs provide the detail necessary to manage specific hazards and risks and to document processes for the management of controls used to ensure that a safe system of work for key work activities and tasks.

The EPC contractor will establish a clear, comprehensive and continually improving set of SOPs to cover the construction phase of the proposed project. SOPs will be developed as a result of the project risk assessment studies and link with the Job Hazard Analysis process for communication of control measures to site personnel. SOPs will be managed through the project document control process.

13.9.5 Materials handling and storage

As part of the proposed project, a materials handling and storage process will be developed to establish and maintain safe systems for the handling and storage of materials.

The EPC contractor will conduct an assessment of manual handling tasks as it will provide an important hazard and control measure as part of the Job Hazard Analysis process. Manual handling or ergonomic risk assessments will be incorporated in induction training and toolbox talks as a means of communicating control measures. Monitoring the effectiveness of manual handling controls will form part of the routine safety inspection or observation program.

The EPC contractor will establish and maintain a register of hazardous materials including chemicals used on the Project. Material Safety Data Sheets will be held on site for all potentially hazardous substances. Hazards associated with the use of hazardous substances will be assessed and incorporated into the task Job Hazard Analysis.

Hazardous materials or dangerous goods will be stored in designated areas consistent with applicable local legislation, codes of practice and segregation requirements. Refueling tanks and tankers will be located within a bunded area remote from accommodation facilities.

Lifting or winching of major plant items and materials will be the subject of and be performed in accordance with, a specific lifting methods statement incorporating a critical lift assessment prepared prior to commencement of the lift. Lifting equipment will be inspected by a competent person (DOSHS approved person) with valid certification and marking requirements recorded in a lifting equipment register prior to use on site.

Plant, equipment and materials will be secured to prevent unauthorized access or damage including deterioration e.g. as a result of excessive heat/cold/moisture/dust.

13.9.6 Maintenance and repair

During the construction phase, the EPC contractor may require establishment of systems for the maintenance of the construction plant and equipment.

Subsequently, the EPC contractor will develop and implement a program for routine inspection and maintenance of plant and equipment on the project site. Critical plant and equipment for inclusion in the inspection and maintenance schedule includes:

- Power Generators;
- Cranes and Lift Trucks;
- Slings and lifting equipment;
- Excavators;
- Site Trucks;
- Transport Vehicles;
- Power Leads and Portable Electrical Tools;
- Ladders and Scaffolding; and
- Safety Harnesses.

The EPC contractor will develop and implement inspection and maintenance schedules and frequencies to reflect manufacturers and legislative requirements as well as good construction work practice.

Plant and equipment requiring registration through the Plant Safety Order under the OSHA will be specified in a Plant and Equipment Register. Formal inspections by DOSHS approved persons will also be documented.

Records of plant and equipment inspections, maintenance, repair or modification will be retained in the Plant and Equipment Register.

Project-authorized drivers or operators will inspect project vehicles and plant regularly, and the results of the inspection recorded in a logbook.

Plant and equipment found to be defective or dangerous will be taken out of service and tagged as “Out of Service” until such time as a qualified technician has made suitable repairs.

13.9.7 Employee selection, competency and training

The EPC contractor will assess and plan the human resource requirements of the project to ensure personnel are suitably fit, competent and personal with the necessary safety behaviors for the tasks assigned to contribute to a positive safety culture on site.

Project H&S training requirements form an integral part of the overall project human resource strategy and training needs analysis. The competency criteria and safety attributes necessary for each position will be described in a Competency and Skills Matrix.

Where a position specification identifies statutory competencies (i.e. certification) evidence of such competencies will be required prior to selection and a copy of the certificate retained on site.

Training programs will be delivered by nominated workplace trainers and be reviewed and reassessed periodically to ensure the adequacy and effectiveness in delivery of required skills, knowledge and competencies.

All personnel on the project site will receive a project specific induction before commencing work and accessing the project site.

Induction training will address site and project specific health and safety issues identified in the hazard identification, risk assessment and control process, their responsibilities for H&S, the project safety management system and specific emergency arrangements.

Induction participants will be required to complete an assessment to determine their level of knowledge and understanding of the project induction training material.

All supervisors will attend a leader specific induction and be assessed for competency in key H&S knowledge prior to commencing work on site. The following includes some key H&S leadership skills:

- Legal obligations;
- Health and Safety responsibilities and Leadership;
- Safety Management System Commitments;
- Project Hazard Identification;
- Accident/Incident reporting;
- Emergency response leadership;
- Development of a JHA;
- Conducting toolbox meetings; and
- Lockout/Tagout (LOTO) procedures.

Specialized training may be required to address safety critical tasks and specific training needs relative to the project i.e. vehicle operation/driving, permit to work, manual handling, first aid, heat stress, etc. These training courses will be developed to complement the project safety management system and controls identified in the hazard identification and risk assessment process.

A specific induction will be developed and conducted prior to the commencement of Commissioning and Hand-over Activities. The focus of the Commissioning component of the induction process will communicate H&S information contained in the Commissioning Manual including isolation and tagging systems and emergency arrangements.

A record of all training will be retained on site in a Project Training and Induction Register. Training course materials, attendance and assessments records will be reviewed both as part of the project human resource strategy, monitoring and audit program.

13.9.8 Workplace environment

Workplace environment is part of the industrial hygiene program for construction sites to establish systems, facilities and processes which ensure and promote a safe work environment. The EPC contractor will develop health and safety processes to ensure and to promote a safe working environment. Management of workplace environment issues will be developed through the Project Construction Hazard Identification Assessment process and may include the following:

- Protection Against Atmospheric Contamination;
- Control of Dust;
- Housekeeping;
- Lighting and Ventilation;
- Noise Assessment & Management;
- Signposting & Hazard Identification;

- Personal Protective Equipment;
- Hygiene;
- Working Hours;
- Workplace Amenities;
- Chemical spill management; and
- Management of defective plant.

13.9.9 First aid and emergency response

13.9.9.1 First aid facilities and services

First Aid management is regulated in Kenya under Legal Notice 160: The Factories and Other Places of Work (First Aid) Rules, 1977. First Aid facilities will be appropriate to the type and location of the work being performed and be consistent with local regulatory requirements and the Project Emergency Response Plan. A risk assessment of possible emergencies with respect to the location/s will be conducted to ensure first aid equipment and resources are appropriate to manage all potential injury events on the site and travelling to and from site.

An approved and appropriate first aid kit will be available with each work-crew, motor vehicle, office, and accommodation facility. First aid equipment checks will form part of the regular site safety inspection program.

Each work-crew will generally have at least one first aider holding a current recognized first aid qualification.

A list of trained first aiders is to be displayed on site notice boards. First aiders will be readily identified (e.g. with a “First Aider” sticker or badge).

A First Aid Treatment Register will be kept for the project.

13.9.9.2 Emergency management

The EPC contractor will assess each project activity and potential external factors or influences that may give rise to identifiable emergency events and develop a project specific Emergency Response Plan.

The project Emergency Response Plan will assign roles and responsibilities of key personnel including assignment of an Emergency Coordinator and be developed in consultation with local authority and community emergency response agencies.

All personnel on site including visitors will be informed of key elements of the project Emergency Response Plan during induction and notified of any changes during Toolbox meetings. Matters to be covered in the project emergency response plan include:

- Muster and Assembly points;
- Emergency notification (sirens, radio, etc.) and communication arrangements;
- Communication protocols, equipment and facilities;
- Communication with Regulatory authorities and the Proponent;

- Interface with site personnel, other involved stakeholders and community emergency response agencies;
- Out of hours emergency arrangements; and
- Camp and facility emergency response arrangements.

An emergency contact list will be maintained and displayed at prominent locations and with each work-crew. The emergency contacts list will include the telephone numbers and location of community emergency response agencies and a list of project first aiders.

Emergency Drills will be scheduled and conducted at appropriate times to ensure readiness, adequacy and effectiveness of the Emergency Response Plan.

13.10 Monitoring and evaluation

13.10.1 Inspection, testing and monitoring

The objective of inspection, testing and monitoring is to ensure that the objectives of the project H&S policy and Safety Management System are implemented.

The EPC contractor will ensure that processes are implemented for the inspection, testing and monitoring of site construction activities, plant and equipment. Typical processes include:

- Procedures for ensuring plant is checked prior to use;
- Planned regime of health and safety inspections;
- Work activity observations;
- Pre-operation inspections of vehicles and plant;
- Inspection and testing of electrical equipment;
- Inspections of cranes and lifting equipment;
- Inspections of emergency, first-aid, fire and spill control equipment; and
- Camp and amenities inspections.

Planned inspections and/or observations will be performed by competent and experienced persons and include elected Health and Safety Representatives or the HSE Manager if there are no representatives. Inspections should follow an agreed format (i.e. checklist), timeframes, and be documented.

Supervisors should be trained to monitor work practices for health and safety issues and potential hazards as part of the daily Supervisor reporting process.

Identified unsafe or untagged plant and equipment should be tagged “Out of Service” until the plant or equipment is repaired or retagged by a competent and authorized person.

Recommendations for the elimination of hazards or unsafe practices or improvements in H&S practices including assigned responsible persons should be recorded in a Corrective Action and System Improvement Request. A Corrective Action Register should be used to track and close-out actions and improvements.

13.10.2 Health monitoring system

The Project should promote a healthy work environment and personnel should be fit to perform their normal duties safely. Health monitoring includes processes to ensure that personnel are fit for work with respect to their mental and physical capabilities. Policies and procedures should be in place to identify and manage employees' "Fitness for Work".

Typical health monitoring and "Fitness for Work" processes include:

- Pre-employment fitness and health assessments;
- Injury and rehabilitation management on and off the work site;
- Employee assistance programs;
- Drug and alcohol policy; and
- Camp and amenity hygiene.

13.10.3 Work injury benefits

Workers compensation in Kenya is covered under the Work Injuries Benefit Act, 2007 (WIBA) and its subsidiary legislation. The EPC contractor will be required to comply fully with the requirements of this Act prior to the pre-construction phase of the project. Evidence of valid workers compensation under the Act will be required to be kept at the project sites.

13.10.4 Accident/Incident reporting and investigation

Mandatory reporting of accidents/incidents is covered under Section 21 of the OSHA. Subsequently the EPC contractor will report all accidents, incidents and near miss incidents no matter how minor to the relevant County OSH Officer using the form titled DOSH 1.

All accidents will be investigated in order to identify, and eliminate or control the causes and prevent recurrences.

The EPC contractor will develop a project specific procedure for the reporting, investigation and implementation of corrective actions arising from accidents and incidents.

The following aspects will form an integral part of the accident/incident reporting and investigation process:

- Making the accident/incident scene safe;
- Protecting others (including members of the public) from injury;
- Treatment, medical assistance and evacuation of injured personnel;
- Assignment of responsibility for the accident/incident site;
- Assessment of the seriousness of the accident/incident event;

- Notification of organizational management personnel, employee representatives and DOSHS;
- Assignment of responsibility for reporting and investigation;
- Identification of witnesses and protecting evidence at the scene;
- Consultation with relevant authorities, site and operations personnel;
- Conducting investigation to identify root causes and recommendations to prevent recurrence; and
- Timely implementation of recommendations.

Corrective Action Requests provide a permanent and traceable record of the close-out of recommendations arising from accident/incident reports and investigations.

The type of accidents and incidents that must be reported as well as the timeliness of reporting and submission of investigation reports are dictated by organizational and legislative requirements.

Safety Alert Notices should be issued to disseminate information on incidents to project personnel.

13.10.5 H&S information and reports

The objective of having H&S information and reports is to establish and maintain a system for the analysis, dissemination, storage archiving and retrieval of information relevant to H&S.

The EPC contractor’s documentation control and records procedure will include maintenance and disposition of H&S information and records.

Typical project information and records include:

<ul style="list-style-type: none"> • Safety alerts • Hazard reports • Accident and incident reports • Hazard identification and risk assessment reports • Job Hazard Analysis • Inspection and maintenance records • Planned Job Observations • Hazardous materials registers • Material Safety Data Sheets 	<ul style="list-style-type: none"> • Noise assessment reports • Ergonomic and manual handling risk assessments • Qualification, certificate, training and induction records • Government notices • Audit reports • Meeting reports, toolbox talks, H&S committee meetings • Corrective actions • Calibration results
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Individual employee health records, including details of medical treatment and rehabilitation need to be controlled to maintain confidentiality.

Project Health and Safety performance will be monitored through a system of agreed leading and lagging indicators.

A Project reporting matrix will be established and displayed at the project site to ensure that Health and Safety reports are prepared and disseminated to relevant personnel within agreed time frames.

13.11 Audit, review and improvement

13.11.1 Project H&S audit

Throughout the construction period, a system and program of health and safety audits will be established, implemented and maintained to verify that the health and safety management arrangements are being implemented to specified regulatory and performance standards and to provide a mechanism to identify opportunities for system improvement.

Experienced and knowledgeable personnel will be used to conduct the audit.

Audit findings will be submitted in a formal report and corrective action request as appropriate.

13.11.2 Management review and improvement

Throughout the construction phase, the Construction Manager will periodically review the effectiveness of the safety management system in meeting the H&S Policy and objectives of the construction companies involved in the project and to drive the implementation processes necessary to achieve the Project H&S objectives.

The review process will utilize progress, audits and risk assessment reports, statistical data and client and stakeholder feedback, etc. to determine which arrangements adopted for the project are effective in meeting the Health and Safety policy objectives and where improvements can be realized.

Performance against the project Health and Safety Policy objectives and Safety Management System and project Health and Safety improvement plan should form a specific component of the project close-out report. Typical elements of the close-out report include:

- Identified areas for health and safety improvement;
- Sources of information used and applicable to the project;
- Effectiveness of employee communication and feedback
- Results of Accident/Incident Investigations;
- Results of monitoring, inspection and audit programs;
- Health and Safety impacts of changes in project delivery;
- Changes in the project organization structure;
- Sampling of management and employee safety perception "climate";
- Improvements in construction work practices and technology; and
- Community Health and Safety impacts and expectations.

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14 Prevention of health hazards and implementation of security measures

14.1 Introduction

Public health is the combination of sciences, skills, and beliefs that are directed to the maintenance and improvement of the health of all people. Therefore, the potential impacts of a major infrastructure project to public health can be substantial in both an adverse and a beneficial manner. Historically, there has not been a set of generally accepted standard guidelines or checklists to direct the public health impacts evaluation of large infrastructure projects, particularly in developing countries. Typically, public health evaluations have primarily focused on morbidity, mortality, and disability. Both the impacts and potential mitigation measures have generally been viewed through a health sector or disease specific perspective (e.g., malaria control programs) and have not necessarily considered the overall potential available to the infrastructure sector to positively impact and improve the quality of life and affect disease rates. Since the project is a sizable infrastructure effort, it is equally appropriate to evaluate its potential impacts in a broader perspective than traditional evaluation of disease morbidity, mortality and disability.

The analysis of potential health impacts for an infrastructure project should be conducted in a manner that is philosophically consistent with the shift from pure disease specific morbidity, mortality, and disability towards a broader consideration of the linkages between the proposed project and environmental health. In this setting, environmental health is the prevention of disease through the control of biological, chemical, or physical agents in the air, water, and food, and the control of environmental factors that may have an impact on the well-being of people.

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.

14.2 Potentially beneficial environment health impacts

In general, increased personal disposable income as a direct result of project employment, business opportunities and associated effects would result in an increase in spending on preventive and curative health services. It is expected that the following sub-sectors of environmental health will improve as a result of the proposed project:

- Respiratory diseases;
- Vector-related diseases;
- Sexually transmitted diseases (STDs);

- Water and food-borne diseases;
- Accidents and injuries, security;
- Chemical exposure-environmental disease.

The specific beneficial impacts of improvement in the above sub-sectors of environmental health as a result of the project are outlined below.

14.2.1 Respiratory diseases

- It is expected that local entrepreneurs would obtain information regarding building sanitation requirements which should positively influence future housing projects;
- New project workers would receive sanitation/hygiene training which should positively impact home environments;
- Diseases discovered during the project worker screening process would be identified for possible treatment.

14.2.2 Vector related diseases

- Local contractors/entrepreneurs would obtain design measures for vector control which should beneficially affect other local projects;
- Existing roads needed for the project will be improved, particularly drainage and the minimization of standing pools of water that provide vector habitats;
- Vector-related diseases which are discovered during new project worker screening would be identified for possible treatment.

14.2.3 Sexually transmitted diseases (STDs)

- New project workers would receive STD/HIV information, education and communication during orientation which should positively influence sexual behavior in the local community;
- STDs discovered during new project worker screening would be identified for possible treatment. This has the potential to reduce the HIV transmission rates.

14.2.4 Water and food-borne diseases

- Project water wells used during the construction phase and no longer needed for operations will be donated to the community providing a source for clean water, if feasible;
- Local entrepreneurs/contractors involved in camp site housing construction would obtain guidelines in the areas of water and food sanitation which should have a positive impact on future local projects;

- New project workers would receive food/water sanitation and hygiene training which should have a positive impact on the home environment.

14.2.5 Accidents and injuries, security

- Driver safety training would be provided to all project drivers thereby positively impacting overall road safety;
- Site-specific safety training received during new project worker orientation should positively influence safe work practices at other local projects;

14.2.6 Chemical exposure-environmental disease

- Programs would target potential chemical exposures and the prevention of environmentally related diseases, thereby positively impacting local health education.

14.3 Potential adverse health impacts

In order to prevent health hazards during the construction and operation phases, four sub-sectors have been selected:

- Temporary housing;
- Transportation;
- Water and sanitation; and
- Telecommunications.

There are fundamentally two types of public health related impacts that are associated with the project: 1) those impacts that arise out of or are a consequence of the project's presence and 2) those impacts that affect the project arising out of or as a consequence of the inherent disease burden in the project area. In this analysis, "impacts" refers to any change, beneficial (positive) or adverse (negative), above the hypothetical baseline that currently exists. A "significant" impact occurs when a meaningful change from existing conditions is either predicted or documented. The definition of "meaningful change" can be described qualitatively semi-quantitatively or fully quantitatively. The metric selected is a function of both the assessor's belief (professional judgment) and the size and numerical depth of the data characterizing existing conditions. For this section of the EIA Study, a qualitative assessment is provided.

Impacts are broadly categorized as having the potential to cause a change. "Significant" is used as a descriptor to imply that the change represents a meaningful movement, either up or down, from current conditions. If an impact is categorized as "mitigable", there is an assumption that 1) the impact is adverse and 2) a series of measures can be prescribed which will modify the effect such that projected deviations from existing conditions are judged to be less than significant "Unavoidable" is a term that is used when permanent and adverse impacts are expected despite a series of scientifically and ethically appropriate countermeasures.

In general, impacts exist in two broad categories: those that are internal (within the project facilities) and are therefore directly amenable to some level of technical and managerial control, and those that are external to the project facilities. This distinction between “internal” and “external” is a useful construct because project design measures can be more readily incorporated into internal activities, e.g., water supply and sanitation for the work force as opposed to external or adjacent community (village) activities. Internal and external adverse impacts requiring mitigation are anticipated during both construction (short-term impacts) and operations (long-term impacts). Overall, most of the impacts and associated mitigation measures would occur during the short-term construction phase of the project. The long-term operations phase is not as work intensive and will require substantially fewer personnel and less external logistical support. As a result, the magnitude of potential effects and associated need for mitigation measures will be significantly reduced.

14.3.1 Temporary housing

Temporary housing impacts are related to the construction phase of the project. Among the significant impacts are increased incidence of vector-borne diseases, respiratory illnesses, food supply and quality issues, injuries, and solid/liquid waste disposal problems for sanitary and non-sanitary wastes. Vector-borne diseases are represented by malaria, filariasis, yellow and dengue fever which are spread by mosquitos. Other vector-related diseases include schistosomiasis which is spread by snails; guinea worm which is spread by water fleas; leishmaniasis which is spread by sand flies (dogs and rodents are the reservoirs); and onchocerciasis which is spread by the blackfly. These diseases may increase due to either enhancement or disruption of breeding grounds for mosquitos and flies (pools of standing water) or habitats (rodents) which may be affected as a result of:

- Construction activities (temporary and permanent housing) and pipeline construction;
- Inadequate drainage within the project's camp area and external to the project (worker housing areas constructed locally);
- Clogged storm drains;
- Poor drainage at water distribution sites;
- Improper trash collection and disposal both within the project facilities and external to the project;
- Increased activity at public facilities due to influx of workers/worker families.

Respiratory illnesses may increase as a result of poor ventilation within temporary and permanent housing facilities both within the project facilities and external to the project facilities. Cooking in living quarters is a common factor in the increase of respiratory illnesses. The impact on respiratory diseases would be a significant but mitigable impact.

The potential for increases in food-borne illnesses would impact the internal project facilities and external community. Improper food sanitation practices could create epidemics of transmission both within project facilities and in the communities. Workers who contract a food-borne illness at project food facilities may transmit the disease to family members who could transmit the infection within the community. Increased utilization and demand on local facilities could impact overall food supplies. Potential impacts from food-borne illnesses are significant but mitigable.

Accidents and injuries may increase as a result of construction activities and workplace violence. There may also be increased rates of confrontations, fights, and crime both internal and external to the project facilities. This impact would be significant but mitigable.

14.3.2 Transportation

According to the World Bank literature review, transportation-related environmental issues with health repercussions are mainly concentrated on pollution control, i.e., air emissions from construction and work camp related activities. The impacts of STDs are considered significant because the oil field and pipeline construction and operation will require road construction and maintenance and the transportation of materials via trucks and railroads. The role of truckers in spreading STDs is widely acknowledged to be a major contributor to the spread of HIV and other STDs.

STD and vector-borne disease transmission associated with road transportation, construction, and operational maintenance is considered significant but mitigable. STD/HIV transmission is a complex mixture of biologic and sociologic factors that are not within the control of a private sector project. The role of government throughout the National AIDS Program is critical and must be coordinated with project initiatives, particularly those involving community information, education, and communication activities. In addition, project work force HIV/AIDS surveillance activities must be coordinated with existing government activities and programs. Other significant but mitigable impacts are accidents and injuries associated with road construction. Increases in vehicular traffic, workers, and pedestrians on new roadways, and road hazards created by construction equipment can enhance the risk of injuries. These potential impacts are significant but mitigable.

The transportation and handling of hazardous materials creates the risk of leaks, spills, and accidental releases. This is a significant-but-mitigable impact.

14.3.3 Water and sanitation

Construction-related activities that impact water supply and sanitation include:

- Spread of vector-borne diseases;
- Storm drainage-related problems; and
- Water utilization and availability problems.

Project water supplies would be obtained by using subsurface aquifers through a series of wells. Hence, the water quality can be closely monitored and maintained. Therefore, spread of water borne diseases through inadequate sources is expected to be a less-than significant impact.

Impacts surrounding storm drainage and runoff are significant but mitigable through the use of project design measures during both the construction and operations phases of the project. All waste effluents are to be treated and monitored so that storm drains do not become open sewers and trigger water borne disease episodes. Similarly, water utilization at active project sources by the external community would be prohibited so that cross contamination and over-utilization are prevented. Conversely, project wells would be given to the community, if feasible, at project completion. The transfer of secure water supplies to the external community is a beneficial impact.

On-site sanitation impacts are related to domestic and industrial solid waste management and environmental control. The large mobile work force associated with construction activities could produce significant solid and sanitary waste impacts; however, standard waste management and environmental control measures will be included in the project design. Therefore, impacts are less than significant. Sanitary and environmental waste issues could spread outside the confines of the project area and impact surrounding communities. These impacts could be produced by storm water/sewer overloads.

The spread of waterborne diseases across the project-community boundary is a significant impact since workers would be moving back and forth between the community and the project zone. Contaminated water and interpersonal contact are considered the main route of transmission of cholera epidemics which can rapidly spread. However, project design and mitigation measures would be implemented to reduce this impact to levels which are less than significant. Moreover, mitigation measures would provide contingency plans for supplemental chlorination, water delivery, and logistical support.

Increases in food/waterborne illnesses as a result of improper food/water sanitation practices both within the project and externally, are a significant but mitigable impact. Workers who contract a food-borne illness at project food facilities may transmit the disease to others within the community. Food management plans would reduce the potentially significant but mitigable impact on local food supply resources.

14.3.4 Telecommunications

Analysis of potential impacts demonstrates that overall beneficial impacts should be derived, particularly in the area of emergency services and reduced air pollution as a result of decreased vehicular use. The projects telecommunications systems would decrease the need for vehicular use for the transport of project-related messages, thereby decreasing vehicular air pollution which may increase respiratory diseases. Enhanced telecommunications systems would improve responses to emergency health needs as well as responses to fires, flood, and disaster. These are viewed as beneficial impacts both internally and externally.

14.4 Mitigation measures for prevention of health hazards

The potential environmental health effects associated with the proposed project were discussed in section 14.3. In summary, potential internal and external health impacts include:

- Increased incidence of respiratory diseases;
- Increased incidence of vector-related diseases such as malaria, schistosomiasis, filariasis and onchocerciasis;
- Increased incidence of sexually transmitted diseases including HIV;
- Increases in incidence of water and food-borne illnesses;
- Increases in accidents and injuries; and
- Increase in chemical exposures and environmental diseases.

The mitigation measures for each of the above environmental health hazards is given in the section below.

14.4.1 Respiratory diseases

To mitigate internal impacts, the Project Engineer should provide sanitation guidelines in the contracts for companies who are responsible for the construction and operation of temporary housing and mobile construction camps. These include living space guidelines such as minimal square footage per occupant, ceiling height, floor elevation, ventilation, exterior openings, lighting, and sanitation. These guidelines should also address toilet facilities, potable water, sewage disposal facilities, laundry, hand washing and bathing facilities. Sanitation and hygiene training would be incorporated into new employee orientation programs. Initial medical screening programs provided through the occupational health program would preclude workers with active respiratory diseases such as tuberculosis from working at the site. Transportation modes provided by the project to locally employed workers to and from the project would not be overcrowded, thus reducing the risk of respiratory disease transmission.

14.4.2 Vector-related diseases

Measures that address vector control and housing standards should be incorporated in the Request for Proposal (RFP) process for construction, operation, and maintenance of temporary and permanent housing. Health screenings and malaria surveillance programs should be implemented through the project occupational health program. Employee orientation sessions would be provided regarding the types of work activities which extend breeding areas for mosquitos due to temporary water accumulation. Measures that prevent water pooling along construction routes, near water sources, drains, sewers, housing areas, and waste management areas would be implemented.

14.4.3 Sexually transmitted diseases

During employee orientation, information, education and communications (IEC) sessions would be conducted for all workers addressing the prevention of STDs, including HIV. Condoms and signage regarding STD prevention would be available. The project occupational health program would provide medications for STDs found in workers which are curable, thereby reducing the number of active treatable STD cases in the population. Active STD prevention is associated with a significant (up to 40 percent) decrease in AIDS case rates. Project contractors, including trucking/transportation contractors, will be required to implement STD IEC programs aimed at reducing the transmission of STDs/HIV. Distribution and availability of condoms will be aggressively promoted.

The Government of Kenya will be responsible for implementing its existing programs and policies with the continued support of the World Bank and other development partners currently involved in Kenya's STD/HIV initiatives. These efforts will be concentrated in the project area during project construction. The role of the government in the overall approach to the problem of STDs is critical since the movement and activity of high risk commercial sex workers is an issue that cannot be controlled by the project. Ongoing monitoring and surveillance of AIDS/HIV rates for the community will be the responsibility of the government using existing policies, procedures, protocols, and strategies. Any monitoring of the work force or other activities for STD/HIV will be consistent and compatible with the overall Kenyan strategies for AIDS/HIV.

14.4.4 Water and food related illnesses

Sanitation requirements would be provided in the contracts for companies who are responsible for the construction and operation of temporary housing and mobile construction camps. These guidelines should address toilet facilities, potable water, sewage disposal facilities, laundry, hand washing, and bathing facilities. Stewardship measures that include timely audits and evaluations should be implemented. Sanitation and hygiene training would be incorporated into new employee orientation programs.

Specifications should be in place for food and water supply maintenance to prevent depletion of local food and water sources. Food sanitation standards should be provided for contractors who provide food service for temporary and permanent housing units. These standards would include: 1) food protection; 2) food storage; 3) food preparation; 4) food display; 5) food transportation; 6) food handlers' health, personal cleanliness, clothing, and practices; 7) equipment and utensil cleaning and sanitization and storage; 8) potable water supply, plumbing, and toilet facilities; 9) insect and rodent control; 10) construction and maintenance of physical food service facilities; 11) bacterial testing; and 12) work practice evaluations. Work practice evaluations are an essential component of an effective program since the prevention of enteric (diarrheal) diseases by their nature, involve behavioral change. Food handlers should have valid 6-monthly Food Handlers Certificates and should participate in health screening programs on a regular basis through the project occupational health service.

The implementation of an effective food sanitation program will create both short-term improvements and widespread sustained improvements over the long-term life of the project.

Local entrepreneurs would have the opportunity to contract as food supply sources for the project. They should be provided information on project requirements such as: 1) food protection; 2) food storage; 3) food preparation; 4) food transportation; 5) food handlers' health, personal cleanliness, clothing, and practices; 6) equipment and utensil cleaning and sanitization and storage; 7) water supply and pit latrines; and 8) insect and rodent control. After meeting measures for the protection of food, these local contractors would be equipped with the knowledge and skills to provide safe food products at local marketplaces, thereby positively impacting local food sources.

14.4.5 Accidents and injuries

Specific measures will be in place to maintain a safe work environment and prevent accidents. Site specific medical emergency response plans will be in place for all work locations. Should an incident occur, specific investigation procedures would be in place to determine the cause and prevent future occurrences. During orientation, on-site safety training for all project personnel and driver safety training for all drivers will be provided. Project workers will be required to use appropriate safety equipment and follow site safety practices.

Road safety signage would be installed along existing roadways utilized for the project. Pictorial construction safety signage around all construction sites would be provided. Access to construction areas will be limited. The project work force, including drivers should participate in a drug and alcohol program.

Cross-cultural training which relays information regarding the variety of cultures represented during the construction phase of the project would be provided during employee orientation. An understanding of cultural behavioral differences can reduce risks for workplace violence. Specific security measures would be in place to address violence at the work site and security problems. Project contractors would be responsible for developing and implementing an accident/injury prevention plan(s) to address worker safety.

The project would provide educational programs geared toward adults and children focusing on construction safety, particularly in areas of excavations, temporary storage of construction/excavation debris, and erosion mudslides. Child safety would also be presented.

14.4.6 Chemical exposure-environmental disease

Standard waste management practices and waste management plans would be incorporated into the project design. Appropriate waste inventory plans would be implemented along with an effective waste management plan and emergency response plan. An occupational health program which would include both medical and industrial hygiene components should be implemented. Contingency plans should be in place for the provision of supplemental water during waterborne disease epidemics. Medical waste would be appropriately separated and managed to prevent the spread of blood-borne pathogens.

Covered parking facilities, if added to the design (currently not included) for motor vehicles would be designed with adequate ventilation measures to prevent accumulation of exhaust gases. Vehicular maintenance procedures would be implemented for equipment utilized for construction.

14.5 Security related mitigation measures

Not only do health issues impact on communities, but the physical safety of communities can also be endangered as a result of the influx of job seekers and construction workers (e.g. potential increase in crime). There is perception that crime increases in an area the moment that construction workers arrive on site. Because of this perception, occurrences of crime during the time of the project are likely to be ascribed to the construction workers. This has a mental health impact, such as fear. However, it should be noted that in most instances it is not the actual construction workers who engage in criminal activities but more likely job seekers who loiter at the site in search of employment.

General security related mitigation measures will include:

- Construction workers should be clearly identifiable. Overalls should have the logo of the construction company on it and/or construction workers should wear identification cards.
- The construction site and construction camp should be fenced and access should be controlled by means of a security access point.
- Loitering of outsiders at the either the construction site or at the construction village should not be allowed. Loiterers at the site or the camp should be removed in cooperation with the local South African Police Service.

14.5.1 Security action plan

The security action plan to be implemented during the construction phase will include the following:

- Access to the construction site will be strictly controlled by a security company;
- There will be 24-hour security on-site;
- Labor should be transported to and from the site to discourage loitering in adjacent areas and possible increase in crime or disturbance;

- Unsocial activities such as consumption or illegal selling of alcohol, drug utilization or selling and prostitution on site should be prohibited. Any persons found to be engaged in such activities shall receive disciplinary or criminal action taken against them;
- The site shall be fenced (where necessary) to prevent any loss or injury to persons or livestock during the construction phase;
- If any fencing interferes with the construction process, such fencing shall be deviated until construction is completed. The deviation of fences shall be negotiated and agreed with the landowner in writing;
- No alcohol/drugs will be present on site;
- No firearms will be allowed on site or in vehicles transporting staff to/from site (unless used by security personnel);
- No harvesting of firewood will be allowed from the site or from the residential and business properties adjacent to it;
- Construction staff is to make use of the facilities provided for them, as opposed to ad-hoc alternatives (e.g. fires for cooking, the use of surrounding bush as a toilet facility are forbidden);
- Trespassing on private/commercial properties adjoining the site is forbidden;
- Driving under the influence of alcohol is prohibited;
- All employees must undergo the necessary safety training and wear the necessary protective clothing;
- Secure the site in order to reduce the opportunity for criminal activity in the locality of the construction site.

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15 Gaps in knowledge and uncertainties encountered

15.1 Introduction

The proposed 220KV transmission line project is a new development not having been undertaken before. 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:

- It is assumed that detailed topographical and geotechnical studies will be carried out as part of the engineering design of the proposed 220KV transmission line project;
- It is assumed that the routing identified by KEL represents a technically suitable site for the proposed 220KV transmission line project and associated infrastructure;
- The ESIA Study was undertaken based on baseline environmental and social studies undertaken by the Firm of Experts and technical knowledge transmission line construction and operational phase impacts;
- 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;
- The cumulative impacts arising from other similar projects have been assessed qualitatively as it is unknown when these projects will realistically commence;
- It is assumed that KEL has signed easement agreements with all affected land owners for the transmission line route and compensated the land owners;
- Due to the interrelated nature of biophysical, social and economic issues, it is assumed that individual specialists collaborated to discuss shared and/or overlapping issues and/or impacts in order to establish complementary ways of avoiding and/or managing and/or mitigating impacts.

KEL and its contractors will implement the measures contained in the EMP, and that the EMP will be revised to include the requisite studies, plans, method statements and operational procedures prior to the commencement of construction and/or operational activities.

KEL and its consultants will adopt a process of continual improvement when managing and/or mitigating negative environmental impacts arising from the project. The EMP will be used as the basis of environmental management and will be regularly improved and refined.

A monitoring and evaluation system, including auditing, will be established and operationalized to track the implementation of the EMP to ensure that management measures are effective to avoid, minimize and mitigate impacts and that corrective action is being undertaken to address shortcomings and/or non-performances.

15.3 Limitations

The strategic importance of the project implies that the project program has been and continues to be under significant pressure. This includes the time available to meet regulatory requirements such as the EIA License for the project.

For avifauna, any inaccuracies in the sources of information used during the ESIA process could limit the outcomes of this study. For example, there are no bird atlases available for the project area and subsequently firsthand knowledge of the avifauna around the project area remains less than comprehensive.

On terrestrial ecology, red listed species by their nature are usually rare and difficult to locate. Compiling the list of species that could potentially occur in an area is limited by the paucity of collection records that makes it difficult to predict whether a species occurs in an area or not. While the methodology used tries to reduce the risk of omitting any species, it is possible that a species that does not occur on a list may unexpectedly occur in the project area.

On the social impact assessment, the demographic data used is largely based on the 2009 national census. While the data provides useful information about the demographic profile around the project area, the information is dated and should be treated with care.

While the development is being designed to significantly minimize risk through implementation of the latest international transmission line industry standards, and will include international peer review, the possibility of incidents resulting in fire, electrocutions, etc. cannot be ruled out.

15.4 Assumptions

It is assumed that the strategic importance of promoting renewable energy such as wind power is supported by the national energy policy.

Given that there is only one operational wind energy project in Kenya, practical experience of the environmental effects of wind energy facilities in the country is extremely limited. Subsequently, estimates of potential environmental and social impacts are based on lessons learnt internationally.

It is assumed that the transmission line routing identified by KEL represents a technically suitable route for the 220KV transmission line project.

15.5 Gaps in knowledge

The baseline environmental and social studies for the proposed 220KV transmission line project were undertaken between February and July 2013. Climatically this was the period when the wet season was in progress and towards June, the cold season was commencing. Following the ESIA, the Firm of Experts established a list of gaps in knowledge:

- Grave sites and cultural resources: While there was no evidence along the proposed transmission line routing, community and traditional leaders need to be consulted on the potential for finding grave sites within the easement;
- Easement agreements: KEL needs to formalize easement agreements with the land owners along the transmission line route;

This study does not consider how the existing and future power needs of Kenya and the future effects of climate change may affect demand side management of the project.

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16 Conclusions

Kipeto Energy Limited (KEL) is proposing to construct a 220kV transmission line between their wind farm sub-station and the proposed Kenya Power Isinya switching sub-station; the total length of the transmission line is about 17km. The project involves acquisition of a wayleave (or right of way – ROW) 60m wide from land owners along the transmission line route.

Once completed, KEL will hand over the transmission line to Kenya Power who will sign a Power Purchase Agreement (PPA) with KEL.

The Environment and Social Impact Assessment (ESIA) for the proposed transmission line project has been undertaken in accordance with the 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 project;
- 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 along and in the vicinity of the ROW 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 – D provide a detailed assessment of the impacts on the social and biophysical environment as a result of the project. This chapter concludes the ESIA Study by providing an assessment summary of the proposed project. In so doing it draws on the information gathered as part of the ESIA process and the knowledge gained by the Firm of Experts and Specialists associated with the proposed project.

Avifauna: the impacts to avifauna resulting from the proposed transmission line are expected to have a medium to low impact prior to mitigation. With mitigation, the residual impacts on avifauna were established to be low. The unmitigated impacts of concern are potential collisions of avifauna with the transmission lines and associated infrastructure and electrocutions associated with the larger birds.

Bats: A total of fifteen species of bats categorized into eight families were surveyed in the Kipeto wind farm and transmission line footprint area respectively. The unmitigated potential impacts associated with bats on the proposed transmission line are electrocution and collisions. Most impacts on bats were classified as either medium or low without mitigation and were all low after mitigation.

Terrestrial ecology: Overall, the proposed 220kV transmission line project is expected to have a medium to low impact on ecology within the project area prior to mitigation. The unmitigated impacts on ecology are more pertinent within riverine areas and bush land that will be cleared for the wayleave than in other parts of the ROW. An additional significant concern without mitigation is the potential introduction of alien invasive species which is considered a long-term irreversible impact if not mitigated effectively.

Socio-economics: Most of the potential positive socio-economic impacts as a result of the construction of the proposed project are expected to be low without enhancement and medium with enhancements. The positive impacts relate to change in the economic profile of the land owners and non-land owners in the Kipeto area. Access roads are expected to be upgraded during the construction phase to allow construction materials to be safely transported to the wayleave.

A potential adverse social impact relates to disturbance caused by construction related activities such as construction plant, vehicles, etc., noise, dust emissions, influx of workers from outside the communities, etc. The damage associated with construction safety hazards is expected to be from medium to low without mitigation measures and low after implementation of the mitigation measures.

16.2 Overall conclusion

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 transmission line project from proceeding provided that the recommended mitigation measures and EMP are implemented and given due consideration during the detailed engineering design and construction phases respectively;
- Based on the social impact assessment, most landowners welcome 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 represents an investment in renewable supply of electrical power to the national grid which is an essential part of the energy mix and security of Kenya;
- By having the proposed project, Kenya will continue to grow economically with additional supply of electricity to the national grid.

The significance levels of the majority of identified negative impacts can generally be reduced by implementing the recommended mitigation measures.

Some of the negative impacts that will require management include:

- Risks to public safety, avifauna, bats during the operational phase;
- Potential negative impacts associated with inconsistent communications with land owners;
- Increased risk of disease with influx of workers.

It is anticipated that it will be possible to successfully mitigate impacts associated with the development. In particular, the transmission line will be designed, constructed and operated according to the latest industry norms and standards. The ESMP includes plans to be formulated during the pre-construction, construction and operational phases respectively and has been developed as part of the ESIA to manage potential impacts. Programs and plans developed and implemented through the ESMP will be monitored and audited to ensure compliance.

As stated above, the project is anticipated to offer several benefits (positive impacts) either directly or through the spin-offs generated by the development and operation of the transmission line. These include: the creation of employment opportunities, especially during the preconstruction and construction phase; national economic development; and improved stability of electrical transmission. These positive impacts should be enhanced wherever possible.

16.3 Overall recommendation

It is the opinion of the ESIA project team that the potential environmental and social impacts associated with the proposed transmission line project should 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 transmission line, the findings of this ESIA and the understanding of the level of significance of potential impacts.

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