ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDY REPORT FOR THE PROPOSED KITUI- MUTOMO- KIBWEZI HIGH VOLTAGE TRANSMISSION LINE PROJECT

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OCTOBER, 2017

CERTIFICATE OF DECLARATION AND DOCUMENT AUTHENTICATION

This document has been prepared in accordance with Environmental (Impact Assessment and Audit) Regulations, 2003 of the Kenya Gazette supplement No. 56 of 13th June 2003, Legal Notice No. 101.

LEAD EIA/AUDIT EXPERTS:

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Date: ----------

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NAME: DR. (ENG.) JOSEPH SIROR

DESIGNATION: GENERAL MANAGER, TECHNICAL SERVICES

Signature----------

Date----------

Do hereby certify that this report was prepared based on the information provided by various stakeholders as well as that collected from other primary and secondary sources and on the best understanding and interpretation of the facts by the Environmental Social & Impact Assessors. It is issued without any préjudice.

EXECUTIVE SUMMARY

Introduction

According to the Ministry of Energy, the existing power transmission system capacity is constrained particularly during peak hours when system voltages in parts of Nairobi, Coast, West Kenya and Mount Kenya drop below acceptable levels, causing occasional load shedding despite the availability of generation capacity.

To address these constraints, the Kenya Electricity Transmission Company (KETRACO) has identified the need for a number of new transmission projects. Among these projects is the 132kV Kitui – Mutomo – Kibwezi transmission line project. The project is aimed at enhancing the adequacy, reliability, and security of electricity power supply in Kitui, and Makueni Counties. The project will also help meet the increasing demand for power supply and minimize the frequency of power outages.

The Kenya Government policy on all new projects requires that an Environmental and Social Impact Assessment (ESIA) study be carried out at the project planning phase in order to ensure that significant impacts on the environment are taken into consideration at the construction, operations and decommissioning stages.

This Environmental Impact Assessment has identified both positive and negative impacts of the proposed project to the environment and proposes mitigation measures in the Environmental Management Plan (EMP) developed to address potential negative impacts, during the construction, operation and decommissioning phases of the project, for overall environmental sustainability.

Study Objectives

The principal objective of this assessment was to identify significant potential impacts of the project on environmental and social aspects, and to formulate recommendations to ensure that the proposed project takes into consideration appropriate measures to mitigate any adverse impacts to the environment and people's health through all of its phases (construction, implementation and decommissioning phases).

Study Methodology

The approach to this exercise was structured such as to cover the requirements under the Environmental Management and Co-ordination (Amendment) Act, 2015 as well as the Environmental Management and Coordination (Impact Assessment and Audit) Regulations 2003. It involved largely an understanding of the project background, the preliminary designs and the implementation plan as well as decommissioning. In

addition, baseline information was obtained through physical investigation of the site and the surrounding areas, desktop studies, public consultations with members of the community in the project areas, survey, photography, and discussions with key people in KETRACO (the proponent).

The key activities undertaken during the assessment included the following:

- Consultations with the key project stakeholders including the project proponent, community members, County administration, opinion leaders and National and County Government departmental heads. The consultations were based on the proposed project, site planning and the project implementation plan;
- Physical inspections of the proposed project area which included observation of available land marks, photography and interviews with the local residents;
- Evaluation of the activities around the project site and the environmental setting of the wider area through physical observations and literature review;
- Review of available project documents; and
- Report writing, review and submissions.

Conclusion

An Environmental and Social Management Plan (ESMP) outline has been developed to ensure sustainability of the site activities from construction through operation to decommissioning. The plan provides a general outlay of the activities, associated impacts, and mitigation action plans. Implementation timeframes and responsibilities are defined, and where practicable, the cost estimates for recommended measures are also provided.

A monitoring plan has also been developed and highlights some of the environmental performance indicators that should be monitored. Monitoring creates possibilities to call to attention changes and problems in environmental quality. It involves the continuous or periodic review of operational and maintenance activities to determine the effectiveness of recommended mitigation measures. Consequently, trends in environmental degradation or improvement can be established, and previously unforeseen impacts can be identified or pre-empted.

It is strongly recommended that a concerted effort is made by the site management in particular, to implement the Environmental Management and Monitoring Plan provided herein. Following the commissioning of the proposed project, statutory Environmental and Safety Audits must be carried out in compliance with the national legal requirements, and the environmental performance of the site operations should be evaluated against the recommended measures and targets laid out in this report.

It is quite evident from this study that the construction and operation of the proposed project will bring positive effects in the project area including improved supply of electricity, creation of employment opportunities, gains in the local and national economy, provision of market for supply of building materials, informal sectors benefits, Increase in revenue, Improvement in the quality of life for the workers and community members, and Improved security.

Considering the proposed location, construction, management, mitigation and monitoring plan that will be put in place, the project is considered important, strategic and beneficial and given that all identified potential negative impacts can be mitigated and that no community objection was received, the project may be allowed to proceed.

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LIST OF ABBREVIATIONS

AFD	Agence Francaise de Development
AfDB	African Development Bank
AGO	Automotive Gas Oil
AST	Above Ground Storage Tank
CB	Circuit Breaker
CT	Current Transformer
CVT	Constant Voltage Transformer
CO_2	Carbon Dioxide
CO	Carbon Monoxide
DO	District Officer
DOHSS	Directorate of Occupational Health and Safety Services
DC	District Commissioner
EA	Environmental Audit
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EMCA	Environmental Management and Coordination Act
EMoP	Environmental Monitoring Plan
EMP	Environmental Management Plan
ERC	Energy Regulatory Commission
GDC	Geothermal Development Company
GHGs	Green House Gases
GoK	Government of Kenya
HFO	Heavy Fuel Oil
IPP	Independent Power Producer
KenGen	Kenya Electricity Generating Company
KETRACO	Kenya Electricity Transmission Company
KFS	Kenya Forest Service
KPLC	Kenya Power and Lighting Company
Kshs.	Kenya Shillings
kV	Kilo Volt
KWH	Kilo Watt Hour
KWS	Kenya Wildlife Service

LCPDP	Least Cost Power Development Plan
LILO	Line In Line Out
L.R	Land Registration
mg/kg	Milli grams per kilogram
MoE	Ministry of Energy
MW	Mega Watts
MVA	Mega Volt Amperes
NEMA	National Environment Management Authority
NOX	Oxides of Nitrogen
OSHA	Occupation Safety and Health Act
PM	Particulate Matter
PPE	Personal Protective Equipment
REA	Rural Electrification Authority
SF_6	Sulphur Hexafloride
SHE	Safety Health and Environment
SOX	Oxides of Sulphur
STD	Sexually Transmitted Diseases
WRMA	Water Resources Management Authority

CHAPTER 1: INTRODUCTION

1.1: PROJECT BACKGROUND

Vision 2030 is Kenya's development blueprint covering the period 2008 to 2030. The objective of Vision 2030 is to help transform Kenya into a, "middle-income country providing a high quality of life to all of its citizens by the year 2030". The Vision outlines the Government of Kenya's economic growth objectives.

Vision 2030 recognizes the energy sector as one of the infrastructure enablers of the economic, social and political pillars underlying the Vision. The sessional paper No. 4 of 2004 on Energy recognizes that affordable, quality and cost effective energy services is an important prerequisite for attainment of accelerated social and economic growth and development. In view of these considerations, energy sector development is a key policy concern for Kenya's development.

To guide the energy sector development, the Ministry of Energy in 2011 developed the Least Cost Power Development Plan (LCPDP). In pursuit of the provisions of section 5 (g) of the Energy Act No. 12 of 2006 that mandates the Energy Regulatory Commission (ERC) to prepare Indicative National Energy Plans, the Commission in conjunction with key stakeholders in the energy sector including; officers from the Ministry of Energy (MoE); Kenya Electricity Generating Company (KenGen); Kenya Power and Lighting Company (KPLC); Kenya Electricity Transmission Company (KETRACO); Geothermal Development Company (GDC); Rural Electrification Authority (REA); The Ministry of State for Planning, National Development; Kenya Vision 2030 Board, Kenya Investment Authority (KenInvest); Kenya Private Sector Alliance (KEPSA); and the Kenya National Bureau of Statistics (KNBS); updates the LCPDP every second year. This report focuses on developments in the electric power sub-sector and takes a long-term view of the sector, given a set of assumptions.

According to ERC annual report 2014/2015, The demand for electric power continued to rise significantly over the last five years driven by a combination of normal growth, increased connections in urban and rural areas as well as the country's envisaged transformation into a newly industrialized country as articulated in Vision 2030. However, the power market remained unbalanced with this demand not fully met by supply. This is mostly due to system constraints and weather challenges. The peak demand rose from 1468MW in 2013/14 to 1512MW in 2014/15. The supply of electricity showed a 6.8% increase from 8,839GWh in 2013/14 to 9280GWh in

2014/15. The recorded total consumption also demonstrated a significant increase, recording a total of 7655GWh compared to 7244GWh in 2013/2014.

The number of customers connected to the national grid increased by 30.5% from 2,767,983 in 2013/14 to 3,611,904 in 2014/15. The customer base had increased by 18.7% between 2012/13 and 2013/14. This increase in number of customers was as a result of the “last mile connectivity” by KPLC where life line customers were being connected at KES 1,160.00 and continued enhanced connectivity by the Rural Electrification Authority to schools and other public amenities. The sales of the commercial and industrial customer category increased marginally, from 3,819GWh in the year 2013/2014 to 4,030GWh in 2014/2015.

As at June 2015, Kenya had an installed electricity generation capacity of 2,299MW comprising of hydro (821MW), thermal (827MW), geothermal (598MW), wind (25.5MW), co-generation (26MW), and solar (0.57MW).

Table 1.1: Installed Capacity and Effective Power Generation

	Installed MW	**Effective MW**
Hydro	820.7	800
Geothermal	588.0	579.9
Thermal (MSD)	720.0	701.5
Temporary Thermal (HSD)	30.0	30.0
Thermal (GT)	60.0	54.0
Wind	25.5	25.5
Cogeneration	26.0	21.5
Interconnected systems	2,270	2,210
Off grid thermal	26.8	23.1
Off grid wind	0.66	0.61
Off grid solar	0.55	0.212
Imports	000	000
Total capacity	**2,299**	**2,234**

Source; KPLC 2014/2015

The existing transmission network lengths stands at 1,434km of 220kV and 2,513km of 132kV while the distribution network stands at 1,212km of 66kV, 20,778km of 33kV and 30,860km of 11kV lines respectively. Sub-station capacity expanded from 3,181MVA in 2013/14 to 3,612MVA in 2014/15.

Table 1.2; Transmission Circuit Network (kms)

Voltage (KV)	2014/2015
220	1,527
132	2,527
66	1,212
33	21,370
11	32,823
415/240 or 433/250	23,502
TOTAL	**82,961**

Source; ERC

The existing transmission system capacity is constrained particularly during peak hours when system voltages in parts of Nairobi, Coast, West Kenya and Mount Kenya drop below acceptable levels, causing occasional load shedding despite the availability of generation capacity.

To address these constraints, the Kenya Electricity Transmission Company (KETRACO) has identified the need for a number of new transmission projects. Among these projects is the 132kV Kitui – Mutomo – Kibwezi transmission line project. The project is aimed at enhancing the adequacy, reliability, and security of electricity power supply in Kitui, and Makueni Counties. The project will also help meet the increasing demand for power supply and minimize the frequency of power outages.

The main characteristics of the Substations envisaged by the project are:

- **Kitui:** To secure in N-1, the supply of Kitui. Presently, Kitui is supplied on 33 kV from Thika.
- **Mutomo:** Is presently not connected to the grid. Since its distance to the grid is about 100 km, the 66 kV level cannot be used, therefore the 132 kV level has to be considered.
- **Kibwezi**: This link Kibwezi - Kitui is proposed to secure in N-1 the supply of Kitui. Note that Kibwezi is expected to be a future hub for coal Generation, but evacuation is expected to be mainly on 400 kV link to Nairobi.

The load forecast is as follows:

		2015	2020	2025	2030
Substation		**MW**	**MW**	**MW**	**MW**
Kitui	A	2.0	3.6	6.8	13.5
Kibwezi	B	10.2	19.6	37.4	71.5
Mutomo	C	8.4	16.1	30.8	58.9

There is a project currently being implemented, that includes a 132/33kV substation at Kitui, under Mwingi-Kitui – Wote - Sultan Hamud TL project.

Objective of the project

- The project is designed for catering the loads of Kibwezi and Mutomo from Kitui.

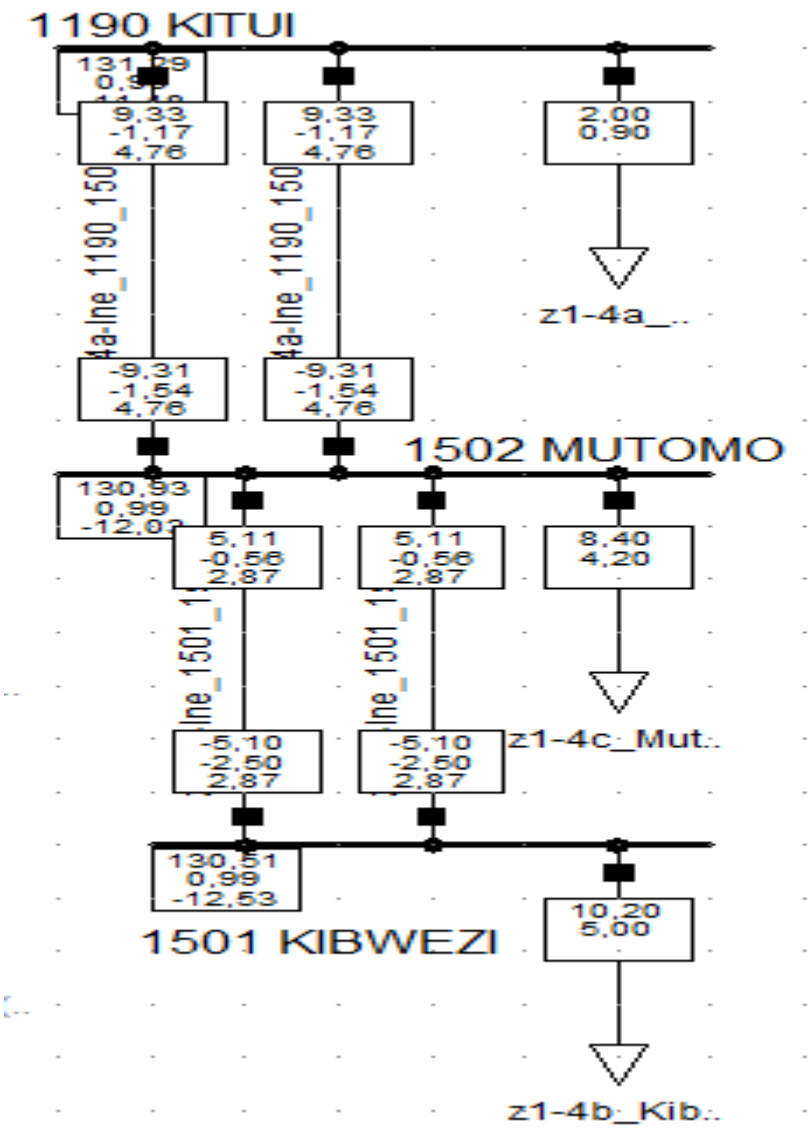
With the load of 2020 and a single circuit installed, the voltage at Mutomo decreases to 0.92 pu, except if approx 5 Mvar of capacitors are installed (voltage then is 0.95 pu at Mutomo). With a Double Circuit 1x200 mm^2 between Kibwezi - Mutomo and 2x200mm^2 between Kitui - Kibwezi sections, (this is the arrangement that proves to be necessary for 2030), there is no need for reactive compensation, the voltages are then above 0.97 pu.

With the load of 2025 and a single circuit, an overload of 125% is observed in the Kitui - Kibwezi section. Hence, a double circuit line is proposed for the Kitui - Kibwezi section. However, the voltage in that case is unacceptable (0.95 pu at Kitui and 0.83 pu in Mutomo). Therefore capacitors have to be installed near the load at each of the three Substations, typically 20 Mvar for the 2025 stage. The voltages then become 0.99 pu in Kitui, 0.97 pu in Kibwezi, 0.95 pu Mutomo.

With the load of 2030, and compensating fully the reactive load, the voltage decreases to 0.93 pu at Mutomo. In which case, the Kibwezi-Mutomo section needs to be designed with a double circuit as well. That way, the planned project is compliant with the N-1 criteria in 2030.

However, this might not lead to voltages of 0.95 pu or above. The network calculations show that there is a need to overcompensate the reactive load, installing 50 Mvar at Kibwezi and Mutomo and 20 Mvar at Kitui.

An option is to consider circuits made of a bundle of two conductors (Lark 2x200 mm^2), which allows to reduce the capacitors to 45 Mvar at Kibwezi and Mutomo and 20 Mvar at Kitui. This situation in 2030 is described by the following single line diagram which shows voltages well controlled (above 0.97 pu).



Conclusion for the design:

- The 132 kV level is proposed as per the initial project, but with a double circuit line having each circuit equipped with a bundle of two 200mm² conductors (double Lark).

The Kenya Government policy on all new projects requires that an Environmental and Social Impact Assessment (ESIA) study be carried out at the project planning phase in order to ensure that significant impacts on the environment are taken into consideration at the construction, operation and decommissioning stages.

This Environmental Impact Assessment has identified both positive and negative impacts of the proposed project to the environment and proposes mitigation measures in the Environmental Management Plan

developed to address potential negative impacts, during the construction, operation and decommissioning phases of the project, for overall environmental sustainability.

1.2: STUDY OBJECTIVES

The principal objective of this assessment was to identify significant potential impacts of the project on environmental and social aspects, and to formulate recommendations to ensure that the proposed project takes into consideration appropriate measures to mitigate any adverse impacts to the environment and people's health through all of its phases (construction, implementation and decommissioning phases).

The specific objectives of this ESIA were to:

- Identify and assess all potential environmental and social impacts of the proposed project;
- Identify all potential significant adverse environmental and social impacts of the project and recommend measures for mitigation;
- Verify compliance with the environmental regulations and relevant standards;
- Identify problems (non-conformity) and recommend measures to improve the environmental management system;
- Generate baseline data that will be used to monitor and evaluate the mitigation measures implemented during the project cycle;
- Recommend cost effective measures to be used to mitigate against the anticipated negative impacts;
- Prepare an Environmental Impact Assessment Report compliant to the Environmental Management and Co-ordination (Amendment) Act, 2015 and the Environmental (Impact Assessment and Audit) Regulations (2003), detailing findings and recommendations.

1.3: TERMS OF REFERENCE (TOR) FOR THE ESIA PROCESS

The following are the TOR for the ESIA process

- Description of the baseline environment (physical, biological, social and cultural)
- Detailed description of the proposed project
- Review Legislative and regulatory framework that relate to the project
- Identify potential environmental impacts that could result from the project
- Carry out public consultation on positive and negative impacts of the project
- Propose mitigation measures against identified environmental and social impacts of the project
- Development of an Environmental Management Plan to mitigate negative impacts
- Development of an Environmental Monitoring Plan
- Prepare an Environmental and Social Impact Assessment Report

1.4: SCOPE OF THE STUDY

The study has been conducted to evaluate the potential and foreseeable impacts of the proposed development. The physical scope is limited to the proposed site and the immediate environment as may be affected or may affect the proposed project. Any potential impacts (localized or delocalized) are also evaluated as guided by EMCA 2015 and the Environmental (impact assessment and Audit) Regulations, 2003. This report includes an assessment of impacts of the construction, operations and decommissioning of the proposed project site and its environs with reference to the following:

- A review of the policy , legal and administrative framework
- Description of the proposed project.
- Baseline information (bio-physical and socio-economic)
- Assessment of the potential environmental impacts of the proposed project on the biophysical, social-economic, religious and cultural aspect
- Recommendation of cost effective measures to be used to mitigate against the anticipated negative impacts
- Proposition of alternatives
- Problems (non-conformity) identification and recommendation of measures to improve the existing management system;
- Preparation of an Environmental and Social Impact Assessment Report compliant to the Environmental Management and Co-ordination (Amendment) Act, 2015 and the Environmental (Impact Assessment and Audit) Regulations (2003), detailing findings and recommendations.

1.5: ESIA APPROACH AND METHODOLOGY

The approach to this exercise was structured such as to cover the requirements under the EMCA, 2015 as well as the Environmental (Impact Assessment and Audit) Regulations 2003. It involved largely an understanding of the project background, the preliminary designs and the implementation plan as well as commissioning. In addition, baseline information was obtained through physical investigation of the site and the surrounding areas, desktop studies, survey, photography, public consultations with members of the community in the project areas, and discussions with key informants (local administration and heads of departments)

The key activities undertaken during the assessment included the following:

- Consultations with the key project stakeholder including the project proponent, community members, County administration, opinion leaders and National and County Government departmental heads. The consultations were based on the proposed project, site planning, project benefits, anticipated impacts, and the project implementation plan;
- Physical inspections of the proposed project area (site assessment) which included observation of available land marks, photography and interviews with the local residents;

- Evaluation of the activities around the project site and the environmental setting of the wider area through physical observations and literature review;
- Review of available project documents; and
- Report writing, review and submissions.

Below is an outline of the basic ESIA steps that were followed during this assessment:

Step 1: Screening

Screening of the project was undertaken to evaluate the need of conducting an EIA and the level of study. Transmission lines are listed under schedule 2 of EMCA, 2015 among projects requiring EIA before commencement. In addition, other considerations taken into account during the screening process included advice by local NEMA office, the physical site location, zoning, nature of the immediate neighbourhood, sensitivity of the areas surrounding the site and socio-economic activities in the area, among others.

Step 2: Desk Study

Documentation review was a continuous exercise that involved a study of available documents on the project including the feasibility study, project set-up plans and architect's statement, land ownership documentation, environmental legislation and regulations, County development plans, location maps, etc.

Step 3: Site Assessment

Site assessment was conducted between 27th September and 6th October 2017 to establish:

- The general environment and its sensitive receptors found within the environs of the project site.
- Flora, fauna and avifauna found on the site;
- The site landscape
- Surface water bodies within the neighbourhood of the site and;
- Land ownership, usage and conflicts

Step 4: Public Consultation

Detailed stakeholders consultations for this study were undertaken from 27th September to 6th October 2017. These consultations were conducted in the form of:

- Key Informant Interviews and questionnaires
- Open-ended questionnaires and
- Public Barazas,

Step 5: Reporting

The ESIA Study Report was written in accordance with the Environmental (Impact Assessment and Audit) Regulations, 2003.

CHAPTER 2: PROJECT DESCRIPTION

2.1: PROJECT DESCRIPTION

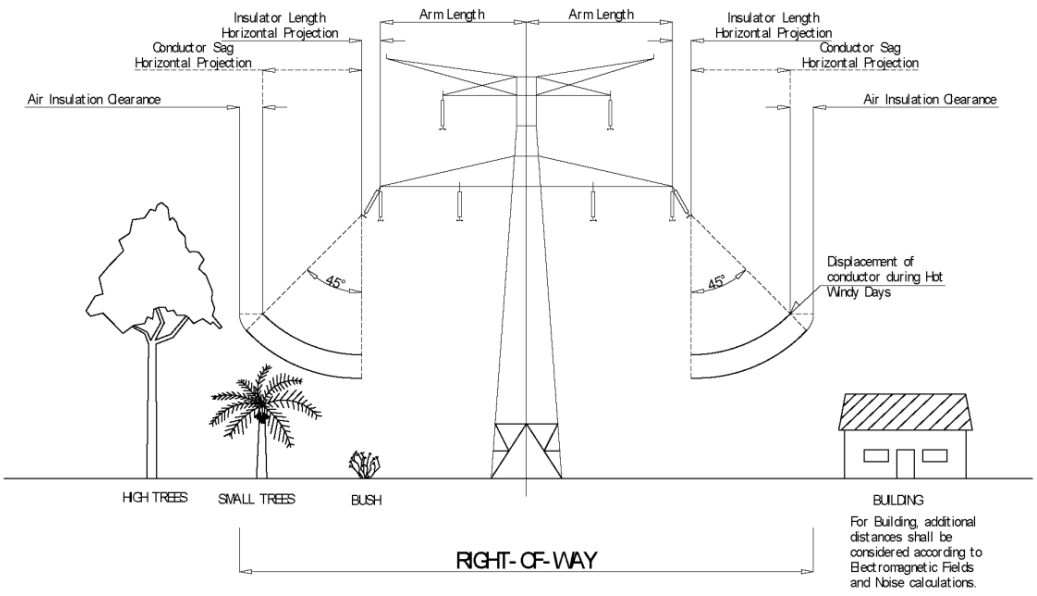
The project will essentially involve the construction of a 132kV transmission line from Kitui, through Mutomo and terminate in Kibwezi, Makueni County.

Detailed scope of work for the project is as follows:

1. Transmission Line
    a) Kitui – Mutomo Double Circuit Transmission Line (60km)
    b) Mutomo - Kibwezi Double Circuit Transmission Line (64km)
    c) 132kV LILO on Juja – Rabai Double Circuit Transmission Line for Kibwezi substation (4km)
2. Substation
    a) 132/33 kV Kitui Substation Bay Extension
    b) 132/33 kV Mutomo Substation
    c) 132/33 kV Kibwezi Substation

2.2: TRANSMISSION LINE DESIGN

2.2.1; Right-of-Way Requirements



A way-leave corridor is a particular width from the centre of the high voltage transmission power line that should be maintained clear so that the safety of lives of people and property is ensured. It is furthermore important to note that the corridor under the high voltage transmission power lines pro-vides for the safety of lives and allows access to routine maintenance work. The width of this corridor is dependent on the reference voltage and should be maintained clear, to ensure safety in the event that a power line conductor snaps. The proposed width for this line being a double circuit, is 40m

2.2.2; Air Space Protection

Where it is likely that the power line is hazardous to aviation and avi-fauna safety because of its height and location, spherical markers will be used to identify overhead wires. The Kenya Civil Aviation Authority (KCAA) regulations, establish standards for determining obstructions in navigable airspace. Issues such as size and height of tower/poles, right-of-way needs, maintenance access, and impacts to the approach zone, clear zone, or safety zone has to be evaluated and approved by KCAA to utilize property near airports and airstrips.

2.2.3; Conductor Clearances

Conductor Vertical Clearances

The following are the minimum vertical clearances to be ensured from the line conductors at maximum sag (inclusive of 0.3m included in sag calculations to accommodate conductor creep) to ground level or objects and crossings as described.

Above terrain in general, including minor roads/tracks	7.0
Above main (paved) roads	8.0
Above secondary (unpaved) roads	8.0
Above railways	8.5
Above steep or swampy ground, inaccessible to vehicles < 3.0m, and above water at max. flood level, except navigable rivers	6.5

Design Factors of Safety

The following design factors are for steel lattice towers and are true for 132 kV lines

Conductors, earthwire and optical fibre earthwire at final maximum working tension based on ultimate nominal breaking load.	3.00
Conductors, earthwire and optical fibre earthwire at still air everyday temperature final tension based on ultimate nominal breaking load	5.00

Tension clamps and mid-span joints based on conductors, earthwire and optical fibre earthwire ultimate nominal breaking load.	0.95
Insulators and Fittings (based on failing load) ▪ under normal working conditions ▪ under broken string conditions	 3.00 3.00
Steel Lattice Towers ▪ Steel towers under normal working conditions ▪ Steel towers under broken wire conditions ▪ Steel towers under maintenance conditions ▪ Cascade Collapse for suspension towers	 2.00 1.50 2.00 1.00
Foundations ▪ Foundations under normal working conditions ▪ Foundations under broken wire conditions ▪ Foundations under maintenance conditions ▪ Factor against overturning/uprooting	 2.50 1.75 2.00 1.20

2.2.4; Tower Layout

Transmission line tower; courtesy of KETRACO staff

Possible Tower Configurations

With regard to line design, there are four (4) different variants, which are technical feasible:

Conventional overhead line (Steel lattice towers with individual foundations)

- Advantages: cost effective design (regarding investment cost); ease of construction (no heavy equipment required).
- Disadvantages: space requirements (easement / permanent land take), visual impact (in urban areas).

Compact overhead line (Self-supported steel lattice towers with monoblock foundations for suspension towers.)

- Advantages: economic design, ease of construction,
- Disadvantages: slightly higher cost for (heavier) suspension towers, access to crane is required.

Tubular steel pylons / Pre-stressed concrete poles.

- Advantages: reduced easement / land take (because of smaller base), visual impact.
- Disadvantages: considerably higher cost than for steel lattice towers, requirements concerning access (temporary land take / destruction) and construction (heavy equipment/ noise).

2.2.5; Tower Type Family Recommendation

Taking into account the cost and space available the best option is to use tower structures of the self-supporting lattice-type galvanized steel frame with square bases, individual concrete foundations per leg, body and leg extensions, cross arms for phase and earth conductors.

Corrosion protection shall be of hot dip galvanization (minimum 610 g/m^2).

The towers shall be fitted with anti-climbing devices at 3m from the ground, step-bolts on two diagonally opposite legs starting above the anti-climbing to the top, name plate and phase plates following the specifications of the Client.

Taking into account the possible theft of tower members, the towers shall be fitted with anti-theft bolts from ground level to the anti-climbing device level.

Tower dimensions

Regardless of dimensions such as footprint, member slope, cross-arms attachment to body width, which is the results of the static calculation and experience of the designer, a tower is defined by other typical dimensions listed below:

- phase to phase distance
- phase to earthwire distance in regards of the location of the earthwire to ensure an optimum against lightning strikes
- attachment height to ground of the suspension and tension string
- phase to structure clearance (which has to be followed by the strings as well as the jumpers of the tension towers)

Tower Height

The minimum tower height H is calculated and equals the sum of the following:

- h1 - Minimum permissible ground clearance

- h2 - Maximum sag (at highest conductor temperature)
- h3 - Vertical spacing between conductors
- h4 - Vertical clearance between ground wire and top conductor

H = h1 + h2 + h3 + h4

2.2.6; Definition of Spans

Each type of tower is characterized by a set of spans called "Typical spans" whose values are involved not only in the calculation of distances between phases, distance to ground, height above ground, but also in the calculation of forces acting on the structures (weight, wind load, etc.).

Those typical spans are:

The basic span is the most economical horizontal distance between two consecutive towers. It is the basis for determining the height of attachment above the ground conductor of the lowest points. It therefore affects mostly the normal height of the tower.

The maximum span is the maximum horizontal distance that can separate two towers. It is the basis for determining the characteristic dimensions of the tower cross-arms and mainly distances between conductor and earthwire

The wind span is mainly used to determine the horizontal force acting on the tower structure. For anchoring supports, wind range is the distance over which the wind is expected to act perpendicularly to the cable. It is equal to the arithmetic mean of adjacent spans of a support.

The weight span is the horizontal distance between the points where the tangent to the parabola is the horizontal distance between the points where the tangents to the curve of the two adjacent spans are horizontal.

2.2.7; Selection of Conductors

The phase conductors used by KETRACO are all of ACSR type, namely with Code Names LYNX, CONDOR and HAWK. Within the project we will try to us as far as possible the same conductor types:

Voltage Level	Phase Conductor Type ACSR
132 kV	1 x LYNX
400 kV	3 x CONDOR

2.2.8; Selection of Shield Wires

Conventional Earth Wire – Type ACS

The earth wire fulfils two functions:

- Shielding the phase conductors from direct lightning strikes
- Reliable high capacity communication channel by using OPGW (Optical Ground Wire).

Because earth wires are usually required to have less sag than the phase conductors, they are normally either ACS or steel construction.

Standard earth conductors used in most of the lines are aluminium-clad steel conductors. They are standardised according to IEC 61089, EN 50182, Table F21 or ASTM B416. The standard earth wire is type ACS at KETRACO.

2.2.9; OPGW Shield Wire

Fibre optic cable links are today the foundation of communications systems, since they have the advantage of large capacity, high speed, and long distance transmission. At the same time they are not influenced by electromagnetic fields and do not show any cross-talk, which is very important for installations on high voltage (HV) lines.

The most common method for this is to install an **OP**tical **G**round **W**ire (**OPGW**), which contains optical fibres, as a substitution of an existing ground wire.

The main characteristics of an OPGW are:

- the mechanical strength, which is mainly determined by the amount of steel;
- the short time current capacity, which is mainly determined by the amount of aluminium (alloy); and
- the number of optical fibers.

The fibres OPGW shall follow the following specifications and recommendations:

Optical fibre:	CCITT (recently ITU-T) recommendation, IEEE 1138, Annexure A for short circuit tests
IEC 60794	Optical Fibre Cables
IEC 61395	Creep test for stranded conductors
EN 187 000	Optical Fibre Cables (Generic specification)

EN 187 100	Optical Telecommunication Cables (Sectional specification)
EN 187 200	Sectional Specification: Optical Cables to be used along Electrical Power Lines (OCEPL)
EN 187 201	Family specification OPGW
EN 187 204	Family specification OPPC
EN 188 000	Optical Fibres (Generic specification)
IEC 60104	Aluminium-magnesium-silicon Alloy Wire for Overhead Line Conductors
IEC 60304	Fibres and binders colours
IEC 60865-1	Short-circuit Currents - Calculation of Effects.
IEC 60889	Hard Drawn Aluminium Wire for Overhead Line Conductors
IEC 60949	Calculation of Thermally Permissible Short-circuit Currents, taking into Account Non-adiabatic Heating Effects.
IEC 61089	Round Wire Concentric Lay Overhead Electrical Stranded Conductors.
IEC 61232	Aluminium-clad Steel Wires for Electrical Purposes
IEC 61597	Overhead Electrical Conductors – Calculation Methods for Stranded Bare Conductors
ITU G.652	Characteristics of a Single-mode Optical fibre

2.2.10; Foundation Design

The foundations shall be of pad and chimney concrete reinforced type. Piles may be employed in bad and buoyant terrain (lake and river crossing). The foundations capacity shall be determined in regards of a soil investigation.

The safety factors shall be as per “Design Factors of Safety”:

- 2.50 in regards of the yield strength of the steel for normal load cases
- 1.25 in regards of the yield strength for exceptional load cases

For the purposes of classification, foundation type selection, the basically soils to be found in the project area have been divided into the groups as per following table.

Soil Type	Soil Conditions
S1	Rock such as granite (with different levels of different minerals included), lightly weathered
S2	Very good soil such as hard clay, dense sand, very weathered rock
S3	Good/Normal soil such as medium-dense or loose soils, such as firm clay and medium sands
S4	Poor soft soil / backfill material
S5	Very poor soil such as waterlogged soils, swamps, soils below water table for a significant period of the year

2.2.11; Tower Footing Resistance

Lightning strikes to towers lead to an increase of the tower's potential, which is essentially determined by the tower footing resistance. If this potential exceeds the electric strength of the insulators, back-ward flashovers occur across the insulators, which, especially when they occur in the direct vicinity of the switchgear, can cause high over-voltage and over-voltage with high rates of change. Here, linking the last towers to the switch gear earthing system as a remedial measure is a suitable method if significantly reducing the tower footing resistance and of preventing backward flashovers across the insulators of these towers. For economic reasons however, this measure is generally restricted to portal and first tower seen from the substation.

Earthing of tower structure shall be made as required by soil conditions and the value of earth resistance at each tower location. One or more ground rods per tower shall be installed depending on the requirements. The design is dependent of the soil resistivity to be performed during the survey by the Contractor.

KETRACO's values for the nominal footing resistance of steel lattice towers are:

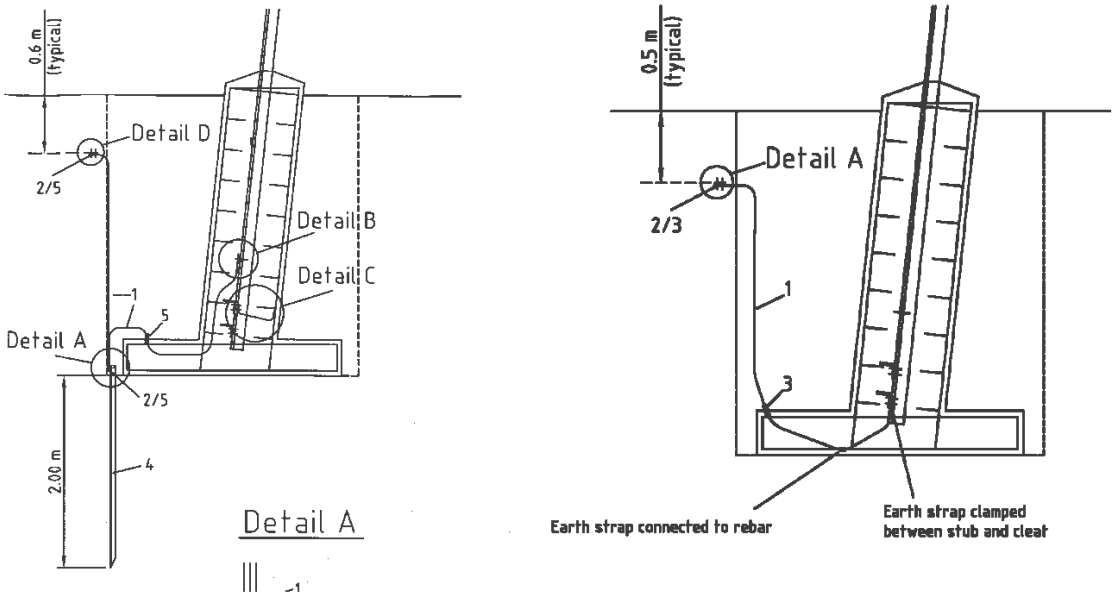
Voltage (kV)	Footing Resistance Ω
132	10
225	10
275	10
400	10

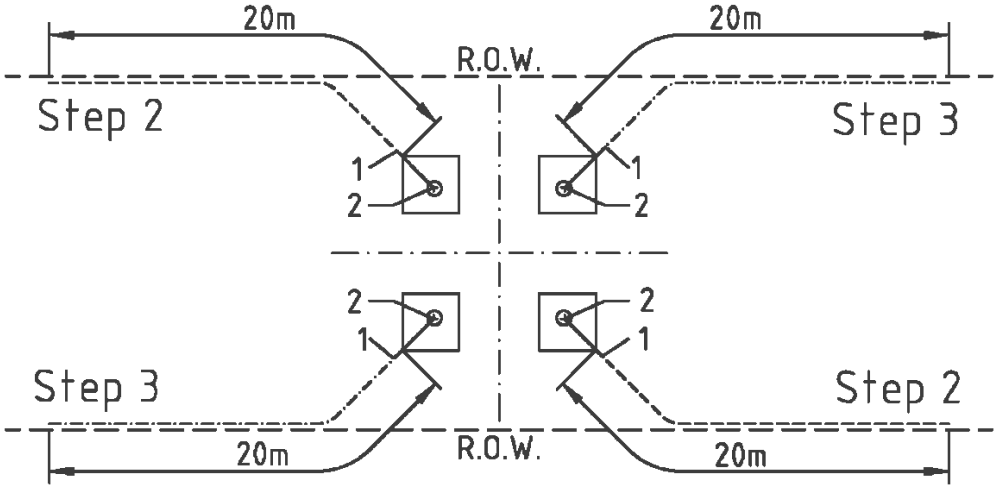
It is propose the use of ground rods of a 35 x 35 x 4 mm diameter cruciform and 3.0 metre long steel rods. Ground rods shall be hot-dip galvanised. The ground rods shall be buried or driven at the base of the tower leg

foundation. In order to avoid vandalism of the earthing material it is propose to connect the foundation steel and tower leg to the earth conductors beneath the soil surface; this is a proven practice at ESKOM South Africa.

Where the measured tower footing resistance is greater than the required value, earth improvements shall be made by additional ground rods or earthing counterpoise cable connected to each tower leg. Earthing cables (counterpoise) shall be of galvanised steel wire with 11.5mm diameter.

The terminal towers shall be connected to the substation earthing grid.





2.2.12; Other Accessories

The following equipment must be included:

- Tower number plates, phase plates, warning plates;
- Anti-climbing devices;
- Spacers for bundled conductors;
- Anti-theft protection bolts.

2.3: SUBSTATION DESIGN

2.3.1; Introduction

Suswa substation; courtesy of KETRACO staff

The design of the substations will consider:

- the most economical means of achieving the full development requirements;
- the stage-by-stage developments of the substations. In some cases, this may involve preferred build of full diameters, co-ordinating the full diameter built with the demand forecast and generation expansion plan;
- any reactive compensation requirements;
- the future inclusion of distribution level substations;
- the co-ordination of overhead line entries, avoiding circuit cross-overs where possible;

- the required insulation withstand level of external insulation for substations to be constructed at altitudes greater than 1000 m above sea level.

The proposed substation layouts shall take into account the results of the system analysis, technical and economic aspects as well as standards of KETRACO in regard to equipment and operation.

The new substations shall be designed as conventional outdoor air insulated 132kV and with a substation control building housing 33kV switchboard, control and protection, communication and auxiliary equipment.

Space for additional bays shall be considered as well.

The layout shall consider the incoming overhead lines, easy access to the equipment and extension possibilities. The control building shall be located in a way to have clear view on the outdoor equipment and the access to the area. The whole substation area shall be fenced.

The substations configuration will be of the single busbar, double busbar system or breaker and a half. For single busbar substations space for future upgrade to double busbar shall be foreseen.

The standard layout used and recommended by KETRACO is:

Voltage	**Type**	
400 kV	Air insulated outdoor	Breaker and a half
220 kV	Air insulated outdoor	Breaker and a half
132 kV	Air insulated outdoor	Single Busbar, single breaker Double Busbar, single breaker
33 kV	Indoor	Single bus

For the 132kV voltage level, it is recommended to use single and double busbar types.

2.3.2; Space Requirements

KETRACO'S guidelines in minimum substation land sizes are as follows.

Voltage	**Type**	**Space [acres]**	**Space [m²]**

132 kV	Air insulated outdoor	5	20.234
220 kV	Air insulated outdoor	10	40.468
400 kV	Air insulated outdoor	50	202.340

Common Requirements for Substations

2.3.3; Power Transformers

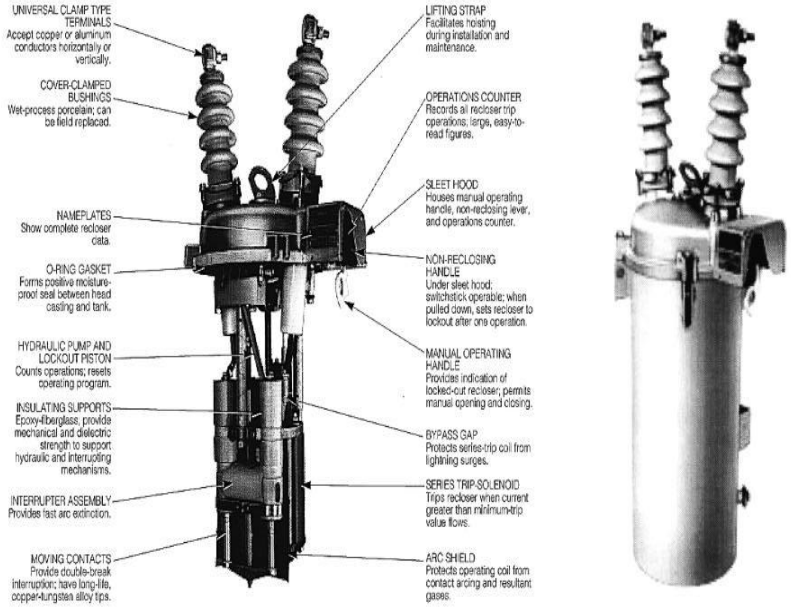
Power transformer; courtesy of KETRACO staff

The transformers shall be of the conservator type, fitted with external coolers and an on-load tap and shall comply with IEC 60076.

Note that the average maximum ambient temperature in any one day is 30 ºC. The maximum temperature rise shall therefore not exceed 55 K of the top oil and 60 K of the winding above the maximum ambient temperature of 40 ºC.

For temperature correction due to attitude reference is made to IEC 60076 which limits the temperature rise further when tested at the operation altitude.

2.3.4; Circuit Breakers



Typical Single-Phase Hydraulically Controlled Oil Circuit Breaker. Courtesy of Cooper Power Systems

The circuit breakers shall comply with IEC 60056.

The circuit breakers shall be of single-pressure, sulphur hexafluoride (SF6) type with self-contained power-operated spring-charged operating mechanism.

- three-pole outdoor type, for the 132kV transformer breakers;
- single phase tripping and reclosing for all line breakers ≥ 132kV.

Each pole of the breaker shall have a mechanical position indicator. The device shall be labelled "ON" and "OFF" and these shall be clearly visible.

The circuit breakers shall be suitable for, single-pole high-speed auto reclosing. The rated operating duty shall be as follows:

- 0-t-CO-t'-CO t - 0.3 sec t' - 3 min
- CO.-.t2-CO t2-15 sec

Three Pole type breakers may have one operating mechanism common to all three poles while single pole type breakers shall have independent operating mechanism per pole.

The control voltage for closing and opening commands and for the operating mechanism motor(s) shall be:

- 110Vdc + 10% - 20%, unearthed, from battery

A "Local/Remote" selector switch and a set of open/close push buttons shall be provided on the control cabinet of the circuit breaker to permit its operation through local or remote push buttons. In the case of a complete failure of the operating mechanism all switches shall be operable manually by means of a lever or crank or another feature.

The circuit breaker shall be supplied with steel supporting structure.

2.3.5; Isolators and Earth Switches

The isolators and accessories shall conform in general to IEC 62271-102

Isolators shall be motorized outdoor off-load type. The operating mechanism for the isolating switches shall be provided for local and remote electrical operation. The earthing switches shall be only manually operated. The auxiliary voltage for the operation of the closing and opening devices shall be 110Vdc, + 10% - 20. Operating motors shall be provided for 240/415Vac 50 Hz or 110Vdc operation.

A "Local/Remote" selector switch and a set of open/close push buttons shall be provided on the control cabinet of the isolator to permit its operation through local or remote push buttons. In the case of a complete failure of the operating mechanism all switches shall be operable manually by means of a lever or crank or another feature. Isolators shall have mechanical interlocking to the associated earth switches.

All disconnecting and earthing devices within the substation shall be interlocked in a manner that ensures that they always operate safely. The system employed shall satisfy two distinct categories:

Operational interlocking. Interlocking associated with normal system operation and switching and intended to ensure that unsafe switching actions are prevented. Such interlocking shall be achieved by electrical means in a manner that permits the equipment to perform any safe operation. Contacts used for interlocking shall be directly driven auxiliary contacts of the main device.

Maintenance interlocking. Interlocking associated with a series of switching operations whose purpose is to render the equipment or sections of the substation safe for access and maintenance by personnel. Such interlocking shall be achieved by mechanical key type interlocks.

2.3.6; Surge Arresters

The lightning arresters shall be of the metal oxide gapless type, complying with IEC 60099-4. Arresters shall be of hermetically sealed units, self-supporting construction, suitable for mounting on tubular.

The surge arresters shall be of heavy-duty station class 3 and gapless type without any series or shunt gaps.

The surge arresters shall be capable of discharging over-voltages occurring during switching of unloaded transformers, reactors and long lines.

132kV class arresters shall be capable for discharging energy equivalent to class 3 of IEC on two successive operations. Surge counters shall be supplied for each single phase arrester.

2.3.7; Tariff Metering

The meters shall conform fully to IEC 60687 for class 0.2s Energy Meters and any other relevant specifications. The class and accuracy of the meters shall be coordinated with the CT and VT tariff metering cores.

The meters shall be programmable and relevant software and connection cable to laptop shall be provided. Meters complying with IEC 61334-4-4-1(DLMS Standard protocol) shall be required. The meters shall have memory and be capable of storage of at least 12 months load profile and other data e.g. freezed Monthly readings.

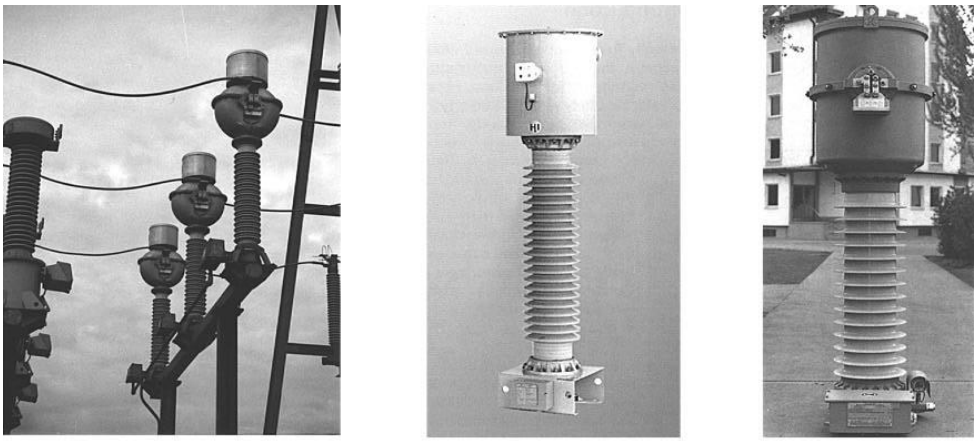
The meters shall be capable of bi-directional metering so as to record faithfully, both export and import quantities. The accuracy shall be as per IEC 60687 in both directions.

2.3.8; Measuring Transformers

The output of the measuring transformers for measuring and protection purposes shall be determined according to the technical requirements, but shall not be less than 125% of the overall computed (design) burden of the connected apparatus and conductors. However, the transformer shall not be loaded less than 60 % of rated burden.

- Power frequency test voltage on secondary windings, 1 min. 2,5 kV
- Overvoltage inter-turn test, 1 min. 3.5 kV

Current Transformers



High-Voltage Current Transformers. Courtesy of Haefely Trench, Scarborough, Ontario, Canada

The characteristics of the current transformers shall comply with the provisions stipulated in IEC 61869 (replacing IEC 60044).

The current transformers shall be designed to carry continuously a current of 120% of the primary rated current. Rated output shall be chosen from preferred standard values in such a manner that secondary burden is between 25% and 100% of the rated burden.

Voltage Transformers

Capacitor Voltage Transformers With and Without Wave Trap. Courtesy of Haefely Trench, Scarborough, Ontario, Canada.

The characteristics of the voltage transformers shall comply with the provisions stipulated in IEC 60044 and IEC 61869 (and IEC 60358 for capacitive voltage transformers).

2.3.9; Earthing

The substation earthing system shall be designed principally according to IEEE 80 – 2000 and IEEE 2012 Guide to Safety in AC Substation Grounding.

The earthing system shall consist of the earth electrode system in the ground under the switchyard, and of the earthing conductors, over-ground, around fences and in the buildings.

2.3: TRANSMISSION LINE ROUTE

The route of traverse and proposed substation sites are roughly defined by coordinates as follows;-

PROPOSED 132KV KITUI – MUTOMO – KIBWEZI TRANSMISSION LINE

Section 1: Kitui – Mutomo Line:

SR NO	ZONE- WGS 84 (37SOUTH)		Longitude	Latitude	AP No	Deviation Angle	Sec length	Cum. Length	Major crossings
	Easting	Northing							
1	381594	9850953	1° 20' 53.6730" S	37° 56' 8.4736" E	AP-0	0		0	
							234		220kV Kamburu LINE (381518.40 m E,9850877.32 m S
2	381428	9850788	1° 20' 59.0181" S	37° 56' 3.0924" E	AP-1	21° 47' 32"L		234	
							513		
3	381223	9850318	1° 21' 14.3221" S	37° 55' 56.4539" E	AP-2	24° 21' 9"L	746	3	
							190		KITUI TO MACHAKOS ROAD (381226.01 m E,9850224.95 m S)
4	381226	9850129	1° 21' 20.4959" S	37° 55' 56.5361" E	AP-3	6° 30' 11"L		936	
							810		
5	381329	9849325	1° 21' 46.6580" S	37° 55' 59.8524" E	AP-4	7° 42' 27"L		1746	
							1026		
6	381594	9848335	1° 22' 18.9274" S	37° 56' 8.4303" E	AP-5	3° 13' 25"R		2772	
							1566		
7	381914	9846802	1° 23' 8.8534" S	37° 56' 18.7523" E	AP-6	16° 50' 43"L	4338	7	
							252		Ithiian SHOP CENTER TO TIVA ROAD (381954.95 m E,9846722.70 m S)
8	382035	9846580	1° 23' 16.0544" S	37° 56' 22.6532" E	AP-7	2° 51' 25"R		4590	
							1192		Ithiiani shopping Centre T KUTUI (382423.56 m E,9845757.44 m S)
9	382553	9845506	1° 23' 51.0459" S	37° 56' 39.4174" E	AP-8	5° 48' 34"R		5783	
							590		
10	382754	9844952	1° 24' 9.1050" S	37° 56' 45.9246" E	AP-9	13° 45' 47"R		6372	
							814		Ithiiani shopping Centre T KUTUI (382759.98 m E,9844917.17 m S)
11	382842	9844142	1° 24' 35.4688" S	37° 56' 48.7564" E	AP-10	10° 50' 53"L		7187	
							823		
12	383083	9843356	1° 25' 1.0837" S	37° 56' 56.5463" E	AP-11	0° 0' 33"R		8009	
							1569		RIVER (SPAN 287 M)(383502.06 m E,9841987.08 m S)
13	383543	9841855	1° 25' 49.9549" S	37° 57' 11.4003" E	AP-12	8° 4' 53"R		9579	
							2138		
14	383876	9839743	1° 26' 58.7264" S	37° 57' 22.1339" E	AP-13	7° 13' 5"R		11716	
							1312		RIVER (SPAN 409M)(383889.03 m E,9839423.23 m S)
15	383916	9838432	1° 27' 41.4443" S	37° 57' 23.4000" E	AP-14	31° 29' 59"L		13029	
							463		WIKILILYE TO NGUNI ROAD (384146.84 m E,9838074.51 m S)
16	384169	9838044	1° 27' 54.0577" S	37° 57' 31.6040" E	AP-15	11° 8' 55"R		13492	
							1085		
17	384577	9837039	1° 28' 26.8047" S	37° 57' 44.7898" E	AP-16	15° 28' 10"R		14577	
							1455		
18	384745	9835594	1° 29' 13.8644" S	37° 57' 50.1917" E	AP-17	10° 32' 40"R		16032	

							1509		
19	384642	9834088	1° 30' 2.8961" S	37° 57' 46.8234" E	AP-18	0° 6' 48"R		17541	
							1680		
20	384523	9832413	1° 30' 57.4635" S	37° 57' 42.9669" E	AP-19	18° 7' 45"L	19221	20	
							2085		
21	385031	9830390	1° 32' 3.3311" S	37° 57' 59.3590" E	AP-20	7° 16' 23"L		21306	
							4465		
22	386657	9826232	1° 34' 18.7821" S	37° 58' 51.9257" E	AP-21	6° 53' 12"L		25771	
							6641		
23	389800	9820381	1° 37' 29.3419" S	38° 00' 33.5444" E	AP-22	9° 6' 17"R		32412	
							2106		
24	390491	9818392	1° 38' 34.1286" S	38° 00' 55.8569" E	AP-23	0° 5' 35"L		34518	
							1532		
25	390996	9816946	1° 39' 21.2443" S	38° 01' 12.1688" E	AP-24	6° 50' 12"L		36050	
							852		
26	391370	9816180	1° 39' 46.1718" S	38° 01' 24.2745" E	AP-25	9° 3' 17"R		36902	
							1277		
27	391744	9814959	1° 40' 25.9440" S	38° 01' 36.3506" E	AP-26	17° 31' 0"R		38179	
							822		
28	391737	9814138	1° 40' 52.7033" S	38° 01' 36.1062" E	AP-27	32° 6' 52"L		39001	
							1799		
29	392679	9812607	1° 41' 42.5762" S	38° 02' 6.5815" E	AP-28	10° 1' 50"R		40798	
							840		
30	392988	9811826	1° 42' 8.0174" S	38° 02' 16.5696" E	AP- 29	1° 45' 41"R		41638	
							2933		
31	393983	9809067	1° 43' 37.8819" S	38° 02' 48.7135" E	AP-30	13° 30' 15"L		44571	
							4161		
32	396269	9805590	1° 45' 31.1282" S	38° 04' 2.6391" E	AP-31	1° 57' 26"R		48732	
							4151		RIVER (SPAN 317M) (397488.12 m E,9803568.53 m S)
33	398430	9802046	1° 47' 26.5809" S	38° 05' 12.5173" E	AP-32	2° 14' 19"L		52883	
							4543		
34	400945	9798263	1° 49' 29.8350" S	38° 06' 33.8438" E	AP-33	5° 0' 50"L		57426	
							4162		
35	403543	9795011	1° 51' 15.7756" S	38° 07' 57.8807" E	AP-34	3° 39' 34"L		61588	
							3592		
36	405960	9792353	1° 52' 42.3648" S	38° 09' 16.0638" E	AP-35	11° 34' 13"L		65180	
							3152		
37	408505	9790494	1° 53' 42.9595" S	38° 10' 38.4267" E	AP-36	29° 51' 0"L		68333	
							702		
38	409203	9790417	1° 53' 45.4783" S	38° 11' 1.0180" E	AP-37			69035	

Section 2: Mutomo – Kibwezi line:

SR NO	ZONE- WGS 84 (37SOUTH)		Longitude	Latitude	AP No	Deviation Angle	Sec length	Cum. Length	Major crossings
	Easting	Northing							
1	409203	9790417	1° 53' 45.4783" S	38° 11' 1.0180" E	AP-0			0	
							726		
2	408649	9789948	1° 54' 0.7291" S	38° 10' 43.0617" E	AP-1	4° 11' 33"L		726	
							1274		
3	407738	9789057	1° 54' 29.7424" S	38° 10' 13.5755" E	AP-2	39° 26' 57"L		2000	
							1411		
4	407587	9787654	1° 55' 15.4108" S	38° 10' 8.6522" E	AP-3	4° 21' 41"L		3411	
							3527		
5	407476	9784129	1° 57' 10.2180" S	38° 10' 5.0073" E	AP-4	3° 29' 24"L		6938	
							4803		
6	407617	9779328	1° 59' 46.5745" S	38° 10' 9.5108" E	AP-5	35° 34' 11"R		11741	
							2433		
7	406261	9777308	2° 00' 52.3238" S	38° 09' 25.5805" E	AP-6	7° 34' 47"L		14174	
							1895		
8	405422	9775610	2° 01' 47.6275" S	38° 08' 58.3764" E	AP-7	15° 22' 37"L		16069	
							1142		
9	405225	9774595	2° 02' 24.1541" S	38° 08' 51.3492" E	AP-8	7° 24' 59"L		17211	
							3525		
10	404989	9770969	2° 04' 18.7326" S	38° 08' 44.3064" E	AP-9	1° 18' 24"R		20736	
							2272		
11	404736	9767960	2° 05' 56.7290" S	38° 08' 36.0484" E	AP-10	35° 5' 43"R		23756	
							1220		
12	403278	9766217	2° 06' 53.4592" S	38° 07' 48.8300" E	AP-11	5° 1' 28"L		26028	
							3083		
13	402580	9765216	2° 07' 26.0438" S	38° 07' 26.2202" E	AP-12	0° 9' 18"L		27248	
							1943		
14	400824	9762683	2° 08' 48.5270" S	38° 06' 29.3139" E	AP-13	2° 47' 26"L		30331	
							1616		
15	399796	9761034	2° 09' 42.2122" S	38° 05' 56.0024" E	AP-14	1° 24' 19"L		32275	
16	398975	9759642	2° 10' 27.5163" S	38° 05' 29.4027" E	AP-15	2° 2' 27"R	2080	33890	CLIFF YETTA PIATAE STARTING AT (398856.90 E .9759453.87S) ENDING AT 398191.63E,9758404.37 S)
17	397855	9757889	2° 11' 24.5762" S	38° 04' 53.1147" E	AP-16	23° 41' 51"R		35970	
							1079		
18	396958	9757290	2° 11' 44.0672" S	38° 04' 24.0541" E	AP-17	20° 55' 6"R		37049	
							1995		ATHI RIVER SPAN - 715M (395150.66 m E,9756877.27 m S) KWAKAVISI TO KAILEMBWA ROAD (395650.23 m

									E,9756994.36 m S)
19	395013	9756848	2° 11' 58.4272" S	38° 03' 21.0853" E	AP-18	4° 10' 37"L		39044	
							1020		
20	394037	9756550	2° 12' 8.1090" S	38° 02' 49.5054" E	AP-19	38° 43' 36"L		40064	
							745		
21	393618	9755934	2° 12' 28.1426" S	38° 02' 35.9082" E	AP-20	34° 14' 18"L		40809	
							2253		
22	393616	9753682	2° 13' 41.5084" S	38° 02' 35.7978" E	AP-21	3° 26' 46"R		43062	
							1924		
23	393498	9751761	2° 14' 44.0336" S	38° 02' 31.9600" E	AP-22	22° 15' 40"R		44985	
							1030		
24	393051	9750834	2° 15' 14.2415" S	38° 02' 17.4468" E	AP-23	0° 17' 36"R		46015	
							3679		
25	391435	9747528	2° 17' 1.8509" S	38° 01' 25.0672" E	AP-24	5° 41' 52"L		49695	
							3241		
26	390308	9744490	2° 18' 40.7713" S	38° 00' 48.5116" E	AP-25	4° 40' 27"R		52935	
							1755		
27	389565	9742900	2° 19' 32.5336" S	38° 00' 24.4432" E	AP-26	11° 58' 56"L		54690	
							1335		
28	389264	9741599	2° 20' 14.8656" S	38° 00' 14.6618" E	AP-27	8° 51' 16"L		56025	
							1701		
29	389140	9739903	2° 21' 10.1202" S	38° 00' 10.5984" E	AP-28	50° 3' 2"L		57726	
							189		KIBWEZI TO KITUI B-7 ROAD (389206.97 m E,9739831.63 m S)
30	389275	9739771	2° 21' 14.3990" S	38° 00' 14.9758" E	AP-29	61° 44' 14"R		57915	
							1089		
31	388977	9738724	2° 21' 48.5089" S	38° 00' 5.3049" E	AP-30	29° 0' 20"R		59004	
							762		
32	388440	9738184	2° 22' 6.0743" S	37° 59' 47.8886" E	AP-31	13° 50' 12"L		59766	
							1030		
33	387908	9737301	2° 22' 34.8001" S	37° 59' 30.6700" E	AP-32	4° 28' 45"L		60796	
							1374		
34	387294	9736073	2° 23' 14.8011" S	37° 59' 10.7484" E	AP-33	0° 35' 21"L		62170	
							428		
35	387106	9735687	2° 23' 27.3396" S	37° 59' 4.6633" E	AP-34			62598	

Section 3: LILO on JUJA Rabai for Kibwezi line:

SR NO	ZONE- WGS 84 (37SOUTH)		Longitude	Latitude	AP No	Deviation Angle	Sec length	Cum. Length	Major crossings
	Easting	Northing							
1	384127	9733789	2° 24' 29.8861" S	37° 57' 28.2195" E	AP-0			0	

2	384164	9733892	2° 24' 26.5222" S	37° 57' 29.4173" E	AP-1	15°18'42"R	110	110	
									kibwezi to mbuinzau railway line (384287.45 m E,9733623.42 m S)
3	384311	9734103	2° 24' 19.6801" S	37° 57' 34.1833" E	AP-2	6°54'19"L	257	366	
4	384483	9734425	2° 24' 9.1897" S	37° 57' 39.7547" E	AP-3	16°40'21"R	365	731	
5	384955	9734901	2° 23' 53.6832" S	37° 57' 55.0548" E	AP-4	10°38'28"R	671	1402	
6	385857	9735524	2° 23' 33.4182" S	37° 58' 24.2859" E	AP-5	4°30'16"R	1097	2499	
7	386731	9736031	2° 23' 16.9287" S	37° 58' 52.5985" E	AP-6	31°43'58"R	1011	3509	
									kibwezi to kalulini road (386917.28 m E,9735725.45 m S)
8	386985	9736024	2° 23' 17.1687" S	37° 59' 0.8139" E	AP-7	254	3763	8	

PROPOSED LOCATION FOR KITUI SUBSTATION

	Alternative1	Alternative2	Alternative3
EASTINGS (M)	382221.12	384650.36	386411.42
NORTHINGS (M)	9848575.86	9845486.13	9837825.79
HEIGHT (M)	1119	1104	1022

PROPOSED LOCATION FOR MUTOMO SUBSTATION

	Alternative1	Alternative2	Alternative3
EASTINGS (M)	410062.60	412742.00	407417.11
NORTHINGS (M)	9797464.05	9794091.00	9790047.84
HEIGHT (M)	875	885	841

PROPOSED LOCATION FOR KIBWEZI SUBSTATION

	Alternative1	Alternative2	Alternative3
EASTINGS (M)	387633.86	389494.36	387903.17
NORTHINGS (M)	9739468.24	9744989.91	9747287.09
HEIGHT (M)	870	822	865

2.4: PROJECT JUSTIFICATION

Currently electricity is accessible to less than 20% of the total population and approximately 5% of rural population. The government's goal is to accelerate access rate to 40% of rural population by 2040.To achieve this, the government has prepared the Energy Scale up program covering the period 2008 to 2017.This would be approached from among others, improvement and expansions of the system networks. This project will contribute in the expansion of the transmission network.

2.5: PROJECT BUDGET

The estimated cost of the project is approximately US Dollars seventy one million, and nine hundred thousand (US$71,900,000)

2.6: TARGET GROUP FOR THE ESIA REPORT

The ESIA Report has been prepared for use by different stakeholders to be involved in the construction, operation, and decommissioning of the proposed project. The report contains useful information on policies and procedures to be adhered to, implementation modalities, analysis of potential environmental and social

impacts and suggested mitigation measures at various stages of project activities. The information will be useful in planning, implementation, management and maintenance of the transmission line project.

In this regard, the report is useful to the following stakeholders:

- Funding agencies and donors;
- Relevant government ministries and agencies for policy implementation;
- Affected and Interested persons;
- Planners and Engineers to be involved in preparation of designs and plans for the project;
- Contractors to be engaged in the project;
- People to be involved in the management and operation of the project.

CHAPTER 3: ENVIRONMENTAL SET-UP OF THE PROPOSED AREA

3.1: BACKGROUND

Kitui County

Kitui County is one of the 47 counties in the country located about 160km east of Nairobi City. It is the sixth largest county in the country, covering an area of 30,496.4 km^2 including 6,369 km^2 occupied by Tsavo East National park. The county shares its borders with seven other counties: Machakos and Makueni counties to the west, Tana River county to the east and south-east, Taita Taveta county to the south, Embu to the north-west, and Tharaka-Nithi and Meru counties to the north. It is located between latitudes 0°10‟ and 3°0‟ south and longitudes 37°50‟ and 39°0‟ east.

Makueni County

The county covers an area of 8,034.7 Km^2. The county borders several counties which include Kajiado to the West, Taita Taveta to the South, Kitui to the East and Machakos to the North. It lies between Latitude 1º 35´ and 3^0 00 South and Longitude 37º10´ and 38º 30´ East.

3.2: PHYSIOGRAPHIC AND NATURAL CONDITIONS

3.2.1; Physical and Topographic Features

Kitui County

Kitui county has a low lying topography with arid and semi-arid climate. Its rainfall distribution is erratic and unreliable. The highlands namely, Migwani, Mumoni, Kitui Central, Mui, Mutitu Hills and Yatta plateau receive relatively high rainfall compared with lowlands of Nguni, Kyuso and Tseikuru. Due to their altitudes, they receive more rainfall than other areas in the county and are the most productive areas. The topography of the county can be divided into hilly rugged uplands and lowlands. The general landscape is flat with a plain that gently rolls down towards the east and northeast where altitudes are as low as 400 metres. The altitude of the Kitui county ranges between 400m and 1800m above sea level. The central part of the county is characterised by hilly ridges separated by wide low lying areas and has slightly lower elevation of between 600m and 900m above sea level to the eastern side of the county. To the western side of the county, the main relief feature is the Yatta Plateau, which stretches from the north to the south of the county and lies between Rivers Athi and Tiva. The plateau is characterised by plain wide shallow spaced valleys.

Apart from the Yatta Plateau and the range of hills in the central part of the county, the topography is undulating, and gives way to plains toward the east. A few hills rise as inselbergs in the plains rising to an altitude of 1,747 metres above sea level. These isolated hills usually affect communication within the county.

The generally flat relief of the Kitui county provides an opportunity for low cost of installing/building of infrastructure such as roads and power lines. It also means putting up buildings is relatively cheaper due to low landscaping costs as compared to counties that have steep slopes and unstable soils.

Makueni County

The county lies in the arid and semi arid zones of the eastern region of the country. The major physical features in Makueni County include the volcanic Chyulu hills which lie along the southwest border of the county in Kibwezi West Constituency, Mbooni Hills in Mbooni constituency and Kilungu Hills in Kaiti constituency which rise to 1,900m above sea level. The county terrain is generally low-lying from 600m above sea level in Tsavo at the southern end of the county.

The main river in the county is Athi River, which is perennial and fed by tributaries such as Kambu, Kiboko, Kaiti, Thwake and Mtito Andei, which drain from various parts of the county. A few other streams flow from the Mbooni and Kilungu Hills but their flow becomes irregular as they move to the low-lying areas. These rivers provide a high potential for both large and small-scale irrigation.

Tsavo National park which lies in the southern part of the county, in Kibwezi West Constituency is considered as one of the world's biodiversity strongholds. It is home to diverse wildlife species which include the famous 'big five' consisting of lion, rhino, buffalo, elephant and leopard. The park also has a great variety of bird life such as the black Kite, crowned crane, lovebird and the sacred Ibis among others.

3.2.2; Climate and Rainfall

Kitui County

The climate of the Kitui County is hot and dry with unreliable rainfall. The climate falls under two climatic zones i.e., arid and semi-arid with most of the County being classified as arid. The County experiences high temperatures throughout the year, ranging from 14°C to 34°C. The hot months are between September and October to January and February. The maximum mean annual temperature ranges between 26°C and 34°C whereas the minimum mean annual temperature ranges between 14°C and 22°C. July is the coldest month with temperatures falling to a low of 14°C while the month of September is normally the hottest with temperature rising to a high of 34°C.

Due to the high temperatures experienced in the county throughout the year the rate of evaporation is high with a mean annual potential evaporation in the central and north-western regions of the county ranging between 1800 to 2000mm while in eastern and north-eastern regions, the range is from 2200 to 2400mm. The bulk of the County falls within 1800 to 2200mm range.

The rainfall pattern is bi-modal with two rainy seasons annually. The long rains fall in the months of March to May. These are usually very erratic and unreliable. The short rains which form the second rainy season fall between October and December and are more reliable. The rest of the year is dry and the annual rainfall ranges between 250mm-1050 mm per annum with 40% reliability for the long rains and 66% reliability for the short rains. Rainfall is highly unpredictable from year to year.

Makueni County

The county experiences two rainy seasons, the long rains occurring in March /April while the short rains occur in November/December. The hilly parts of Mbooni and Kilungu receive 800-1200mm of rainfall per year. High temperatures of 35.8 ^{0}C are experienced in the low-lying areas causing high evaporation which worsens the dry conditions.

Climate variations and extreme differences in temperatures can be explained by change in altitude. The areas to the North such as Kilungu and Mbooni hills are usually cool with temperatures ranging from 20.2 ^{0}C to 24.6^0 C, while the low-lying areas of the South such as Kitise are usually hot. Generally, the county experiences high temperatures during the day and low temperatures at night. During the dry periods between May and October the lower parts of the county experience severe heat.

The Northern part of the county is hilly with medium rainfall ranging from 800mm to 1200mm and has high potential for food crop production. This part of the County , covering mainly in Kilungu and Kaiti has few natural and planted forests the area is therefore suitable for horticulture and dairy farming.

Over time, the county has experienced climate change and variability which includes insufficient rain and prolonged dry spells among others. Human activities such as farming on hill tops, charcoal burning, and sand harvesting have contributed to this scenario. As a result there has been crop failure affecting the food security and thus economic activities. Water scarcity has also become worse due to this condition. Increase in population puts a lot of pressure on land and other resources. To mitigate the effects of water scarcity, the community has resulted into construction of sand dams which are capable of retaining water. Soil erosion control measures are also being undertaken.

3.2.3; Ecological Conditions

Kitui County

The County of Kitui is endowed with various natural resources such as forests, permanent and seasonal rivers, hills, rocks, wildlife among others. Apart from the natural resources, the county can also be divided into nine Agro Ecological Zones which include: UM3, which is very small (in pockets), and Semi-arid farming zones which include; UM3-4 the transitional marginal coffee zone around Migwani and Kitui Central. The UM4 is considered as the sunflower- maize zone or Pigeon peas-maize zone. LM3 is the cotton zone, is very small and many are steep slopes mainly for forest reserves, while LM4 is marginal cotton zone. LM5 is the livestock-millet zone which is suitable for livestock and millet production, while LM6 and IL6 are the ranching zones; here no rain-fed agriculture is suitable except with runoff-catching techniques. IL5 is suitable for both livestock and millet production.

These semi-arid zones have good potential for agricultural development and are currently either cultivated or lying fallow under woodland. Due to population pressure the less fertile semi-arid ranching areas are currently used for food crops production and livestock keeping which leads to frequent crop failures as these areas are not suitable for growing of certain crops under rain-fed agriculture.

Makueni County

The county is largely arid and semi arid and usually prone to frequent droughts. The lower side which is very dry receives little rainfall ranging from 300mm to 400mm. The depressed rains in the lower part of the county hardly sustain the major staple food of maize and beans. Unfortunately, the traditional crops which are drought tolerant have largely been abandoned. This means livestock rearing remains the common viable economic activity being undertaken by the local people in the lower region. The condition has negatively affected agriculture which is the main economic activity in the county.

3.2.4; Forestry

Kitui County

Kitui County has 14 gazetted forests and 15 ungazetted forests. Taking all forms of forests into account, there are about 34,544.1 ha of forest in The Kitui County, under different ownership. The forest cover is crucial for climate change, water resource management, control of soil erosion, and boosting agriculture in the County. The table below shows forest type and size for Kitui County.

Gazetted and the Ungazetted forests in the Kitui County

GAZETTED FORESTS			UNGAZETTED FORESTS		
No.	**Name**	**Area (Ha)**	**No.**	**Name**	**Location**
1	Kabonge	31.80	1	Ilima Yimwe	Yatta
	Kyawea	63.10	2	Kwa Vonza	Yatta
	Museve	42.20	3	Mwakini	Yatta
	Mutuluni	596.00	4	Maathani	Yatta
	Mutitu	1,958.00	5	Kiongwe	Chuluni
	Endau	6,717.80	6	Kivongo Valley	Central
	Makongo	3,431.80	7	Mataitho	Central
	Engamba	2,142.00	8	Nzanzu	Nuu
	Nthoani	1,387.00	9	Nzia	Mutitu
	Mutha	1,361.00	10	Maimu	Mutomo
	Mumoni Hills	10,522.9	11	Kyongoani	Chuluni
	Gaikuyu Hills	3075	12	Nzaayani	Chuluni
	Mba/Kyuikuyu	732.0	13	Mutaitho	Mwingi East
	Nuu	3,532.0	14	Mai	Mwingi East
			15	Kyui	Mwingi East
	TOTAL	**35,592.6**			

Source: County Environment office

Makueni County

The total area under forest cover in the county is 191 Km^2, which includes 151Km^2 of the five Gazetted forests and 40 Km^2 of the three non-gazetted forests. The Gazetted forests are Nthangu, Makuli, Mbooni, Kilungu and Kibwezi forests.

3.2.5; Wildlife

Kitui County

While the County does not boast of a great variety in wildlife species; Elephants, Baboons, Buffaloes, Hippos, Vervet and Sykes monkeys account for the dominant species. These wildlife species are found in Tsavo East, Kora and Mwingi National Game reserves. Elephants, Leopards, buffalos, lions, hyenas are found in South Kitui Game Reserve and Mwingi Game Reserve which borders Meru and Kora reserves. Other wildlife includes Hippos and Crocodiles in Tana River, and various bird species. The flora in the County includes Aloe Vera, Baobab, and *Melia volkensii* (Mukao).

Makueni County

Tourism activities are mainly confined within the park which is rich in diverse wildlife which include the famous 'big five' consisting of Maasai Lion, Black Rhino, Cape Buffalo, Red Elephant and Leopard. The park also is home to a great variety of bird life such as the Black Kite, Crowned crane, Lovebird and the sacred Ibis.

3.2.6; Water Resources

Kitui County

Kitui County has scarce water resources due to the inadequate and unreliable rainfall and limited surface water sources. The major sources of surface water are seasonal rivers that form during the rainy seasons and dry up immediately after the rains. The Athi and Tana Rivers are the only perennial rivers in the County, and form the borders with neighbouring counties. The drainage system of the Kitui County is largely comprised of the Athi and Tana River catchments. The seasonal rivers within the County flow in a general north, north-west direction and drain into Tana River. Seasonal rivers include Rivers Nzeeu, Tiva, Mwita Syano and Thua in Kitui while in Mwingi there is Tyaa, Enziu, Kamuwongo, Katsee, and Muoo.

The main sources of water include 150 dams, 153 water pans/earth dams, 683 shallow wells, 264 boreholes, 33 protected springs, two permanent rivers namely Tana River and Athi River and 5 unprotected springs. Only a total of 4,774 households have roof catchment systems to harvest rainwater and the potential to increase this is high. The County has inadequate water for both domestic and agricultural use. The majority of the population depends on surface and sub-surface dams which often do not hold sufficient water due to low rainfall and high evaporation rates during the dry seasons.

Treated water is only available in Kitui town, Mwingi town and along Masinga pipeline. There are also minor supply systems at Mutomo, Migwani, Kwa Vonza, and Ukasi. This is insignificant in relation to the all the water used by the households in the County.

Makueni County

The county has two permanent rivers; Athi and Kibwezi. There are four protected springs and 117 boreholes. Households with piped water are 12,671 while 27,752 households have access to potable water. There are 289 water pans and 159 surface dams.

The water demand in the county is 22,113m^3/day and the developed sources have an average production of 13,607m^3/day. There are two major rivers; Athi which is permanent and Thwake which is semi-permanent. Other big rivers include Kaiti, Muooni and Kikuu all of which are seasonal. There are 278 earth dams with a

storage capacity of 3,265,543M^3 while the sand dams are 118. There are four protected springs and 117 boreholes.

There are 159 water supply schemes with a production capacity of 1360.7m^3/hour. Households with piped water are 12,671 while 27,752 households have access to potable water while there are 289 water pans.

The average distance to nearest water source is eight Kilometres indicating that there is need for initiating more water projects. Athi River which is perennial passes through the county and can be used for development of major water supply schemes. Sand and earth dams are used in water harvesting. Due to perennial water shortages, the local community has picked up the practice of roof catchments and installation of and storage tanks to harvest rain water.

3.2.7; Energy Access

Kitui County

The main sources of energy in the county are: Fuel wood which is mainly in the form of firewood in the rural areas while in urban centres it is sold and used as charcoal; Petroleum products such as kerosene/paraffin, liquefied petroleum gas (LPG), motor gasoline, diesel oil and fuel oil; Electricity of which only a small part of the county is connected to the national grid; and alternative sources of energy such as solar power, biogas and wind power whose potential is yet to be harnessed. Electricity in Kenya is produced from hydropower, geothermal and oil sources but only 3.8% of households in Kitui County are connected to the national grid. The electricity connection is low in the county with only 74 trading centres having electricity which is less than half of the trading centres. Due to the low connections, electricity supply is quite unreliable to most households and businesses. The level of access in the rural areas is negligibly low.

Access to affordable energy services is an essential prerequisite to achieving economic growth and poverty reduction. It is essential for the Rural Electrification Programme to be extended to more areas in the County in order to cover more wards. There is also need to embrace renewable energy strategies in Kitui County as this will improve energy access to most households within the County. Biogas, Biofuel, Biomass, Wind power and solar energy have great potential to be harnessed since the climate of the County is windy and hot throughout the year. The Ministry of Energy, Environment and Mining Investments Development has proposed a feasibility study for renewable energy in the County, which will assist in further exploitation of these resources. It also proposes to support the Rural Electrification Programme and the uptake of energy efficiency measures in households.

Kitui County is endowed with huge deposits of coal in the Mui Coal Basin, which traverses Mwingi Central and Kitui East sub counties. This coal basin is divided into four main blocks, A, B, C and D. Feasibility studies have confirmed the commercial viability of these deposits the national government has since signed a concession with a Chinese firm to mine the coal. An expression of interest for construction of coal powered plant to generate electricity has also been advertised for. This concession for exploration is in block C and D of the basin, with blocks A and B still unconcessioned. The potential of coal deposits in block C is estimated at 400,000 million metric tonnes of coal that can be exploited for nearly 50 years. These deposits alone have an estimated value of Sh3.4 trillion at current market rates, while the value of the reserves in Blocks A, B and D is yet to be determined.

Makueni County

Electricity coverage within the county has been expanded through the rural electrification programme. More than 2000 households have been connected. Electricity is mostly used in the households for lighting purposes. There is need to upscale connections particularly in the upcoming markets and institutions. The county experiences long hours of sunshine that has not been exploited to provide solar energy largely. This is largely due to lack of financial capabilities and low awareness of technologies for installation and utilization of this environmentally friendly renewable source of energy.

Firewood is the major source of cooking fuel accounting for 84.8 per cent of households, followed by charcoal at 11.1per cent. However, this poses a great danger to the environment. Paraffin is the most used source of energy for lighting in the households at 69 per cent followed by electricity and solar at 5.9 per cent and 3.8 per cent respectively.

3.2.8; Land Use

Kitui County

Mean Holding Size

The county has a total area of 30,496.4 km^2 of which; 6,369 km^2 of the County land consists of the Tsavo East National Park and is not available for agriculture, 14,137.2 km^2 is arable agricultural land and 6,364.4 km^2 non-arable land. Over 85% of the County's population lives in rural areas. The average population density is 44 persons/km^2 which is generally sparse. The average size of land holding in the County is 0.12 km^2 per person (12 ha per person).

Percentage of Land with Title Deeds

Over 46% of the County land falls in the arable category with 83% of the inhabitants lacking title deeds because most of the land has not been adjudicated. Only about 17% of land owners in the County have title

deeds. The process of land adjudication and registration has been particularly slow. Without titles, land owners are constrained with regards to securing investment loans from banks and Micro Finance Institutions (MFIs).The County Ministry of Lands, Infrastructure and Urban Development has started the process of land adjudication so as to fast track the issuance of title deeds to land owners in the county.

Makueni County

The county has a total arable land of 5042.69Km^2 which is 74 percent of the total area. A total of 1,762.71Km^2 is non-arable accounting for 21.9 percent of the total area. Part of the 2,023 Ha of land that Konza Technology City lies in the county. There are no water masses or industrial area in the county while the urban area accounts for only 7.4 percent of the total area.

Most of the land is used for agricultural purposes since most people depend on agriculture and livestock for their livelihood. The County has potential in horticulture and dairy farming especially the hilly parts of Kilungu and Mbooni west sub counties.

The lowlands are used for livestock keeping, cotton and fruit production. Fruits grown are mainly mangoes, pawpaw and oranges. These areas include; Kathonzweni, Mbooni East, Nzaui and Makueni sub counties. There is an upcoming fruit processing plant at Wote town to process the fruits as well as a ginnery for cotton processing. This will go a long way in value addition for these products.

Mean Holding Size

The county has a mean holding size of 1.58 Ha. This means that every household occupies or owns an average area equivalent to 1.58 Ha. This is high compared to the national mean holding of 0.97Ha per household.

Percentage of Land with Title Deed

In the county 186,814 land owners have title deeds which is only 19.8 per cent of all land owners. The percentage is low compared to the national figure where 39.4 per cent of land owners in the country have title deeds.

Incidence of Landlessness

Incidence of landlessness is highly recorded in Kibwezi West and East Constituencies where there are about 5,000 squatters. There are 25 settlement schemes in Kibwezi West and East Constituencies. There is need to have a permanent solution to the squatter problem.

3.2.8; Population

Kitui County

Population Size and Composition

Population dynamics form an integral part of socio-economic and cultural development for the county. The county's population was 1,012,709 according to the population and household census report of 2009. The report showed that 531,427 were females while 481,282 were males and this was projected to grow to 1,065,330 by 2013. The population growth rate of the county at 2.1% is slightly lower than the national rate of 2.6%. High population exerts pressure on social and natural resources, and it is imperative for the county to develop strategies in addressing the population growth rate.

The county has a high population of children, as shown in the 2009 census report, where the population between the ages of 0-14 years, was 238,928 male and 232,820 females which represented 46.6% of the total population. The population between 65-80 years was 23,391 males and 29,449 females translating to 5.2% of the entire population. This implies a higher dependency of children between 0-14 years than elderly population between 65-80 years. The county should take note of this because it means that there are more people to feed, more schools to build and pressure to create more employment opportunities.

The census shows that there were 81,525 males and 79,977 females in the age cohort 0-4 years, 32,655 males and 40,691 females in the age cohort 20-24 years. This implies that transition from infant to teenage is higher for females than males and thus there is higher mortality for males than females in the county. These statistics tally with normal demographic structures. This also means that the county health authorities should focus on the causes of infant mortality to ensure that male children transition to teenage is improved.

Population density and distribution

The population patterns and distribution in the county are largely influenced by landholding and ownership, availability and accessibility of water, and fertility of soils. The current trend in the county is that more people tend to concentrate on foot hills and plateaus where agriculture is possible. Other settlements are concentrated near towns due to the availability of reliable social amenities and employment opportunities. Climatic conditions have also influenced the settlement patterns, and the majority of people live in scattered settlements with only 5% living in an urban environment. The most densely populated area is Kitui Central with 208 persons per km^2 and the lowest is Kitui East with 25 persons per km^2. The county average is 44 persons per km^2. With the exception of the areas bordering the Tana River county, which experience cattle rustling and banditry the rest of the County does not have any major human conflicts.

The Kitui Town is approximately twice as populous as Mwingi Town and is expected to be so even by the year 2017. It is anticipated that with the development of the Special Economic Zones, the exploitation of coal in Mui basin and limestone in Mutha, more towns will eventually emerge due to high migration into the county and increased economic activity.

Makueni County

Population size and composition

The 2012 projected population in the county stands at 922,183 consisting of 449,036 males and 473,147 females. This is an increase from 884,253 persons as per the 2009 by Kenya National Population and Housing Census. The annual population growth rate stands at 1.4 per cent while the male-female sex ratio stands at 100:105.

In the county 14.3 per cent of the population is below the age five years as compared to 1.8 per cent of the population who are above 80 years of age. The five to nine year group has highest number of persons at 138,986, representing 15.1 per cent of the total population. The population reduces as the age progresses reaching the lowest number at the 75-79 age cohort which constitutes 0.8 per cent of the total population.

Population Density and Distribution

The county is generally sparsely populated except in Kaiti and Mbooni constituencies which have Kilungu and Mbooni hills respectively. These areas have a fairly high projected population density of 296 and 203 persons per square kilometre, respectively compared to the county's density of 115 in 2012. Kaiti and Mbooni constituencies also lie in the fertile upper parts of the county which experiences a higher average rainfall of 800mm-1200mm.

Kibwezi East Constituency is the sparsely populated with 63 persons per Km^2 mainly because it lies on the infertile lowlands characterised by annual insufficient rainfall of 351.9mm - 687.4mm.

Makueni Constituency has the highest population compared to all the other five constituencies followed by Mbooni, Kibwezi West, Kibwezi East, Kaiti and Kilome.

Out of the six constituencies, Makueni has the highest population of 202,010 which accounts for 22 per cent of the total population. Mbooni is the second largest accounting for 21 per cent followed by Kibwezi West at 19 per cent while Kibwezi East has 15 per cent of the total population. Kaiti and Kilome Constituencies have the least population which accounts for 14 per cent and 10 per cent of the total population respectively. The high

population in Makueni is attributed to the location of the county headquarters in the constituency. Mbooni constituency is relatively highly productive in terms of agriculture thereby attracting a larger population.

3.3: PROJECT SITE DESCRIPTION

3.3.1; Transmission Line Route Description

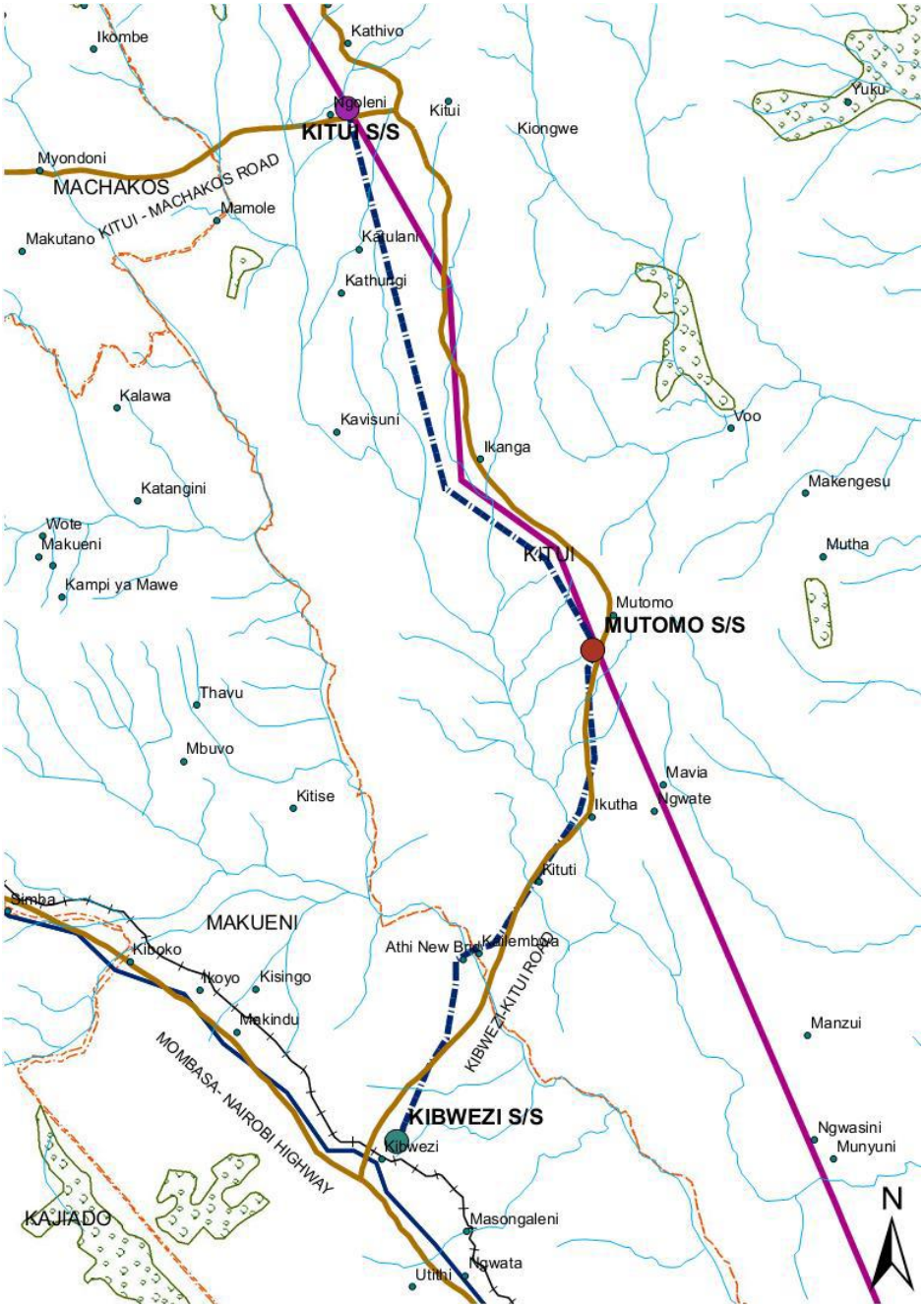
Detailed description of the transmission line route is in appendix I.

The proposed route starts from the 132/33kV Kitui substation and takes a south westerlycourse to avoid the highly populated areas of Kitui town. It runs for a few kilometers in farmlands before crossing the Kitui - Machakos Road and the existing Kiambere – Rabai high Voltage Transmission line. The line then proceeds on to run nearly parallel to the Kitui -Mutomo Road, Myei River, and the Kiambere – Rabai Transmission Line. The distance between the Kitui – Mutomo Road and the TL varies from 3 to 6 km.

The line runs for a distance of 44km before making a slight angle in an easterly direction and continuing farther for a distance of 24 km to reach the site of the proposed Mutomo Substation.

The line then starts from the proposed site of the 132/33kV Mutomo Substation and runs over a distance of 37 km parallel to Kibwezi-Mutomo B7 road up to Kailembwa AP 16. It would cross the Yatta Plateau through the narrow road while maintaining a minimum separation of around 50 meters from the main road.

The TL then crosses River Athi with a span of about 715 meters. Thereafter it takes a South Westerly course and continues along the profile of the road to Kibwezi crossing it on its way and covering 23 km to reach the proposed site for Kibwezi Substation.



Matinyiani to Wikililye

The Kitui – Mutomo - Kibwezi transmission line will start at the Kitui KETRACO Substation, which is located at Matinyani Location, Matinyani Sub-county in Kitui County just a few meters off Kitui-Nairobi highway. This substation is part of the 132kV Mwingi-Kitui-Wote- SultanHamud transmission line project which by the time of assessment was yet to be completed.

The transmission line then proceeds on a south westerly direction to avoid the highly populated areas of Kitui Town. It then crosses the Kitui – Machakos Highway and the existing Kiambere – Rabai High Voltage Transmission line as it moves away from Kitui Town towards Wikililye Market.

The landscape is relatively flat with shrubs mostly not exceeding ten meters except for a few mango trees and some indigenous trees. Most of the structures are permanent and semi-permanent, built using bricks and a few stone buildings. The evident social economic activity within this area is subsistence farming of mangoes and seasonal crops such as maize, beans, and cowpeas among other crops. Farming is largely rain fed which the team was informed was hardly reliable. Livestock keeping supplements the agricultural effort, with cows, goats, and sheep being reared.

Wikililye to Kisasi

Wikililye to Kisasi area presents an inconsistent terrain with mild slopes but the general picture is that of a flat terrain. The vegetation is mainly bushy with patches of rock outcrops.The profile of structures is a mix of semi-permanent mud buildings, and permanent brick houses.

Agricultural activity is low as only small bare portions of land are visible and even so, these portions are sparsely distributed and are only capable of supporting subsistent farming. Livestock rearing can be described as an all year economic activity as herds of goats and cows in good health are evident.

From Kyangunga, there are flat and gentle slopes, short vegetation and the existing old TL is visible. There are many rock outcrops in this area and a small lagga before you get to Kisasi.

Kisasi to Mosa

From Kisasi to Mosa, the land is generally flat and buildings are close. Slight changes in the gradient are visible characterized by mild slopes and rocky outcrop. This area is generally dry with short vegetation and

baobab is the dominant tree species. Structures are mostly permanent and semi-permanent brick buildings. Several brick-making kilns are visible,which is the main construction material. Cattle rearing is the main economic activity. In this area, the TL runs in an almost parallel direction with the Kitui- Mutomo Road but farther away from the road.

Mosa to Ikanga

This is a generally dry area with amixture of short and tall vegetation. The terrain is flat and the houses are very sparsely populated. However, close to Mosa Town houses are closely located, both semi-permanent and permanent. Livestock keeping is the main economic activity besides subsistence farming as evidenced by many small farms.

Ikanga to Mutomo

Among the key features in Ikanga is River Nzeeu, which is located approximately 500 meters from Ikanga Town towards the proposed route of the transmission line. This is the main water source for Ikanga Town and surrounding villages. Ikanga being an area where water issues are sensitive, the presence of this river needs to be taken into consideration in the Environmental Management Plan. Two kilometers from Ikanga Town is a seasonal river called Semea also a key water feature and feeds water to River Nzeeu. From Semea River to a small stream, called Kithina the terrain is slightly sloping. As you approach Kyatune the terrain turns hilly with many rock outcrops. Most of the trees are short with shrubs and some baobab trees scattered unevenly. About three kilometres to Mutomo is a small town called Uae and where a big dam is situated two kilometres from the main road. Mutomo Town is developed in comparison with the small towns previously described and most of the buildings are permanent. It is in Mutomo where the second KETRACO sub-station will be constructed.

Mutomo to Ikutha

This is a dry area and water scarcity is severe as evident by the high number of donkeys carrying/ ferrying water in jerricans and the long queues of people fetching water at water points. This activity is highly noticeable in Kitoo Village.

Very little agricultural activity takes place in this vicinity; livestock keeping is evident by herds of goats and cows, which also graze in the woodlands. Residents have taken up charcoal burning as an economic activity and many charcoal bags are placed on the roadside. There are several boreholes and water reservoirs tanks to check water scarcity in between this area at a small village called Mung'aluni.

The terrain here is flat with woodlands and bushes. Baobab trees are a key feature in this section. At Ikutha, there are gentle slopes and flat areas with short vegetation. There are a few hills and rocky patches of land. There is a seasonal river at Ikutha called Wiitu, which is a main source of water for residents.

Most of the structures are semi-permanent and huts.

Ikutha to Athi

Athi Town lies at the boarder of Kitui and Makueni counties and the terrain is characterised by small hills and ridges in some sections, cliff at Athi river crossing to Yatta Plateau, short shrubs, baobab trees, and several small streams such as Ndiliu, Waa waNdiu, and Katulani.

Livestock keeping is the main economic activity; however, there is evidence of subsistence farming. When water levels are high in Athi River, residents practice small scale fishing as reported by the local residents.

Structures are both permanent brick houses and semi-permanent mud huts. As you approach Athi River, the terrain is gently sloping towards the river and there are small hills on the eastern side of Kitui- Kibwezi Road. Throughout this section, the TL runs parallel and very close (a few metres) to the road.

Athi to Kisayani

From Athi River, there is a slight ascend then the terrain takes a flat orientation with woodlands. This area is generally dry with short vegetation. Baobab trees are a common feature.

Small-scale farming, livestock-keeping and charcoal burning are the main economic activities. In Makaani Town, bags of charcoal are evident staying true to the town's name.

Structures are mostly permanent around Athi Town, but as you move farther from the town semi-permanent structures become dominant.

Kisayani to Kibwezi

The transmission line crosses the road just before Kaluluini centre to the left hand side of the Kibwezi – Mutomo road, turning east slightly before taking the general southward direction. It then crosses the road back to the right-hand side at Kalamba, turning slightly westwards then taking the general southward direction towards Kibwezi. From here, the TL takes a deviation from the main road as it heads towards Kibwezi Town.

At Kisayani the terrain is flat with short vegetation and baobab trees. Cattle-rearing is among the key economic activities locals engage in. A few mango trees are visible from the roadside. Bare farmlands indicating reliance on rain fed agriculture and seasonal farming are evident.

The vegetation is relatively green as you approach Kibwezi Town as well the structures are permanent and the distance between households is comparatively smaller. There is a stream a few meters before start of the tarmac road to Kibwezi Town. Business activities increase significantly, as you approach Kibwezi Town.

However, it is important to note that the TL deviates from the road taking a south-west direction to avoid passing through Kibwezi Town (a heavily built up environment with many anthropogenic activities along each street of the upcoming urban centre), running approximately 4 kilometres before finally terminating at the proposed substation site on a bare land after the Kibwezi Railway Line.

3.3.2; Baseline Biophysical

Appendix II gives detailed floral and faunal report for the Kitui – Mutomo – Kibwezi transmission line

Flora and Fauna

In order to elicit the desired results, flora and fauna of this region will be discussed in sections whereby each section represents the area traversed by the proposed transmission line from location-location, location-sub-location or sub-location-sub-location. Dividing the areas into sections is according to the consultant knowledge based on species diversity, density, distribution and transition to different ecotones. As a result, the following sections were obtained:

SECTION 1: This consists of the area where Kitui substation is located (Matinyani) to Mulutu. This area has marginal potential for agriculture and is only suitable for drought resistant crops. The climax vegetation type in the area is dwarf woodland or bushland dominated by *Acacia* species associated with *Themeda triandra.*

From field obsevations the Matinyani area consisted of bushland dominated by *Acacia Senegal, Uvaria scheffleri, Cassia abbreviate, Adenia lanceolata, Senna bicapsularis* with a general vegetation height of 5m largely dictated by *Acacia Senegal*. However, in Mulutu where the proposed transmission line traverses a road, the vegetation is planted *Jacaranda mimosifolia* associated with *Vitex keniensis* which can go upto 20m in height.

Plate 1: Kitui substation where the proposed power line will start.

Plate 2: The current vegetation structure between Matingani and Mulutu

SECTION 2: Area from Mulutu to Wikililiyee. The species composition in this region is almost similar to the one in section 1 above, the only difference is that it has been modified by human activities. The agro-ecosystems in this section shows high density of *Mangifera indica, Carrica papaya, Croton macrostachyus, Juniperus procera, Cassia spectabilis* with some small patches of crop fields of drought resistant crops such as Cow peas. The average height of the woody layer is 25m.

Plate 3: Agroecosystems of section 2 in the background is *Mangifera indica.*

Plate 4: vegetation structure towards wikililiyee.

SECTION 3: Consist of the area from Wikililiyee to Kisasi traversed by the transmission line. The area shows dry Acacia-Commiphora bushland with some signs of combretum spp confined in the shallow rocky soils. Other species which were more frequent included *Acacia xanthohloea, Terminalia mantale, Balanites aegyptiacca, Rhus natalensis, Grewia bicolor, Olea europoea* and *Euphorbia tirucalli* widely planted as a hedge plant and has gone wild in many places.

Plate 5: Acacia xanthophloea dominating most of the areas in section 3

Plate 6: Disturbed lands in Kisasi dominated with dwarf woody species.

SECTION 4: The current vegetation status from Kisasi to Mosa. The most abundant plant species in this region is *Adansonia digitata* (Baobab) which even left standing where land is cleared. The vegetation almost forms uniform layer with dominant shrubs like *Moringa spp*, *Sterculia spp* and *Maerua spp*. The density however varies and highest on seasonal water courses (Luggas) which shows some abundance of *Acacia tortilis, Capparis spp, Salvadora persica, Acacia Kirkii* and *Boscia spp.*

Plate 7: Adansonia digitata dominating most parts of section 4

Plate 8: Vegetation along lugga observed towards Mosa in the background is A. kirkii.

SECTION 5: Vegetation types and distribution between Mosa and Ikanga traversed by the transmission line. The most dominant species in this region include Cassia spectabilis, Harisonia abyssinica, Barleria teutanis, Clutia abyssinica and Turaea robusta. This area is where theline also traverses River Nzeu with its riparian zone dominated by Hyphaene compressa (Doum palm), Rauvolia mannii, leucas grandis and Salvadora persica. The dominant grasses are *Chloris roxburghiana* and *Digitaria macroblephera*.

Plate 9: vegetation types between Mosa and Ikanga mostly dominated by Cassia spectabilis and some Doum palm also present.

SECTION 6: Consists of area between Ikanga and Mutomo. The area shows high abundance of *Eurphobia candelabum, Croton dichogamus, Balanites spp, Acacia brevispica* and *Phylanthus sepialis.* The ground is mostly covered with sisal, Dobera glabra and Solanum incunum.

Plate 10: Photo of Acacia reficiens, eurphobia candelarum and sisal in the site.

SECTION 7: Shows the area from Mutomo to Ikutha. This region has some rocky outcrops and is characterized by the presence of large shrubs and small trees such as *Diospyros lycioides, acokanthera oppositifolia, Fluggea virosa, Aloe kedongensis* and *Rhus erosa.* About 3km from Ikutha, charcoal burning was evident where Acacia species mostly Acacia Senegal and Acacia tortilis are used. This shows current disturbance existing in the area.

Plate 11: Rocky outcrop vegetation and disturbed sites through charcoal burning observed in the site

SECTION 8: Consists of area from Ikutha to Kilawa. The topography in this area is hilly and mostly dominated by dwarf trees and shrubs with average height of 3m. Some of the species identified include Delonix elata, Dalbergia lactea, Psydrax aethiopica, Balanites glabra, lippia kituiensis, Ozoroa insignis and Calotropis procera being abundant.


Plate 12: General vegetation types and structure between Ikutha and Kilawa

SECTION 9: This section is the area where Athi River adjoins the proposed transmission line. The Athi River ecosystems was considered the most ecologically sensitive due to habitats in both the upper and lower flood plains being niche to some endemic species. The site has high abundance of *Hyphaene compressa, phoenix reclinata, Acacia kirkii, Salvadora persica, Ipomoea spathulata, Cussonia arborea, Delonix elata, Anacardium occidentale, Rauvolfia mannii, Bidens hildebrandtii, Ruttya fruticosa, Thunbergia holstii, Moringa borziana, Acacia tortilis, Pavetta abyssinica, Ocimum suave, Acacia etbaica.*

Plate 13: Athi River ecosystems traversed by the proposed transmission line showing its riparian vegetation.

SECTION 10: Consists of area from Athi to Kibwezi through Kisayani. This is where the proposed transmission line traverses some planted forest of Cassia spectabilis. Also along the route line is Mangifera indica orchard. Towards Kibwezi is a dense woodland of Acacia tortilis, Terminalia brownie, Cordia sinensis among others.

Plate 14: Planted forest of Cassia spectabilis traversed by the proposed transmission line and Mangifera indica orchard observed between Kisayani and Kibwezi

Very few data exists on wild animal occurrence and diversity in the study area since they don't have any protection status. These areas have largely been depleted of medium to large sized mammals which were either hunted for meat or killed on sight because were vermin. No wild mammals of conservation concern were encountered and/or heard of along the proposed transmission line route.

A few large mammal species were reported by local residents to have previously lived in some areas along the line route but have now been locally exterminated. Since none of the mammals of conservation concern were encountered, it is not considered that the proposed transmission line will have significant conservation concern regarding terrestrial mammals.

The construction process will have some impact on the habitat for fauna. Apart from relatively direct loss of habitat, changes to soil temperatures and vegetation cover will also impact the abundance and community structure of fauna.

Although most of the area including that to be followed by proposed power transmission line, is disturbed, it retains considerable bird population. Birds are mobile and in this study, a good number were observed which was then augmented with the existing data on forest birds or water birds of the study area.

Farmland sites had numerous trees, including a big variety of native species such as *Markhamia lutea*, *Adansonia digitata* which was particularly common, as well as fruit trees such as *Artocarpus heterophyllus.* Many birds depend upon trees for roosting, nesting or feeding. There was no real forest along the transmission line route, but many forest generalist and visitor species are found outside forest in areas with plenty of trees.

Numbers of species in other categories were relatively small, and the four regionally-listed species are all widespread. These are the Grey Parrot (R-NT), Spot flanked Barbet, White-headed Saw-wing and Red-chested Sunbird. Only a small population of aerial species (swifts, bee-eaters, swallows) were encountered. There were few open areas of grassland, hence few species of that specialty, and only 7 migrants.

3.3.3; Physical Cultural Resources (PCR) – Archeological and Cultural Heritage

Physical cultural resources, are defined as movable or immovable objects, sites, structures, groups of structures, and natural features and landscapes that have archaeological, paleontological, historical, architectural, religious, aesthetic, or other cultural significance. Physical cultural resources may be located in urban or rural settings, and may be above or below ground, or underwater. Their cultural interest may be at the local, provincial, or national level, or within the international community. Examples of PCR include;

Human-made

- Religious buildings such as temples, mosques, churches
- Exemplary indigenous or vernacular architecture
- Buildings, or the remains of buildings, of architectural or historic interest
- Historic or architecturally important townscapes
- Historic roads, bridges, walls, dams, fortifications, water works
- Archaeological sites (unknown or known, excavated or unexcavated)
- Commemorative monuments
- Historic sunken ships

Natural

- Holy waters and holy wells
- Sacred waterfalls
- Sacred groves and individual sacred trees
- Historic trees
- Sacred mountains and volcanoes
- Caves currently or previously used for human habitation or social activity
- Paleontological sites (ie., deposits of early human, animal or fossilized remains)

- Natural landscapes of outstanding aesthetic quality

Combined Human-made and Natural

- Sites used for religious or social functions such as weddings, funerals, or other traditional community activities
- Places of pilgrimage
- Burial grounds
- Family graves in the homestead
- Historic gardens
- Cultural landscapes
- Natural stones bearing historic inscriptions
- Historic battlegrounds
- Combined human and natural landscapes of aesthetic quality
- Cave paintings

Movable

- Historic or rare books and manuscripts
- Paintings, drawings, icons, jewellery
- Religious artefacts
- Historic costumes and fabrics
- Memorabilia relating to the lives of prominent individuals or to events such as historic battles
- Statues, statuettes and carvings
- Modern or ancient religious artefacts
- Pieces broken off from monuments or historic buildings
- Unregistered archaeological artefacts
- Antiquities such as coins and seals
- Historic engravings, prints and lithographs
- Natural history collections such as shells, flora, minerals

Result of assessment and way-forward

During the assessment, none of the above PCRs was found. However, chance finds cannot be disqualified. During excavations for the tower bases, workers may come across Archaeological finds.

Upon discovery of a heritage site or an Archaeological find, the construction site will be stopped, the site if possible will be restricted using tapes or local materials, and relevant authorities including local administration officers and the museums of Kenya informed for further instructions.

3.3.4; Safety of Aircrafts

The Kenya Civil Aviation Authority (KCAA) regulations, establish standards for determining obstructions in navigable airspace. Issues such as size and height of tower/pylons, right-of-way needs, maintenance access, and impacts to the approach zone, clear zone, or safety zone has to be evaluated and approved by KCAA to utilize property near airports and airstrips.

Section 56 of Civil Aviation Act (Restriction of building in declared areas) observes that, the Cabinet Secretary may, where he considers it to be necessary in the interests of the safety of air navigation, by order published in the Gazette, prohibit the erection within a declared area of any building or structure above a height specified in the order. A “declared area” in this case means any area adjacent to or in the vicinity of an aerodrome which the Cabinet Secretary may by notice in the Gazette declare to be a declared area.

Section 57 (Control of structures, etc., on or near aerodromes), observes that, the KCAA Director General may consider provisions for civil aviation safety and security or efficiency of air navigation ought to be made;

- whether by lighting or otherwise for giving aircraft warning of the presence of any building, structure, tree or natural growth or formation on or in the vicinity of an aerodrome; or
- by the removal or reduction in height of any such obstruction or surface,

Result of assessment and way-forward

The only identified airstrip near the transmission line was in Kitui. However, the transmission line may pass an area that have possibilities of low flying aircrafts.

The Kitui airstrip is quite far from the TL and there are no significant impacts on air safety are envisaged, however, KETRACO will be required to acquire a KCAA license for this transmission line. This may involve overflying the transmission line.

Where it is likely that the power line is hazardous to aviation safety because of its height or location, spherical markers will be used to identify overhead power lines or KETRACO will consider reducing the size of its towers in such sections.

CHAPTER 4: RELEVANT LEGISLATIVE AND REGULATORY FRAMEWORKS

4.1: INTRODUCTION

According to the Kenya National Environment Action Plan (NEAP, 1994) the Government recognized the negative impacts on ecosystems emanating from economic and social development programmes that disregarded environmental sustainability. Following on this, establishment of appropriate policies and legal guidelines as well as harmonization of the existing ones have been accomplished or is in the process of development. The NEAP process introduced environmental assessments in the country culminating into the enactment of the Policy on Environment and Development under the Sessional Paper No. 6 of 1999.

An EIA is a legal requirement in Kenya for all development projects. The Environmental Management and Co-ordination (Amendment) Act, 2015, is the legislation that governs EIA studies. This project falls under the Second Schedule that lists the type of projects that are required to undergo EIA studies in accordance with section 58 (1- 4) of the Act. Projects under the Second Schedule comprise those considered to pose potentially negative environmental impacts.

Kenyan law has made provisions for the establishment of the National Environment Management Authority (NEMA), which has the statutory mandate to supervise and co-ordinate all environmental activities. Policies and legislation highlighting the legal and administrative requirements pertinent to this study are presented below.

4.2: THE CONSTITUTION

The Kenyan Constitution states that every person has the right to a clean and healthy environment, which includes the right –

a) to have the environment protected for the benefit of present and future generations through legislative and other measures, particularly those contemplated in Article 69 and
b) to have obligations relating to the environment fulfilled under Article 70.

Article 69 observes that;

(1) The State shall—

a) Ensure sustainable exploitation, utilization, management and conservation of the environment and natural resources, and ensure the equitable sharing of the accruing benefits;

b) Work to achieve and maintain a tree cover of at least ten per cent of the land area of Kenya;
c) Protect and enhance intellectual property in, and indigenous knowledge of, biodiversity and the genetic resources of the communities;
d) Encourage public participation in the management, protection and conservation of the environment;
e) Protect genetic resources and biological diversity;
f) Establish systems of environmental impact assessment, environmental audit and monitoring of the environment;
g) Eliminate processes and activities that are likely to endanger the environment; and
h) Utilize the environment and natural resources for the benefit of the people of Kenya.

(2) Every person has a duty to cooperate with State organs and other persons to protect and conserve the environment and ensure ecologically sustainable development and use of natural resources.

4.3: POLICY

Kenya Government's environmental policy aims at integrating environmental aspects into national development plans. The broad objectives of the national environmental policy include:

- Optimal use of natural land and water resources in improving the quality of human environment
- Sustainable use of natural resources to meet the needs of the present generations while preserving their ability to meet the needs of future generations
- Conservation and management of the natural resources of Kenya including air, water, land, flora and fauna
- Promotion of environmental conservation through the sustainable use of natural resources to meet the needs of the present generations while preserving their ability to meet the needs of future generations
- Meeting national goals and international obligations by conserving bio-diversity, arresting desertification, mitigating effects of disasters, protecting the ozone layer and maintaining an ecological balance on earth.

4.4: LEGAL FRAMEWORK

Application of national statutes and regulations on environmental conservation suggest that the Proponent has a legal duty and social responsibility to ensure that the proposed development be implemented without compromising the status of the environment, natural resources, public health and safety. This position enhances the importance of this environmental impact assessment for the proposed site to provide a benchmark for its sustainable operation.

Kenya has approximately 77 statutes that relate to environmental concerns. Environmental management activities were previously implemented through a variety of instruments such as policy statements and sectoral laws as well as through permits and licenses. Most of these statutes are sector-specific, covering issues such as public health, soil erosion, protected areas, endangered species, water rights and water quality, air quality, noise and vibration, cultural, historical, scientific and archaeological sites, land use, resettlement, etc.

Some of the key national laws that govern the management of environmental resources in the country are hereby discussed however it is worth noting that wherever any of the laws contradict each other, the Environmental Management and Co-ordination (Amendment) Act, 2015 prevails.

4.4.1; The Environmental Management and Co-ordination (Amendment) Act, 2015

Provides for the establishment of appropriate legal and institutional framework for the management of the environment and related matters. Part II of the Environment Management & Coordination (Amendment) Act, 2015 states that every person in Kenya is entitled to a clean and healthy environment and has the duty to safeguard and enhance the environment. In order to partly ensure this is achieved, Part VI of the Act directs that any new programme, activity or operation should undergo environmental impact assessment and a report prepared for submission to the National Environmental Management Authority (NEMA), who in turn may issue an EIA license as appropriate. The approval process time frame for Project Reports is 45 days and for full EIA Study is 90 days.

This Project falls within Schedule 2 of EMCA 2015 and therefore requires an EIA. The Proponent has commissioned the environmental and social impact assessment study in compliance with the Act. The Proponent shall be required to commit to implementing the environmental management plan laid out in this report and any other conditions laid out by NEMA, prior to being issued an EIA license.

4.4.2; The Environmental (Impact Assessment and Audit) Regulations, 2003

The regulations observe that; No proponent shall implement a project -

a) likely to have a negative environmental impact; or
b) for which an environmental impact assessment is required under the Act or these Regulations;

Unless an environmental Impact Assessment has been concluded and approved in accordance with the Regulations.

This Study is aimed at ensuring compliance of these regulations. The study has collected information on project design, the relevant baseline data, conducted an elaborate public consultation process and created an Environmental and Social Management Plan(ESMP) and a monitoring plan (ESMoP) that if implemented will ensure conservation and protection of environment and improved livelihoods.

4.4.3; Environmental Management and Coordination (Noise and Excessive Vibration Pollution Control) Regulations, 2009.

The regulations observe that, except as otherwise provided in the Regulations, 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.

In determining whether noise is loud, unreasonable, unnecessary or unusual, the following factors may be considered:

- Time of the day;
- Proximity to residential area;
- Whether the noise is recurrent, intermittent or constant;
- The level and intensity of the noise;
- Whether the noise has been enhanced in level or range by any type of electronic or mechanical means; and,
- Whether the noise is subject to be controlled without unreasonable effort or expense to the person making the noise.

The Proponent shall observe policy and regulatory requirements and implement the measures proposed in this documenting as an effort to comply with the provisions of the Regulations.

4.4.4; Environmental Management and Coordination, (Water Quality) Regulations 2006

The Regulations observe that, every person shall refrain from any act which directly or indirectly causes, or may cause immediate or subsequent water pollution, and it shall be immaterial whether or not the water resource was polluted before the enactment of the Act. It further observes that, no person shall throw or cause to flow into or near a water resource any liquid, solid or gaseous substance or deposit any such substance in or near it, as to cause pollution.

It goes on to state that, no person shall:

a) discharge, any effluent from sewage treatment works, industry or other point sources into the aquatic environment without a valid effluent discharge license issued in accordance with the provisions of the Act.

b) abstract ground water or carry out any activity near any lakes, rivers, streams, springs and wells that is likely to have any adverse impact on the quantity and quality of the water, without an Environmental Impact Assessment license issued in accordance with the provisions of the Act; or

c) cultivate or undertake any development activity within a minimum of six meters and a maximum of thirty meters from the highest ever recorded flood level, on either side of a river or stream, and as may be determined by the Authority from time to time.

The Proponent will observe the requirements of these regulations especially during the construction phase.

4.4.5; Environmental Management and Co-ordination (Waste Management) Regulations, 2006.

The regulation observes that;

1. No person shall dispose of any waste on a public highway, street, road, recreational area or in any public place except in a designated waste receptacle.
2. Any person whose activities generate waste shall collect, segregate and dispose or cause to be disposed off such waste in the manner provided for under these Regulations.
3. Without prejudice to the foregoing, any person whose activities generates waste has an obligation to ensure that such waste is transferred to a person who is licensed to transport and dispose off such waste in a designated waste disposal facility.
4. Any person whose activities generate waste, shall segregate such waste by separating hazardous waste from non-hazardous waste and shall dispose of such wastes in such facility as is provided for by the relevant Local Authority.
5. Any person who owns or controls a facility or premises which generates waste shall minimize the waste generated by adopting the cleaner production principles.

The Proponent shall observe the guidelines as set out in the environmental management plan laid out in this report as well as the recommendation provided for mitigation /minimization /avoidance of adverse impacts arising from the Project activities.

4.4.6; Environmental Management and Co-ordination (Air Quality) Regulations, 2009.

The objective of these Regulations is to provide for the prevention, control and abatement of air pollution to ensure clean and healthy ambient air. The regulations observe that;

1. No person shall-

a) act in a way that directly or indirectly causes, or is likely to cause immediate or subsequent air pollution; or

b) emit any liquid, solid or gaseous substance or deposit any such substance in levels exceeding those set out in the First Schedule.

c) No person shall cause emission of the priority air pollutants prescribed in the Second Schedule to exceed the ambient air quality limits prescribed in the First Schedule.

2. No person shall cause emission of the priority air pollutants prescribed in the Second Schedule to exceed the ambient air quality limits prescribed in the First Schedule.
3. No person shall cause the Ambient Air Quality levels specified in the First Schedule of these Regulations to be exceeded.
4. No person shall cause or allow particulate emissions into the atmosphere from any facility listed under the Fourth Schedule to these Regulations in excess of those limits stipulated under the Third Schedule.
5. Any person, being an owner of premises, who causes or allows the generation, from any source, of any odour which unreasonably interferes, or is likely to unreasonably interfere, with any other person's lawful use or enjoyment of his property shall use recognised good practices and procedures to reduce such odours to a level determined by the odour panel, including any guidelines published by the Authority for reducing odours.

The Proponent shall observe policy and regulatory requirements and implement the mitigation measures proposed in this document in an effort to comply with the provisions of these Regulations on abatement of air pollution.

4.4.7; Environmental Management and Coordination (Wetlands, River Banks, Lake Shores and Sea Shore Management) Regulation, 2009.

The Objectives of these Regulations include-

a) to provide for the conservation and sustainable use of wetlands and their resources in Kenya;
b) to promote the integration of sustainable use of resources in wetlands into the local and national management of natural resources for socio-economic development;
c) to ensure the conservation of water catchments and the control of floods;
d) to ensure the sustainable use of wetlands for ecological and aesthetic purposes for the common good o all citizens;
e) to ensure the protection of wetlands as habitats for species of fauna and flora;
f) provide a framework for public participation in the management of wetlands;
g) to enhance education research and related activities; and
h) to prevent and control pollution and siltation.

The Proponent shall comply with the provisions of these regulations

4.4.8; Environmental Management and Coordination (Conservation of Biological Diversity and Resources, Access to Genetic Resources and Benefit Sharing) Regulations, 2006.

The regulations observe that;

(1) A person shall not engage in any activity that may-

a. have an adverse impact on any ecosystem;
b. lead to the introduction of any exotic species;
c. lead to unsustainable use of natural resources,

Without an Environmental Impact Assessment Licence issued by the Authority under the Act.

The Proponent shall comply with the provisions of these regulations

4.4.9; Environmental Management and Coordination (Controlled Substances) Regulation, 2007, Legal Notice No. 73

The Controlled Substances Regulations defines controlled substances and provides guidance on how to handle them. The regulations stipulate that controlled substances must be clearly labelled with among other words, "Controlled Substance-Not ozone friendly'' to indicate that the substance or product is harmful to the ozone layer. Advertisement of such substances must carry the words, "Warning: Contains chemical materials or substances that deplete or have the potential to deplete the ozone layer." Persons handling controlled substances are required to apply for a permit from NEMA.

Proponent will not use controlled substances in the operation of the project. Hazardous materials such as PCB based coolants will not be used in the transformers, capacitors, or other equipment.

4.4.10; The Occupational Health and Safety Act, 2007

This is an Act of Parliament to provide for the safety, health and welfare of workers and all persons lawfully present at workplaces, to provide for the establishment of the National Council for Occupational Safety and Health and for connected purposes. Of importance to the proposed project are:

- Registration of workplaces
- Health General Provisions (including cleanliness, overcrowding, ventilation, lighting, drainage of floors, and sanitary conveniences)
- Safety General Provisions (including ladders, ergonomics at the workplace, Fire prevention, safety provisions in case of fire, evacuation procedures)

- Welfare General Provisions (including supply of drinking water, washing facilities, accommodation for clothing, facilities for sitting, and first-aid)
- Prevents employment of children in workplaces where their safety and health is at risk.
- Encourages entrepreneurs to set achievable safety targets for their enterprises.
- Promotes reporting of work-place accidents, dangerous occurrences and ill health with a view to finding out their causes and preventing of similar occurrences in future.
- Promotes creation of a safety culture at workplaces through education and training in occupational safety and health.

Failure to comply with the OSHA, 2007 attracts penalties of up to Ksh. 300,000 or 3 months jail term or both or penalties of Ksh. 1,000,000 or 12 months jail term or both for cases where death occurs and is in consequence of the employer

The report advices the Proponent on safety and health aspects, potential impacts, personnel responsible for implementation and monitoring, frequency of monitoring, and estimated cost, as a basic guideline for the management of Health and Safety issues in the proposed project.

4.4.11; The Public Health Act (Cap. 242)

The Act Provides for the securing of public health and recognizes the important role of water. It provides for prevention of water pollution by stakeholders, among them Local Authorities (county councils). It states that no person/institution shall cause nuisance or condition liable to be injurious or dangerous to human health.

The Proponent shall observe policy and regulatory requirements and implement measures to safeguard public health and safety.

4.4.12; Occupiers Liability Act (Cap. 34)

Rules of Common Law regulates the duty which an occupier of premises owes to his visitors in respect of danger and risk due to the state of the premises or to things omitted or attributes an affliction on his/her health to a toxic material in the premises.

The Proponent shall endeavour to ensure that the management of health and safety issues is of high priority during the operational phase of the project.

4.4.13; The Standards Act Cap 496

The Act is meant to promote the standardization of the specification of commodities, and to provide for the standardization of commodities and codes of practice; to establish a Kenya Bureau of Standards, to define its functions and provide for its management and control. Code of practice is interpreted in the Act as a set of rules relating to the methods to be applied or the procedure to be adopted in connection with the construction, installation, testing, sampling, operation or use of any article, apparatus, instrument, device or process.

The Act contains various specifications touching on electrical products. The Proponent shall ensure that commodities and codes of practice utilized in the project adhere to the provisions of this Act.

4.4.14; Energy Act, 2006

The Act prescribes the manner with which licenses shall be obtained for generating, transmitting and distributing electricity. The provisions of this Act apply to every person or body of persons importing, exporting, generating, transmitting, distributing, supplying or using electrical energy; importing, exporting, transporting, refining, storing and selling petroleum or petroleum products; producing, transporting, distributing and supplying of any other form of energy, and to all works or apparatus for any or all of these purposes. The Act establishes an energy commission, which is the main policy maker and enforcer in the energy sector. This commission among other things is responsible for issuing all the different licenses in the energy sector. Section 6 (1) observes that, the Cabinet Secretary shall develop and publish national energy plans in respect of fossil fuels, renewable energy and electricity, which shall be reviewed every three years. Subsection 4 (e), observes that the development of the energy plans shall take into account environmental, health, safety and socio-economic impacts

The Proponent shall observe the guidelines as set out in the Energy Act

4.4.15; Land Registration Act, 2012

An Act of Parliament to revise, consolidate and rationalize the registration of titles to land, to give effect to the principles and objects of devolved government in land registration, and for connected purposes

The Proponent shall adhere to the requirements of the Act in the implementation of land acquisition.

4.4.16; The Community Land Act, 2016

AN ACT of Parliament to give effect to Article 63 (5) of the Constitution; to provide for the recognition, protection and registration of community land rights; management and administration of community land; to

provide for the role of county governments in relation to unregistered community land and for connected purposes

The Proponent shall comply with the provisions of the Act in the acquisition of community Land.

4.4.17; Forests Act

An Act of Parliament to provide for the establishment, development and sustainable management, including conservation and rational utilisation of forest resources for the socio-economic development of the country. The Act applies to all forests on public, community and private lands.

The principles of this Act include

- good governance in accordance with Article 10 of the Constitution;
- public participation and community involvement in the management of forests;
- consultation and co-operation between the national and county governments;
- the values and principles of public service in accordance with Article 232 of the Constitution;
- protection of indigenous knowledge and intellectual property rights of forests resources; and
- international best practices in management and conservation of forests.

This act will not be invoked as there are no gazetted forests in the project area

4.4.18; National Museums and Heritage Act, 2006

An Act of Parliament to consolidate the law relating to national museums and heritage; to provide for the establishment, control, management and development of national museums and the identification, protection, conservation and transmission of the cultural and natural heritage of Kenya; to repeal the Antiquities and Monuments Act (Cap. 215) and the National Museums Act; and for connected purposes

The proponent shall follow due procedures in case of unearthing any antiquity.

4.4.19; The Civil Aviation Act, 2013

Under this Act, the Kenya Civil Aviation Authority (KCAA) has to authorize and approve the height of the mast for the purpose of ensuring the safety of flying aircraft over the proposed project area.

Section 56 of Civil Aviation Act (Restriction of building in declared areas) observes that, the Cabinet Secretary may, where he considers it to be necessary in the interests of the safety of air navigation, by order published in the Gazette, prohibit the erection within a declared area of any building or structure above a height specified in

the order. A “declared area” in this case means any area adjacent to or in the vicinity of an aerodrome which the Cabinet Secretary may by notice in the Gazette declare to be a declared area.

Section 57 (Control of structures, etc., on or near aerodromes), observes that, the KCAA Director General may consider provisions for civil aviation safety and security or efficiency of air navigation ought to be made;

- whether by lighting or otherwise for giving aircraft warning of the presence of any building, structure, tree or natural growth or formation on or in the vicinity of an aerodrome; or
- by the removal or reduction in height of any such obstruction or surface,

The Proponent shall comply with the provisions of the Act in seeking authorization from KCAA.

4.4.20; Physical Planning Act (Cap286)

The Act provides for the preparation and implementation of physical development plans and for related purposes. It gives provisions for the development of local physical development plan for guiding and coordinating development of infrastructure facilities and services within the area of authority of County, municipal and town council and for specific control of the use and development of land.

The Proponent shall secure all mandatory approvals and permits as required by the law.

4.4.21; Penal Code Act (Cap.63)

The Act states that if any person or institution that voluntarily corrupts or foils water for public springs or reservoirs, rendering it less fit for its ordinary use is guilty of an offence. Section 192 of the same Act says a person who makes or vitiates the atmosphere in any place to make it noxious to health of persons /institution is dwelling or business premises in the neighbourhood or those passing along public way, commit an offence.

The Proponent shall observe the guidelines as set out in the environmental management and monitoring plan laid out in this report as well as the recommendation provided for mitigation/ minimization/ avoidance of adverse impacts arising from the project activities.

4.4.22; Work Injury Benefits Act, 2007.

An Act of Parliament to provide for compensation to employees for work related injuries and diseases contracted in the course of their employment and for connected purposes

The proponent will ensure that, any consultant work for this project observes this law

4.4.23; Workmen's Compensation (Compulsory Insurance) Order.

The Oder observes that, every employer to whom this Order applies shall insure and keep himself insured with an insurer carrying on business in Kenya as an insurance company, in respect of any liability which he may incur, under the Act, to each workman employed by him either exclusively or in part in any undertaking or in part of any under-taking referred to in paragraph 2 of the order.

The proponent will ensure that, any consultant work for this project observes this law

4.4.24; The Wildlife Conservation and Management Act, 2013.

An Act of Parliament to provide for the protection, conservation, sustainable use and management of wildlife in Kenya and for connected purposes. The act observes that, it is desirable that the present powers relating to the management and conservation of wildlife in Kenya be amalgamated and placed in a consolidated Service of the Government; and that the prime objective of the Service be to ensure that wildlife is managed and conserved so as to yield to the Nation in general and to individual areas in particular, optimum returns in terms of cultural, aesthetic and scientific gains as well as such economic gains as are incidental to proper wildlife management and conservation and which may be secured without prejudice to such proper management and conservation. The Act however, observes that, it is necessary, for the achievement of that objective, that full account should be taken of the varied forms of land use and the interrelationship between wildlife conservation and management and other forms of land use.

The proponent will ensure that, the requirements of this law are observed.

4.4.25; The Water Act, 2016.

An Act of Parliament to provide for the regulation, management and development of water resources, water and sewerage service; and for other connected purposes. This Act provides for the regulation, management and development of water resources and water and sewerage services in line with the Constitution. Authorities shall, in administering or applying this Act, be guided by the principles and values set out in Articles 10,43. 60 and 232 of the Constitution. it establishes the Water Resources Authority ("Authority"), the National Water Harvesting and Storage Authority, the Water Services Regulatory Board, the Water Sector Trust Fund and the Water Tribunal.

The proponent will ensure that, the requirements of this law are observed.

4.4.26; HIV and AIDS Prevention and Control Act, 2006.

An Act of Parliament to provide measures for the prevention, management and control of HIV and AIDS, to provide for the protection and promotion of public health and for the appropriate treatment, counseling, support and care of persons infected or at risk of HIV and AIDS infection, and for connected purposes.

The object and purpose of this Act is to;-

a) promote public awareness about the causes, modes of transmission, consequences, means of prevention and control of HIV and AIDS;
b) extend to every person suspected or known to be infected with HIV and AIDS full protection of his human rights and civil liberties by;-
   - prohibiting compulsory HIV testing save as provided in this Act;
   - guaranteeing the right to privacy of the individual;
   - outlawing discrimination in all its forms and subtleties against persons with or persons perceived or suspected of having HIV and AIDS;
c) (iv) ensuring the provision of basic healthcare and social services for persons infected with HIV and AIDS;
d) (c) promote utmost safety and universal precautions in practices and procedures that carry the risk of HIV transmission; and
e) (d) positively address and seek to eradicate conditions that aggravate the spread of HIV infection.

The proponent and all his contractors will ensure that, the requirements of this law are observed.

4.4.27; National Gender and Equality Commission Act, 2011.

An Act of Parliament to establish the National Gender and Equality Commission as a successor to the Kenya National Human Rights and Equality Commission pursuant to Article 59(4) of the Constitution; to provide for the membership, powers and functions of the Commission, and for connected purposes. Key to this act is the affirmative action, popularly known as the Two-thirds gender rule, that requires not more that two-thirds of people who hold public office be from the same gender.

The proponent will try to ensure that, the requirements of this law are observed.

4.4.28; Agriculture and Food Authority Act, 2013.

An Act of Parliament to provide for the consolidation of the laws on the regulation and promotion of agriculture generally, to provide for the establishment of the Agriculture and Food Authority, to make provision for the

respective roles of the national and county governments in agriculture excluding livestock and related matters in furtherance of the relevant provisions of the Fourth Schedule to the Constitution and for connected purposes

The proponent will ensure that, the requirements of this law are observed, although only a small section of the project site practice agriculture.

4.4.29; Mining Act, 2016.

AN ACT of Parliament to give effect to Articles 60, 62 (1)(f), 66 (2), 69 and 71 of the Constitution in so far as they apply to minerals; provide for prospecting, mining, processing, refining, treatment, transport and any dealings in minerals and for related purposes

Section 20 (Functions of the Director of Mines) part 1(l) observes that, the Director of Mines shall, through the Principal Secretary, be responsible to the Cabinet Secretary for exercising regulatory administration and supervision over the use of commercial explosives in accordance with the Explosives Act (Cap. 115).

The proponent will, before any blasting or explosive is used, apply for a blasting License from the Director of Mines

4.4.30; Valuers Act.

This is an Act of Parliament to provide for the registration of valuers and for connected purposes. The Act establishes a Valuers Registration Board, which has the responsibility of regulating the activities and conduct of registered valuers in accordance with the provisions of the Act.

The proponent will ensure that, the requirements of this law are observed.

4.4.31; Employment Act, 2007.

An Act of Parliament to repeal the Employment Act, declare and define the fundamental rights of employees, to provide basic conditions of employment of employees, to regulate employment of children, and to provide for matters connected with the foregoing

The proponent will ensure that, the requirements of this law are observed.

4.5 INTERNATIONAL OBLIGATIONS

4.5.1 World Bank's Safeguard Policies

This EIA is also based on internationally respected procedures recommended by the World Bank, covering environmental guidelines. Reference has been made to the Environmental Assessment Operational Policy (OP) 4.01, and Environmental Assessment Source Book Volume II, which provides the relevant sectoral guidelines as discussed below.

The objective of the World Bank's environmental and social safeguard policies is to prevent and mitigate undue harm to people and their environment in the development process. These policies provide guidelines for bank and borrower staffs in the identification, preparation, and implementation of programs and projects. Safeguard policies have often provided a platform for the participation of stakeholders in project design, and have been an important instrument for building ownership among local populations. (World Bank, 1999-2006)

4.5.1 World Bank Safeguard Policy 4.01-Environmental Assessment

The environmental assessment process provides insights to ascertain the applicability of other WB safeguard policies to specific projects. This is especially the case for the policies on natural habitats, pest management, and physical cultural resources that are typically considered within the EA process. The policy describes an environmental assessment (EA) process for the proposed project. The breadth, depth, and type of analysis of the EA process depend on the nature, scale, and potential environmental impact of the proposed project. The policy favours preventive measures over mitigatory or compensatory measures, whenever feasible.

The operational principles of the policy require the environmental assessment process to undertake the following

- Evaluate adequacy of existing legal and institution framework including applicable international environmental agreements. This policy aims to ensure that projects contravening the agreements are not financed.
- Stakeholder consultation before and during project implementation
- Engage service of independent experts to undertake the environmental assessment
- Provide measures to link the environmental process and findings with studies of economics, financial, institutional, social and technical analysis of the proposed project.
- Develop programmes for strengthening of institutional capacity in environmental management

The requirements of the policy are similar to those of EMCA which aims to ensure sustainable project implementation. Most of the requirements of this safeguard policy have been responded to in this report by evaluating the impact of the project, its alternatives, existing legislative framework and public consultation.

4.5.2 Bank Safeguard Policy 4.04-Natural Habitats

This safeguard policy requires that the study use precautionary approach to natural resources management to ensure environmental sustainability. The policy requires conservation of critical habitat during project development. To ensure conservation and project sustainability the policy requires that:

- Project alternative be sought when working in fragile environment areas;
- Key stakeholders be engaged in project design, implementation, monitoring and evaluation including mitigation planning.

The requirements of this policy were observed as much as possible during the EIA study. The consulting team engaged several stakeholders during project impact evaluation and those consulted included the NEMA, WRMA, KWS, IUCN and KFS among others.

4.5.3 Bank Safeguard Policy 4.09-Pest Management

This policy promotes the use of ecologically based biological or environmental pest management practices. The policy requires that procured pesticides should meet the WHO recommendations and not be among those on the restricted list of formulated products found in the WHO Classes IA and IB or Class II.

This policy is not triggered since routine maintenance of project site will not involve the use of pesticides or agrochemical materials to control vegetation growth. In practice clearance of vegetation growth along way leave is done using mechanical methods especially slashing of grass.

4.5.4 Bank Safeguard Policy 4.12-Involuntary Resettlement

Resettlement due to infrastructure development is not a new phenomenon in Kenya but the government has no Policy Document or Act that aims at ensuring that persons who suffer displacement and resettlement arising from such development activities can be compensated adequately for their losses at replacement costs.

The World Bank's Operational Policy 4.12 has been designed to mitigate against impoverishment risks associated with Involuntary Resettlement and the restoration or improvement of income-earning capacity of the Project Affected People (PAP).

The proponent already has a RAP Policy Framework. For this project, the proponent will conduct, at the right time, a detailed RAP and ensure it is implemented as per this OP

4.5.5 Bank Safeguard Policy 4.12-Indigenous People

This policy requires project to be designed and implemented in a way that fosters full respect for Indigenous Peoples' dignity, human rights and cultural uniqueness and so that they receive culturally compatible social and economic benefits and do not suffer adverse effects during the development process.

This policy is not triggered as the proposed project area is not occupied by IP (in the strict sense of the Banks definition of IP) who identifies with the areas.

4.5.6 World Bank Safeguard Policy BP 17.50- Public Disclosure

This BP encourages Public Disclosure (PD) or Involvement as a means of improving the planning and implementation process of projects. This procedure gives governmental agencies responsibility of monitoring and managing the environmental and social impacts of development projects particularly those impacting on natural resources and local communities. The policy provides information that ensures that effective PD is carried out by project proponents and their representatives. The BP requires that Public Involvement should be integrated with resettlement, compensation and indigenous peoples' studies. Monitoring and grievances address mechanism should also be incorporated in the project plan.

The proposed project incorporated public participation and stakeholders' consultation as part of the ESIA studies in order to collect the views of the local communities and their leaders for incorporation in the project mitigation plan. The consultation was successful and the community members gave a number of views that have been considered in the mitigation plan. Further public sensitization and disclose in Counties and Sub-County offices will be done by KETRACO during project implementation

4.5.2 United Nations Framework Convention on Climate Change, 1992

The objective of the treaty is to stabilize greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Bush clearing on the way-leave trace, extra efficiency (30% of energy is lost while transmitting power on 33kV line as opposed to high voltage lines), and communities using electricity as opposed to fuel wood will invoke this treaty

The Proponent shall comply with the provisions of this convention

4.5.3 United Nations Convention on Biological Diversity, 2000

The objectives of this Convention are the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources, including by appropriate access to genetic resources and by appropriate transfer of relevant technologies, taking into account all rights over those resources and to technologies, and by appropriate funding.

The Proponent shall comply with the provisions of this convention

4.5.4 Ramsar Convention – on Wetlands of International Importance especially as a Waterfowl Habitat

The Convention's mission is "the conservation and wise use of all wetlands through local and national actions and international cooperation, as a contribution towards achieving sustainable development throughout the world".

The Proponent shall comply with the provisions of this convention

CHAPTER 5: STAKEHOLDER CONSULTATION

5.1: INTRODUCTION

Stakeholder consultation was undertaken among people living in the environs of the proposed transmission project as an integral part of the ESIA study. The aim was to ensure that all stakeholder interests were identified and incorporated in project development: at planning, implementation, and operation phases.

The specific objectives for consultation process were to:

- Create public awareness about the proposed project
- Seek public opinion and concerns relating to the project and more specifically problems they anticipate and ways of overcoming them.
- Obtain professional advice from sector heads including departmental heads and local administration
- Consultatively and in a participatory way identify potential positive and negative impacts of the project and seek remedial measures
- Sell the project to the public for their acceptance and ownership

These meetings enabled interested and affected parties to contribute their concerns (views and opinions on the proposed project) which might have been overlooked during the scoping exercise. Findings of stakeholder analysis were very important in predicting impacts and development of ESMP. Public consultations for the proposed project followed several steps as described below:

5.2: IDENTIFICATION OF STAKEHOLDERS

The proposed project will typically involve land acquisition for construction of permanent structures and/or infrastructure including steel pylons, transformers, towers, bus bars, among other infrastructure. Of necessity, land for the location of these permanent structures must be acquired. Communities living within the environs of the proposed site were identified as Project Affected Persons (PAPs).

This study also identified a second category of stakeholders comprised of GoK officers in charge of diverse sectors, which are likely to be impacted by the project. This category was also consulted as key informants on sectoral policy and to advise the ESIA study on mitigation measures to be put in place so as to minimize adverse impacts in respective sectors. This category also included local policy makers and opinion leaders, local administration, local authorities and civic leaders.

5.3: APPROACH TO STAKEHOLDER CONSULTATIONS

A detailed stakeholder consultation for this study was undertaken from 27th September to 6th October 2017. These consultations were conducted in the form of:

5.3.1; Key Informant Oral Interviews:

The following people were consulted:

Kitui

1. Intern, National Environment Management Authority (NEMA)
2. ICT, System Administration Manager, Tanathi Water Services Board.
3. County Labour Officer, Ministry of Labour,
4. Director, Physical Planning Department, Ministry of Lands.
5. Livestock Breeding Officer, Livestock Development and Fisheries.
6. Assistant Director, Fisheries Department.
7. County Executive Committee Member, County Ministry of Trade, Industry, IT and Cooperatives.
8. Chief Officer, Agriculture, Water and Irrigation.
9. Ecosystem Conservator, Kenya forest Service.
10. Chief Officer, Ministry of Health and Sanitation.
11. Water Rights Officer, Water Resources Authority.
12. Assistant County Commissioner, Athi Sub-county.
13. Chief Matinyani Location.
14. Chief Wikililye Location.
15. Chief Kisasi Location.
16. Chief Mosa Location.
17. Chief Ikanga Location.
18. Chief Mutomo Location.
19. Chief Ikutha Location.
20. Chief Athi Location.
21. Assistant Chief, Wikililye Location.
22. Assistant Chief, Mosa Location.
23. Assistant Chief, Ikanga Location.

Makueni

1. CEO, National Environment Management Authority (NEMA)
2. County Director of Health, Ministry of Health.
3. Director, Socio-Economic Planning.

4. County Veterinary Officer, Agriculture, Livestock and Fisheries Department.
5. Ecosystem Conservator, Kenya forest Service.
6. Liaison Officer, Tana River Development Authority.
7. County Irrigation Officer, National Irrigation Board.
8. Director, Lands and Physical Planning.
9. Senior Warden Chyulu Hills National Park
10. Senior Grounds Officer, Kenya Civil Aviation Authority, Nairobi
11. Acting Chief Officer, Trade, Tourism and Cooperatives.
12. County Drought Coordinator, National Drought Management Authority.
13. County Surveyor, County Survey Office.
14. Accountant, National Drought Management Authority.
15. Occupational Health and Safety Officer, Ministry of Labour.
16. Chief Kisayani Location.
17. Chief Kibwezi Location.

5.3.2; Key Informant Questionnaires:

Open-ended questionnaires were administered to stakeholders comprised of GOK officers and civil society groups in charge of diverse sectors which are likely to be impacted by the project. Concerns, views and opinions from a total of 23 respondents were received.

5.3.3; Community Questionnaires:

Open-ended questionnaires were administered to households, and small business enterprises neighboring the site. Concerns, views and opinions from a total of 262 respondents were received.

5.3.4; Public Baraza

Public barazas were held in Matinyani, Wikililye, Kisasi, Mosa, Ikanga, Mutomo, Ikutha, Athi, Kisayani and Kibwezi, with the assistance of the local administration and leaders. In the Barazas, the team introduced themselves, their consultancy firm and the proponent; explained to the communities the proposed project; highlighted the advantages of the project; informed the participants that, they had been contracted among others to help develop an environmental management plan that would ensure any negative impacts of the project are mitigated and that the participants had been identified as an important stakeholder who would assist in developing the management plan and therefore the reason for the visit; they then gave the participants a chance to ask questions which were then answered.

The issues and benefits as identified by the participants are highlighted below;

MATINYANI; 3rd October, 2017- 9:00 am; Venue: Kalia Chief's Office

Questions and comments	Answers
What are the benefits that the PAPs will get?	For the entire county, power will be reliable (no more blackouts), adequate for everyone including those who want to invest in heavy industries and secure (no more over-voltages that result in destruction of electrical equipment). More jobs will be available for the youth and many other benefits. For PAPs there will be compensation is of structures; Trees and crops and Land.
What happens if TL pass through areas of importance like graves and burial sites within properties of PAPs?	Part of the work of the consultant is to identify all culturally important areas and beliefs and come up with plans that ensure they are as much as possible not interfered with. Burial sites are a public utility and it is KETRACO's policy not to affect public utilities – so the TL will be relocated to avoid this. It may however not be possible to avoid over-running all the individual graves but KETRACO will ensure no excavation of graves is done and if done by mistake all necessary cultural procedures are followed to right the wrong.
Will KETRACO supply power to the locals?	No; KETRACO will only transmission the power, step it down at the substation and give it to Kenya Power to supply the customers


Assistant Chief Matinyani address the baraza


Participants follow proceedings of baraza

WIKILILYE; 3rd October, 2017- 2:00pm; Venue: Wikililye Market

Questions and comments	Answers
Are there any benefits to the community once the project is implemented?	Power will be adequate and reliable; Youth will get jobs. Security will be enhanced. And depending on availability of finances KETRACO can provide CSRs like tree seedlings
What are the health effects of the proposed	There are no health effects as long as you

TL?	observe the way-leave corridor requirements. Similar transmission lines are being built in the US, Europe and Japan and if they had health effects, these countries would not allow their construction. New technology have come with new safety measures i.e. new TL have very little if any corona effects (responsible for the continuous noise by the conductors).
What is the distance of the way leave?	It covers an area of 30m wide; 15m on either side of the center line.
How will those living far off from the TL benefit?	When more power is added to the grid, there will be enough power to be supplied to local communities. More people will be able to access electricity/ power.
The project should be implemented as soon as possible.	
Citizens should be involved in the planning process of the proposed project.	

Participants prepare for the start of Wikililye Baraza

Chief Wikililye welcoming speach

Question time

Assistant Chief Wikililye giving a vote of thanks

KISASI; 4th October, 2017- 10:00am; Venue: Kisasi Market

Questions and comments	Answers
Will the TL pass along the road just like the distribution lines?	Since it requires a way leave of 30m, it has to pass far away from main road; probably in the bushes and people's farms.
What are the intentions of such public consultations?	According to the constitution, public consultation has to be carried out for any proposed project before implementation so as to gather views, opinions and concerns regarding the proposed project before. This project is for the people of Kisasi and it is very important that they are informed about it early enough and constantly so that they can buy into it and there will be problems during implementation
Will compensation be done to only those land owners with title deeds? What of those who don't have titles?	Compensation is done to both PAPs with title deeds and those who don't have title deeds. KETRACO understands that not all rightful owners of land have titles deed and so it has its own internal procedures to identify these rightful owners
What are the activities that can be done on the way leave?	Some examples include grazing and cultivation. However, one cannot build a

	structure or grow tall trees on the way-leave corridor.
Has the feasibility study been done to determine the exact route of TL?	Feasibility of the proposed TL has been done; the line route has been identified though the route might change depending on the results of this EIA, Survey works and soil investigation by KETRACO and other studies
Will the power be stepped down at certain intervals or anyone can tap into the TL?	There will be substations at Kitui, Mutomo and Kibwezi where the high voltage power will be stepped down before distribution to the consumers.
The project should be implemented as soon as possible.	


The ESIA team describe the project to the people of Kisasi

MOSA; 4th October, 2017- 2:00 pm; Venue: Mosa Market

Questions and comments	Answers
Will compensation of land be the same to all the affected persons?	Compensation will be done according to the current market values for land and replacement cost for structures. Valuation of trees and crops will be in line with values gazetted by KFS and Ministry of Agriculture. On top a 15% disturbance fee will be paid.

Where will the TL pass?	The TL will pass farther away from the roads since it requires a way-leave corridor of 30m. It will pass through people's properties.
When will the proposed project be implemented?	The project will be implemented once all procedures that precede construction are completed. These include EIA and other Government Department Licenses, procurement of consultants, way-leave acquisition among others. This may take up to 12months to complete

The Public Baraza in Mosa

Participants follow proceedings in the Mosa meeting

IKANGA; 5th October, 2017- 12:00 noon; Venue: Ikanga Resource Centre.

Question and comments	Answers
Where will the substations be located?	The substations will be located in Kitui, Mutomo and Kibwezi.
Will the compensation be actualised unlike previous projects in the area?	It is the policy of KETRACO to compensate any PAPs along the RoW of the TL. Compensation must be done.
With more power, does that mean that more people will be connected to electric power?	When the proposed project will be implemented, there will be adequate, efficient and reliable power to boost the existing power, hence there will be more connectivity of the same.
Who are the consultants?	The consultants have been contracted by KETRACO to conduct an ESIA of the proposed TL in Kitui and Makueni Counties. An important part of their work is to come with a management plan that will ensure the project does not impact negatively on the environment and the communities.
Who shall we be reporting to issues about power blackouts?	Kenya Power deals directly with customers, so such cases will still be handled by the Kenya Power.
Is compensation done before or after construction?	Compensation is done before the construction phase of the project so as to ensure that the wayleave is cleared of any structures.
Why are the public being consulted?	The public have to be consulted for any proposed project before implementation so as to gather their views, opinions and concerns regarding the proposed project which will be incorporated in the ESMP before submission to NEMA and a licence for the proposed project issued. The community had been identified as an important stakeholder who would assist in developing the management

	plan.
What are some of the negative environmental impacts of the proposed project?	Examples include; cutting down of some tall trees on the wayleave, noise pollution from vehicles when transporting materials to the construction site and dust emission during excavation works.
Will the members of the community still be involved when the project is being implemented?	Public consultation is a continuous process throughtout all phases of the project. KETRACO has a robust department of Socio-Economists and Environment that ensure this.
What are the dangers of living on the way leave of the TL?	In case the conductors snap - fall (which is very rare), it can be harmful
Where will the TL pass? Will it follow the road or pass through people's farms?	The TL does not follow the road since it requires a way leave of 30m. It has to pass far away from main road; hence it will pass through people's properties.
Why can't the old existing TL be used?	This is a very good question that we may not have an adequate answer but we will revert to our bosses to consult. But the line was constructed in the 90s and technology has changed. TLs have a life time after which they have to be decommissioned.
Are there some projects that KETRACO can do to communities to improve their livelihoods?	The community are to agree on which projects they would like the proponent to do to them for instance, tree planting, building classrooms and drilling boreholes. KETRACO has a CSR department that looks into that.
Kenya Power has become a monopoly and residents are not satisfied with their services. There should be another company to rival Kenya Power. KETRACO should make sure that when they transmit power to Kenya Power, final consumers are connected to the power without delay.	


The Ikanga community keenly listen to the ESIA team

An ESIA team member answering a question

MUTOMO; 5th October, 2017- 9:00 am; Venue: Mutomo Chief's Camp

Questions and comments	Answers
How long will this project take to start?	Without delays, a project may take off at least nine months after NEMA has issued a licence.
What is the role of the community concerning this project?	To share their concerns, views and opinions regarding the proposed project
Will there be KETRACO offices build around project sites?	There will be a control room in each substation that will be operated by a few technicians as the substations are automated.
Will the transmission line pass underground?	No. It will be transmitted overhead. Underground transmission is ideal but the

	costs are very high
Is there any standard payment of land rates?	The land compensation is done according to land value at that time and in that particular area. Valuers call it prevailing market value
There are a lot of blackouts here where it takes even three to five days. Will this project solve this problem?	Power for Mutomo is by a 33kV from Kibwezi and it is not a wonder that you have as many outages. When this project is implemented and a sub-station is built in Mutomo, the power will be stepped down and supplied from Mutomo and there will be no more blackouts since it will be adequate and distributed in shorter distances

Meeting in Motomo Town

An ESIA team member emphasize a point

IKUTHA; 5th October, 2017- 2:00 pm; Venue: Ikutha Chief's Camp.

Questions and comments	Answers
Does KETRACO connect power to consumers?	No. Kenya Power does. KETRACO transmits high voltage electric power over long distances once it has been generated, steps it down at its substations and gives to Kenya Power to distribute to end users.
Will community members be employed when the project has being implemented?	Unskilled labour is a preserve for the community. KETRACO will ensure locals get the available jobs.
Can the community members get a written document regarding the details of the ESIA?	The ESIA report will be a public document. Once submitted NEMA offices in Kitui and Wote will have copies where public can access. The report will also be posted online in the NEMA and KETRACO websites
In case of accidents, are the workers insured during the construction phase of the project?	Workman Compensation Act requires all formal workers be insured against accidents be it occupational. KETRACO has a very strict health and safety policy that guards against work related accidents. It will therefore ensure contractors adhere to this during implementation.

The Chief Ikutha explain a point to the participants

ATHI; 6th October, 2017- 2:00 pm; Venue: Athi Market.

QUESTIONS AND COMMMENTS	ANSWERS
Has survey of the TL been done to determine the PAPs?	The survey will be done immediately before the construction phase when all the processes are completed and the line firmed up.
How will the TLs be connected?	There will be substations at Kitui, Mutomo and Kibwezi which connect the TLs.
Will there be compensation of planted and natural trees?	Yes; there will be compensation of trees and crops that will be tampered with.
Will the locals be given jobs to do?	When the project reaches a particular area, the residents of that area will be given first priority to take up the available jobs.
What are the average heights of trees that will be affected?	Short trees of less than 6 feet tall will not be affected.
Athi has a lot of minerals that need adequate and reliable power to enable mining of the resources.	



Meeting at the Athi bridge

KISAYANI; 6th October, 2017- 12:00 noon; Venue: Kathiaka Chief's Camp.

Questions and comments	Answers
Is compensation done before or after project construction?	Compensation for structures and land are paid before construction. Payment for trees and crops is once the trees are cut or crops destroyed.
Is the same value being paid to someone with mud house and stoned house?	It will be paid according to construction cost of that house. It is called replacement cost. Plus an added 15% disturbance fee.
What if my land has no title deed, will I be compensated?	Yes. Compensation is made to those land owners who have title deeds and those who don't have title deeds.
Thanks for passing information to us, we really support the project.	


Kisayani meeting

KIBWEZI; 6th October, 2017- 9:00 am; Venue: Kibwezi Township Ground.

Questions and comments	Answers
Which area of Kibwezi will the TL pass?	The TL will pass out of Kibwezi Town to avoid demolished of many buildings. Most of the buildings in the town are commercial and it would be uneconomical to demolish such buildings. The TL will try to avoid densely populated areas as much as possible.
What is the difference between KETRACO and Kenya Power?	KETRACO transmits high voltage electric power over long distances once it has been generated by KenGen, while Kenya Power distributes power to customers/ consumers once it has been stepped down at the substation. Kenya Power deals directly with final consumers of electricity.
Will there be a fresh registration of consumers of power?	No; Consumers will continue to be served by Kenya Power and any other new client will be registered by Kenya Power. The aim of the proposed project is to boost the existing power in the project area.
What is the linkage between KETRACO and Kenya Power?	KETRACO is mandated to transmit high voltage electric power over long distances once it has been generated at source while Kenya Power distributes power to customers once it has been stepped down at the substation.
Will the compensation be uniform across all PAPs?	Each PAP will be compensated for what is affected. Amount of compensation will therefore not be the same. The rates for land compensation might also be different depending on area.
Will the locals be given jobs this time around or will they be discriminated upon like in previous projects?	When the project reaches Kibwezi, the residents of Kibwezi will be given first priority during recruitment of the available jobs.

	Residents of another locality cannot be hired to come and work in a different area other than their own.
Is there a final map of the route of the TL?	This is a proposed route of the TL and it may change depending on the results of several surveys including EIA, RAP, soil and others


Meeting in Kibwezi Town

5.4: Outcome of the Stakeholder Consultations:

5.4.1; Important Issues as raised by key informant

Makueni/ Wote

Key Informant	Information Provided
National Drought Management Authority	Since this project will improve availability of grid power to the drought-prone southern Makueni, the project is beneficial to the community. Care should be taken in the design of the line to ensure conservation of endangered trees like Datburgia melano (miringo) which is common in the area of focus. Attention also needs to be paid to farmers who are carrying out small scale/ micro irrigation activities along the River Athi where the line will pass.
Department of Trade, Tourism, and Cooperatives	This is a good project and very key to trade development in the county. Faster implementation and operationalization will be much appreciated.
Ministry of Lands, Housing, Physical	The county government fully supports the project because it stands to benefit from accrued interest in terms of employment opportunities, labour, compensation for those affected and provision of adequate power to propel

Planning, Urban Development and Mining	the industrial base of the county. Value for compensation of those affected by the wayleave and hence need for proper sensitization. Disruption of wildlife migratory corridors as a result of the wayleave hence utmost care to be observed during construction. The project is fully supported.
National Irrigation Board	The TL should not pass where the population is dense. Employ casuals from local populace; do some social facilities development (CSR) and let citizens advise on most urgent ones.
TARDA- County Liaison Office	The project will lift up the standards of living of the community especially the areas where it is passing by supplying the electricity. The business community will benefit since for some time, there has been shortage of electricity and this TL will increase more connectivity to all Kenyans who are living in the said areas.
Department of Agriculture, Livestock and fisheries.	Veterinary services will improve since it will enable the sector to control animal diseases and important infrastructure in the same sector. The department has many refrigerators scattered across the county which will benefit from the proposed project.
Kenya Forest Service	Blending the pylons with the environment with the forest where required; painting the same to match the background and make the forest green. Consider employment to the local youth.
Department of Finance and Socio-Economic Planning	Consider livelihood programmes to empower the communities that will benefit from the compensation. This will enable them have sustainable livelihoods transitioning them from their current livelihoods without making them worse off. Consider collaboration with the county government on CSR activities like education for sustainable livelihoods for the communities affected. The area around the project is environmentally fragile; consideration should be made on the environment/ water catchment areas e.g. Kibwezi. Kibwezi Town is rapidly growing as an urban area (a trading hub) connecting coast Mombasa, Northern Tanzania through Loitoktok and interior eastern Kenya (Kitui and Garissa). The presence of the SGR station and tarmacking of Kitui-Kibwezi Road will open up the town, increasing the demand for the electricity (currently, the proportion of power in the county

	with access to electricity is 5.9%). More power will be incentive to heavy industries and other development of infrastructure. The magnitude of compensation should be that that leads to sustainable livelihoods. There should be collaborative efforts between KETRACO and the county government to compensate the community. Large proportions of the community (96%) still use wood fuel which leads to environmental degradation.
Ministry of Health and Sanitation	The proposed project will go a long way to address the power outages especially in hospitals. Such facilities will now have the capability to run equipment like those of radiology which demand a lot of power.
County Survey Office	The project will affect people's property and therefore compensation to the land owners is recommended. The county is planning on carrying out detailed geological studies and in case valuables which are economical to extract are identified along the route of the TL, re-routing is recommended.

Kitui

Key Informant	Information Provided
Ministry of Health and Sanitation	Many of the health facilities along the proposed high voltage power line will benefit from power connectivity. The proposed project will reduce drastically the frequent power outages in the health facilities.
Ministry of Agriculture, Water and Irrigation	Ensure re-greening the environment. Avoid cutting of trees in dry areas like Kitui. Compensate adequately. CSR to construct in these dry areas. Public participation of this project.
County Ministry of Trade, Industry, IT and Cooperatives	Kitui is the next investment frontier for; cement factories, coal related industries and steel industries. There are constant power outages and power supply is outstripped by demand. There is need to increase power connectivity to homes, institutions and towns.

	The county government of Kitui has a role to play as per Schedule 4 of the Constitution 2010.
Kenya Forest Service	The project is useful to the Kitui community since electric power has been very unstable causing an economic loss. The concern is mostly about cutting of trees along the power line. Only the necessary trees standing on the wayleave should be cut. We have experienced destruction of trees which are surrounding and not interfering.
Water Resources Authority	The project will increase/ or provide adequate power and improve livelihood of the area residents. It will also impact positively on water supplies whose sources are deep wells/ or boreholes which require power to operate the pumping water systems.
Department of Fisheries	No objection. The project is highly welcome.
Department of Livestock Development and Fisheries	The project will assist in taking care of frequent blackouts experienced in Kitui. With reliable source of electric power the department will be able to implement various programmes with ease such as construction of milk cooling plants; construction of slaughter houses among others.
Department of Physical Planning	The project is necessary to help trigger economic and social development of the county more and soon the revitalization of industries and power supply reliably. However, environmental concerns including safety of residents should be well elaborated and considered in the management plan (EMP). The department and the county government of Kitui welcome the initiative and requests consultation wherever necessary from KETRACO to realize implementation and smooth operation of the project.
County Labour Office	The project will create employment. It also should provide good terms and conditions of employment i.e. fair and good salary, safety at the place of work etc.
TANATHI Water Services	The project will finish power blackout problems in the region.

Board	The project will give birth to industrialization in the area. Power is very vital for industries to come up. As a water service board, TANATHI Water Services Board will benefit because our objective is to give water to people from various TANATHI water projects. Power is very key in achieving this task. Proper compensation to people affected by the pylons should be considered.

5.4.3; Important Issues as raised by the community

- Whether or not compensation will be done to only those PAPs with title deeds.
- When compensation will be done (before or after the project construction).
- If compensation be actualised unlike previous projects.
- Whether or not valuation for compensation will be the same for each PAP.
- The benefits that the PAPs will experience when the project is implemented.
- The CSR initiatives that have been put in place by the proponent. The proponent should assist with CSR initiatives like drilling of boreholes/ wells.
- Health effects of the proposed TL.
- Citizens should be involved in the planning process and/ or phases of the proposed project.
- The wayleave distance.
- Actions taken by the proponent if the TL affects areas of importance like burial sites within properties of PAPs.
- The project should not impact negatively on the locals.
- The project should be implemented as soon as possible.
- How long it will take before the project is implemented and the duration of the project to be completed.
- Where the TL will pass and how far from the roads it will pass.
- Intentions of such public consultations for proposed projects.
- Activities that can be done on the wayleave.
- Whether or not the feasibility study had been done and if there's a final map of the route of the TL.
- The proponent should consider obtaining construction materials from the project areas and from the residents.
- The criteria for employment; locals should not be discriminated upon like in previous projects where people from other localities came to work in other locations.
- Average height of trees that will be affected by the project.

- How the TLs will be connected.
- Linkage between KETRACO, Kenya Power and REA.
- Whether or not workers are insured during the construction phase of the project.
- If the community members can access written documentation concerning details of the ESIA.
- If KETRACO connects power to consumers.
- KETRACO should make sure that when they transmit power to Kenya Power, final consumers are connected to the power without delay.
- Dangers of living on the wayleave of the TL.
- Whom to report issues of power blackouts.
- Where the substations will be located.
- If the TL will pass underground.
- Role of the community concerning the proposed project.
- Benefits to those people living far away from the proposed TL.
- Athi has a lot of minerals that need adequate and reliable power to enable mining of the resources.

5.4.4; Some of the benefits as identified by the community

- It will promote business activities.
- There will be adequate and reliable power for use by consumers.
- Employment opportunities will be created within and around the project areas.
- The project will assist in empowering the locals.
- Introduction of industries to process the minerals within the counties.
- Efficient and reliable power/ electricity throughout the counties.
- Communication will be enhanced in regions where poor communication had not been addressed.
- Informal sector will grow such as jua kali.
- The cost of electricity will be lowered hence making it affordable.
- Enhancement of security in the project areas.

5.5: Overall picture from the stakeholder consultations.

The overall picture emergent from the stakeholder consultations is that their attitude towards the project is positive and desirous.

In addition, the project is seen as being strategic to stabilising power supply which is crucial to sustained economic growth. In order to sustain this overwhelming public support, the project development should proceed simultaneously with resolution of stakeholder concerns.

CHAPTER 6: RESETTLEMENT ACTION PLAN (RAP)

6.1: INTRODUCTION

A Resettlement Action Plan (RAP) is a document drafted by a project proponent (where there is a likelihood of people being resettled due to the project) or an appointee of the project proponent, specifying the procedures to be followed and the actions to be taken to properly resettle and compensate affected people and communities.

A RAP must identify the full range of people affected by the project and justify their displacement after consideration of alternatives that would minimize or avoid displacement. The RAP outlines eligibility criteria for affected parties, establishes rates of compensation for lost assets, and describes levels of assistance for relocation and reconstruction of affected households.

The Kitui – Mutomo - Kibwezi high voltage transmission line is a linear project and will lead to Linear resettlement. Linear resettlement describes projects having linear patterns of land acquisition (highways, railways, canals, and power transmission lines). In sparsely populated rural areas, a linear project such as an electric transmission line may have minimal impact on any single landholder. Compensation is characterized by a large number of small payments for the temporary loss of assets such as structures, crops and land. If well designed, linear projects can easily avoid or minimize the demolition of permanent structures. Conversely, in a densely populated urban area, a linear project such as a road upgrading may require the demolition of structures along the project right-of-way, thereby significantly affecting large numbers of people. Linear resettlement contrasts with site specific resettlement because of the problems that frequently arise when resettlement actions have to be coordinated across multiple administrative jurisdictions and/or different cultural and linguistic areas.

6.2: OBJECTIVES OF RAP

The main objectives of a RAP is to;

- To avoid or minimise involuntary resettlement;
- To ensure that affected individuals and households and/or displaced communities are meaningfully consulted, have participated in the planning process, and are adequately compensated to the extent that at least their pre-displacement incomes have been restored and that the process has been a fair

and transparent one to ensure that people and enterprises affected by the project are compensated for any loss of property and/or socio-economic displacement as a result of the project;

- To provide project affected people (PAPs) with the opportunities to restore or improve their living standards and income earnings capacity to at least pre-project levels; and
- To provide guidelines to stakeholders participating in the mitigation of adverse social impacts of the project, including rehabilitation/ resettlement operations in order to ensure that PAPs will not be impoverished by the adverse social impacts of the project.

6.3: COMPONENTS OF RAP

An effective RAP will have the following essential components;

- identification of project impacts and affected populations;
- a legal framework for land acquisition and compensation;
- a compensation framework;
- a description of resettlement assistance and restoration of livelihood activities;
- a detailed budget;
- an implementation schedule;
- a description of organizational responsibilities;
- a framework for public consultation, participation, and development planning;
- a description of provisions for redress of grievances; and
- a framework for monitoring, evaluation, and reporting.

6.4: METHODOLOGY AND SCOPE

For the preparation of this indicative RAP, a census survey was carried out to identify the Project Affected Persons (PAPs), and their structures which will be affected. A valuation of the structures to be affected was done and an estimate of the amount of money to be compensated for each structure provided. The census was, however, limited to the 30m way – leave corridor.

Valuation method used for land and structures considered the current replacement cost of lost asset as well as types and levels of compensation under Kenyan law. For trees, reference was made to Diameter at Breast Height (DBH) and Kenya Gazette Supplement No.132, the Forest Act. A 15 percent disturbance cost was added as per KETRACO's Resettlement Policy Framework.

It is imperative to note here that, the processes preceding the construction phase of the project, which include EIA License approval, mobilization of project funds, and sourcing for a contractor, may take a considerable

duration of time (on average KETRACO projects take 18 months to reach construction phase) and that by the time of construction;

1. More people may have resettled on the way-leave corridor and
2. Property prices may have escalated

Conducting an elaborate RAP at this time may not be the most appropriate. An effective RAP is done immediately before the construction phase of the project.

This RAP report, therefore, is an indicative Resettlement Action Plan and should form a guide to a more elaborate RAP to be conducted by the project proponent immediately before project construction phase.

The report comprises the findings of the site visit carried out and the census survey against the background of the national legal and institutional frameworks, and the World Bank Involuntary Resettlement Policy (OP/BP 4.12). It provides an overview of the affected households and communities, structures on the way-leave at the time of the study, and an estimate budget to be used by the proponent for the purposes of compensating Land, structures, and trees. The report also contains a comprehensive Terms of Reference (TOR) – appendix IV - to be used by the project proponent for an elaborate RAP immediately before the construction phase.

6.5: RESULTS

6.5.1; Results Summary

From the census results, the 30m corridor over the distance of 128km of the transmission line will affect a total of 787 households. The transmission line will affect a total of 1,310 acres of land at an approximated cost of Ksh. 393,083,783. A total of 152 different types of structures will have to be relocated and this will cost KETRACO approximately Ksh. 128,950,000 and a total of 14,085 different types of trees will be affected at an approximated cost of Ksh. 115,453,200. Detailed results of the RAP are given in appendix III.

6.5.2; Housing typologies amongst the PAPs

The type of housing in the project areas are of different kinds including permanent, and semi-permanent houses and huts, toilets and sheds. The following are some of the structures on the way-leave.




































CHAPTER 7: POTENTIAL ENVIRONMENTAL AND SOCIAL IMPACTS OF THE PROPOSED PROJECT

7.1: INTRODUCTION

A summary of the main potential impacts of the proposed project based on stakeholders' views; Assessment of the project area and evaluation of project processes, JBIC Environmental Checklist 15: Power Transmission and Distribution Lines; World Bank Project/Site Screening Criteria Worksheet; KETRACO ESIA Screening Form; ADB Guidelines; and consultants' previous experience in undertaking ESIAs is discussed below.

7.2: POSITIVE IMPACTS

Broadly, the identified positive impacts associated with the proposed transmission line project include;.

7.2.1; Reliable and Secure Electricity Power Supply

The project will enhance the adequacy, reliability, and security of electricity power supply in Kitui, and Makueni Counties. The Counties at the moment are mainly fed by 33kV distribution lines, and cannot host heavy industries that are power intensive. With a potential for heavy industries in the counties, the need for adequate, reliable, and secure power cannot be overemphasized. The project will also help meet the increasing demand for power supply and minimize the frequency of power outages (blackouts).

7.2.2; Contribute towards reduction in Greenhouse Gas emission

Current electricity power transmission mode in the Counties is mainly through 33kV distribution lines. Studies show that, the 33kV distribution lines loose up to 30 per cent of the power they transmit. High voltage transmission lines on the other hand are efficient and hardly lose any power they are transmitting. The project therefore, will contribute towards saving power loses which translates to reduced generation of excess power (lost during transmission) and therefore a reduction in the generation of greenhouse gasses. The project will further eliminate the need for diesel generated power and reduce dependence on fuel-wood. This will again help reduce emission of greenhouse gasses.

7.2.3; Contribute towards lowering the cost of electricity

The project as stated above will help reduce transmission loses by about 30 percent. This will translates into reduced power production costs and as a consequence the final power tariffs per kilowatt hour charged to Kenya Power customers.

7.2.4; Employment Opportunities

The construction of the proposed project will create employment opportunities for both skilled and unskilled personnel. The proponent has committed to ensure that priority is given to the local community.

7.2.5; Contribution towards reduction of environmental pollution

Studies show that, the dominant energy source in the county is fuel-wood. The project will provide alternative energy source and thus reduce reliance on fuel-wood thereby contributing towards among others, the national goal of meeting the minimum forest cover

7.2.6; Gains in the Local and National Economy

Expected gains in the local and national economy from the construction and operation of the proposed project will be in the form of consumption of locally available materials including: fine and course aggregates, timber, cement, glass, metal, and among other construction materials; taxes levied from contractors and employees; and income from business associated with the project.

7.2.7; Informal Sector Benefits

The project will require supply of large quantities of building materials most of which will be sourced locally. It will also spur the growth of small business enterprises including kiosks to serve construction workers and employees, barbershops, mills, cell phone charging, photocopying shops among others.

7.2.8; Development of Other Sectors

Increase in reliability and security of power supply in the region will enhance efficiency and productivity of other sectors including health, education, water supply, agriculture and livestock production, industry, etc.

7.2.9; Security

With increased lighting in the project area and presence of guards on the project site the security of the area will be enhanced.

7.3: NEGATIVE IMPACTS

The following negative impacts are also associated with the proposed project.

7.3.1; Noise Pollution

The construction and decommissioning works of the project will most likely be noisy due to the moving machines (concrete mixers, tippers, drilling etc.) and incoming vehicles to deliver construction materials to site or take away debris.

This impact will be more localized and felt in the construction of the substations as compared to the construction of the transmission line. Machines like tippers and concrete mixers produce continuous loud noise over a long period of time every day. Operators of these machines are therefore exposed to high levels of noise over long period which is continuous. This as a stand alone can be rated as high but overall noise impact for this project is however rated moderate to low.

Some sections of the transmission line like areas between Mosa and Mutomo and Mutomo and Athi have rocky outcrops. Blasting of rocks, to excavate for tower foundation, in these areas might be necessary. Depending on the frequency and area of blasting, the impact can be rated as high to medium.

7.3.2; Generation of Exhaust Emissions

Exhaust emissions are likely to be generated by the motored equipment during the construction and decommissioning phase of the proposed project. Motor vehicles that will be used to ferry construction materials, take away debris during decommissioning phase or those used for general operation activities (operation phase) will also have impacts on air quality. Diesel operated power back-ups (Generators) if used may also produce exhaust emission

7.3.3; Dust Emissions

The construction phase of transmission lines require use of large amounts of cement. Workers, especially, those who work on the concrete mixers will therefore be exposed to cement dust.

Dust emission is also likely to occur during the site clearance, excavation and spreading of the topsoil during construction of the substations, excavation of foundation for steel towers and by uncovered trucks delivering loose aggregates to the site.

The road between Wikililye to Mutomo and Mutomo to Kibwezi is loose gravel, not tarmacked. Motor vehicles accessing the site will for therefore, lead to dust emissions.

Dust emissions are also likely to occur during the decommissioning phase.

7.3.4; Solid and Liquid Waste Generation

It is expected that solid waste will be generated in all phases of the project.

During construction, generated waste will include; excavated soil and rocks, residual loose and fine aggregates, cement bags, wooden boxes used to deliver tower parts, drums used to deliver mineral oil for transformers, conductors, steel, metal, plastic, glass, paper, organic, cables, paints, adhesives, sealants, fasteners, wastewater, sewage etc.

Experience from the already built transmission lines in Kenya show that, many contractors fail to collect (effectively) the remnants of the loose aggregates (locally known as kokoto) and concrete from the tower bases. This creates a small patch that is not ecologically productive and can be seen many years after construction. Nothing can grow on this patch. Assuming that, this transmission line will have an approximated 400 towers and that each patch is about a meter squared, the transmission line will create a desert equivalent to 400 square meters which is about 0.1 acres. Not big but a significant figure.

7.3.5; Oil Spill Hazards

Oil spill hazards may occur in all phases of the project.

Mineral oil is used in the transformers and other electrical equipment as a coolant. Oil spill, may therefore, occur during storage, transportation, and when the transformers are being filled with oil. Oil spills may also occur during regular maintenance of transformers and other electrical equipment that use oil.

Motorized machinery on the proposed site may be containing moving parts which will require continuous oiling to minimise the usual corrosion or wear and tear. This has a potential for oil spills and accidents.

7.3.6; Destruction of Existing Vegetation and Habitats

The project will require a way-leave of 30 meters width for the 128km. Within the way-leave, selective clearing of vegetation will be necessary to (1) remove any tall trees that pose a risk to the transmission line, (2) give way for the construction of the towers; and (3) give room for workers to do survey work and stringing of the transmission line. Also vegetation within sections of the substations that will hold the power lines and buildings will be cleared.

This impact will be more felt during the construction phase.

The impact will be long-term, as it would persist as long as the facility is in operation. However, the overall intensity of this impact is rated as medium, as the impact is not likely to be of wider significance given the paucity of species of conservation concern in the area, as well as the overwhelmingly intact nature of the surrounding landscape.

Operational phase impacts are likely to be restricted to maintenance activities within the way-leave corridor. As such these impacts are considered to have low intensity, and an overall moderate-minor significance. This significance rating is based on vegetation clearance without the use of herbicides, which is not recommended.

A detailed description of Flora of the proposed transmission line, how they will be impacted and proposed mitigation measures are given in Appendix II.

7.3.7; Disturbance of Faunal Species

There are several potential impacts on wildlife during construction of power transmission lines. The two most significant effects identified are physical changes to wildlife habitat and temporary disturbance to wildlife from the presence of construction workers and machinery.

Some of the factors anticipated to affect wildlife and wildlife habitat include clearing and disposal of vegetation, temporary access trails, crossing water bodies, waste and chemicals, and barrow pits (tower foundation pits).

Construction phase activities that will impact on animal life in the area include:

- Increased human activity and associated noise
- Possible increase in hunting due to increased number of people in the area.
- Increased traffic of trucks and heavy machinery and associated noise.
- Increased noise and dust levels due to construction activities.
- Stripping of vegetation and soil to clear and level areas for infrastructure.

Shy mammals will move away from the noise and disturbance during the construction phase. Some mammals will be vulnerable to illegal poaching due to the presence of personnel in the site.

A detailed description of Fauna of the proposed transmission line, how they will be impacted and proposed mitigation measures are given in Appendix II.

7.3.8; Avifauna Mortalities

Habitats and flight pathways of birds will be unavoidably altered by the presence of overhead power lines and associated structures. Migration and distribution patterns will also be affected if birds avoid areas adjacent to these structures.

Avifauna mortality by power lines can either be due to bird electrocution or bird strikes by the conductors. The separation between the conductors of the transmission line shall be a minimum of 30m and therefore, bird electrocution will be highly unlikely (electrocution can only occur if the bird touches at least two conductors). Bird strike by the conductors is however, likely and in a few circumstances may lead to mortality.

A detailed description of avi-fauna of the proposed transmission line, how they will be impacted and proposed mitigation measures are given in Appendix II.

7.3.9; Impacts on Workers' and Community Health and Safety

Workers and community members in the project area may be exposed to various risks and hazards in all phases of the project. The most serious hazards in the construction of transmission lines is probably

1. falling from height during tower erection and stringing
2. falling objects i.e. from high levels of towers and excavations,
3. collapsing of excavations,
4. poor hygiene as the contractor may find it difficult to provide sanitary welfare in the bushes
5. attack by wild animals,
6. road accidents,

Other hazards may include; slips and trips, electrical shocks, dust, noise and vibrations, fire, bruises and cuts, etc.

7.3.10; Soil Erosion

The Kitui – Mutomo transmission line runs parallel to River Myei but at a distance from Kitui to just before Mutomo. Between Ikanga and Mutomo, the TL crosses River Nzeeu and two streams Semea and Kithina. Just before you reach Ikutha town is a stream called Wiitu and the TL crosses three more streams, Ndiliu, Waa-Wa-Ndiu, and Katulani between Ikutha and Athi Town Centers. River Athi is the biggest water body that the TL crosses.

In these areas, if not checked, soil erosion from the loose excavated soil, may lead to deposition which may in turn lower the output of the Rivers and streams.

7.3.11; Visual and Aesthetic Impacts

The physical presence and profile of the proposed transmission line and substations will alter the visual and aesthetic effects of the surrounding area. The project terrain is rather flat and concealing the tall pylons of the TL will be a difficult challenge.

Contractor's materials' yard/camp sites and the temporary structures built by the contractor in both the substations and materials yard/camp sites will also impact on visual and aesthetic nature of the surrounding areas.

7.3.12; Incidences of Electrocution

This impact will be felt during the operation phase of the project.

Various stakeholders were concerned by the fact that, the project may lead to members of the community being electrocuted. Some were even worried that, touching the pylons may lead to electrocution. While it is true that the proposed project will be dealing with electricity, the safety design of the project leaves very little chance of electrocution. The conductors are 30m high, the towers at some height are surrounded by barbed wire and have clear danger warnings to deter people and animals from climbing, and should a tower collapse or a conductor snap, a signal is sent in seconds which results in an immediate shut down.

Access to the substation by unauthorised people or animals may lead to electrocution incidences.

7.3.13; Perceived Danger of Electrostatic and Magnetic force

Electric power lines are considered a source of power frequency, electric and magnetic fields, which may have a perceived health effect. The strength of both electric and magnetic fields is a function of the voltage and the lateral distance from the power lines to the receptor. Many studies published during the last decade on occupational exposure to Electro-Magnetic Fields (EMF) have exhibited a number of inconsistencies and no clear, convincing evidence exists to show that residential exposures to electric and magnetic fields are a threat to human health. However, the EMF decrease very rapidly with distance from source and there should be no potential health risks for people living outside of 30m corridor.

7.3.14; Increase in Social Vices

With an increase in the population of the area boosted by the project employees the social set up of the area will be affected. This change may be in the form of loose morality, an increase in school drop-out due to cheap labour, child labour, and increased incidences of HIV/AIDS and other communicable diseases.

This impact will be more pronounced in towns and near villages.

7.3.15; Cultural Heritage and Archaeological Finds

Though not identified during the EIA assessment, the transmission line may traverse through cultural heritage areas. Further, during excavations for the tower bases, workers may come across Archaeological finds.

7.3.16; Land take – Resettlement and Loss of Use

As mentioned earlier, the proposed project will require a corridor of 30m width. Within the 30m corridor, no structures or tall trees are allowed. All other forms of land use including grazing and farming are allowed.

The indicative RAP survey showed that the transmission line will affect a total of 787 households/communities with a total acreage of 1,310 acres of land consisting mainly of agricultural farms, grazing fields and bushes. A total of 152 different types of structures will have to be relocated and a total of 14,085 different types of trees may be affected.

7.4: PROPOSED MITIGATION MEASURES

The following are proposed mitigation measures to avoid, offset or minimize the identified negative impacts.

7.4.1; Noise Pollution

Ensure that noise levels emanating from machinery, vehicles and noisy construction activities (e.g. excavation, blasting) are kept at a minimum for the safety, health and protection of workers within the vicinity of site and nearby communities. No worker should be exposed to continuous loud noise for over 4 hours and those working in continuous loud noise should be provided with necessary PPEs and impelled to use them.

The contractor will adhere to the EMCA Noise and Excessive Vibration Pollution Control Regulation, 2009 and will be required to implement noise control measures amongst exposed work force and community. This will include provision of hearing protective devices such as ear plugs and ear muffs; avoiding construction or demolition activities during the night, education and awareness programmes and creation of a buffer to propagate against noise pollution among other noise control measures.

The contractor should only blast rocks where it is very necessary. Blasting may require a variation of the NEMA License.

7.4.2; Generation of Exhaust Emissions

To mitigate against exhaust emissions, the proponent is advised to sensitise truck drivers and machine operators to switch off engines when not in use; regularly service engines and machine parts to increase their

efficiency and reduce generation of exhaust emission; and where feasible use alternative non-fuel construction equipment.

7.4.3; Dust Emissions

The proponent will endeavour to minimize the effect of dust on the surrounding environment resulting from use of cement, site clearance, excavation, spreading of the topsoil, demolition works and temporary access roads to ensure protection of health and safety of workers and communities. Control measures will include, use of PPE; regular sprinkling of water on dusty areas and temporary access roads; and observing set speed limits among other measures.

7.4.4; Solid and Liquid Waste Generation

To avoid waste generation or to minimize the amount of waste generated, the following measures are recommended;

- use of an integrated solid waste management system i.e. the 3 R's: Reduction at source, Reuse and Recycle;
- accurately estimate the dimensions and quantities of materials required especially fine and loose aggregates for tower bases;
- use of durable, long-lasting materials that will not need to be replaced as often, thereby reducing the amount of construction waste generated over time;
- providing facilities for proper handling and storage of construction materials to reduce the amount of waste caused by damage;
- use of building materials that have minimal or no packaging to avoid the generation of excessive packaging waste;
- providing waste collection bins at designated points on site;
- Ensuring that, all remnants of loose gravel and concrete are effectively collected from the tower bases and re-used or disposed of in an environmentally friendly manner.
- disposing waste more responsibly by contracting a registered waste handler who will dispose the waste at designated sites or landfills only and in accordance with the existing laws.
- drainage and effluent from storage areas, workshops and camp sites shall be captured and treated before being discharged into the drainage system in line with applicable government water pollution control regulations;
- construction waste shall not be left in stockpiles along the road, but removed and reused or disposed of on a regular basis
- proper procedures for the management of human waste will be put in place in order to prevent outbreak of diseases;

- place in strategic places signs against littering and dumping of wastes;
- audits waste generation and develop Waste Reduction Action Plans (WRAP).

7.4.5; Oil Spill Hazards

The proponent will endeavour to prevent petroleum products used in the substations which include bitumen, oils, lubricants and gasoline from contaminating soils and water resources (ground and surface water). To accomplish this, the proponent will;

- install oil trapping equipment in areas where there is a likelihood of oil spillage;
- collect the used oils and re-use, re-sell, or dispose of appropriately using expertise from licenced waste handlers;
- prepare a written substations response plan and display it on strategic areas and train workers on specific procedures to be followed in the event of a spill;
- immediately institute clean up measures in case of an oil spill;
- design the substations to have spill prevention and detection systems to protect the environment especially where the transformers will be located;
- design appropriate protection devices against accidental discharge of transformer oil substances;
- route drains through an oil/water separator;
- ensure regular inspection and maintenance of the transformers to minimize spillage;
- ensure that all waste oils from maintenance of transformers and other associated equipment should be segregated and disposed properly by a reputable/registered waste handler in accordance with the waste disposal plan.

7.4.6; Destruction of Existing Vegetation and Habitats

To minimize destruction of existing vegetation and habitats;

- Vegetation clearing will be kept to a minimum. The vegetation of the site is largely low and open and therefore whole-sale vegetation clearing will only be applied if necessary and within the project route.
- Document pre- and post- construction vegetation cover and recovery of the ground layer incase available.
- All no-go areas will be clearly demarcated.
- Regular monitoring will be undertaken to ensure that alien plants are not increasing as a result of the disturbance that has taken place.
- Any extensive cleared areas that are no longer or not required for construction activities will be re-seeded with locally sourced seed of suitable species. Bare areas can also be packed with bush removed from other parts of the site to encourage regeneration and limit erosion.

- No construction vehicle will be allowed to drive around the veld. All construction vehicles will remain on properly demarcated roads.
- Fires will only be allowed in fire-safe demarcated areas
- Vegetation clearing for maintenance activities will be done manually wherever possible. The use of herbicides will be avoided.
- Collection or harvesting of any plants on the site is to be strictly forbidden throughout all phases of the project.
- with assistance from community, KFS and KWS, KETRACO to initiate a tree planting exercise. School Greening Programmes in schools that are along the transmission line would be very useful.
- On the un-used portions of the acquired substations land; design and implement an appropriate landscaping programme for the substations site;

7.4.7; Disturbance of Faunal Species

To minimize effects on faunal species

- Ensure no worker engage in acts of poaching
- Restrict construction to day time
- Observe applicable Game Reserve regulations
- Bush clearing to be selective. Only tall trees on the wayleave corridor or vegetation on the footprints of the towers to be removed
- Consult the local KWS officer and communities to advice on construction timings to avoid disturbing wildlife.
- Tower foundation pits should be properly condoned to ensure no animal stray into the pits
- Any fauna directly threatened by the construction activities will be removed to a safe location by the environment control officer or other suitably qualified ecologist.
- No dogs will be allowed on the site.
- Fires will only be allowed in fire-safe demarcated areas
- Should the site need to be fenced, the fencing will be constructed in a manner which allows for the passage of small and medium sized mammals, at least at strategic places.
- In order to reduce collisions of vehicles with fauna, a 30km/hr speed limit will apply to all vehicles using the site.
- Animals will have right of way
- No unauthorized persons will be allowed onto the site and those authorized to be instructed to follow the measures stated herein.

7.4.8; Avifauna Mortalities

To minimize bird collisions leading to their mortality;

- In consultation with KFS, KWS, Nature Kenya, IUCN, WWF, and any other organizations that deals with bird conservation, the proponent will identify all bird migration corridors in the project area
- In these corridors, the proponent will undertake wire marking to alert birds of the presence of power lines, allowing them time to avoid collision and will build raptor platforms for bird roosting and nesting
- The proponent will ensure that any maintenance on the transmission infrastructure of the site retains the bird friendly design features
- Any electrocution and collision events that occur should be recorded, including the species affected and the date. If repeated collisions occur, then further mitigation and avoidance measures may need to be implemented.

7.4.9; Impacts on Workers' and Community Health and Safety

The proponent will implement all necessary measures to ensure health and safety of the project workers and the general public during construction, operation and decommissioning of the proposed project as stipulated in the Occupational Safety and Health Act, 2007. This will include but not limited to

- Registration of workplaces by the contractor where it is required
- Identify all hazards before undertaking a process
- Conduct and continually review a risk assessment
- Hold daily morning toolkit talks where safety is the key issue
- Train workers on health and safety
- Identify and train fire marshals and first aiders.
- Only use experienced workers during erection of towers and stringing. Before climbing the towers, the workers should be reminded of the danger ahead and the need for being careful. Strict supervision on those on top of towers should be the norm.
- Ensure use of double harness while atop the towers
- Where there are risks of attack by wild animals, ensure workers are accompanied by armed guards
- Collect daily security briefs and avoid insecure places
- Ensure no un-authorised persons access live sections of substations
- Provide all necessary PPEs

7.4.10; Soil Erosion

To reduce soil erosion, the proponent will;

- apply soil erosion control measures such as levelling of the project site to reduce run-off velocity and increase infiltration of storm water into the soil;

- ensure that construction vehicles are restricted to use existing graded roads;
- implement a storm water management plan that minimizes impervious area infiltration by use of recharge areas and
- use of detention and/or retention with graduated outlet control structure will be designed.

7.4.11; Visual and Aesthetic Impacts

To reduce impacts on visual and aesthetic values of the area, the project proponent will;

- undertake extensive public consultation during the planning of the project;
- design structures at the site in such a way as to improve the beauty of the surroundings;
- restore site areas through backfilling, landscaping and planting of trees, shrubs and grass on the open spaces to re-introduce visual barriers;
- design and implement an appropriate landscaping programme.

7.4.12; Incidences of Electrocution

To reduce incidences of electrocution, the proponent will;

- ensure strict adherence to the safety designs established;
- all towers should have safety warnings and a perimeter barb wire to ensure people and animal don't climb the towers
- put in place a maintenance system to ensure physical integrity of project components;
- ensure that access to the live sections of the project should only be by authorization and trained personnel;
- erect a perimeter fence on substations to deny unauthorized people access the substations;
- place warning signs on strategic places;
- conduct periodic awareness and sensitization campaigns for the neighbouring communities.

7.4.13; Perceived Danger of Electrostatic and Magnetic force

The proponent will conduct education and awareness campaigns to dispel fear among community on the effects of electrostatic and magnetic forces

7.4.14; Increase in Social Vices

To minimize project effects on local social set up, the proponent will;

- conduct periodic sensitization forums for employees on ethics, morals, general good behavior and the need for the project to co-exist with the neighbours;
- offer guidance and counseling on HIV/AIDS and other STDs to employees;
- provide condoms to employees; and

- ensure enforcement of KETRACO's policy on sexual harassment and abuse of office.

7.4.15; Cultural Heritage and Archaeological Finds

There is need to conduct a detailed Cultural Heritage and Archaeological Impact Assessment for this transmission line. It is also suggested that the contractor and sub-contractors be trained on this issue by National Museums of Kenya (NMK) in consultation with KETRACO.

Upon discovery of a heritage site or an Archaeological find, the construction site will be stopped, the site if possible will be restricted using tapes or local materials, and relevant authorities including local administration officers and the NMK informed for further instructions.

7.4.16; Land take – Resettlement and Loss of Use

- Conduct a detailed and elaborate RAP
- Conduct consultation meetings with Project Affected Persons
- Ensure timely compensation for loss of property and land use.
- Ensure adherence to country legal legislations and World Bank Safeguard Policy 4.12 on Involuntary Resettlement

CHAPTER 8: ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

8.1: ESMP FOR THE CONSTRUCTION PHASE

Table 8.1: ESMP for the construction phase of the proposed project

Potential Negative Impacts	Recommended Mitigation Measures	Responsible Party	Time Frame	Cost (Ksh)
1. Minimization of Noise and Vibration				
Noise and vibration	**1.** Sensitise construction vehicle drivers and machinery operators to switch off engines of vehicles or machinery not being used.	KETRACO & Contractor	Entire construction period	0
	2. Sensitise construction drivers to avoid running of vehicle engines or hooting	KETRACO & Contractor	Entire construction period	0
	3. Regular servicing of engines and machine parts to reduce noise generation	KETRACO & Contractor	Entire construction period	0
	4. Ensure that all generators and heavy duty equipment are insulated or placed in enclosures (containers) to minimize ambient noise levels.	KETRACO & Contractor	Entire construction period	Design cost
	5. Trees to be planted around the site to provide some buffer against noise propagation	KETRACO & Contractor	Entire construction period	40,000
	6. The noisy construction works will entirely be planned to be during day time when most of the neighbours will be at work.	KETRACO & Contractor	Entire construction period	0

Potential Negative Impacts	Recommended Mitigation Measures	Responsible Party	Time Frame	Cost (Ksh)
	7. Provide necessary PPE to workers who may be exposed to high levels of noise and ensure proper and constant use	KETRACO & Contractor	Entire construction period	Ear plugs and ear muff @5000 each
	8. All construction equipment and machinery to be used must be tested to verify if they are compliant with Kenya and the internationally acceptable standards of noise.	KETRACO & Contractor	Entire construction period	
2. Abate Air Pollution				
Dust emission	**1.** Ensure strict enforcement of on-site speed limit regulations	KETRACO & Contractor	Entire construction period	0
	2. Avoid excavation works in extremely dry weather			0
	3. Sprinkle water on graded access routes when necessary to reduce dust generation by construction and vehicles			100,000
	4. Stockpiles of earth should be enclosed / covered / watered during dry or windy conditions to reduce dust emissions			0
	5. PPE to be provided to employees and ensure proper and constant use			Dust coats and dust masks@5000 per employee
Exhaust emission	**1.** Sensitise truck drivers and machine operators to switch off engines when not in use			0
	2. Regular servicing of engines and machine parts to reduce exhaust emission generation			0
	3. Alternative non-fuel construction equipment shall be used where feasible			0

Potential Negative Impacts	Recommended Mitigation Measures	Responsible Party	Time Frame	Cost (Ksh)
3. Minimize solid and liquid waste generation and ensure efficient waste management during construction				
Increased solid waste generation	**1.** Use of an integrated solid waste management system i.e. the 3 R's: 1. Reduction at source 2. Reuse 3. Recycle	KETRACO and Contractor	Entire construction period	0
	2. Accurate estimation of the dimensions and quantities of materials required.			0
	3. Use of durable, long-lasting materials that will not need to be replaced as often, thereby reducing the amount of construction waste generated over time			0
	4.Provide facilities for proper handling and storage of construction materials to reduce the amount of waste caused by damage			Design cost
	5. Use building materials that have minimal or no packaging to avoid the generation of excessive packaging waste			0
	6. Reuse packaging materials such as cartons, cement bags, empty metal and plastic containers to reduce waste at site			0
	7. Waste collection bins to be provided at designated points on site			20,000
	8. Dispose waste more responsibly by contracting a registered waste handler who will dispose the waste at designated sites or landfills only and in accordance with the existing laws.			20,000/month
Generation of wastewater	**1.** Provide means for handling sewage generated at the construction site	KETRACO and	One-off	Design cost

Potential Negative Impacts	Recommended Mitigation Measures	Responsible Party	Time Frame	Cost (Ksh)
	2. Conduct regular checks for sewage pipe blockages or damages since such vices can lead to release of the effluent into the land and water bodies	Contractor	Entire construction period	0
	3. Monitor effluent quality regularly to ensure that the stipulated discharge rules and standards are not violated			10,000 - quarterly
4. Minimize Oil Spills				
Oil spills Hazards	**1**. Install oil trapping equipment in areas where there is a likelihood of oil spillage e.g. during maintenance of vehicles.	KETRACO and Contractor	Continuous	Design cost
	2. In case of an oil spill, immediate clean up measures will be instituted			
	3. Storage and liquid impoundment areas for fuels, raw and in-process material solvents, wastes and finished products should be designed with secondary containment to prevent spills and the contamination of soil, ground and surface water		One-off	10,000
	4. A written substations response plan should be prepared and retained on the site and the workers should be trained to follow specific procedures in the event of a spill.		One-off	0
	5. Collected used oils should be re-used, disposed of appropriately by licenced waste handlers, or be sold for reuse to licensed firms		Continuous	10,000 per month
5. Minimize vegetation disturbance at and or around construction site				

Potential Negative Impacts	Recommended Mitigation Measures	Responsible Party	Time Frame	Cost (Ksh)
Destruction of existing vegetation and habitat	**1.** Conduct selective clearing of vegetation on the way-leave corridor. Avoid unnecessary vegetation clearing; only tall trees that pose a danger to the transmission line and vegetation on the foot plinth of the tower to be removed.	KETRACO and Contractor	Continuous	0
	2. Ensure proper demarcation and delineation of the project area to be affected by construction works.			0
	3. Specify locations for trailers and equipment, and areas of the site which should be kept free of traffic, equipment, and storage.			0
	4. Designate access routes and parking within the site.			0
	5. With Assistant from community, KWS and KFS, initiate a tree planting exercise		Entire construction period	50,000
	6. Design and implement an appropriate landscaping programme for the substations site.			50,000
	7.Support community initiatives in tree planting	KETRACO and community	Entire project period	50,000
6. Minimize Disturbance on faunal species				
Disturbance on wildlife	**1.** Ensure no worker engage in acts of poaching	KETRACO, and Contractor	Entire construction period	0
	2. Restrict construction to day time			
	3. Observe applicable Game Reserve regulations			
	4. Bush clearing to be selective. Only tall trees on the wayleave corridor or vegetation on the footprints of the towers to be removed			

Potential Negative Impacts	Recommended Mitigation Measures	Responsible Party	Time Frame	Cost (Ksh)
	5. Consult the local KWS officer and conservancy owners for advice on construction timings to avoid disturbing wildlife.			
7. Minimize occupational health and safety risks				
Impacts on workers' and community health and safety	**1**. Ensure strict compliance with the Occupational Safety and Health Act (OSHA) 2007	KETRACO, DOHSS and Contractor	Entire construction period	100,000
	2. Prohibit access by unauthorized personnel into the construction site			0
	3. Train all employees and regularly sensitize them on safe working procedures			30,000
	4. Periodic community sensitization of the dangers posed by the project		Quarterly during the entire construction period	50,000
	5. Place warning signs where necessary		Whenever necessary	20,000
	6. Provide necessary PPEs to workers		Continuous	20,000
	7. Erect a perimeter fence to enclose the substations		One-time off	Design cost
8. Reduce soil erosion and storm-water runoff				
Soil erosion and storm-water runoff	**1.** Surface runoff and roof water shall be harvested and stored in tanks so that it can be used for cleaning purposes.	KETRACO and Contractor	Entire construction period	20,000
	2. A storm water management plan that minimizes impervious area infiltration by use of recharge areas and use of detention and/or retention with graduated outlet control structure will be designed.		First quarter	

Potential Negative Impacts	Recommended Mitigation Measures	Responsible Party	Time Frame	Cost (Ksh)
	3. Apply soil erosion control measures such as levelling of the project site to reduce run-off velocity and increase infiltration of storm water into the soil.			
	4. Ensure that construction vehicles are restricted to use existing graded roads		Entire construction period	
	5. Ensure that any compacted areas are ripped to reduce run-off.			
	8. Roof catchments will be used to collect the storm water for some substations uses			40,000
	9. Construction of water pans to collect storm water for substations use, tree planting and landscaping.			10,000 per unit
9. Visual and aesthetic impacts				
Visual and aesthetic impacts	**1.**Extensive public consultation during project planning	KETRACO and community	Planning phase	50,000
	2. Structures at the site should be designed in such a way that they will improve the beauty of the surroundings.			
	3. Restore site area through backfilling, landscaping and planting of trees, shrubs and grass on the open spaces to re-introduce visual barriers,		Continuous	50,000
	4. Design and implement an appropriate landscaping programme		Quarter one	20,000
10. Increase in social vices				
Increase in social vices including HIV/AIDS	**1**. Periodic sensitization forums for employees on ethics, morals; general good behaviour and the need for the project to co-exist with the neighbours	Contractor	Entire construction period	50,000

Potential Negative Impacts	Recommended Mitigation Measures	Responsible Party	Time Frame	Cost (Ksh)
	2. Guidance and counselling on HIV/AIDS and other STDs to employees	KETRACO and contractor		10,000
	3. Provision of condoms			10,000
	4. Contractor to have a strong policy on sexual harassment and abuse of office guided by proponent's policy on the same	Contractor	Quarter one	0
11. Cultural Heritage and Archaeological Finds				
Cultural Heritage and Archaeological Finds	**1.** Upon discovery of a heritage site or an Archaeological find, the construction site will be stopped, the site if possible will be restricted using tapes or local materials, and relevant authorities including local administration officers and the museums of Kenya informed for further instructions.	Contractor and KETRACO	Entire construction period	0
12. Land take – Resettlement and loss of use				
Resettlement and loss of use	**1.** Conduct a detailed and elaborate RAP	KETRACO	Continuous	To be determined
	2. Conduct consultation meetings with Project Affected Persons			
	3. Ensure timely compensation for loss of property and land use.			
	4. Ensure adherence to country legal legislations and World Bank Safeguard Policy 4.12 on Involuntary Resettlement			

8.2: ESMP FOR THE OPERATION PHASE

Table 8.2: ESMP for the operation phase of the proposed project

Expected Negative Impacts	Recommended Mitigation Measures	Responsible Party	Time Frame	Cost (Ksh)
1. Abate Air Pollution				
Generation of exhaust emission	**1.** Vehicle idling time shall be minimised	KETRACO	Entire implementation time	0
	2. Regular servicing of engines and machine parts to reduce exhaust emission generation			
2. Minimization of solid and liquid waste generation and ensuring more efficient waste management				
Solid waste generation	**1.** Use of an integrated solid waste management system i.e. the 3 R's: 1. Reduction at source 2. Reuse 3. Recycle	KETRACO	Continuous	0
	2. Provide solid waste handling facilities such as rubbish bags and skips		One-off	20,000
	3. Ensure that wastes generated are efficiently managed through recycling, reuse and proper disposal procedures.		Continuous	0
	4. A private licensed company to be contracted to collect and dispose solid waste on regular intervals			50,000 /year
	5. Place in strategic places signs against littering and dumping of wastes			10,000 /year
	6. Audits on waste generation and			

Expected Negative Impacts	Recommended Mitigation Measures	Responsible Party	Time Frame	Cost (Ksh)
	development of Waste Reduction Action Plans (WRAP)			To be determined
Liquid waste generation	**1.** Conduct regular checks for sewage pipe blockages or damages since such vices can lead to release of the effluent into the land and water bodies	KETRACO	Continuous	20,000 / annum
	2. Monitor effluent quality regularly to ensure that the stipulated discharge rules and standards are not violated			
	3. Audits on liquid waste generation and development of liquid Waste Reduction Action Plans			
Release of sewage into the environment	**1.** Provide adequate and safe means of handling sewage generated at the substations	KETRACO	One-off	40,000
	2. Conduct regular inspections for sewage pipe blockages or damages and fix appropriately		Continuous	0
	3. Ensure regular monitoring of the sewage discharged from the project to ensure that the stipulated sewage/effluent discharge rules and standards are not violated			0
3. Minimize Oil Spills				
Oil spills Hazards	**1**. Install oil trapping equipment in areas where there is a likelihood of oil spillage e.g. during maintenance of vehicles	KETRACO	Continuous	0

Expected Negative Impacts	Recommended Mitigation Measures	Responsible Party	Time Frame	Cost (Ksh)
	2. In case of an oil spill, immediate clean up measures will be instituted			
	3. The substations should be designed with spill prevention and detection systems to protect the environment especially where the transformers will be located.		One-off	Part of construction cost
	4. Design appropriate protection devices against accidental discharge of transformer oil substances.			
	5. The substations design should provide adequate storage areas for the transformer oil			
	6. Drains should be routed through an oil/water separator		One-off	Part of construction cost
	7. Frequent inspection and maintenance of the transformers should be done to minimize spilling		Continuous	0
	8. A written substations response plan should be prepared and retained on the site and the workers should be trained to follow specific procedures in the event of a spill.		One-off	0

Expected Negative Impacts	Recommended Mitigation Measures	Responsible Party	Time Frame	Cost (Ksh)
	9. The substations operator should ensure the proper containment or collection and disposal for the waste oil or used oil			0
	10. All waste oils from maintenance of transformers and other associated equipment should be segregated and disposed properly by a reputable/registered waste handler in accordance with the waste disposal plan		Continuous	20,000/year
	11. Storage and liquid impoundment areas for fuels, raw and in-process material solvents, wastes and finished products should be designed with secondary containment to prevent spills and the contamination of soil, ground and surface water		One-off	Project construction cost
4. Avifauna mortality				
Avifauna mortalities	**1.** To minimize collisions, undertake wire marking to alert birds to the presence of power lines, allowing them time to avoid the collision	KETRACO	One-off	Part of construction cost
	2. Build raptors platforms for bird roosting and nesting			
5. Minimize occupational health and safety risks				

Expected Negative Impacts	Recommended Mitigation Measures	Responsible Party	Time Frame	Cost (Ksh)
Impacts on workers' and community health and safety	Implement all necessary measures to ensure health and safety of the workers and the general public during operation of the proposed project as stipulated in the Occupational Safety and Health Act, 2007	KETRACO	Continuous	50,000/month
6. Minimize Electrocution Incidents				
Electrocution from live power lines or electric equipment	**1.** Put in place a maintenance system to ensure physical integrity of project equipment is maintained	KETRACO	Planning stage	0
	2 Access to the substations should only be by authorization and trained personnel		Continuous	
	3. Erect a perimeter fence to deny unauthorized people access the substations			
	4.. Clear warning signs to be placed on strategic places			
	5. Conduct periodic awareness and sensitization campaigns for the neighbouring communities		Continuous	20,000/session
7. Electrostatic and magnetic forces				
Perceived danger of Electrostatic and Magnetic force	**1.** Conduct education and awareness campaigns to dispel fear among community on the effects of electrostatic and magnetic forces	KETRACO	Continuous	20,000 / annum

Expected Negative Impacts	Recommended Mitigation Measures	Responsible Party	Time Frame	Cost (Ksh)
8. Increase in social vices				
Increase in social vices including HIV/AIDS	**1**. Periodic sensitization forums for employees on ethics, morals; general good behaviour and the need for the project to co-exist with the neighbours	KETRACO	Continuous	30,000/year
	2. Guidance and counselling on HIV/AIDS and other STDs to employees			
	3. Provision of condoms			
	4. enforcement of KETRACO's policy on sexual harassment and abuse of office			

8.3: ESMP FOR DECOMMISSIONING PHASE

Table 8.3: ESMP for decommissioning phase of the proposed project

Expected Negative Impacts	Recommended Mitigation Measures	Responsible Party	Time Frame	Cost (Ksh)
1. Reduction of Noise and vibrations				
Increased noise and vibration	**1.** Install portable barriers to shield compressors and other small stationary equipment where necessary.	KETRACO and Contractor	Continuous	To be determined
	2. Demolish mainly during the day. The time that most of the neighbours are out working.			
	3. Provide appropriate PPE to workers			
	4. Co-ordinate with relevant agencies and neighbouring communities regarding all demolition activities			
2.Abatement of air pollution				
Generation of dust	**1.** Watering all active demolition areas as and when necessary to lay dust.		Continuous	0

Expected Negative Impacts	Recommended Mitigation Measures	Responsible Party	Time Frame	Cost (Ksh)
	2. Cover all trucks hauling soil, sand and other loose materials or require all trucks to maintain at least two feet of freeboard.	KETRACO and Contractor		
	3. Pave, apply water when necessary, or apply (non-toxic) soil stabilizers on all unpaved access roads, parking areas and staging areas at demolition sites.		One-off	10,000
	4. Provide appropriate PPE to all workers		Continuous	Dust coats and dust masks@5000 per employee
Generation of exhaust emission	**1.** Vehicle idling time shall be minimised	KETRACO and Contractor	Continuous	0
	2. Regular servicing of engines and machine parts to reduce exhaust emission generation			
3. Waste management				
Demolition waste	**1.** Use of an integrated solid waste management system i.e. through a hierarchy of options: 1.Source reduction 2.Reusing 3. Recycling 4.Incineration 5. Sanitary land filling.	KETRACO and Contractor	Continuous	0
	2. All machinery, equipment, structures and partitions that will not be used for other purposes must be removed and recycled/reused as far as possible or they be taken to a licensed waste disposal site	KETRACO and Contractor	One-off	0

Expected Negative Impacts	Recommended Mitigation Measures	Responsible Party	Time Frame	Cost (Ksh)
	3. Dispose waste more responsibly by contracting a registered waste handler who will dispose the waste at designated sites or landfills only and in accordance with the existing laws.	KETRACO and Contractor	Continuous	Cost borne by the contractor
4. Oil spills				
Oil spills Hazards	**1**. Install oil trapping equipment in areas where there is a likelihood of oil spillage e.g. during maintenance of construction facility and vehicles.	KETRACO and Contractor	Continuous	0
	2. In case of an oil spill, immediate clean up measures will be instituted			
	3. Close surveillance of the fuel and cooling oil store			
5. Impacts on workers' and community health and safety				
Health and Safety for workers' and community members	**1**. Ensure strict compliance with the Occupational Safety and Health Act (OSHA) 2007	KETRACO DOHSS and Contractor	Continuous	To be determined
	2. Prohibit access by unauthorized personnel into the demolition site			
	3. Place warning signs where necessary			
6. Rehabilitation of project site				
Vegetation disturbance	**1.** Implement an appropriate re-vegetation programme to restore the site to its original status	KETRACO and community	One-off	50,000

Expected Negative Impacts	Recommended Mitigation Measures	Responsible Party	Time Frame	Cost (Ksh)
	2. Consider use of indigenous plant species in re-vegetation			
	3. Trees should be planted at suitable locations so as to interrupt slight lines (screen planting), between the adjacent residential area and the development.			

CHAPTER 9: ENVIRONMENTAL MONITORING PLAN (EMoP)

9.1: ENVIRONMENTAL MONITORING PLAN

Table 9.1: Environmental Monitoring Plan for the proposed project

Monitoring scope	Frequency			Methodology	Responsible entity
	Construction	Implementation	Decommissioning		
1. Noise and vibration impacts	Daily observation; monthly noise level analysis		Daily observation; monthly noise level analysis	Noise level analysis; quarterly reports on log of vehicle and machine servicing; trees planted; number of (noise) licences given; PPE provided; and sensitization meetings held	KETRACO and Contractor
2. Impacts on air pollution	Daily dust observation; monthly air quality analysis	Monthly air quality analysis	Daily dust observation; monthly air quality analysis	Daily dust observation; quarterly air sampling and lab analysis; quarterly reports on PPE provided; log of vehicle and machine servicing; sensitization meetings held; frequency of sprinkling water	KETRACO and Contractor

Monitoring scope	Frequency			Methodology	Responsible entity
	Construction	Implementation	Decommissioning		
3. Solid and liquid waste generation	Monthly	Monthly	Monthly	Reports on waste management plans developed; amounts of waste generated; facility provided for handling and storage of waste; methods employed for waste disposal; training meetings held, Waste water quality analysis; Reports on liquid waste management plans developed; number of inspections held to identify leaking or blocked pipes	KETRACO and Contractor
4. Oil spills	Daily	Monthly	Daily	Reports of oil trapping equipment installed; number of oil spill incidents and corrective measures taken	KETRACO and Contractor
5. Destruction of existing vegetation and habitats	Daily			Reports on site zoning program; community initiatives held on tree planting; landscaping programme on re-vegetation implemented	KETRACO and Contractor
6. Disturbance of faunal species	Monthly			Reports on wildlife sighted, meetings with KWS and conservancy owners, bush clearing	KETRACO and Contractor

Monitoring scope	Frequency			Methodology	Responsible entity
	Construction	Implementation	Decommissioning		
7. Avifauna mortalities		Quarterly		Reports on wire marking and raptor platforms build; incidents of bird strikes	KETRACO and Contractor
8. Health and Safety issues	Daily	Monthly	Daily	Quarterly reports on health and safety plans; SHE training programs; records of any incident, accident; investigation and corrective actions; PPE provided; progress of perimeter wall construction; warnings posted;	KETRACO and Contractor
9. Soil erosion	Daily			Reports on storm water management and soil erosion control plans developed; amounts of run-off and roof water harvested; water harvesting and storage facilities installed	KETRACO and Contractor
10. Visual and aesthetic impacts	Quarterly			Reports on public consultation held; landscaping programme designed and implemented	KETRACO and Contractor

Monitoring scope	Frequency			Methodology	Responsible entity
	Construction	Implementation	Decommissioning		
11. Electrocution incidences		Quarterly		Reports on maintenance system developed; electrocution accidents occurrence and corrective measures taken; visitors and employees access to the substations log; progress on construction of the perimeter wall; warning signs posted; sensitization workshops held	KETRACO and Contractor
12. Perceived danger of Electrostatic and Magnetic force		Quarterly		Reports on education and awareness campaigns held	KETRACO and Contractor
13. Increase in social vices	Monthly	Monthly		Reports on sensitization forums held; sessions held on guidance and counselling on HIV/AIDS and other STDs; number of condoms issued	KETRACO and Contractor
14. Cultural Heritage and Archaeological Finds	Monthly			Reports on heritage areas and archaeological finds found	KETRACO
15. Land take - Resettlement and Loss of use	Monthly			Reports on RAP implementation including compensation for land, structures and crop/trees damage	KETRACO

Monitoring scope	Frequency			Methodology	Responsible entity
	Construction	Implementation	Decommissioning		
16. Rehabilitation of project site			Monthly	Reports on re-vegetation programme developed and implemented; number and species of trees planted	KETRACO and Contractor

CHAPTER 10: ANALYSIS FOR ALTERNATIVES

10.1: Introdcution

One of the functions of the Environmental and Social Impact assessment process is to describe and evaluate various alternatives to the proposed project. Alternatives examined during the study are discussed below;

10.2; The "Do Nothing" Option

For this project, the no-development option would mean the proposed project will not be implemented. The implications of this would be no additional reliability and security of electricity supply to Kitui and Makueni Counties and the surrounding regions. Given that the level of impacts associated with the project are low and that there is high probability of mitigation of these negative impacts, the "no-go" option would not be the most viable option in this instance.

10.3; Demand-side Management Option

Demand Side Management (DSM) is a function carried out by the electricity supply utility aimed at encouraging a reduction in the amount of electricity used at peak times. This is achieved by influencing customer usage to improve efficiency and reduce overall demand. These efforts are intended to produce a flat load duration curve to ensure the most efficient use of installed network capacity. By reducing peak demand and shifting load from high load to low load periods, reductions in capital expenditure (for network capacity expansion) and operating costs can be achieved. One of the basic tools is the price differentiation (such as time-of-use tariffs) between peak demand time and low demand time. This option is practiced to a certain extent, but is currently not considered feasible for managing the level of growth forecast for Kitui, and Makueni Counties.

10.4; Line Routing and Substation Siting Alternatives

In proposing the above line route and substation location, consideration was given to social and environmental impacts of the project. The transmission line will generally follow open ground with minimum settlement and hence the need for relocation/resettlement will be minimal. The transmission line and substation sites have been located to avoid areas of dense settlement and where impacts on environment and local people e.g. from loss of farmland, grazing land, or environmentally sensitive areas are minimal.

10.4; Alternative Processes and Materials

Highly refined mineral insulating oils are used to cool transformers and provide electrical insulation between live components. Sulfur hexafluoride (SF_6) may also be used as a gas insulator for electrical switching equipment and in cables, tubular transmission lines and transformers. Polychlorinated Biphenyls (PCB) can be used as a dielectric fluid to provide electrical insulation. SF_6 is a greenhouse gas with a significantly higher Global Warming Potential (GWP) than carbon-dioxide. PCB is a highly toxic substance that is no longer commonly used for electrical insulation. For this project the proponent is advised to use mineral insulating oil for cooling and insulation and to minimize or completely stop the use of SF_6 and PCB.

10.5; Proceed with the proposed project with mitigation measures

This option is the preferred option and it entails carrying out the proposed project with mitigation measures to prevent, offset, or avoid its negative impacts thereby maximizing it gains. This option would therefore lead to achieving the proposal's objectives sustainably and contribute to the achievement of other sectorial and policy goals and objectives. As compared to the other options, this option uses the strengths of the other options such as using different water and energy sources thereby creating synergy and increasing the project's cost-effectiveness. This option also involves using the best available building materials and process to minimize risks to environmental and social systems in the area and globally.

CHAPTER 11: RECOMMENDATIONS AND CONCLUSION

11.1: INTRODUCTION

An Environmental Management Plan (EMP) for the project has been developed to ensure sustainability of the site activities from construction through operation to decommissioning. The plan provides a general outlay of the activities, associated impacts, and mitigation action plans. Implementation timeframes and responsibilities are defined, and where practicable, the cost estimates for recommended measures are also provided.

A monitoring plan has also been developed and highlights some of the environmental performance indicators that should be monitored. Monitoring creates possibilities to call to attention changes and problems in environmental quality. It involves the continuous or periodic review of operational and maintenance activities to determine the effectiveness of recommended mitigation measures. Consequently, trends in environmental degradation or improvement can be established, and previously unforeseen impacts can be identified or pre-empted.

It is strongly recommended that a concerted effort is made by the site management in particular, to implement the Environmental Management and Monitoring Plan provided herein. Following the commissioning of the 132Kv transmission line and substations, statutory Environmental and Safety Audits must be carried out in compliance with the national legal requirements, and the environmental performance of the site operations should be evaluated against the recommended measures and targets laid out in this report.

It is quite evident from this study that the construction and operation of the proposed transmission line project will bring positive effects in the project area including improved supply of electricity, cleaner environment, creation of employment opportunities, gains in the local and national economy, provision of market for supply of building materials, Informal sectors benefits, Increase in revenue, Improvement in the quality of life for the workers and community members, and Improved security.

Considering the proposed location, construction, management, mitigation and monitoring plan that will be put in place, the project is considered important, strategic and beneficial and given that no immitigable negative impacts were encountered and that no community objection was received, the project may be allowed to proceed.

11.2: RECOMMENDATIONS

Following the impact analysis presented in the previous sections, the following recommendations were made

- The proposed project to be implemented in compliance with the relevant legislation and planning requirements
- The proponent to ensure implementation of the mitigation measures provided in the ESMP
- The proponent to conduct and implement a detailed and elaborate Resettlement Action Plan
- The proponent to monitor implementation of the ESMP using the developed ESMoP
- The proponent to conduct annual Environmental Audits and submit to NEMA
- NEMA to consider, approve and grant an Environmental Impact Assessment License to the proponent

11.3: CONCLUSION

From the foregoing, it is noted that;

- no immitigable negative impacts were encountered
- No objection from the community was received
- Identified potential negative impacts can be mitigated
- Benefits to the community, region, and the country at large are immense

The ESIA team, therefore, recommends to NEMA to consider, approve and grant an **Environmental Impact Assessment License** to the proponent and the proponent to implement the project with strict adherence to the proposed ESMP

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