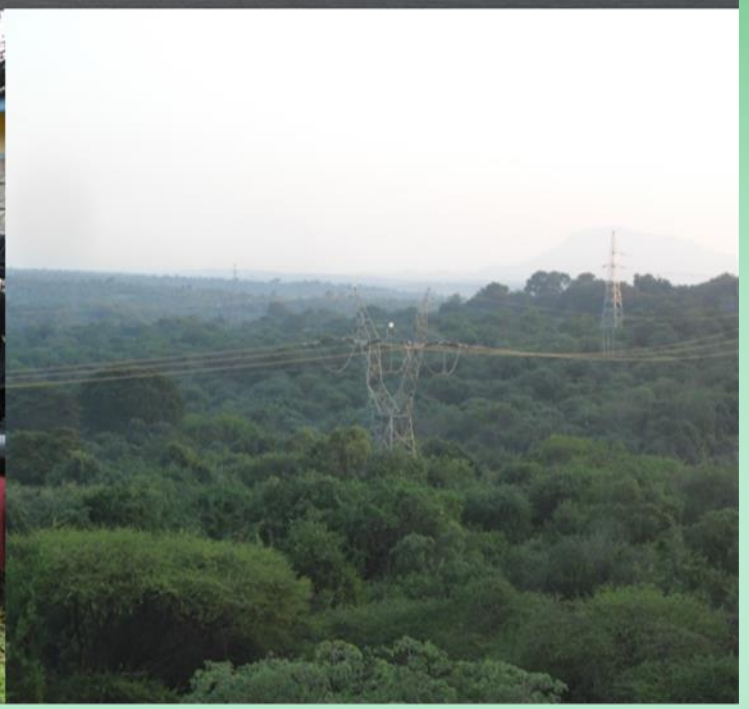
ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDY REPORT FOR THE PROPOSED KAMBURU-EMBU-KIBIRIGWI-THIKA TRANSMISSION LINE PROJECT



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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 220kV Kamburu – Embu - Kibirigwi - Thika transmission line project. The project is aimed at enhancing the adequacy, reliability, and security of electricity power supply in Embu, Kirinyaga, Muranga and Kiambu Countites. The project will also help meet the increasing demand for power supply and minimize the frequency of power outages.

The main objectives of the project are:

- To create the North Eastern part of the 220 kV Network and
- To supply the loads of Embu (Kutus) and Kibirigwi (Kiganjo) from the power available from Kamburu (supplied from Gitaru) and Thika.

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 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 EMCA, 1999 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, provincial administration, opinion leaders and district 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, 1999
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 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 220kV Kamburu – Embu - Kibirigwi - Thika transmission line project. The project is aimed at enhancing the adequacy, reliability, and security of electricity power supply in Embu, Kirinyaga, Muranga and Kiambu Countites. The project will also help meet the increasing demand for power supply and minimize the frequency of power outages.

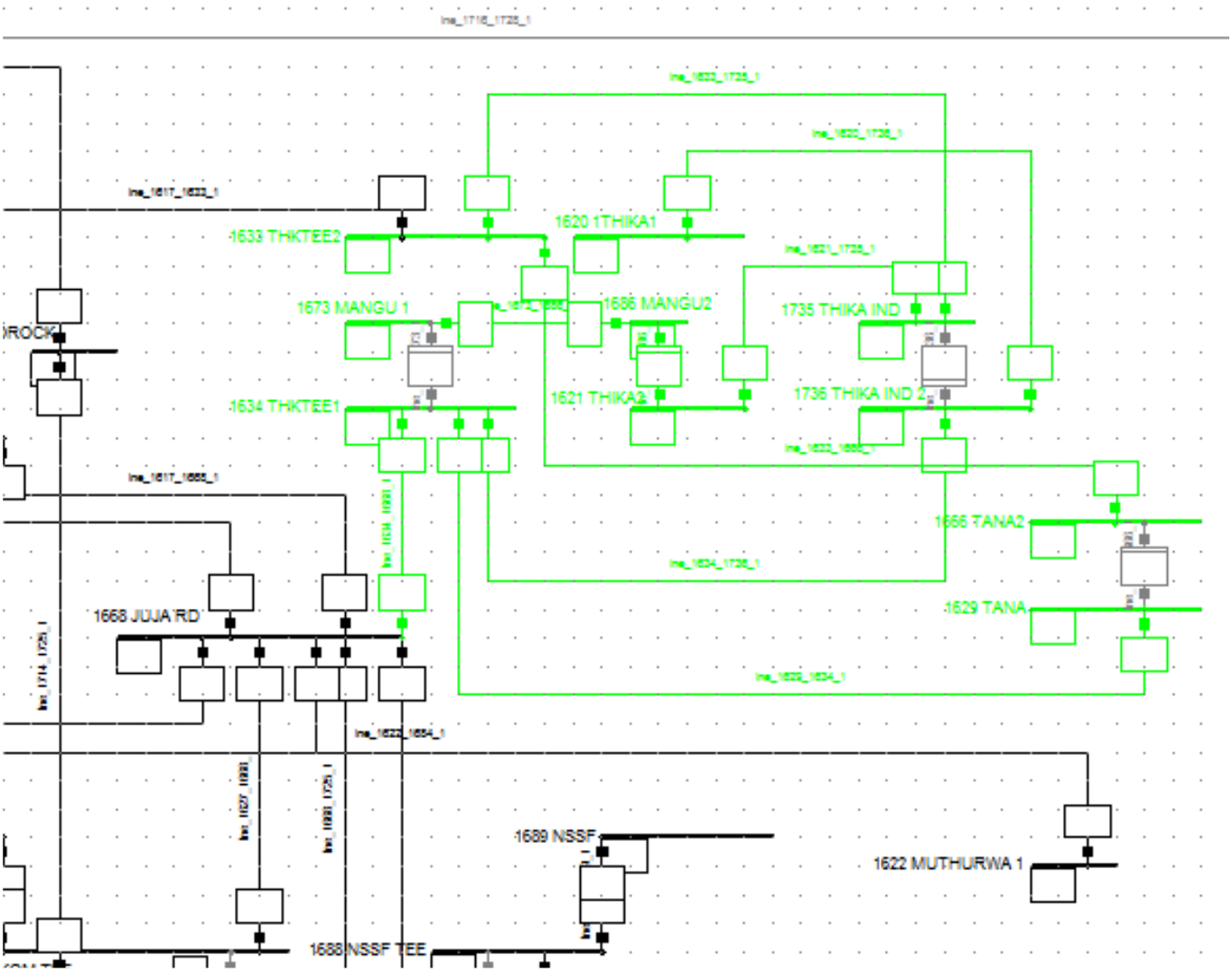
The main objectives of the project are:

- To create the North Eastern part of the 220 kV Network
- To supply the loads of Embu (Kutus) and Kibirigwi (Kiganjo) from the power available from Kamburu (supplied from Gitaru) and Thika.

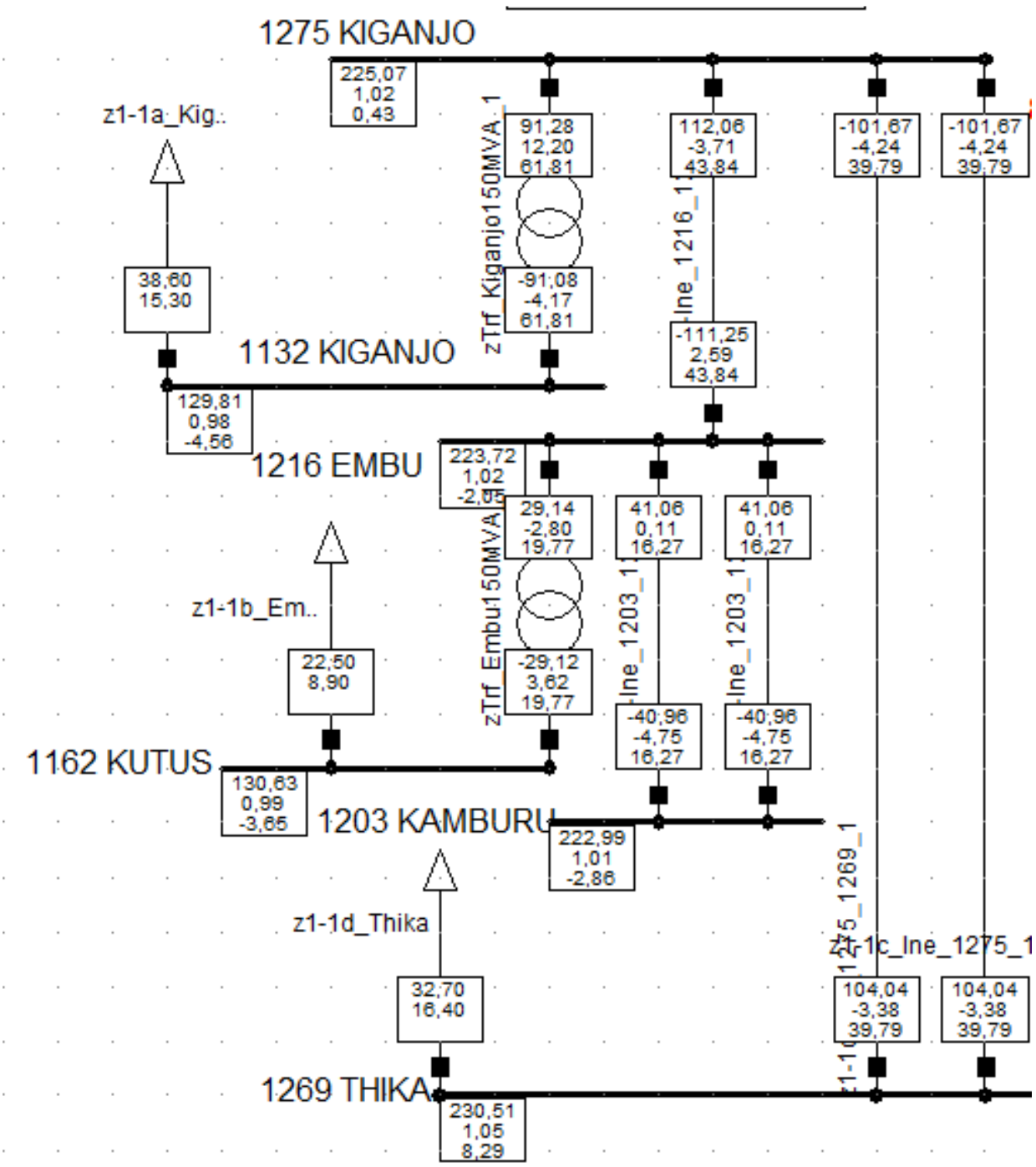
The project is required essential for the following reasons:

- Kiganjo is presently supplied by a 33/132 kV substation (1352 KIGA33 and 1132 KIGA) supplying already 32.08 MW. If this load increases to around 45 MW, then the voltage decreases to 0.91 pu which is not acceptable. Hence reinforcement is necessary.
- Embu (Kutus) is supplied by a 33 kV network
- Thika was supplied by 66 kV Substations. Thika had 16.79 MW at peak in 2013 (2 x 9.85 MW). Two 66 kV circuits feed each transformer 66/11 kV. If this load increases as per the forecast for 2018 to 2x16.4

MW = 32.8 MW, there would be a voltage collapse on the whole area around Thika, as shown by the area in green (picture of the 66 kV network). However, a 132/66kV Substation has been established at Thika for evacuation of 87MW generation of IPP at Thika.



The diagram below shows the active power (MW), the reactive power (Mvar) and the loading (%) for the lines in the 2015 stage. Note that loads represent HV/33 kV Transformers and downstream equipments in the Distribution network as needed. Here, HV refers to 132 kV in Kiganjo and Kutus and 220 kV in Thika.



The project aims over creating a 220 kV loop between two existing and planned Substations of Kamburu and Thika respectively. The project appears to be driven by the need to supply new loads at Kiganjo (227 MW in

2030), Embu (Kutus: 156 MW in 2030) and Thika (212 MW in 2030). The timing of the project should therefore be in tandem to the commissioning of the new loads.

In view of space constrain at existing 132kV Kiganjo substation and non availability of suitable land in nearby area for establishment of 220/132kV, it is proposed to estabilished 220/132 kV substation at Kibrigwai which is about 26.5 kms from Kiganjo. The load to Kiganjo will be catered from Kibrigwi substation by connecting 132kV Kiganjo-Masinga line to Kibrigwi Substation with LILO arrangement. Depending on future load growth at Kiganjo, another 132kV D/c line from kibrigwai to Kiganjo can be set in future.

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 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 Coordination Act (1999) 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 1999 and the Environmental Management and Coordination (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 Coordination Act (1999) 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, 1999 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 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, provincial administration, opinion leaders and district 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, 1999 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 project set-up plans and architect's statement, land ownership documentation, environmental legislation and regulations, district development plans, location maps, etc.

Step 3: Site Assessment

Site assessment was conducted between 13th and 20th December 2016 to establish:

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

Step 4: Public Consultation

Detailed stakeholders consultations for this study were undertaken from 9th to 22nd December 2016. 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 220kV double circuit transmission line from Kamburu to Embu, then Kibirigwi (Kiganjo) and terminate in Thika

Detailed scope of work for the project is as follows:

1. Transmission Line
    a) Kamburu – Embu - Kibirigwi - Thika 220kV D/c line (147km)
2. Substations
    a) Extension of 220kV substation at Kamburu
    b) Extension of 132kV substation at Embu
    c) New 220/132kV substation at Kibirigwi
    d) Extension of 132kV substation at Thika

2.2: TRANSMISSION LINE DESIGN

2.2.1; Line Configuration

The 220 kV D/c transmission line shall have vertical configuration of conductors.

2.2.2; Towers

The towers shall be self-supporting latticed bolted steel towers fabricated from structural steel. Tower components and bolts & nuts shall be hot dip galvanized.

The following configuration of towers shall be used in the line:

a) 'S' type suspension towers for upto 2 degree angle of deviation.
b) 'LA' type light angle tension towers for upto 15 degree angle of deviation.
c) 'MA' type light angle tension towers for upto 30 degree angle of deviation.
d) 'HA' type light angle tension towers for upto 60 degree angle of deviation and suitable for dead end condition. These shall also be used for terminal locations.

The standard extensions/truncations normally used for various types of towers are as follows:

a) S : -3m, 0m, 3m, 6m,18m
b) LA & MA : : -3m, 0m, 3m, 6m
c) HA : -3m, 0m, 3m, 6m, 18m

Besides the standard body extensions, the following leg extensions shall also be designed to be used at hill slope locations:

All towers : -2m, -1m, 0m, 1m, 2m, 3m

In addition to the above, special towers, for major river crossing, power line crossing and the places where the terrain is particularly different, such as approach to the sub-station, forest stretches etc. shall also be used. All towers shall be designed in accordance with latest edition of International Standards.

Structural steel sections used in towers shall be of Mild Steel (MS) and High Tensile (HT) steel of requisite quality as per ASTM A36M and A572M(Grade 345) respectively or equivalent International Standards.

All structural steel shall be hot dip galvanized in accordance with the requirements of ASTM A123M. The minimum coating thickness shall not be less than 86 microns, equivalent to 610 g/sq.m.

The basic spans, wind spans and weight spans for various towers are as follows:

Basic Span = 300 m

Table 2.1; Basic Spans, Wind Span and Weight Span

Sl. No.	Application	Designation	Angle (degree)	Wind Span (m)	Weight Span (m)	
					Max.	Min.
1	Suspension	S	0 -2	300	450	100
2	Tension	LA	0 - 15	300	450	200
3	Tension	MA	15 -30	300	450	200
4	Tension	HA	30 -60	300	600	500

Tower Type LA, MA & HA can be used for longer wind spans with reduced angle of deviation in the valleys wherever ground clearance permits so.

All international codes for design of Steel Transmission Line Tower have switched over to probabilistic method of design from deterministic method. In this regard, following standards shall be adopted:

a) ASCE-52:1988 - "Guide for Design of Steel Transmission Line Towers" issued by American Society of Civil Engineers.
b) IEC – 826:1991 - “Technical Report on Loading and Strength of Overhead Transmission Line Towers" issued by the International Electro Technical Commission.

All structures shall be designed to withstand loadings due to maximum wind,
maximum ice prevalent in the line route.

2.2.3; Conductors

Conventional ACSR type conductor is proposed based on system requirements as this is the most common type of conductors with proven technology having low cost & easy availability.

Single ACSR Lynx conductor (30/2.79 mm Aluminum and 7/2.79 mm steel) of overall diameter 19.53 mm shall be used.

The maximum allowable every day tension shall not exceed 20% of the ultimate tensile strength of the conductor.

2.2.4; Earthwire

Optical Ground Wire (OPGW) shall be used on the line. The mechanical & electrical characteristics of OPGW shall be similar to the conventional aluminium clad steel wire of 7/3.15mm. The OPGW shall contain 48 nos. of fibres (DWSM) conforming to ITU-T G.652D.

OPGW shall withstand two successive lightning stroke of 150 kA. Shielding angles of 30 deg is considered for transmission line.

The maximum allowable every day tension shall not exceed 15% of the ultimate tensile strength of the OPGW.

2.2.5; Insulator and Hardware Fittings

The Insulator strings shall consist of Standard discs made of either electro-porcelain or toughened glass for a three phase, 132 kV transmission line in a medium polluted atmosphere (20 mm/kV phase-to-phase) The discs shall be cap and pin, ball and
socket type.

As an alternative, insulator strings with composite long rod insulators shall be used. Suitable hardware fittings shall be used for attachment of the insulators with the tower at one end and also for supporting the conductors at the other end. Corona control rings or grading rings will be used for improving corona and RIV performance as well as to improve the voltage distribution across the insulators discs.

2.2.6; Line Accessories

Mid span compression joint for conductor/ earthwire

Compression joints suitable for conductor /earth wire shall be used for joining two lengths of conductor / earthwire. The minimum slipping strength of the joint after compression shall not be less than 95% of the UTS of conductor / earthwire.

Repair sleeve for conductor

Repair sleeve shall be used only for repairing not more than two strands broken in the outer layer of aluminium. It shall be of compression type in two parts with provision of seat of sliding of keeper piece.

Vibration dampers for conductor/ earthwire

Stockbridge vibration dampers shall be used to reduce the maximum dynamic strain caused by aeolian vibrations to a value of 150 micro-strain.

Flexible copper bond for earthwire

Flexible copper bonds shall be used for good electrical continuity between the earth wire and the tower. Two bonds per suspension tower and four bonds per tension tower shall be used.

Suspension/Tension clamps for earthwire

Suitable suspension / tension clamps shall be used for attachment of earthwire at suspension/tension towers.

2.2.7; Tower foundations

Reinforced Cement concrete footings are proposed to be used for all types of towers in conformity with the practice followed in Kenya. All the footing of the tower are proposed to be of spread type footing with maximum depth of 3.0 meters below ground level and all the four footings of the tower shall be similar irrespective of down thrust and uplift.

The locations where chiseling, drilling and blasting is required for excavation, hard rock type foundations are to be used. For these locations rock anchoring is to be provided to resist the uplift.

2.2.8; Grounding

The tower footing resistance shall be kept below 10 ohms. Normally pipe type grounding shall be used. In case of rocky ground where the ground resistance is high, counterpoise earthing shall be used to bring the tower footing resistance down to acceptable level.

2.2.9; River Crossings

Special towers shall be used for major river crossings where the span is more than 600 mtrs with anchor towers on either end of river crossing span.

2.2.10: Power line, Railway line, Road and Telecommunication line crossings

The transmission lines shall be crossing power lines, railway lines roads and Post &Telecommunication lines for which suitable extensions of towers shall be used. The standard extension normally used for various types of towers are as follows:

a) A & C : 3m, 6m, 9m
b) B & D : 3m, 6m,9m, 18m & 25m

2.3: SUBSTATION DESIGN

The basic design concepts for the Substations are described in the following paragraphs. It shall be noted that these parameters shall act as basic design parameters for the Substations and for bidding purposes, detailed specifications are to be framed.

The substations are assumed to be designed with the aim of keeping the costs at minimum and accordingly only equipment considered to be strictly necessary have been included. However, due considerations have been taken with respect to:

a) Easy and risk-free operation
b) Enable easy maintenance and repair
c) Enabling future modifications and expansions
d) The importance of the respective substations

The switchgear in the substations would be conventional outdoor air-insulated switchgear for 220kV, 132 kV and 33kV. Equipment for control, protection and auxiliary power will be housed in a small control room building. The Single Line Diagram for all the Substations considered present assignment i.e. Assignment IV has been enclosed with this document.

2.2.1; Substation concept

The substation system is considered with one and a half breaker switching scheme for better reliability, availability and enable easy maintenance.

Each line/transformer/bus reactor shall be terminated in respective independent bay having switchgear equipment, protection and control system. The scheme has two main buses. Each diameter comprising of

three bays (i.e. 2 nos main bays & 1 no tie bay) shall be terminated to both the buses. All Isolators and earth switches devices are assumed motor-operated.

For the system of the substation the following switchgear has been considered:

The main bay for transformer/line/Bus Reactor shall include

a) Circuit-breaker with single pole & three pole operation - 1 pc
b) Isolator with one earth E/S (one on each side of the circuit breaker) - 2 pcs
c) Isolator with one earth switch for line/transformer/reactor - 1 pc
d) Current transformer (one per phase) - 3 pcs
e) Capacitive Voltage transformers (one per phase) - 3 pcs (only for line and main bus)
f) Surge Arrestors (one per phase) - 3pcs

The tie bay shall include

a) Circuit-breaker with single pole & three pole operation - 1 pc
b) Isolator with one earth E/S (one on each side of the circuit breaker) - 2 pcs
c) Current transformers (one per phase) - 3 pcs

Each main bus shall include

a) Bus Capacitive Voltage transformers (one per phase) - 3 pcs
b) Earth Switch - 1 pc

The advantage of one and a half breaker switching scheme is that the availability (line or transformer) will not be generally affected each time the bay equipment for the particular feeder needs to be maintained. However the advantage of better reliability, availability and ease of maintenance is at a small incremental cost.

All equipments shall comply to IEC/equivalent international standards. The switchyard layout is considered with adequate space for road and accessibility for easy maintenance of bay equipments.

2.2.2; Design Requirement

The following table shows the minimum design requirements from point of view of the electrical system and other general data.

Table 2.2: Substations Design requirements

Data	**220kV**
Operating Voltage	220 kV
Max. Continous System Voltage	245 kV

System frequency	50 Hz
Maximum Design Load	1600 A
Rated Circuit Current	40 kA,1Sec
Power Frequency Withstand Voltage (rms) at System Frequency for 1 min.	460 kV
Rated BIL (Crest)	1050 kVp
System Earthing	Solid

2.2.3; Power Transformers

Outdoor transformers are assumed. Power transformers shall conform to IEC: 60076 in general. These transformers shall generally have OLTC cooling arrangement type ONAN/ONAF .The air core reactance shall be of the order of 20%. Tertiary windings shall be provided for large auto transformers, which shall be capable of being loaded.

The transformers shall be provided with Nitrogen Injection based Fire Prevention & Extinguishing System for all new 220kV Sub-stations. All the 220/33kV & 132/33kV Transformers would be two-winding type and 220/132kV transformers shall be auto transformer with on-load tap-changers. The neutral earthing of the transformers/reactors shall be solidly grounded.

Space should be foreseen in the layout so that the transformers can be replaced with bigger transformers in future. Also there will be space for accommodating minimum one no of transformers in future.

2.2.4; Shunt Reactors

Shunt Reactors, wherever provided, shall comply to IEC:289/IS:5553 in general 245kV & 145kV Shunt reactors shall have linear characteristics upto 1.4 p.u. voltage. These should be ONAN Cooled. The neutral of bus reactors shall be solidly grounded.

2.2.5; Circuit Breakers

Circuit breakers shall in general comply to IEC 62271-100 & IEC-60694 and shall be of SF6 type for 245/145kV and Vacuum type for 36kV. The rated break time shall not exceed 65 ms for 245kV & 145kV circuit breakers. 220kV & 132kV Circuit Breaker shall be suitable for single phase and three phase auto reclosing. However, 132kV CB for Transformer/reactor bays and all the 33kV Circuit breakers shall be suitable for three phase auto reclosing.

2.2.6; Isolators

The isolators shall comply to IEC 62271-102 in general. Isolators shall be generally horizontal double break type keeping in view the bus switching schemes proposed. Isolators shall be motor operated. Earth switches are provided at various locations to facilitate maintenance. Main blades and earth blades shall be interlocked and interlock shall be fail safe type. All earth switches shall be motor operated type.

2.2.7; Current Transformers

Current Transformers shall comply to IEC 60044-1 in general. All ratios shall be obtained by secondary taps. Current transformers shall have five secondary cores for 220KV & 132kV. The metering core shall be of 0.2S accuracy class. For 33kV CT maximum 3 Nos. secondary cores with metering core of 0.2 accuracy class shall be considered. The burden and knee point voltage shall be in accordance with the requirements of the system including possible feeds for telemetry.

2.2.8; Capacitor Voltage Transformers

Voltage transformers shall comply with IEC 60044-5 in general. These shall have three secondaries out of which two shall be used for protection and one for metering. Accuracy class for protection core shall be 3 P and for metering core shall be 0.2. The Capacitance of CVT shall be 4400pF depending on requirements.

2.2.9; Surge Arresters

Station class current limiting, heavy duty gapless type Surge arresters conforming to IEC 60099-4 in general shall be provided. The rated voltage of Surge arrester and other characteristics are chosen in accordance with system requirements. Surge arresters shall be provided near line entrances and transformers/reactors so as to achieve proper insulation coordination. These shall be fitted with pressure relief devices and diverting ports suitable for preventing shattering of porcelain housing providing path for the flow of rated currents in the event of arrestors failure.

The switchgear shall be designed and specified to withstand operating conditions and duty requirements.

2.2.10; Auxiliary power

For new substations, duplicated station service supply should be foreseen, so that there will be no interruption of service even if one supply should suffer a failure. (Cost of duplicated supply is moderate compared to the overall cost of the substation.)

Operation of circuit-breakers and systems for protection and control will be fed from a DC-system with battery back-up. Voltage will be 110V-DC to cope with the physical distances in the sub-stations. The system will be isolated from earth to reduce risk of mal-operation because of earth-faults. The DC system will be duplicated,

including two rectifiers and two batteries. This is to enable maintenance, repair and replacements without interrupting the supply.

One No. of DG set of suitable capacity should be considered for each new sub-station.

2.2.11; Control and protection

The control and monitoring of the sub-station shall be using Sub-station Automation System based on IEC 61850 communication protocol. The sub-station shall have provision for operation from local and remote i.e. Remote control centre/National Load Dispatch using Fiber optic based SDH communication equipment.

Protective functions will be split between the two DC systems to ensure the best independency between protection functions that are back-up for each other.
Circuit breakers will have duplicated trip coils. Trip coil circuits will include circuit supervision. Protective relays will be programmable and will include test facilities.

The protection scheme shall include:

220kV lines:

- Line differential protection (Main-I)
- Distance protection (Main-II)
- Directional earth fault protection
- Autoreclosing with synchro-check
- Breaker failure protection
- Synchro-check blocking of circuit-breaker closing

Transformer 220kV bays:

- Differential protection
- Directional overcurrent protection
- Directional earth fault protection
- Restricted earth fault protections
- Overload protection
- Overflux protection
- Breaker failure protection
- Bucholz relay for transformer tank
- Bucholz relay for on-load tap changer
- Temperature protection (oil and winding)

- Oil level protection
- Pressure relief device

Transformer 33kV bay:

- Restricted earth-fault protection
- Non-directional earth-fault protection
- Non-directional earth-fault protection

220kV/132kV bus:

- Busbar protection

33kV lines:

- Non directional over-current protection
- Non-directional earth-fault protection
- Auto-reclosing function
- Synch-check blocking of circuit breaker closing
- Under frequency protection with load shedding of 33kV lines

For tele-protection, data & speech application, optical fibre based telecommunication (SDH) equipment has been considered. For 132kV & 220kV transmission line protection scheme i.e. Line Differential Relays & Distance Relays above communication link has been considered. The new substation shall be integrated into the existing Load Dispatch Centre.

2.3: TRANSMISSION LINE ROUTE

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

KAMBURU – EMBU – KIBIRIGWI - THIKA COORDINATES

PROPOSED KAMBURU TO EMBU(KUTUS) LINE					
SR NO	ZONE – WGS 84 (37SOUTH)		Geographical		AP. No.
	Easting	Northing	Longitude	Latitude	
1	354162	9910642	0° 48' 29.6580" S	$37^0$48’29.6580”S	Kamburu SS
2	354345	9911141	0° 48' 13.4279" S	37° 41' 27.7329" E	AP-1

3	354324	9911220	0° 48' 10.8209" S	37° 41' 27.0433" E	AP-2
4	354338	9911309	0° 48' 7.9302" S	37° 41' 27.5161" E	AP-3
5	353907	9911670	0° 47' 56.1385" S	37° 41' 13.5481" E	AP-4
6	353633	9911737	0° 47' 53.9512" S	37° 41' 4.6672" E	AP-5
7	352125	9912557	0° 47' 27.2397" S	37° 40' 15.9190" E	AP-6
8	351205	9913452	0° 46' 58.0726" S	37° 39' 46.1683" E	AP-7
9	350831	9913516	0° 46' 55.9738" S	37° 39' 34.0419" E	AP-8
10	350672	9913518	0° 46' 55.9260" S	37° 39' 28.9071" E	AP-9
11	350067	9913671	0° 46' 50.9285" S	37° 39' 9.3252" E	AP-10
12	46270	9913824	0° 46' 45.9049" S	37° 37' 6.5244" E	AP-11
13	345058	9914346	0° 46' 28.8899" S	37° 36' 27.3319" E	AP-12
14	342253	9915990	0° 45' 35.3309" S	37° 34' 56.6313" E	AP-13
15	340161	9917124	0° 44' 58.4100" S	37° 33' 48.9835" E	AP-14
16	339713	9917556	0° 44' 44.3342" S	37° 33' 34.4974" E	AP-15
17	337558	9919186	0° 43' 51.2417" S	37° 32' 24.8031" E	AP-16
18	334644	9921118	0° 42' 48.3068" S	37° 30' 50.5712" E	AP-17
19	333082	9923392	0° 41' 34.2601" S	37° 30' 0.0850" E	AP-18
20	332370	9925844	0° 40' 14.4264" S	37° 29' 37.0992" E	AP-19
21	326790	9931037	0° 37' 25.2642" S	37° 26' 36.6530" E	AP-20
22	324043	9933159	0° 36' 16.1515" S	37° 25' 7.8171" E	AP-21
23	323173	9934496	0° 35' 32.6343" S	37° 24' 39.7217" E	AP-22
24	322137	9935637	0° 34' 55.4601" S	37° 24' 6.2220" E	AP-23
25	321260	9936913	0° 34' 13.9370" S	37° 23' 37.8836" E	AP-24
26	320917	9937551	0° 33' 53.1526" S	37° 23' 26.7794" E	AP-25

27	320841	9938405	0° 33' 25.3551" S	37° 23' 24.3343" E	AP-26
28	320952	9939111	0° 33' 2.3976" S	37° 23' 27.9231" E	AP-27
29	321131	9939357	0° 32' 54.3981" S	37° 23' 33.7299" E	AP-28

PROPOSED EMBU (KUTUS) TO KIBRIGWI LINE					
SR NO	**ZONE – WGS 84 (37SOUTH)**		**Geographical**		**AP. No.**
	Easting	**Northing**	**Longitude**	**Latitude**	
1	320953.1427	9939616.693	0° 32' 46.1044" S	37° 23' 28.0308" E	Embu SS
2	320803.9	9939665.269	0° 32' 44.5215" S	37° 23' 23.2053" E	AP-1
3	320512.6943	9939673.595	0° 32' 44.2479" S	37° 23' 13.7871" E	AP-2
4	320134.2303	9939509.118	0° 32' 49.6000" S	37° 23' 1.5460" E	AP-3
5	318057.3673	9939245.366	0° 32' 58.1694" S	37° 21' 54.3778" E	AP-4
6	316738.6992	9939140.641	0° 33' 1.5674" S	37° 21' 11.7313" E	AP-5
7	315621.7729	9938746.367	0° 33' 14.3947" S	37° 20' 35.6067" E	AP-6
8	314259.0661	9938477.754	0° 33' 23.1282" S	37° 19' 51.5350" E	AP-7
9	313761.3065	9938682.6	0° 33' 16.4539" S	37° 19' 35.4397" E	AP-8
10	313157.9204	9938608.793	0° 33' 18.8515" S	37° 19' 15.9259" E	AP-9
11	311023.0874	9936772.105	0° 34' 18.6321" S	37° 18' 6.8700" E	AP-10
12	310505.7674	9936554.125	0° 34' 25.7243" S	37° 17' 50.1383" E	AP-11
13	309147.9242	9935713.084	0° 34' 53.0942" S	37° 17' 6.2191" E	AP-12
14	308452.0971	9935480.045	0° 35' 0.6747" S	37° 16' 43.7146" E	AP-13
15	307339.6988	9935494.475	0° 35' 0.1938" S	37° 16' 7.7413" E	AP-14
16	305209.5695	9935641.338	0° 34' 55.3908" S	37° 14' 58.8579" E	AP-15

17	304562.8483	9935793.915	0° 34' 50.4167" S	37° 14' 37.9457" E	AP-16
18	303225.9463	9935461.375	0° 35' 1.2298" S	37° 13' 54.7096" E	AP-17
19	302431.9121	9935603.559	0° 34' 56.5925" S	37° 13' 29.0337" E	AP-18
20	301518.2489	9936144.765	0° 34' 38.9628" S	37° 12' 59.4935" E	AP-19
21	301093.4295	9937295.82	0° 34' 1.4832" S	37° 12' 45.7675" E	AP-20
22	300281.2901	9938071.968	0° 33' 36.2058" S	37° 12' 19.5128" E	AP-21
23	299906.2209	9938780.062	0° 33' 13.1485" S	37° 12' 7.3911" E	AP-22
24	299508.8521	9940062.846	0° 32' 31.3809" S	37° 11' 54.5538" E	AP-23
25	299699.1339	9940675.437	0° 32' 11.4385" S	37° 12' 0.7128" E	AP-24
26	299811.6559	9940771.357	0° 32' 8.3167" S	37° 12' 4.3523" E	AP-25

PROPOSED THIKA TO KIBRIGWI LINE					
SR NO	**ZONE – WGS 84 (37SOUTH)**		**Geographical**		**AP. No.**
	Easting	**Northing**	**Longitude**	**Latitude**	
1	299731	9940740	0° 32' 9.3212" S	37° 12' 1.7294" E	AP-0
2	299597	9940292	0° 32' 23.9223" S	37° 11' 57.4208" E	AP-1
3	299554	9939458	0° 32' 51.0676" S	37° 11' 56.0083" E	AP-2
4	299445	9939364	0° 32' 54.1452" S	37° 11' 52.4927" E	AP-3
5	299389	9939146	0° 33' 1.2134" S	37° 11' 50.6781" E	AP-4
6	299493	9938063	0° 33' 36.4855" S	37° 11' 54.0113" E	AP-5
7	299802	9937627	0° 33' 50.6820" S	37° 12' 4.0097" E	AP-6
8	300081	9936874	0° 34' 15.2003" S	37° 12' 13.0242" E	AP-7
9	300385	9935481	0° 35' 0.5556" S	37° 12' 22.8405" E	AP-8

10	300720	9934473	0° 35' 33.3767" S	37° 12' 33.6630" E	AP-9
11	301158	9933155	0° 36' 16.2918" S	37° 12' 47.8128" E	AP-10
12	301317	9932285	0° 36' 44.6184" S	37° 12' 52.9452" E	AP-11
13	301377	9931829	0° 36' 59.4652" S	37° 12' 54.8805" E	AP-12
14	301306	9931567	0° 37' 7.9944" S	37° 12' 52.5816" E	AP-13
15	301471	9930690	0° 37' 36.5490" S	37° 12' 57.9077" E	AP-14
16	301842	9930043	0° 37' 57.6178" S	37° 13' 9.8979" E	AP-15
17	302551	9929479	0° 38' 15.9882" S	37° 13' 32.8192" E	AP-16
18	302950	9928872	0° 38' 35.7551" S	37° 13' 45.7153" E	AP-17
19	303632	9927775	0° 39' 11.4786" S	37° 14' 7.7575" E	AP-18
20	305002	9926734	0° 39' 45.3917" S	37° 14' 52.0651" E	AP-19
21	305562	9925209	0° 40' 35.0626" S	37° 15' 10.1463" E	AP-20
22	306808	9922277	0° 42' 10.5134" S	37° 15' 50.3928" E	AP-21
23	307253	9921083	0° 42' 49.3993" S	37° 16' 4.7702" E	AP-22
24	307298	9920458	0° 43' 9.7534" S	37° 16' 6.2229" E	AP-23
25	307180	9920160	0° 43' 19.4498" S	37° 16' 2.4050" E	AP-24
26	305065	9917614	0° 44' 42.3157" S	37° 14' 53.9753" E	AP-25
27	304315	9916618	0° 45' 14.7335" S	37° 14' 29.7080" E	AP-26
28	303408	9915505	0° 45' 50.9581" S	37° 14' 0.3618" E	AP-27
29	303223	9914762	0° 46' 15.1459" S	37° 13' 54.3691" E	AP-28
30	303464	9912982	0° 47' 13.1018" S	37° 14' 2.1386" E	AP-29
31	302846	9909897	0° 48' 53.5332" S	37° 13' 42.1097" E	AP-30
32	302312	9908208	0° 49' 48.5150" S	37° 13' 24.8161" E	AP-31
33	302183	9907687	0° 50' 5.4755" S	37° 13' 20.6367" E	AP-32

34	301722	9906833	0° 50' 33.2727" S	37° 13' 5.7157" E	AP-33
35	301361	9905796	0° 51' 7.0292" S	37° 12' 54.0257" E	AP-34
36	301171	9905014	0° 51' 32.4861" S	37° 12' 47.8694" E	AP-35
37	300648	9904577	0° 51' 46.7056" S	37° 12' 30.9492" E	AP-36
38	299721	9903811	0° 52' 11.6300" S	37° 12' 0.9589" E	AP-37
39	298521	9903559	0° 52' 19.8155" S	37° 11' 22.1479" E	AP-38
40	296588	9903011	0° 52' 37.6260" S	37° 10' 19.6280" E	AP-39
41	296402	9902916	0° 52' 40.7159" S	37° 10' 13.6115" E	AP-40
42	294344	9902381	0° 52' 58.1003" S	37° 09' 7.0499" E	AP-41
43	293626	9902260	0° 53' 2.0279" S	37° 08' 43.8290" E	AP-42
44	290891	9899930	0° 54' 17.8375" S	37° 07' 15.3453" E	AP-43
45	288690	9898626	0° 55' 0.2520" S	37° 06' 4.1471" E	AP-44
46	288325	9898226	0° 55' 13.2677" S	37° 05' 52.3369" E	AP-45
47	288194	9897651	0° 55' 31.9846" S	37° 05' 48.0907" E	AP-46
48	288302	9896866	0° 55' 57.5423" S	37° 05' 51.5695" E	AP-47
49	288153	9896589	0° 56' 6.5574" S	37° 05' 46.7462" E	AP-48
50	287434	9896030	0° 56' 24.7429" S	37° 05' 23.4854" E	AP-49
51	286822	9895064	0° 56' 56.1799" S	37° 05' 3.6774" E	AP-50
52	286681	9894209	0° 57' 24.0117" S	37° 04' 59.1023" E	AP-51
53	286560	9893870	0° 57' 35.0456" S	37° 04' 55.1833" E	AP-52
54	283226	9891099	0° 59' 5.1919" S	37° 03' 7.3177" E	AP-53
55	281797	9890069	0° 59' 38.6951" S	37° 02' 21.0878" E	AP-54
56	281645	9888059 1°	00' 44.1256" S	37° 02' 16.1334" E	AP-55
57	281279	9886808	1° 01' 24.8432" S	37° 02' 4.2731" E	AP-56

58	280175	9885497	1° 02' 7.4990" S	37° 01' 28.5462" E	AP-57
59	280064	9884200	1° 02' 49.7188" S	37° 01' 24.9303" E	AP-58
60	281543	9882148	1° 03' 56.5458" S	37° 02' 12.7100" E	AP-59
61	281543	9882148	1° 03' 56.5458" S	37° 02' 12.7100" E	Thika SS

PROPOSED LILO on KIGANJO –MASINGA LINE FOR KIBRIGWI SUBSTATION LINE					
SR NO	**ZONE – WGS 84 (37SOUTH)**		**Geographical**		**AP. No.**
	Easting	**Northing**	**Longitude**	**Latitude**	
1	298996	9940499	0° 32' 17.1865" S	37° 11' 37.9856" E	Kibirigwi SS
2	299118	9940486	0° 32' 17.6064" S	37° 11' 41.9326" E	AP-1
3	299565	9940721	0° 32' 9.9583" S	37° 11' 56.3864" E	AP-2
4	299727	9940768	0° 32' 8.4315" S	37° 12' 1.6245" E	AP-3

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 thirty five million, two hundred thousand (US$ 35,200,000) for the transmission lines and US Dollars eleven million (US$ 11,000,000) for the substations. This totals to US Dollar forty six million, two hundred thousand (US$ 46,200,000)**

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.

2.7: ANALYSIS FOR ALTERNATIVES

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;

2.7.1; 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 Samburu County 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.

2.7.2; 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 Samburu County.

2.7.3; Line Routing and Substation Siting Alternatives

Two alternatives for the line routing, based on effects on public utilities; distance; human settlement; ecologically sensitive areas; and topography were proposed. Three alternative sites for Kibirigwi substation were also proposed. The GPS coordinates and a maps are given in appendix IV

2.7.4; Alternative Processes and Materials

Highly refined mineral insulting 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.

CHAPTER 3: ENVIRONMENTAL SET-UP OF THE PROPOSED AREA

3.1: BACKGROUND

Embu County

Embu County is located approximately between latitude 0o 8' and 0o 50' South and longitude 37° 3' and 37° 9' East. It borders Kirinyaga County to the West, Kitui County

to the East, Machakos County to the South, Murang'a County to the South West, Tharaka Nithi County to the North and Meru to the North West. The county is divided into four constituencies, namely; Runyenjes, Manyatta, Mbeere South and Mbeere North covering a total area of 2,818 sq. km.

Embu County depicts two distinct areas with different agro-climatic and natural characteristics. The upper area around Mount Kenya consists of Runyenjes and Manyatta consituencies, while the lower part consists of Mbeere North and Mbeere South constituencies. The county is traversed by road B6 (Makutano -Meru), which is the major transport spine and passes through major urban centres in the county such as Embu and Runyenjes. Parts of its borders are defined by permanent rivers such as the Tana, Rupingazi, Kii and Thuci. The county is one of the five whose borders extend to the top of Mount Kenya, the second highest Mountain in Africa at 5199m.

Kirinyaga County

Kirinyaga County is one of the 47 counties in Kenya and is located between latitudes 001‟ and 00 40‟ South and longitudes 370 and 380 East. The county borders Nyeri County to the North West, Murang‟a County to the West and Embu County to the East and South. It covers an area of 1,478.1 square kilometres.

Muranga County

Murang'a County is one of the five counties in Central region of the Republic of Kenya. It is bordered to the North by Nyeri, to the South by Kiambu, to the West by Nyandarua and to the East by Kirinyaga, Embu and Machakos counties. It lies between latitudes 0o 34' South and 107' South and Longitudes 36o East and 37o 27' East. The county occupies a total area of 2,558.8Km^2.

Kiambu County

Kiambu County is one of the 47 counties in the Republic of Kenya. It is located in the central region and covers a total area of 2,543.5 Km^2 with 476.3 Km^2 under forest cover according to the 2009 Kenya Population and Housing Census. Kiambu County borders Nairobi and Kajiado Counties to the South, Machakos to the East, Murang'a to the North and North East, Nyandarua to the North West, and Nakuru to the West. The county lies between latitudes 0^0 25' and 1^0 20' South of the Equator and Longitude 36^0 31' and 37^0 15' East.

3.2: PHYSIOGRAPHIC AND NATURAL CONDITIONS

3.2.1; Population

The four affected counties have one of the biggest populations per county and the population density is quite high too. The population along the proposed lines is thus similar to the counties' settlement patterns and bears the characteristics portrayed by population of the four counties at large. The projects more to affecting four counties, it passes through six districts. These districts are Mbeere, Embu, Kirinyaga, Murang'a North, Murang'a South and Thika West. Starting from Mbeere district, where Kamburu is located, population as of the 2009 census stood at 219,220 people with the number of females in the district standing at 150,949 people and that of males being 146,043 people. Embu district had a population of 296,992 people during the same census: 108,934 of those being male and 110,960 being female. However of the two districts, the proposed project will affect directly people in only two constituencies, Manyatta and Mbeere South. Manyatta's population stood at 154,632 people as of the last census, 49.2% of which was male. The population density was 575 people per square kilometre at the time. The population is projected by the Embu County Integrated Development Plan to be 172,958 people with a density of 643 people per square kilometre in the year 2017. Mbeere South's population stood at 130, 185 people as of the 2009 census, 50.8% of which was male and the population density was 99 people per square kilometre. The same plan projects the population of the constituency to be 145,614 people with the density at 110 people per square kilometre in 2017.

In Kirinyaga the population of males stood at 260,630 people that of females stood at 267,424 people and all that sums up to 528,054 people. The proposed line will pass through 3 out of 4 of constituencies in the county and district. The constituencies are Gichugu, Kirinyaga Central, and Ndia. These constituencies are quite populous. Gichugu had a population of 124,672 people as of the last census with a density of 545 people per square kilometre 49% of this population is male. The constituency is projected to have a population of 140,567 people and a density of 612 people per square kilometre in 2017 by the Kirinyaga County Integrated Development Plan. Kirinyaga Central's population of 113,355 was 48.8% comprised of males in 2009 and the population density stood at 653 people per square kilometre. The projections by the county development plan put the population of the constituency at 127,807 people with a density of 736 people per density of 471 people

per square kilometre. 48.6% of the population at the time was male. The projections of the population in 2017 are 112,203 people and a density of 531 people per square kilometre.

Murang'a north recorded a population of 346,283 people, 48% which was male in the last census. Murang'a South had a population of 432,701, 48.6% of which was male. The project will pass through four constituencies in Murang'a County namely Kiharu, Maragua, Kandara and Gatanga. Kiharu constituency had a population of 181,076 people, 48.3% of which was male during the last census. The density stood at 441 people per square kilometre. The population of the constituency is projected to be 186,964 people in 2017 with a population density of 456 people per square kilometre by the Murang'a county Integrated Development Plan. In Maragwa the population stood at 152,272 people with 49.1% of the population being male. The population density stood at 278 people per square kilometre. The projections of the constituency place the population to be at 157,224 people in 2017 with the density being 287 people per square kilometre by the county's development plan. Kandara constituency had a population of 156,663, 48.4% of which were male and the population density was 664 people per square kilometre. The population of the constituency is projected to be 161,757 people in 2017 with a population density of 686 by the county's development plan. Finally, Gatanga constituency had a population of 163,597 people in the census with 49.5% of the population being male. The population density was 278 people per square kilometre. The projections for the constituency for the year 2017 are that it will have a population of 168,917 people and a population density of 282 people per square kilometre.

Thika west district, the only district in Kiambu County that the project will pass through, had a population of 218,544 people as of the last census. 50.1% of the population in the district was male. The proposed project will primarily affect the residents located in only one constituency in the county that is Thika Town constituency. The population of people in the constituency is 165,342 and the population density is at 760 people per square kilometre. The percentage of males in the constituency was 50% percent at the time. The population of the constituency is projected to be 207,020 people with a population density of 952 people per square kilometre in 2017 by the Kiambu County integrated development plan.

3.2.2; Climate and Rainfall

Embu County

The rainfall pattern is bimodal with two distinct rain seasons. Long rains occur between March and June while the short rains fall between October and December. Rainfall quantity received varies with altitude averaging to about 1,067.5 mm annually and ranging from 640 mm in some areas to as high as 1,495 mm per annum. Temperatures range from a minimum of 12^0 C in July to a maximum of 30^0C in March with a mean of 21^0 C.

The extensive altitudinal range of the county influences temperatures that range from 20^0C to 30^0C. July is usually the coldest month with an average monthly temperature of 15^0C while September is the warmest month with an average monthly temperature rising to 27.1^0C. There is however localised climate in some parts of the county especially the southern region due to their proximity to the Kiambere, Masinga, Kamburu and Kindaruma dams.

Kirinyaga County

The county has a tropical climate and an equatorial rainfall pattern. The climatic condition is influenced by the county position along the equator and its position on the windward side of Mt Kenya. The county has two rainy seasons, the long rains which average 2,146 mm and occur between the months of March to May and the short rains which average 1,212 mm and occur between the months of October to November. The amount of rainfall declines from the high altitude slopes of Mt. Kenya towards the Semi-arid zones in the eastern part of Mwea constituency. The temperature ranges from a mean of 8.1^0C in the upper zones to 30.3^0C in the lower zones during the hot season.

Muranga County

The County is divided into three climatic regions: The western region with an equatorial type of climate, the central region with a sub-tropical climate and the eastern part with semi-arid conditions.

The long rains fall in the months of March, April and May. The highest amount of rainfall is recorded in the month of April, and reliability of rainfall during this month is very high. The short rains are received during the months of October and November. The western region, Kangema, Gatanga, and higher parts of Kigumo and Kandara, is generally wet and humid due to the influence of the Aberdares and Mt. Kenya. The eastern region, lower parts of Kigumo, Kandara, Kiharu and Maragwa constituencies receive less rain and crop production requires irrigation.

Kiambu County

The county experiences bi-modal type of rainfall. The long rains fall between Mid-March to May followed by a cold season usually with drizzles and frost during June to August and the short rains between Mid-October to November. The annual rainfall varies with altitude, with higher areas receiving as high as 2,000 mm and lower areas of Thika Town constituency receiving as low as 600 mm. The average rainfall received by the county is 1,200 mm.

The mean temperature in the county is 26^0C with temperatures ranging from 7^0C in the upper highlands areas of Limuru and some parts of Gatundu North, Gatundu South, Githunguri and Kabete constituencies, to 34^0C in the lower midland zone found partly in Thika Town constituency (Gatuanyaga), Kikuyu, Limuru and Kabete

constituencies (Ndeiya and Karai). July and August are the months during which the lowest temperatures are experienced, whereas January to March are the hottest months. The county's average relative humidity ranges from 54 percent in the dry months and 300 percent in the wet months of March up to August.

3.2.3; Land and Land Use

Embu

The County is characterised by a predominantly rural settlement pattern. There is a concentration of people along the major permanent water sources such as rivers and dams where irrigation, farming and fishing are carried out. The settlement pattern is also influenced by social economic activities, rain and soil fertility. The lower parts, covering areas which receive less rainfall have a more scattered settlement pattern compared to the upper parts which receive more rainfall. The county has three major urban centres, namely Embu Siakago and Runyenjes towns.

There are also major market centres like Ishiara, Karaba, Kiritiri, Gachoka, and Kianjokoma. These areas have relatively better developed infrastructure and therefore have good potential for business enterprises. Urban centres expand as new ones also emerge especially along major roads such as the Embu-Meru highway, Kiritiri - Embu road, Embu - Siakago – Kiritiri road and Embu – Ishiara road. There has been recent rise in people living in slums especially in Embu town. Challenges in urban settlements include poor housing, deteriorating environment, unemployment, insecurity and poor infrastructure and services.

Mean Holding Size

The county is characterised by a predominantly rural settlement pattern. The average farm size for small scale farming is 0.8 ha. The rising population in the county especially in the high agricultural productive areas has continued to exert pressure on land and other natural resources which will lead to smaller acreages in the near future. The settlement pattern in the county is influenced by social economic activities, rainfall and soil fertility.

Percentage of Land Owners with Title Deeds

According to the Kenya Integrated Household Budget Survey (2005/06), 46.4% of the poor population in Manyatta and Runyenjes consituencies have title deeds for their land while 20.8% of the poor population are not in possession of title deeds. The remaining 32.8 % of the poor population do not own land. In Mbeere North and Mbeere South constituencies, 10.2% of the poor population have title deeds for their parcels of land while 47.6% of the poor population do not have title deeds for their land. The remaining 42.2% do not own land. The same survey indicates that 35.9 % of the non-poor in Manyatta and Runyenjes constituencies have title deeds for their land while 31.2 % do not have title deeds for their parcels of land. The remaining 33.0% of the non-poor population do not have land. In Mbeere North and Mbeere South constituencies, 22.3% of the non-poor

population have title deeds while 33.6% of the non-poor do not have title deeds. The remaining 44.1% of the non-poor do not own land.

Kiriyanga

Individual people own most of the land in the upper parts of the county (Gichugu, Kirinyaga Central and Ndia Constituencies) while in the lower parts (Mwea Constituency); National Irrigation Board (NIB) owns most of the land. There is one settlement scheme located in Mwea Constituency known as South Ngariama Ranch where the community without land was settled in 2007.

Mean Holding Size

There are 154,220 households and the total land mass is 1478.1 ha giving a mean land holding size of 0.0958 ha/HH. In the lower regions of the county which comprise Mwea Constituency, the average land holdings are larger while they are smaller in the central and upper regions of Gichugu, Ndia and Kirinyaga Central Constituencies.

Percentage of land with title deeds

While 67 percent of farmers in the county have title deeds, 23 percent of the farmers especially in the lower zones of Mwea Constituency are farming on the land owned by National Irrigation Board.

Incidence of landlessness

This is not a major issue in the County. Most of the land in the upper parts of the county is ancestral land which has been passed down from one generation to the next over past years, therefore there are no major conflicts as most of the land is inherited. Most of the lower parts of the county comprising Mwea Constituency most of the land is owned by NIB and farmers lease the land which is under irrigation.

Muranga County

Mean Holding Size

The county has a total area of 2,558.9Km2, of which 11.2Km2 is water mass. The arable land is, 2,135 Km2 while non-arable land is 163.3 Km2. The gazetted forest covers an area of 254 Km2 is Gazetted forest land while approximately 20 Km2 is urban area. The average farm size under large scale holdings is 16 acres. Total acreage under food crop farming is 329,234 acres while that under cash crop farming is 177,636 acres. The land under soil conservation is 33,254 acres; under farm forestry is 270,879 while area under organic farming is 385,364.5 acres.

The main land use activities in the county are: cash crop farming, subsistence farming, livestock keeping, fish farming, housing and forestry.

Per centage of Land with Title Deeds

Murang'a County is predominantly agricultural and, therefore, land holding is considered important. It is estimated that 64.9per cent of farmers have title deeds while 35.1 per cent do not have title deeds.

Incidence of Landlessness

Majority of the county population own land. Incidence of landlessness is approximately 0.2per cent. This is as a result of concerted efforts by the government to resettle the landless at Maranjau area in Kambiti Location of Maragwa constituency.

Kiambu County

Mean holding size

The size of arable land in the county is 1,878.4 Km2 and the non-arable land is 649.7 Km2 and 15.5 Km2 is under water mass. The average holding size of land is approximately 0.36 Ha on small scale and 69.5 Ha on large scale. The small land holdings is mostly found in upper parts of Gatundu North, Gatundu South, Kiambaa, Limuru and Kikuyu constituencies. The fragmentation of the land has made it uneconomical and hence majority of the farmers are converting their farms into residential plots to supplement the meagre income from the farms. The large land holdings are usually found in the lower parts of the county especially in Juja constituency and the upper highlands in Limuru and Lari constituencies.

Percentage of land with title deeds

Plans indicated that 85 percent of the population with land in the county have title deeds to their land and there are no recorded cases of incidences of landlessness. The remaining 15 percent have not received their title deeds due to unfinished land adjudication process and non payment of the necessary levies.

3.2.4; Forestry

Embu County

The county has gazetted and non-gazetted forests. Mt. Kenya forest is the only gazette forest in the county. It is an expansive mountainous forest that traverses a number of counties. The county has only one gazetted and four non gazetted forests which are Kiang'ombe, Kirimiri, Kianjiru and Kiambere with a total of 3,751ha.

Kirinyaga County

The main types of forests in the county are indigenous natural forests which cover an area of 35,876 Ha, plantations which cover 1,540 Ha, bamboo forests which cover 7,500 Ha, bushland/grassland forests that cover 6,956 Ha and tea zone forests which cover 290 Ha.

Muranga County

The county has five indigenous gazetted forests covering a total area of 254.4 Km2. They are: Gatare, Karua, Kimakia, Kiambicho and Wanjerere forests. These forests are divided into two zones; the tropical montane forest zone located along the Aberdare ranges and the semi-arid forest zone located in the lower parts of the county. However, there are 204,557 farm forests which are privately owned plantations.

Kiambu County

The main forests types in the county are natural/indigenous and plantation forests. Exotics are mainly planted in private farm forests but the data on the specific forest size is not available though plans to carry out a survey are in process. The county has six obiliz forests with the major ones being Kieni and Kinale forests occupying an area of 426.62 Km^2.

3.2.5; Flora

Embu County

The calliandra tree is being planted on steep eroded slopes to provide stability and prevent landslides. The tree also builds soil fertility as it fixes nitrogen. The tree is also being used as stake for climbing beans and tomatoes. A number of fruit trees do very well in the county. The growing of trees such as mangoes, avocados, passion fruits and watermelons has improved the nutrition of the people in the county.

Kirinyaga County

The main types of forests in the county are indigenous natural forests which cover an area of 35,876 Ha, plantations which cover 1,540 Ha, bamboo forests which cover 7,500 Ha, bushland/grassland forests that cover 6,956 Ha and tea zone forests which cover 290 Ha. Provision of wood fuel and generation of energy for industries,Tea factories are sometime supplied with Eucalyptus fuel wood from all the forest stations through contractors. Farmers have embraced the practice of planting Agro forestry tree species like calliadra, lecaena,casuarinas. These trees are nitrogen fixing hence are used to reclaim degraded soils. Nearly all the households grow fruits trees like mangoes and avocadoes. Some have fruit orchards on their farms.

Animal feeds production ventures in the county, trees like lecaena and calliadra are used for production of fodder for livestock. In the county, there has been promotion of high value indigenous trees on private farms

like Prunus Africana (Muiri), Kigelia Africana (Muratina) and Fagara macrophylla (Munganga). There has also been promotion of herbs from gazetted forests which are used by herbal doctors to cure various diseases and elements.

Murang'a County

The area under forest cover in Murang'a totals to 11095.3 Ha. in government forests.

There are two main forests in the county; Wanjerere on the Abardare ranges and Kiambicho hills on the lower part of the district. Several tree species are found in the county and the most common area are: *Podocarpus falcutus/ latifolias* (Muthengera), *Makaranga kilimadscharica* (Mukuhakuha), *Markhamia lutea* (Muu), *Prunus africanum* (Muiri), *Tabernaemotanas stapfianas* (Mwerere), *Croton macrostacheus* (Mutundu), *Croton megalocarpus* (Mukinduri), *Millettia dura* (Muhatia), *Ocotea usambarensis* (Muthaiti) *Teclea nobilis* (Munderendu), *Ficus sycamorus* (Mukuyu), *Ficus natalensis* (Mugumo), *Albizia gummifera* (Mukurwe), *Bridelia micrantha* (Mukoigo), *Syzygium guinense* (Muriru), *Grevillea robusta* (Mukima), *Eucalyptus spp*. (Mubau/ Blue gum). The above tree species are found both in the forest and farm lands

Over 170 tree nurseries have been established in the county with an average production of 300 seedlings. These nurseries are categorized as groups, Individual, Schools, Companies and Departmental Nurseries. The main tree-planting season is April – May whereas tree planting is a continuous process as long as plant survival is assured.

Kiambu County

Dairy farmers plant fodder trees like Calleindra, Sesbania sesban, Leucaena leucacephella which they use to feed their livestock. There is also bee keeping. Farmers also plant fruit trees where they produce mangoes, avocados, macadamia, oranges, guava and loquats for sale.

The obilizati trees are planted around identified water catchment sites in order to protect these areas. Kieni forest has several hectares of eucalyptus trees which are sold to tea factories around the area. The county is mainly agricultural and there is need to ensure continuous improvement on soil fertility. In this regards, agro forestry trees like Calliandra Calothyrsus and Leucaena species are grown in alley cropping for their nitrogen fixing properties and cut back for green manure. The county has plenty of *Croton megatocepus* (mukinduri), *Prunus africanum* (muiri) and neem tree (*Melliaa azandiach*) which are of high value although extraction is done in small-scale.

3.2.6; Fauna

Embu County

There are two national parks namely; Mwea and Mt Kenya that are managed by KWS that have great potential for the tourism industry in the county. Mwea game reserve is home to species such as the Elephant, lesser kudu, Nile crocodile, hippo, giraffe, Burch ell's zebra, buffalo, leopard, grey duiker, black -backed jackal, bushbuck, waterbuck, olive baboon, Sykes' monkey, serval cat, spotted hyena, warthog, rock hyrax, bush pig, impala and hartebeest. Rare animals like; Stripped ground squirrel, Genet cat and Black backed jackal yellow baboons.

Over 200 species of birds are also to be found in the reserve which is renowned for its water birds and waders. Mwea game reserve is the only protected area in which the globally threatened and Kenya-endemic Hinde's babbler is known to occur. The reserve also shelters two other rare species; Pel's fishing owl and the white backed night heron.

Mwea National Reserve which is located within the lower parts of Embu County at a distance of about 200km from Nairobi. It is a major attraction site for wild game viewingboat rides at Kamburu dam, hippo point, rare birds watching and a walking circuit. It is also the meeting point of rivers Tana and Thiba, Kamburu and Masinga Hydro-electric dams, which harbor variety of biodiversity. In Mt. Kenya National Park, wildlife species include Elephants, tree hyrax, white tailed mongoose, suni, black fronted duiker, mole rat, bushbucks, water buck and Elands. Animas rarely seen include leopard, bongo, giant forest hog and rhino. Over 130 bird species are also available in the National park. Its ecosystem comprises of small hills with bushy vegetation and scattered bushes of acacia and baobab.

Kirinyaga County

Some of the wildlife found in this county include elephants, buffaloes which live in Dense forest to open plains. There are also hippos, monkeys, bushbucks, crocodiles and snakes which can be found in Mt. Kenya National Park. There are also birds such as the Birds Bronze Sunbird. This is a large and distinctive sunbird with elongated central tail feathers which looks black from a distance.Close up it shows bronze reflections on the head and back as well as some copper colouring elsewhere.

Murang'a County

Wildlife animals are found in the forests, rivers and farmland. Vervet monkies for example are very common in farm land. They cause a lot of harvoc to people crops. Also animals like elephants used to cause harvoc to the forest neighbouring community by breaking into people farm. This resulted in human wildlife conflict. On farmland These are few wild animals in the district that are found in the rivers, there are such animals like

Hippopotamus and crocodile. These are found in the two major rivers – Mathioya and Sagana and are a threat to the community.

There are a lot of birds in the county of various species raging from domestic to the wild ones. Despite the avian flu incident in the word, no case was reported in Murang'a. Wildlife in Murang'a is a resource that has not yet been tapped. (Murang'a DEAP, 2007)

Kiambu County

Kiambu County has few wildlife resources since many gazetted forests were allocated illegally to individuals. An example is Kinare forest in Lari Constituency, whose ecosystem constitutes of a dense forest with elephants, hyenas, bush baby, baboons, colobus monkeys, dik-dik, bush pigs, tree and ground squirrels, porcupines and many species of birds such as weaver, guinea fowls, sparrow among others.

3.2.7; Water Resources

Embu

Provision of clean and safe water for domestic use and irrigation is important in the county. The county is served by six major rivers; Thuci, Tana, Kii, Rupingazi, Thiba and Ena. The county also shares some major dams, which generate hydroelectric power for the country. These dams include Kiambere, Gitaru, Kindaruma and Masinga all of which are situated along the Tana River.

Kirinyaga

There are six main rivers in the county namely: Sagana, Nyamindi, Rupingazi, Thiba, Rwamuthambi and Ragati, which ultimately drain into the Tana River. These rivers are the principal source of water. Other resources are unprotected springs which are 29 in number, 12 water pans, 3 dams, and 208 shallow wells, boreholes & protected springs. Water quality in the county is good in the upper parts where there are numerous springs, but in the lower parts of Mwea Constituency the water is contaminated due to use of fertilizers and pesticides in irrigation.

Muranga

Murang'a County's water resources are rivers, shallow wells, springs, dams, boreholes and roof catchment. There are 10 permanent rivers, 400 shallow wells, 75 springs, 30 dams and 100 bore holes that supply water for domestic and agricultural use in the county. All these sources supply 60 per cent of the county population with clean and safe drinking water.

Kiambu

About 90 percent of the county's water resources comprise of both surface and ground water resource potential. Domestic water supply has recorded a noticeable growth over the last 5 years; 35 percent of the population have access to potable water.

3.2.8; Energy Access

Embu

Embu County is a major stakeholder in the energy sector nationally. It is host to the regionally famous sevenfolk project which has an installed capacity of 543.2 MW, placing its contribution to the national installed H.E.P capacity at 80.2 percent

In contrast to this rich energy endowment, only 21.2 per cent of households in Runyenjes and Manyatta constituencies are connected to electricity while a mere 4.9 per cent in Mbeere North and Mbeere South constituencies are connected to electricity. The main source of energy is fire wood (80.4 per cent) while electricity coverage is more confined to urban areas as compared to rural areas. Many trading centres have not been connected to the national grid although the rural electrification programme is reversing this scenario. The other major beneficiaries of rural electrification are public institutions such as schools and health facilities. The majority of residents use paraffin as the main source of lighting. The traditional stone fire is the most prevalent cooking appliance used by the county population.

Kirinyaga

All the major towns and urban centres in the county such as Kerugoya, Sagana, Wang"uru, Kianyaga, Kimunye, Kagio, and Kagumo are connected with electricity, however the major source of energy in the county is firewood which is used by 105,756 households followed by charcoal and gas used by 59,579 households and 28,987 households respectively. There are only 11,652 rural homes with electricity and 40 trading centres are not connected to the national grid.

Muranga

All the major towns and urban centres in the county such as Kerugoya, Sagana, Wang"uru, Kianyaga, Kimunye, Kagio, and Kagumo are connected with electricity, however the major source of energy in the county is firewood which is used by 105,756 households followed by charcoal and gas used by 59,579 households and 28,987 households respectively. There are only 11,652 rural homes with electricity and 40 trading centres are not connected to the national grid.

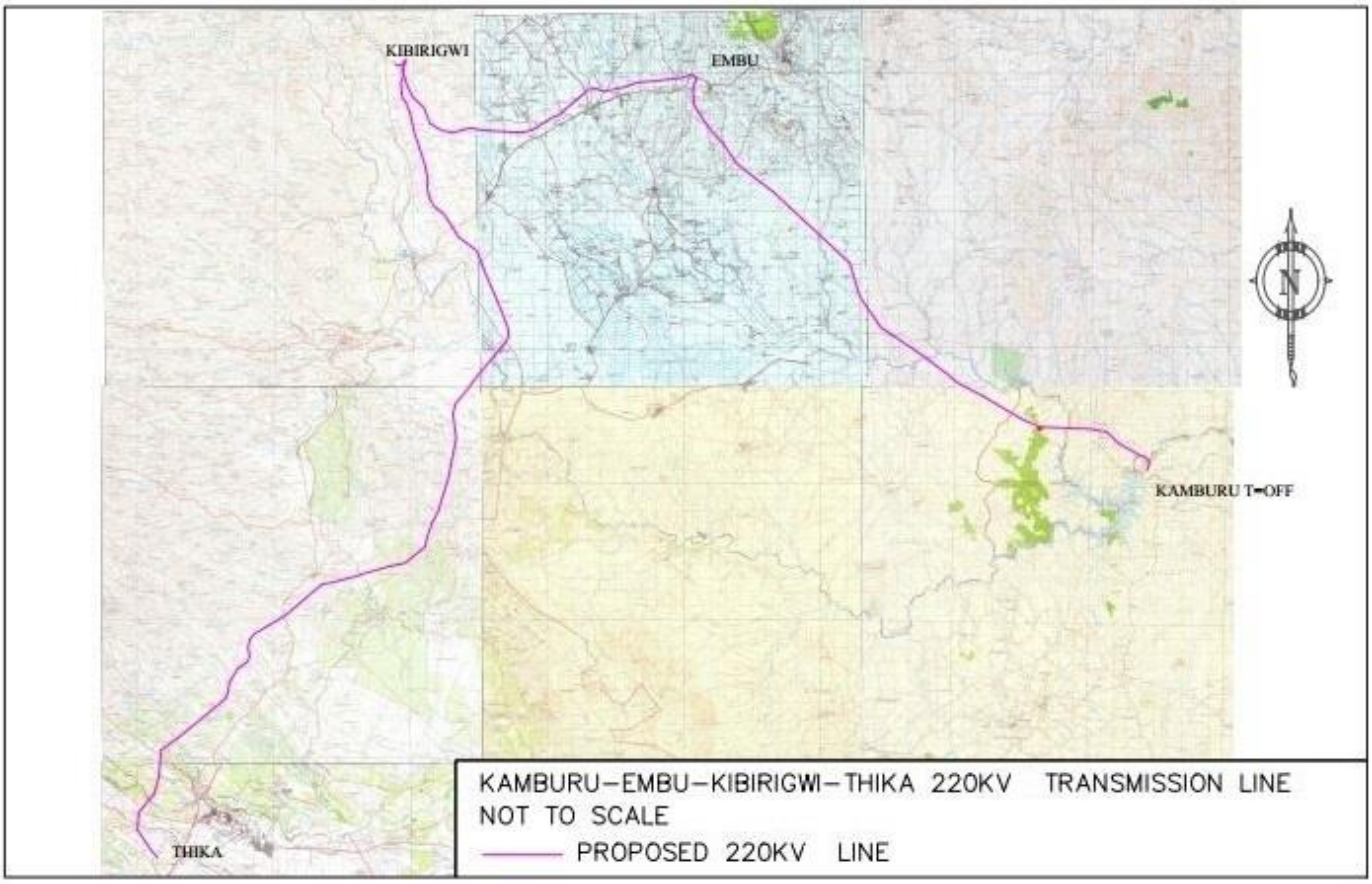
Kiambu

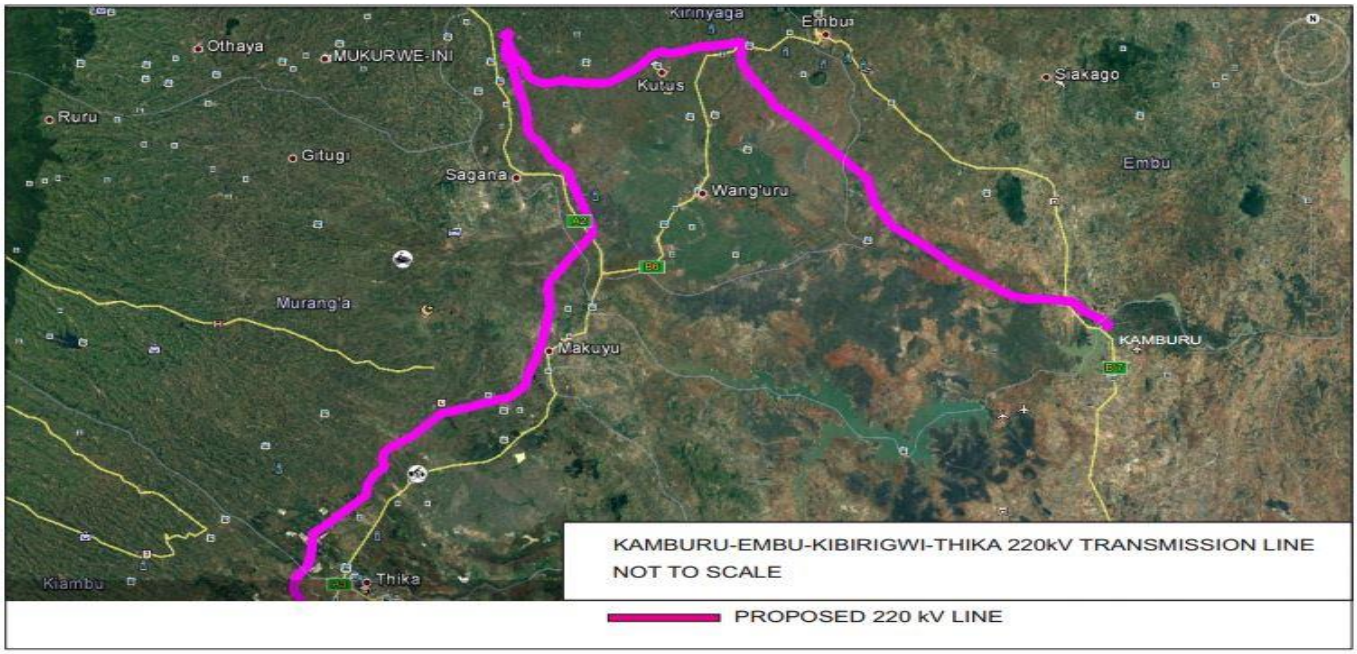
The main source of cooking energy in the county is firewood which accounts for about 47.3 percent, while paraffin is the major source of lighting fuel. This poses a great challenge to the realisation of 10 percent forest cover within the county. Connection to the national grid is good with 98 percent of all trading centres connected and only 4 percent of public institutions currently not connected. However, connection to individual homes is low and there is need for up-scaling of the rural electrification programme. Kiambu County is endowed with a number of big rivers which can be exploited for power generation. As indicated in the photo below the presence of fourteen falls and a number of other small falls like Thika falls presents a big opportunity for hydropower generation, as the country gears towards adoption of green energy.

3.3: PROJECT SITE DESCRIPTION

3.3.1; Transmission Line Route Description

The proposed transmission line runs from Kamburu Power station to Thika in Kiambu County through three counties, namely Embu, Kirinyaga and Murang'a. Power will be drawn from the Kamburu power station located 50 kiometres from Embu town, just off the Embu- Siakago Road. It then terminates 147 kilometres from take-off in Thika. The proposed line is a 220kV line and the main objective for its construction is to create the North Eastern part of the 220 kV Network and to supply the loads of Embu (Kutus) and Kibirigwi (Kiganjo) from the power available from Kamburu and Thika among other benefits.


KIBIRIGWI
EMBU
KAMBURU T-OFF
THIKA
N
KAMBURU–EMBU–KIBIRIGWI–THIKA 220KV TRANSMISSION LINE
NOT TO SCALE
PROPOSED 220KV LINE



The line traverses a region with a mixture of hilly and relatively sloppy landscapes. From the take off to the terminus, the line crosses over a number of physical features. The area covered by the line has also seen some developments and thus the population in some parts is not that sparse. The land use generally in the areas affected is for agriculture and it is the same activity that provides income for the locals. Where the land has not affected cultivated land, it mostly passes through shrubs, small forests and economically unused land.

Kamburu and the Surroundings

The take-off point and the area around Kamburu is generally flat with shrubs being the ground cover in the area. There are no settlements in the area.

The Landscape around Kamburu

Kamburu to Embu

There were minimal physical features on the stretch between Embu and Kamburu. The features were mainly rivers, both seasonal and main. The line first crosses Tana River and the stretch from there is flat with many shrubs occupying the area. Photos of the take-off site and the point at which the transmission line crosses the river are unavailable as the area is cordoned off as a zone of no photo taking. Thiba River is the next physical feature and the line crosses over it in Makima division.

The area being a lowland also has several seasonal rivers. The transmission line crosses over one seasonal river in the same division of Makima at Mashamba village.

In the lower side of Embu district, the line crosses over two main Rivers, River Nyamindi and River Ruvingashi in that order. As the line approaches the settled areas of Embu districts, it crosses over a large stretch of land under tree cover that is not a gazetted forest land. The topography is generally flat and there are no major hills or valleys. Other features the line crosses over which are manmade include the Embu airfield, and a quarry.

Mashamba Seasonal River

Embu-Kibirigwi Line

The transmission line crosses over Nyamindi River again just a few metres from the Kutus substation after crossing the Embu-Kutus Road at Mururi Village. From this point the transmission line traverses through the county of Kirinyaga in people's farmlands. A large portion of the land in this stretch is under cultivation and the human settlements are denser in this areas. The pictures below show a general overview of a sample of the cultivated lands between Embu and Kibirigwi.

Maize Farm

Coffee Farm

The topography of the area is largely flat with plains dominating a huge stretch of the area as is evidenced in the photos above. However in the stretch after Kiandai village, the transmission line passes over Kiamuguongo hill and a valley as it approaches Kibirigwi as can be seen in the pictures below.

Kiamuguongo Hill from the other side of the Hill

The hill is occupied by human settlements and farmlands occupy a huge segment of the hill.

Apart from the topography, the transmission line runs over a small wetland, and two rivers, Rwamuthambi River and Thiba River again.

A wetland in Gitwe, Kirinyaga

Kibirigwi to Thika.

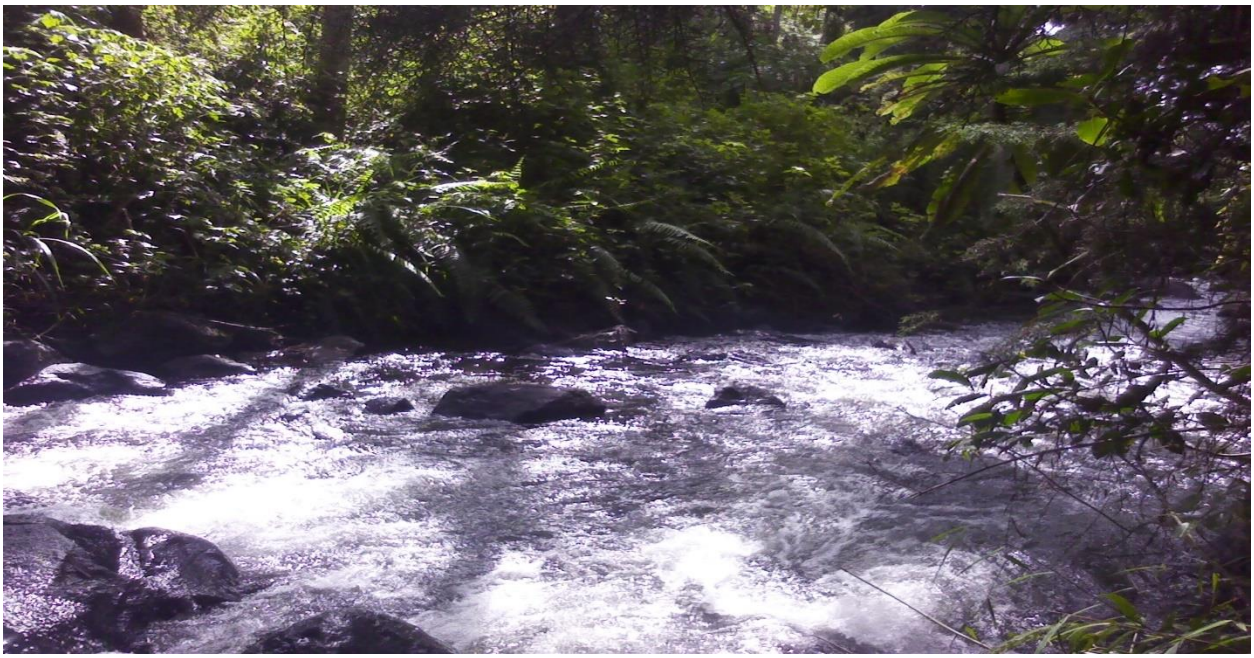
The proposed line traverses Kirinyaga and Murang'a counties to Thika from the proposed sub-station.the bulk of physical features crossed over by the line are on this final stretch. However, the stretch is characterised by land under cultivation as was the case in the previous routes. The line passes through Kiamuguongo hill again. After that section of the route, the land is through which the line passes through is a plain stretching from Ndia to Mwea constituency.

Topography of the land in Ndia and Mwea

The line crosses Sagana, Mutoho, Thika and Chania Rivers in the final route to the terminus.

River Chania

Sagana River at Kayuyu



Thika River at Kaburugi

The section of the line traversing Murang'a County is slightly hilly with portions having a considerable size of land covered by trees. The county also record denser populations as compared to Embu but the number of affected settlements is lesser than that of Kirinyaga.

The landscape in Murang'a

Landscape in Muranga

The other feature is a small wetland located beside the Thika-Gatura Road

Wetland

The Terminus

The line finally terminates at 220kV substation, in Thika, Kiambu County. The proposed line crosses two high voltage power transmission lines, a 132kV line and a 66kV line. The area of the proposed terminus is flat with minimal vegetation. The trees are mainly acacia trees and it is located just about 100 metres from the Nairobi-Nanyuki Railway.

The site of the proposed terminus

Existing Power Trasmission lines

3.3.2; Substation Siting

Kamburu substation lies within Embu County, while Kutus substation (referred to as Embu) lies within Kirinyaga County. Kiganjo and Thika Substations lie in Nyeri and Kiambu Counties respectively.

Kamburu Substation:

The 220 /132kV Transmission Substation at Kamburu is located within the seven folks on River Tana and is approximately 50 kms from Embu town. It is a major source of power supply for the seven folks and interconnects the Masinga, Gitaru and Kiambere Hydro Power Stations to Dandora via a 220/132 kV Transmission System. The important technical features of the Substation are described below:

- The Substation has a 3 Bus in 220kV switchard with installation of automation system.
- There are 4 no. 220 kV incoming / outgoing feeder bays for: Gitaru, Kiambere and 2 no. to Nairobi (Dandora 1 & 2)

- The Substation feeds to 132 kV switchyard of KPLC on a back to back arrangement via 6x90 MVA Single Phase Transformers
- A Fiber Optic system is installed in the Substation
- The protection is on 110 volts DC
- There is adequate space for extra 2 no. 220 kV bays in the existing Substation towards the power station end of the Bus for which land development and shifting of existing 220 kV line bays is essential. The alternative would be to take outlets for 220 kV line from the other end of Bus (away from Control Room). However this will have to cross 1 no. of 220 kV and 2 nos. of 132 kV lines emanating from the Kamburu KPLC Substation.
- The existing Substation switch yard Control Room does not have adequate space for accommodating new 220 kV Line Control Panels and Fire protection/detection arrangements. Further existing arrangements for temperature control (air conditioning) are inadequate and it is recommended that this aspect be addressed in this exercise and during the expansion of the Substation/Control Room.

220 kV Embu (Kutus) Substation

Ms. Kenya Power Company has a 132/33 kV Substation at Kutus which is 7.6 kms (Radial Distance) away from Embu town. The 132 kV line is constructed by making a LILO/tapping arrangement on the existing 132 kV Masinga - Kiganjo line.

The land at Kutus Substation measures 5 acres and nearly 2.5 acres has been used for 220 kV Substation. The remaining balance of 3 acres would not be sufficient for a 220 kV substation which would require land measuring 10 acres and therefore an additional 5 acres would have to be sought and acquired adjacent/within the vicinity of the 132 kV Substation.

For setting up of a 220/132 kV Substation the land adjacent to the 132 /33 kV Substation would be ideal and this requires negotiation with Ms. KPC. Alternately a Substation may be established at Difathas which is 2.1 km away along the Embu - Nairobi highway incase the land adjacent to the Substation is not available.

Kutus Power Station

The Proposed Kibirigwi Sub-Station.

The location of the proposed Kibirigwi is a few metres off the Kagio-Kiganjo road, about 1.5 kilometres from the Nairobi-Nyeri highway (A2). The location of the sub-station is currently a household whose farm is under cultivation. Alternatives to this site are given in appendix IV.

The site of the proposed Kibirigwi Sub-Station

220/400 kV Thika Substation

Thika is an industrial town in Kiambu County; with a population of 200,000 according to the 2007 national census and lies along the A2 road from Nairobi to Nyeri. The town is fast growing and has several industries.

The substation land is identified along Dick Harris road next to the KETRACO 132/33kV substation and where the 132 kV line from Thika to Gatundu and Githambo crosses. This land is flat and has an area of adequate proportions for a 400 and 220 kV Substation. It is self draining and construction materials and labour are locally available.

3.3.3; Baseline Biophysical

Geology and Soils:

The area geology is Granitic rock, loam silt soil, cotton soil and loam (red) soil. The area around Kamburu is more rocky which has weathered due to water runoff. The area would experience rock blasting which would increase soil erosion, dust and noise. Embu - Kibirigwi – Thika is mostly covered with bigger percentage of land being Loam (red) soil and smaller percentage of cotton soil scattered in different areas especially on the river lines and thika.

Topography:

The topography of the area (around Kamburu) is gently undulating with a few hills of moderate height then changes on the approach to Embu where the hills and valleys become more pronounced while at kirinyaga most of the area is flat with gentle vallelies. Then from kibirigwi through Murang'a, steep hills which changes at Thika where flat ground is found. The altitude varies between 1000 to1350 meters at Kamburu to Embu and 1000 to 2000 between Embu, to Thika above sea level.

Flat terain in Embu

Steep terain in Kirinyaga and Murang'a

Hydrology:

The area is served by several rivers Nyamindi, Sagana, Tana River, Mathioya River and Chania(Thika). Tana is the biggest river in the area and it has several small tributaries along its course most of which are seasonal.

Wetlands

Wetlands are lands that are either permanently or seasonally saturated with and have characteristic vegetation adapted to the soil conditions. The role of wetlands is flood control, water purification and high biological diversity makes them very important.

Types of inland wetlands in Kenya consist of;

a) River line, which can be perennial or intermittent floodplain wetland,

b) Lacustrine, these are permanent, seasonal or saline and
c) Palustrine, consisting permanent fresh water swamps.

Types of wetlands that will be traversed;

- Riverline. Nyamindi, sagana (Tana). Chania and Thika rivers being the main ones. The major land uses of these wetlands are large and small scale farming through irrigation which has resulted overutilization of water hence reducing the water volume and increase of soil erosion.
- Palustrine. These is observed mainly in Kirinyaga County and some sections of Murang'a County where small scale farming of rice is practiced grazing during dry seasons due to retention of high biomass.

Riverline

Palustrine (swamp)

Fauna:

Animals:

The proposed transmission lines will pass on the on settlement hence does not have much effect on wildlife apart from Kamburu area where there is bush land where some animal species like antelope, Warthog and Impala are present. The domestic animal in the study area is cattle, goats and sheep.

There is not much danger on any of the animals apart from the wild animals mentioned above being exposed to poacher due the clearance of the line corridor especially kamburu dam where the bush land is.

Birds:

The project area has many species of birdlife consisting of Heron *(Adrea spp*), Stork (*Ciconia spp*), Hornbill (*Tockus spp*), cattle egrets and swallow (*Hirundo albigularis*). Some common water birds include Spurwing goose (*Plectopterus gambensis*), Crowned Crane (*Bulirica Regulorum*) and Openbill (*Amustomus Lamelligerus*).

Fish

There are many fish species in the Tana River and its tributaries. Common fish species found in the area include Tilapia, Mudfish and Cat Fish.

Flora

Vegetation

Vegetation in Mbeere is mainly arid and semi arid but grass and wood lands are found. Common trees include Ficus sycamore (Mukuyu), Terminalia brownii grevilia,etc. Kirinyag'a, Murang'a and thika is a wet land with most of trees being exotic agroforestly which include Eucalyptus, Grevilia, cypress and fruit tree like Mangifera indica.

Vegetation around Kamburu

On farm trees

The line will have an effect to the vegetation especially in reducing forest cover which currently falls below 10%. In mbeere, indigenous tree species like *Acacia sp*. and *Terminalia brownii* which dominate the area are the most threatened.

Young *Melia volknsii* plantation that will be affected by the line.

mature mango trees

Due to this, strict measure should be taken to replace the tree by identifying other open fields and plant more.

Full list of tree species.

1) *Acacia sp.*
2) *Balanitesaegyptiaca.*
3) *Tipona tipu*
4) *Terminalia brownii.*
5) *Melia volknsii.*
6) *Eucalyptus sp.*
7) *Grevillia robusta.*
8) *Ficus sycomorus.*
9) *Euphorbia candelabrum .*

10) Acrocarpus fraxinifolius.
11) Croton megalocarpus.
12) Croton macrostachyus.
13) Spathodea nilotca.
14) Sesbania sesban.
15) Jacarada mimosifolia.
16) Cordia abysnica.
17) Vitex keniensis.
18) Macadamia integrifolia.
19) Ehretia cymosa.
20) Calondedron capense.
21) Bamboo sp.
22) Makhamia lutea.
23) Catha edulis

Fruit trees.

1) Mangoes *(Mangifera indica).*
2) Avocado *(Persia Americana).*
3) Macadamia *(Macadamia integrifolia).*
4) Oranges.
5) Paw paw *(Carica papaya).*

The main grasses in the area is mainly found along streams and small rivers include Elephant grass (Pennistum purpureum) commonly found in the uplands and some wetlands and Hippo grass (Echinochloa stagnina).

Agriculture

A mixture of subsistence and commercial farming is practiced in most areas. Small scale farming of rice is practiced in Kirinyaga and commercial farming of coffee in along the proposed line all the way from Embu to Thika.

The main subsistence crops are maize, beans, sweet potatoes and a wide variety of vegetables. Some people also keep cattle, goats and chicken.


Subsistence farming


commercial farming (coffee)

Food crops found along the line.

1) Maize.
2) Beans.
3) Potatoes.
4) Bananas.
5) Green gram.
6) Rice.
7) Coffee.
8) Tomatoes.
9) Arrowroot.
10) Kale.
11) Cabbage.

Ecological zones.

The project is divided in four sections.

a) Kamburu to Embu
b) Embu (Kutus) to Kibrigwi
c) Thika to Kibrigwi
d) Lilo on Kiganjo –Masinga line for Kibrigwi substation line

Table 3.1: Summery description of the line.

Section Identify	Section description	Description	Data collection points
A	Ap0 – Ap28 Kamburu - Embu	AEZ IV-V Bush land, mixed livestock and crops.	AP0,AP8, AP10, AP12, AP13, AP16, AP20, AP26.
B	Ap0 – Ap25 Embu (Kutus) to Kibrigwi	AEZ II-III. Agroforestry, fodder and fruit trees	AP0, AP4, AP9, AP16, AP20.
C	Ap0 – Ap60 Thika to Kibrigwi	AEZ II-III. Agroforestry, fodder and fruit trees	Ap0,AP6, AP11, AP17, AP24, AP33, AP41, AP49, AP60.
D	Ap0 – Ap3 Lilo on Kiganjo –Masinga line for Kibrigwi substation line	AEZ II-III. Agroforestry, fodder and fruit trees	AP0, AP3.

Table 3.2: Vegetation type as related to agro-climatic zones

Eco-climatic zone.	Appr. Area (Km2)	Climax vegetation and land use
I (Afroalpine)	800	Moorland and grassland, used for tourism.
II High potential.	53,000	Forest and derived grasslands – suitable for intensive agriculture.
III Medium potential.	53,000	Moist woodland, bushland or savanna. Potential agricultal and livestock land.
IV Semi-arid.	48,200	Dry forms of woodland or savanna often with Marginal agricultural
V Arid.	300,000	Land not suitable for agriculture used mainly by livestock and wildlife.
V Very arid.	112,000	Dwarf shrub grassland and shrub grassland mainly however dominated by annual grasses.
Rest (Water)	15,600	

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 Act 1999, 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 Act 1999 prevails.

4.4.1; The Environment 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 1999 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.

4.4.4; 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.

4.4.5; 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.

4.4.6; 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

4.4.7; 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

4.4.8; 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.

4.4.9; 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. The Act has the following functions among others:

- Secures safety and health for people legally in all workplaces by minimization of exposure of workers to hazards (gases, fumes & vapours, energies, dangerous machinery/equipment, temperatures, and biological agents) at their workplaces.
- 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.

4.4.10; 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.

4.4.11; 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.

4.4.12; 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 materials 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 expected to become the main policy maker and enforcer in the energy sector. This commission among other things shall be responsible for issuing all the different licenses in the energy sector.

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

4.4.15; Land Acquisition Act (Cap. 295)

This Act provides for the compulsory or otherwise acquisition of land from private ownership for the benefit of the general public. Section 3 states that when the Minister is satisfied on the need for acquisition, notice will be issued through the Kenya Gazette and copies delivered to all the persons affected. Full compensation for any damage resulting from the entry onto land to things such as survey upon necessary authorization will be undertaken in accordance with section 5 of the Act. Likewise where land is acquired compulsorily, full compensation shall be paid promptly to all persons affected in accordance to sections 8 and 10 along the following parameters:

- Area of land acquired,
- The value of the property in the opinion of the Commissioner of land (after valuation),
- Amount of the compensation payable,

- Market value of the property,
- Damages sustained from the severance of the land parcel from the land,
- Damages to other property in the process of acquiring the said land parcel,
- Consequences of changing residence or place of business by the land owners,
- Damages from diminution of profits of the land acquired.

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

4.4.16; The Registered Land Act Chapter 300 Laws of Kenya:

This Act provides for the absolute proprietorship over land (exclusive rights). Such land can be acquired by the state under the Land Acquisition Act in the project area.

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

4.4.17; The Land Adjudication Act Chapter 95 Laws of Kenya

This Act provides for ascertainment of interests prior to land registrations under the Registered Land Act.

The Proponent has undertaken a survey and commissioned a study which complies with the provisions of the Act. Public consultations have also been undertaken extensively in the affected project area.

4.4.18; The Antiquities and Monuments Act, 1983 Cap 215

The Act aim to preserve Kenya's national heritage. Kenya is rich in its antiquities, monuments and cultural and natural sites which are spread all over the country. The National Museums of Kenya is the custodian of the country's cultural heritage, its principal mission being to collect, document, preserve and enhance knowledge, appreciation, management and the use of these resources for the benefit of Kenya and the world. Through the National Museums of Kenya many of these sites are protected by law by having them gazetted under the Act.

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

4.4.19; The Civil Aviation Act, Cap 394

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.

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

4.5: INTERNATIONAL OBLIGATIONS

4.5.1; World Bank's Safeguard Policies

Relevant World Bank Safeguard policies for this project include;

1. OP 4.01; Environmental Assessment
2. OP 4.04 - Natural Habitats
3. OP 4.10 - Indigenous Peoples
4. OP 4.11 - Physical Cultural Resources
5. OP 4.12 - Involuntary Resettlement

The Proponent shall comply with the provisions of the safeguard policies

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.

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's consultation for this study was undertaken from the 9th to 22nd December 2016. These consultations were conducted in the form of:

5.3. Key Informant oral Interviews:

The following people were consulted:

Embu

1. Chief Officer, Environment and Natural Resources, Embu County.
2. Director, Finance and Planning, Embu County Government.
3. Regional Manager, Water Resources Management Authority.
4. Technical Manager, Embu Water and Sanitation Company.
5. Chief County Officer, Health Department, Embu County.
6. County Public Health Officer, Embu County Health Department.
7. Assistant Manager, Kenya Electricity Generating Company, Embu.
8. Assistant Officer, Kenya National Bureau of Statistics.
9. Assistant Director, Kenya Forest Service.
10. Senior Warden, Kenya Wildlife Service, Embu Station.
11. Operation Commander, Eastern Conservancy, Embu Base.
12. Head of Agriculture Section, Department of Agriculture, Embu.
13. Agribusiness Officer, Department of Agriculture.
14. Secretary, Occupation Health and Safety Department, Ministry of Labour and Social Sercices.
15. Runyenjes Sub-county Officer in Charge of Livestock Production.
16. Physical Planner, Embu County Government.
17. Solid Waste Management Officer, Ministry of Environment, Lands, and Natural Resources.
18. Chief, Mavuria Location.

Kerugoya

1. Administration Officer, National Environment and Management Authority.
2. Assistant Technical Co-ordination Manager, Water Resources Management Authority.
3. Director, Economic Planning, Kirinyaga County.
4. Chief Officer, Lands, Housing and Urban Development, Kirinyaga County.
5. County Labour Officer, Kirinyaga County.
6. Director, Public Health, Kirinyaga County.
7. County Statistics Officer, Kenya National Bureau of Statistics, Kirinyaga County.

8. Assistant Ecosystem Conservator, Kenya Forest Service.
9. Secretary, Kenya Wildlife Service.
10. Administration Officer, National Environment Management Authority.
11. Secretary, Department of Livestock.
12. Deputy County Commissioner, Kirinyaga Central Sub-county.
13. Assistant County Commissioner, Kirinyaga West Sub-county.
14. Assistant County Commissioner, Njukiini Division.
15. Chief, Kerugoya Location.
16. Chief, Kibirigwi Location.
17. Assistant Chief, Njukiini Divison.
18. Chief, Kibingoti Location.
19. Chief, Sagana Location.
20. Chief, Makutano Location.

Murang'a

1. Assistant Technical Coordination Manager, Upper Tana Sub-region, Water Resources Management Authority.
2. Principal Agricultural Officer, Department of Agriculture.
3. Ecosystem Conservator, Kenya Forest Service.
4. Fisheries Officer, Department of Fisheries Development.
5. Deputy County Environment Officer, Department of Environment and Natural Resources.
6. County Labour Officer, Labour Department, Ministry of East African Community, Labour and Social Protection.
7. County Public Health Officer, Ministry of Health, Murang'a.
8. Administration Officer, National Environment Management Authority.
9. Physical Planner, Murang'a County.
10. Technical Manager, Murang'a Water and Sanitation Company.
11. Chief, Kambiti Location.
12. Chief, Maragua Location.
13. Chief, Sabasaba Location.

Kiambu

1. County Physical Planner, Kiambu County.
2. Administration Officer, National Environment Management Authority.
3. Environment Officer, Ministry of Environment and Natural Resources.

4. Technical Coordination Manager, Upper Athi Sub-region, Water Resources Management Authority.
5. Managing Director, Kiambu Water and Sewerage Company.
6. County Executive Commissioner, Department of Health, Kiambu County.
7. Sub-County Livestock Production Officer, Department of Agriculture, Livestock and Fisheries.
8. County Architect, Directorate of Public Works.
9. Information Officer, Kenya News Agency, Ministry of Information, Communication and Technology.
10. Secretary, Department of Housing.
11. Secretary, Department of Agriculture.
12. Secretary, Kenya Rural Roads Authority.
13. Secretary, County Economic Planning.
14. Meteorological Officer, Kenya Forest Service.
15. Secretary, Department of Occupation Health and Safety, Ministry of Labour and Social Services.
16. Chief, Witeithie 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 67 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 343 respondents were received.

5.3.4; Public Baraza

Public barazas were held in Mavuria, Kerugoya, Kibirigwi, Kibingoti, Sagana, Njukiini, Makutano, Kambiti, Maragua, Sabasaba and Witeithie with the assistance of the local administration and leaders. In the Barazas, the team introduced themselves, their consultancy 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;

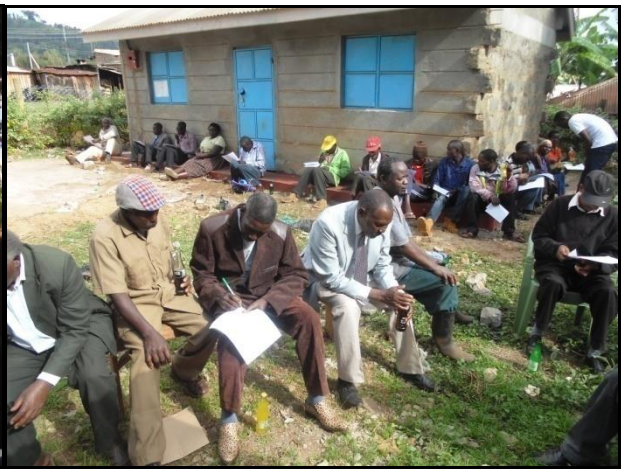
KERUGOYA (13th December, 2016- 10:00 am at the Chief's Camp)

ISSUES	BENEFITS
Compensation of affected assets should be done satisfactorily	It will promote business activities
Labour offered should include the skilled and unskilled personnel within the community members	Employment opportunities will be created
Those who will be affected directly should be made aware of the advantages and disadvantages of the transmission line	Introduction of industrialisation


KIBIRIGWI (13th December, 2016- 3:00 pm at the Chief's Camp)

ISSUES	BENEFITS
Compensation of affected assets should be done satisfactorily	It will promote business activities
Labour offered should include the skilled and unskilled personnel within the community members	Employment opportunities will be created
Difference between KENGEN, KETRACO and Kenya Power.	Improved standards of living
The duration of the project.	Introduction of industrialisation
The power should be affordable to the consumers	
The dangers associated with the project during construction.	



KIBINGOTI (14th December, 2016- 9:00 am at the Chief's Camp)

ISSUES	BENEFITS
Compensation of affected assets should be done satisfactorily	It will promote business activities
Labour offered should include the skilled and unskilled personnel within the community members	Employment opportunities will be created
The power should be affordable to the consumers	Improved standards of living
	Introduction of industrialisation




SAGANA (14th December, 2016- 3:00 pm at the Chief's Camp)

ISSUES	BENEFITS
Compensation of affected assets should be done satisfactorily	It will promote business activities
Labour offered should include the skilled and unskilled personnel within the community members	Employment opportunities will be created
The power should be affordable to the consumers	Improved standards of living

	Introduction of industrialisation
	Reduced power outages




NJUKIINI (15th December, 2016- 10:00 am at the Chief's Camp)

ISSUES	BENEFITS
Compensation of affected assets should be done satisfactorily	It will promote business activities
Labour offered should include the unskilled	There will be affordable electricity

and skilled personnel within the community members	
The power should be affordable to the consumers	Employment opportunities will be created
	Improved standards of living
	Introduction of industrialisation
	Reduced power outages

MAKUTANO (15th December, 2016- 3:00 pm at the Chief's Camp)

ISSUES	**BENEFITS**
Compensation of affected assets should be done satisfactorily	It will promote business activities
Labour offered should include the unskilled and skilled personnel within the community members	It will reduce insecurity in the county through efficient lighting
Difference between KENGEN, KETRACO and	There will be affordable electricity

Kenya Power	
Whether the route has been identified or not	Employment opportunities will be created
Why fibre optic cable from only one telecommunication company is being carried by the pylons.	Improved standards of living
The safety measures that will be put in place when the project is implemented	Introduction of industrialisation
The power should be affordable to the consumers	Reduced power outages
The possible health effects associated with the transmission line.	
Access to fibre network	
The proposed project should be brought to the attention of all stakeholders that are going to be affected by it	
All undertaking should be according to the wishes of the residents.	

MAVURIA (16th December, 2016- 11:00 am at the Chief's Camp)

ISSUES	BENEFITS
Compensation of affected assets should be done satisfactorily	It will promote business activities
Labour offered should include the unskilled and skilled personnel within the community members	It will reduce insecurity in the county through efficient lighting
The difference between KENGEN, KETRACO, Kenya Power and REA	There will be affordable electricity
The exact areas that the transmission line will pass and what will be affected.	Employment opportunities will be created
Duration of the project.	Reduced power outages
The power should be affordable to the consumers	Improved standards of living
The proposed project should be brought to the attention of all stakeholders that are going to be affected by it	Introduction of industrialisation


KAMBITI (19th December, 2016- 10:00 am at the Chief's Camp)

ISSUES	BENEFITS
Compensation of affected assets should be done satisfactorily	Employment opportunities will be created
Labour offered should include the unskilled and skilled personnel within the community members	Improved standards of living
The difference between KENGEN, KETRACO, Kenya Power	Reduced power outages
The proposed project should be brought to the attention of all stakeholders that are going to be affected by it	
Utilisation of the way-leave for other uses after erection of pylons	
The project should start as soon as possible	


MARAGUA (19TH December, 2016- 2:00 pm at the Chief's Camp)

ISSUES	BENEFITS
Compensation of affected assets should be done satisfactorily	It will promote business activities
Labour offered should include the unskilled and skilled personnel within the community members and it should be guaranteed.	Employment opportunities will be created
The difference between KETRACO and Kenya Power	Introduction of industrialisation
When the proposed project will start and duration of the project.	Reduced power outages
The possible health effects associated with the transmission line and the necessary safety precautions.	Enhancement of communication

SABASABA (21st December, 2016- 10:00 am at the Chief's Camp)

ISSUES	BENEFITS
Compensation of affected assets should be done satisfactorily	It will promote business activities
When the proposed project will start and duration of the project. (the project should be completed in the shortest time possible)	Employment opportunities will be created
Full consultations to the public to enhance conducive environment during the implementation of the project.	Introduction of industrialisation
	Reduced power outages and sufficient power
	Value addition in the areas affected




WITEITHIE (21st December, 2016- 2:00 pm at the Chief's Camp)

ISSUES	BENEFITS
Compensation of affected assets should be done satisfactorily	It will promote business activities
Labour offered should include the unskilled and skilled personnel (especially the youth) within the community members	Employment opportunities will be created
The possible health effects associated with the transmission line and the necessary safety precautions.	Reduced power outages

Whether the proponent can do CSR projects in the area such as street lighting and provision of amenities in their market place.	

5.4: Outcome of the Stakeholder Consultations:

5.4.1; Important Issues as raised by key informant

Embu

- Displacement (social cost) of persons.
- Possible injury to workers during construction.
- Proper signage and warning to be embraced by the developer.
- Compensation (of land, structures and crops/ vegetation) if any, should be done.

- As much as possible, the transmission line should avoid forest areas as these are water catchment sites and hence their clearance will affect their water catchment function.
- The county as at current has a forest cover of below 10%, which is the minimum recommended for any piece of land. Any clearance for way-leave will mean further reducing the forest cover.
- Cost implication should be looked at so that every household can manage connection; meaning that the radius covered by one transformer should not dictate the connection cost.
- Attitude of the staff handling the project must be positive.
- The project should involve locals as workers for improvement of social-economic status.
- The effects of the project to the day-to-day life of people living in the area and environment should be minimized through the use of latest modern technologies.

Kerugoya

- More power is needed in the urban and rural areas due to increase in population.
- Public health is about disease prevention and promotion of health for the communities to achieve high standards of living. In order to sustain a clean and healthy environment free from disease-causing micro-organisms, the department requires power to generate more agro-products in order to sustain nutritional aspect for steadfast economic growth.
- Without efficient and reliable power, most of the businesses cannot continue.
- Power transmission lines should avoid locating pylons on wetlands and rivers riparian zones.
- Sub-stations should be located away from water resources to avoid contamination by wastes during construction and operation.
- Way-leaves should be obtained especially where water sources may be affected by the project.
- Any pylon in contact with groundwater should be relocated to spots away from the resource.

Murang'a

- High voltage lines should not pass under or near buildings.
- Provide warning signs in any risk areas.
- Provide appropriate Personal Protective Equipment (PPE) during construction.
- Provide social amenities in construction sites.
- The high voltage transmission line which will pass through the county will require trees to be cleared along the way-leave. KETRACO should think of supporting tree-planting in the county.
- KETRACO should try to avoid wetland areas while planning for the high voltage transmission line.
- The legal processes on water permits for abstraction, management of the water resources in terms of water catchment areas should not be overlooked.

- Management, protection and conservation of water resources in collaboration with the water resources users associations (WRUAs) in place and other key stakeholders.
- The involvement of all key stakeholders from the initial implementation and handing over of the project is key to avoid conflict of interest.

Kiambu

- Proper compensation of farmers whose land will be negatively affected by the proposed project.
- Whether the proposed project affects climate change in terms of food production and if incase it does, the mitigation measures to be put in place.
- Due construction of pylons; due consideration should be given to existing and proposed water installations for instance, Riara and Kamiti water works; elevated water tanks and water pipelines. This will help minimize damages.
- The project should be away from the riparian reserve of any body of water be it a river, wetland or spring. If the project is within the proximity of the bodies mentioned, KETRACO should contact the office for making of the riparian.
- The new power line should be a guarantee to serve as an alternative when there is power rationing.

5.4.2; Some of the benefits as identified by key informant

Kerugoya

- There will be creation of jobs for the youth.
- The economy of the county will grow.
- There will be reduced power black-outs (particularly on Mondays).
- The project is a key pillar in helping the county achieve Vision 2030 by providing reliable power and increase industrialization.
- In making the county a 24-hour economy, reliable power is a key factor to sustain the expanding business and industrialization in Kenya.

Embu

- The big towns and small market centres will be a 24-hour economy.
- Citizens will have a great opportunity to improve economically.
- Reliable electricity supply.
- Minimised power outages.
- Employment and job creation.
- The project will enhance value addition of agricultural produce and processing thus earning more profits for the farmers produce.
- The project will improve the market infrastructure, as well as the efficiency of equipment used.

- The power will boost development in the county by availing power to industries, homes and transport sector (equipping Embu Airport).

Murang'a

- The project will create an enabling environment for job creation for the youth especially in the area of value addition of agricultural produce.
- It will contribute to the expansion of the economy and urban centres in the county.
- This project will (may) make the Kenya Forest Service agency's offices that are not powered to have power.
- The recurring power shortages (rationing) will be minimized.
- More users will be connected to power.
- It will go a long way in assisting the community to get more access to electricity connectivity. Hence it is a viable project.
- Kiambu
- The project might address the many challenges associated with inadequate power supp,ly and associated power outages within Kiambu and its environs.
- This is a great project whose impact will alleviate the perennial power shortages and black-outs experienced in Kiambu town. It is worth to note that in today's world nothing much can be accomplished without electricity.

5.4.3; Important Issues as raised by the community

- The power should be affordable to the consumers.
- 70% of labour offered should include the unskilled and skilled personnel within the community members.
- The valuation of land to be compensated should be done satisfactorily.
- Those who will be affected directly and indirectly should be made aware of the advantages and disadvantages of the transmission line.
- The possible health effects associated with the transmission line and the necessary safety precautions.
- Access to fibre network.
- All undertaking should be according to the wishes of the residents.
- When the proposed project will start and the duration of the project.
- Utilisation of the way-leave for other uses after erection of pylons.
- Whether the proponent can do CSR projects in the area such as street lighting and provision of amenities in their market place.

5.4.4; Some of the benefits as identified by the community

- There will be reduced power outages in the project areas.
- There will be affordable electricity within the project affected areas.
- Introduction of industrialization.
- Improved standards of living of community members.
- Creation of employment to residents of affected counties.
- Promotion of business activities.
- It will reduce insecurity in the county through efficient lighting.
- There will be enhancement in communication

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 Kamburu – Embu – Kibirigwi - Thika 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 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 40m way – leave corridor.

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. It 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). The report 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 structures. The report also contains a comprehensive Terms of Reference (TOR) to be used by the project proponent for an elaborate RAP immediately before the construction phase.

6.5: RESULTS

6.5.1; Baseline Information on Social Issues

Demographics

The four affected counties have one of the biggest populations per county and the population density is quite high too. The population along the proposed lines is thus similar to the counties' settlement patterns and bears the characteristics portrayed by population of the four counties at large. The projects more to affecting four counties, it passes through six districts. These districts are Mbeere, Embu, Kirinyaga, Murang'a North, Murang'a South and Thika West. Starting from Mbeere district, where Kamburu is located, population as of the 2009 census stood at 219,220 people with the number of females in the district standing at 150,949 people and that of males being 146,043 people. Embu district had a population of 296,992 people during the same census: 108,934 of those being male and 110,960 being female. However of the two districts, the proposed project will affect directly people in only two constituencies, Manyatta and Mbeere South. Manyatta's population stood at 154,632 people as of the last census, 49.2% of which was male. The population density was 575 people per square kilometre at the time. The population is projected by the Embu County Integrated Development Plan to be 172,958 people with a density of 643 people per square kilometre in the year 2017. Mbeere South's population stood at 130, 185 people as of the 2009 census, 50.8% of which was male and the population density was 99 people per square kilometre. The same plan projects the population of the constituency to be 145,614 people with the density at 110 people per square kilometre in 2017.

In Kirinyaga the population of males stood at 260,630 people that of females stood at 267,424 people and all that sums up to 528,054 people. The proposed line will pass through 3 out of 4 of constituencies in the county and district. The constituencies are Gichugu, Kirinyaga Central, and Ndia. These constituencies are quite populous. Gichugu had a population of 124,672 people as of the last census with a density of 545 people per square kilometre 49% of this population is male. The constituency is projected to have a population of 140,567 people and a density of 612 people per square kilometre in 2017 by the Kirinyaga County Integrated Development Plan. Kirinyaga Central's population of 113,355 was 48.8% comprised of males in 2009 and the

population density stood at 653 people per square kilometre. The projections by the county development plan put the population of the constituency at 127,807 people with a density of 736 people per density of 471 people per square kilometre. 48.6% of the population at the time was male. The projections of the population in 2017 are 112,203 people and a density of 531 people per square kilometre.

Murang'a north recorded a population of 346,283 people, 48% which was male in the last census. Murang'a South had a population of 432,701, 48.6% of which was male. The project will pass through four constituencies in Murang'a County namely Kiharu, Maragua, Kandara and Gatanga. Kiharu constituency had a population of 181,076 people, 48.3% of which was male during the last census. The density stood at 441 people per square kilometre. The population of the constituency is projected to be 186,964 people in 2017 with a population density of 456 people per square kilometre by the Murang'a county Integrated Development Plan. In Maragwa the population stood at 152,272 people with 49.1% of the population being male. The population density stood at 278 people per square kilometre. The projections of the constituency place the population to be at 157,224 people in 2017 with the density being 287 people per square kilometre by the county's development plan. Kandara constituency had a population of 156,663, 48.4% of which were male and the population density was 664 people per square kilometre. The population of the constituency is projected to be 161,757 people in 2017 with a population density of 686 by the county's development plan. Finally, Gatanga constituency had a population of 163,597 people in the census with 49.5% of the population being male. The population density was 278 people per square kilometre. The projections for the constituency for the year 2017 are that it will have a population of 168,917 people and a population density of 282 people per square kilometre.

Thika west district, the only district in Kiambu County that the project will pass through, had a population of 218,544 people as of the last census. 50.1% of the population in the district was male. The proposed project will primarily affect the residents located in only one constituency in the county that is Thika Town constituency. The population of people in the constituency is 165,342 and the population density is at 760 people per square kilometre. The percentage of males in the constituency was 50% percent at the time. The population of the constituency is projected to be 207,020 people with a population density of 952 people per square kilometre in 2017 by the Kiambu County integrated development plan.

Household and Family Structure

The proposed project will not affect mere populations whose composition exist singly and independently. A large part of the population will be families or households of people living together. There is a difference between a family and a household. A family must contain two or more members who not only live together but are also related, either by marriage or blood. A household needs not contain two or more members and they need not be related. In looking at both households and family structure and composition shall be looked at in

the form of county averages. The four counties also record a high number of households. Embu County as of the last census had 131,683 households with an average membership of 3.9 persons per household, Kirinyaga had 154,220 households with an average membership of 3.4 persons per household, Murang'a with 255,696 and the average number of people per household is 3.7 and Kiambu County with 469,244 households and an average of 3.4 people in each household.

In line with the classification of households by the United Nations statistics department based on composition, most households are nuclear families, with a substantial percentage being one person households, extended family households and composite households(that which have at least one dweller not related to the host family). Non family households are uncommon in the larger region of the proposed project but is notable in Kiambu County, with it forming 2% of the households. This could be attributed to the fact that most of Kiambu County is urban and this includes the area where the project is in the county.

The headship of the households is predominantly male across the region with Embu recording a 67.3% headship for males during the last census, Kirinyaga recording a 70% male headship, Murang'a recorded a 62.8% male headship and Kiambu recorded a 71.8% male headship. Most of the households were headed by adults aged between 35 and 59 years.

Vulnerable Groups.

In the determination of who form vulnerable populations the baseline characteristic that informs such a classification is the magnitude of negative impact the affected person will suffer in case the proposed project is to change their way of life from the usual or the one they are accustomed to. In this case, the populations that can be classified as vulnerable are:-

1) Persons with Disability
2) Children headed households
3) Female headed households
4) Aged persons
5) Aged people headed households
6) Households headed by persons with disability

Embu county recorded 1.2% of its population as disabled, Kirinyaga recorded 1.1%. Murang'a recorded 2.0% of its population and Kiambu recorded 2.8% of its population during the last census.

2.2% of households in Embu County were children headed, 2.4% in Kirinyaga, 2.5% in Murang'a and 5.2% Kiambu as recorded by the last census. The percentage of households headed by aged persons is higher.

Embu County had 19.6% of the households headed by aged persons, Kirinyaga recorded 18.8% of households, Murang'a had 26.5% of households and Kiambu recorded 13.4% of households being headed by aged persons in the last census.

These vulnerable groups is found to be on the path of the proposed line, would suffer more during relocation more than any other group.

Literacy Levels

The percentage of people who have attended school in the areas is very high with only a few having never attended school, be it pre-school, primary school, secondary school or any tertiary institution. Embu district recorded the highest number of such people with the percentage being 2.1% in the 2009 census. Mbeere recorded 1.6%, Kirinyaga had 1.2%, Muranga North had 1.3% Murang'a south recorded 1.4% and Thika west had 1.6% of the population having never attended school.

Economic Activity

In a bid to know whether the people who will be primarily affected by the project, understanding the economic activities and income generating activities of the locals is important. And in line in that identifying the economically inactive or unclassified is important in order to determine the dependency levels of the areas. Mbeere district recorded the lowest number of the economically inactive and unclassified at 32.9% of the population from the last census. Embu district had 34.8% of its population, Kirinyaga's stood at 33.9%, Murang'a North was at 40%, Murang'a South had 43.3% of the population under that category and finally Thika West had 41% of its population under that category. Agriculture is the main source of income in the counties of Embu, Kirinyaga and Murang'a. The affected part of Kiambu is largely urban therefore the main source of income is through informal jobs dubbed the Juakali sector.

6.5.2; Housing typologies amongst the PAPS

The type of housing in the project areas are of different kinds such as mud houses, semi-permanent and permanent housing.

6.5.3; Summary of Affected Public Facilities

1) Ebenezer Adult Education Centre
2) A.C.K(Anglican Church of Kenya Mbeere Ngecha Church
3) Gitwe Mixed Secondary School, the proposed line flies over the only School block
4) Kiamburi Tea Factory
5) Kiandagae Pry. School the proposed line cuts across the playground
6) St. Peters Kiandai Catholic Church
7) Kiandagae Secondary School. the proposed line cuts across the playground
8) Kiandai A.I.C church
9) Rukanga Dispensary the proposed line flies in the middle of the facility

10) A.C.K. St. Peter's Rukanga
11) Rukanga primary and secondary school the proposed line cuts across the playground for both institutions
12) A.C.K Mt. Kenya Central Diocese St. John's Church Muchangara
13) ACK Murang'a South Diocese St. Philip's Tukuyu Church
14) Nguthuru Polytechnic the proposed line flies over the only block
15) Nguthuru Primary School
16) Makima Project

Makima site is a research project by Kenya forest and research institute in partnership with japan government, the proposed line cuts over the project.

6.5.4; Results Summary

From the census results, the 40m corridor over the distance of 147km of the transmission line will affect a total of 89 households with a total of 404 PAPs. A total of 266 different types of structures will have to be relocated and this will cost KETRACO approximately Ksh. 129,880,000

The table below gives detail of the census.

Table 6.1; RAP census results

Kamburu- Embu Link

Location	Village	Physical Features	Public Amenities/ Roads	Households	Total PAPs	Type	Number	Valuation (Ksh)
AP0-AP8	0	0		0	0	Small structure[1]	0	
						Temporary structure[2]	0	
						Semi-Permanent Structure[3]	0	
						Permanent Structure[4]	0	
AP8-AP9	Machang'a	0	Embu-Siakago Road	0	0	Small structure[1]	0	
						Temporary structure[2]	0	
						Semi-Permanent Structure[3]	0	
						Permanent Structure[4]	0	
AP9-AP10	Machang'a	0	Ebenezer Adult Education Centre	0	4	Small structure[1]	0	
						Temporary structure[2]	0	
						Semi-Permanent Structure[3]	0	
						Permanent Structure[4]	2	6,000,000
AP9-AP10	Kiangungi	0	0	1	5	Small structure[1]	1	50,000
						Temporary structure[2]	1	100,000
						Semi-Permanent Structure[3]	0	
						Permanent Structure[4]	1	400,000
AP10-AP11	Makima	Thiba River	0	2	11	Small structure[1]	3	150,000
						Temporary structure[2]	4	600,000
						Semi-Permanent Structure[3]	0	
						Permanent Structure[4]	0	
AP11-AP12	Makima	0	A.C.K Diocese of Mbeere Ngecha Church	0	0	Small structure[1]	0	
						Temporary structure[2]	2	500,000
						Semi-Permanent Structure[3]	0	
						Permanent Structure[4]	0	
AP13-AP14	Mashamba and Uthaanwa	Mashamba Seasonal River	0	3	8	Small structure[1]	0	
						Temporary structure[2]	3	450,000
						Semi-Permanent Structure[3]	0	
						Permanent Structure[4]	0	
AP15-AP16		Thiba River	0	0	0	Small structure[1]	0	
						Temporary structure[2]	0	
						Semi-Permanent Structure[3]	0	
						Permanent Structure[4]	0	
AP 16-AP17	Siomanthi	0	0	1	10	Small structure[1]	0	

						Temporary structure[2]	2	150,000
						Semi-Permanent Structure[3]	0	
						Permanent Structure[4]	1	600,000
AP17-AP20		Nyamindi River	South Ngariama Settlement Scheme	0	0	Small structure[1]	0	
						Temporary structure[2]	0	
						Semi-Permanent Structure[3]	0	
						Permanent Structure[4]	0	
AP20-AP21	Kajiji	0	0	3	12	Small structure[1]	3	150,000
						Temporary structure[2]	3	430,000
						Semi-Permanent Structure[3]	2	600,000
						Permanent Structure[4]	0	
AP21-AP22	Kamunyange	0	0	3	10	Small structure[1]	2	100,000
						Temporary structure[2]	4	400,000
						Semi-Permanent Structure[3]	2	400,000
						Permanent Structure[4]	4	5,500,000
AP22-AP23	Kambiti	0	Church	2	11	Small structure[1]	3	130,000
						Temporary structure[2]	4	400,000
						Semi-Permanent Structure[3]	1	200,000
						Permanent Structure[4]	5	3,200,000
AP23-AP25		0	0	0	0	Small structure[1]	0	
						Temporary structure[2]	0	
						Semi-Permanent Structure[3]	0	
						Permanent Structure[4]	0	
AP25-AP26		0	0	1	5	Small structure[1]	2	80,000
						Temporary structure[2]	2	170,000
						Semi-Permanent Structure[3]	0	
						Permanent Structure[4]	0	
AP26-AP27		0	0	3	8	Small structure[1]	4	200,000
						Temporary structure[2]	0	
						Semi-Permanent Structure[3]	1	170,000
						Permanent Structure[4]	2	1,600,000
AP27-AP28		0	0	0	0	Small structure[1]	0	
						Temporary structure[2]	0	
						Semi-Permanent Structure[3]	0	
						Permanent Structure[4]	0	

Small structure[1] - include; huts, toilets, animal sheds, stores/granaries etc; Temporary structure[2] - include; mud and timber walled houses with iron-sheet roofing, etc

Permanent structure[3] – include stone, brick, and block walled structures

Embu- Kibirigwi Link

Location	Village	Physical Features	Public Amenities/ Roads	Households	Total PAPs	Type	Number	Valuation (Ksh)
AP0-AP2	0	Nyamindi River	Embu- Makutano Road	0	0	Small structure[1]	0	
						Temporary structure[2]	0	
						Semi-Permanent Structure[3]	0	
						Permanent Structure[4]	0	
AP2-AP3	Mururi	0	0	2	8	Small structure[1]	0	
						Temporary structure[2]	2	180,000
						Semi-Permanent Structure[3]	2	480,000
						Permanent Structure[4]	1	500,000
AP3-AP4	Mururi	0	0	1	7	Small structure[1]	11	550,000
						Temporary structure[2]	9	900,000
						Semi-Permanent Structure[3]	2	600,000
						Permanent Structure[4]	1	1,800,000
AP4-AP5	Kamuthithi	0	0	9	27	Small structure[1]	6	300,000
						Temporary structure[2]	17	1,750,000
						Semi-Permanent Structure[3]	5	1,000,000
						Permanent Structure[4]	5	6,800,000
AP9-AP10	Gatuto and Gitwe	Small Swamp	• Gitwe Mixed Secondary School • Kiamburi Tea Factory • Gatuto	11	40	Small structure[1]	4	280,000
						Temporary structure[2]	23	2,300,000

			Trading Centre • Gatuto Road			Semi-Permanent Structure[3]	4	800,000
						Permanent Structure[4]	3	11,000,000
AP 16-AP 17	Kiandagae/ Kiandai	Rwamuthambi River	• Kiandagae Pry. School • Cattle Dip • St. Peters Kiandai Catholic Church • Kiandagae Secondary School. • Kiandai AIC • Kiandai Shopping Centre • Kagio-Kibingoti Road	7	50	Small structure[1]	0	
						Temporary structure[2]	5	670,000
						Semi-Permanent Structure[3]	4	2,400,000
						Permanent Structure[4]	2	3,000,000
AP17-AP25	Kianjang'a		132kV Power Line.	Kiamuguongo Hill		Small structure[1]	0	
						Temporary structure[2]	0	
						Semi-Permanent Structure[3]	0	
						Permanent Structure[4]	0	

Small structure[1] - include; huts, toilets, animal sheds, stores/granaries etc

Temporary structure[2] - include; mud and timber walled houses with iron-sheet roofing, etc

Permanent structure[3] – include stone, brick, and block walled structures

Kibirigwi- Thika Link

Location	Village	Physical Features	Public Amenities/ Roads	Households	Total PAPs	Type	Number	Valuation (Kshs)
AP0-AP1	0	0		1	6	Small structure[1]	2	130,000
						Temporary structure[2]	0	0
						Semi-Permanent Structure[3]	0	0
						Permanent Structure[4]	2	2,300,000
AP6-AP7		Kiamuguongo hill and a valley	Mining sites. Brick making quarry			Small structure[1]	0	
						Temporary structure[2]	0	
						Semi-Permanent Structure[3]	0	
						Permanent Structure[4]	0	
AP16-AP17		0	0	1	0	Small structure[1]	2	80,000
						Temporary structure[2]	0	
						Semi-Permanent Structure[3]	0	
						Permanent Structure[4]	2	1,600,000
AP19-AP20	Muthithi	0	0	0		Small structure[1]	0	
						Temporary structure[2]	0	
						Semi-Permanent Structure[3]	0	
						Permanent Structure[4]	0	
AP23-AP24		0	0	5	27	Small structure[1]	0	
						Temporary structure[2]	0	
						Semi-Permanent Structure[3]	6	900,000
						Permanent Structure[4]	3	1,800,000
AP24-AP25	Rukanga	0	• A2 Highway • Rukanga Mixed Secondary School • Rukanga Pry. School. • A.C.K. St. Peter's	6	30	Small structure[1]	0	
						Temporary structure[2]	0	
						Semi-Permanent Structure[3]	6	3,800,000

			• Rukanga • Rukanga Dispensary			Permanent Structure[4]	17	20,000,000
AP25-AP26	Kayuyu	Sagana River	Kayuyu Pry. School.	0	0	Small structure[1]	0	
						Temporary structure[2]	0	
						Semi-Permanent Structure[3]	0	
						Permanent Structure[4]	1	3,000,000
AP29-AP30	Muchangara	0	A.C.K Mt. Kenya Central Diocese St. John's Church Muchangara	1	1	Small structure[1]	0	
						Temporary structure[2]	0	
						Semi-Permanent Structure[3]	0	
						Permanent Structure[4]	3	7,000,000
AP31-AP32	Kambiti	0	0	1	5	Small structure[1]	0	
						Temporary structure[2]	0	
						Semi-Permanent Structure[3]	0	
						Permanent Structure[4]	1	1,550,000
AP 32-AP33	Kahuho	0	Kahuho Trading Centre	10	34	Small structure[1]	0	
						Temporary structure[2]	0	
						Semi-Permanent Structure[3]	0	
						Permanent Structure[4]	10	9,000,000
AP35-AP36	Mihang'o					Small structure[1]	0	
						Temporary structure[2]	0	
						Semi-Permanent Structure[3]	0	
						Permanent Structure[4]	0	
AP 42- AP43	Mutoho	Mutoho River	Murang'a-Kenol Road	1	6	Small structure[1]	0	
						Temporary structure[2]	0	
						Semi-Permanent Structure[3]	2	300,000
						Permanent Structure[4]	0	
AP44-AP45	Gati Iguru	0	Kagia Road	2	11	Small structure[1]	2	
						Temporary structure[2]	0	
						Semi-Permanent Structure[3]	2	380,000

						Permanent Structure[4]	2	1,750,000
AP45-AP46	Riandegwa	0	0	4	20	Small structure[1]	5	250,000
						Temporary structure[2]	0	
						Semi-Permanent Structure[3]	4	560,000
						Permanent Structure[4]	2	1,950,000
AP46-AP47	Wagithiiya	0	0	4	26	Small structure[1]	0	
						Temporary structure[2]	0	
						Semi-Permanent Structure[3]	0	
						Permanent Structure[4]	4	
AP47-AP48	Tukuyu	0	• Kangari Road • ACK Murang'a South Diocese St. Philip's Tukuyu Church • Tosheka Shopping Centre	0	0	Small structure[1]	0	
						Temporary structure[2]	1	110,000
						Semi-Permanent Structure[3]	0	
						Permanent Structure[4]	5	7,500,000
AP49-AP50	Nguthuru		• Nguthuru Polytechnic • Nguthuru Pry. School.	2	9	Small structure[1]	2	80,000
						Temporary structure[2]	0	
						Semi-Permanent Structure[3]	1	300,000
						Permanent Structure[4]	2	4,100,000
AP51-AP52	Gituri		Kandara Road	2	13	Small structure[1]	3	160,000
						Temporary structure[2]	0	
						Semi-Permanent Structure[3]	2	240,000
						Permanent Structure[4]	2	3,000,000
AP53-AP54	Kaburugi	Bamboo Forest Thika River	Thika-Kiunya Road	0	0	Small structure[1]	0	
						Temporary structure[2]	0	
						Semi-Permanent	0	

						Structure[3]		
						Permanent Structure[4]	0	
AP54-AP55		Swamp Bamboo Forest	C67(Thika-Gatura Road)	0	0	Small structure[1]	0	
						Temporary structure[2]	0	
						Semi-Permanent Structure[3]	0	
						Permanent Structure[4]	0	
AP56-AP57	Ngoingwa	Chania River	C66(Thika-Mangu Road)	0	0	Small structure[1]	0	
						Temporary structure[2]	0	
						Semi-Permanent Structure[3]	0	
						Permanent Structure[4]	0	
AP59-AP60	Kuraiha	0	A high voltage power line, 220kV and a 66kV power line	0	0	Small structure[1]	0	
						Temporary structure[2]	0	
						Semi-Permanent Structure[3]	0	
						Permanent Structure[4]	0	
Total				**89**	**404**		**266**	**129,880,000**

Small structure[1] - include; huts, toilets, animal sheds, stores/granaries etc

Temporary structure[2] - include; mud and timber walled houses with iron-sheet roofing, etc

Permanent structure[3] – include stone, brick, and block walled structures

6.5.4; Pictorially

Ebenezer Education Centre

A.C.K Ngecha Church, Mbeere Diocese

A block at Gitwe Secondary School

Kiamburi Tea Factory

Kiandagae Primary School

Kiandai Catholic Church

Rukanga Health Centre

A.C.K St. Peter's Church, Kirinyaga Diocese

Rukanga Primary and Secondary School

Kayuyu Primary School

A.C.K St. John Muchangara Church

A.C.K Muranga South Diocese, Tukuyu Church

Nguthuru Polytechnic

Nguthuru Primary School

6.6: TERMS OF REFERENCE (TORS)

KETRACO will be required to conduct an elaborate RAP immediately before the project construction phase. The following Terms of Reference (TORs) will be useful to ensure the RAP is elaborate enough, effective, and contain all important components in line with local legislations and the World Bank Safeguard policies.

6.6.1; Objective of the Study

The objective of the study is to carry out a detailed Resettlement Action Plan (RAP).

6.6.2; Scope of Study

The Project Scope will include carrying out a baseline Socio-Economic Survey on the people affected, valuation of structures, land, crops and trees, Compensation Mechanism, Conflict Redress Mechanism and a report detailing all these variables.

The valuation of structures and land must be done by a registered and licensed valuer.

6.6.3; Study Tasks

Task 1: Carry out a detailed survey on the actual number of people to be affected by the proposed line

- A concise description of project area including location of the project area and the number of people to be affected by the project in each location or district
- Undertake a socio-economic baseline survey of the people affected by the project
- Description of categories of people to be affected; partially or wholly taking into account gender, vulnerability and other diversity concerns.
- Identify all the people to be affected (PAPs) on the entire trace of the line providing their names with their official identification as in the National Identity card, phone contacts and physical contacts (street/estate, village, sub-location, location, District and County).

Task 2: Carry out a detailed evaluation of the amount of land to affected by the project

- Description of the total land that will be affected by the way leave access
- Baseline description of land tenure, land use patterns and transfer systems
- Evaluation of farmland; commercial and subsistence farm land that will be affected by the proposed line and give a rough estimate of land values
- Provide a report on the type of effect for every parcel of land affected in terms of partial or entire parcel.
- For each PAP whose land is affected, provide 1)actual acreage of land to be taken by the transmission line way leave 2)total acreage of PAPs land
- For each PAP whose land is affected, conduct valuation of the affected strip and compute compensation values. Provide type and methodology of compensation, preferred method of valuation with justification and the compensation framework including country laws and regulations.
- Provide details of the land affected in terms of type of tenure and land use patterns
- For each PAP whose land is affected, provide the following information on the status of land ownership documents 1)title deed LR No. and name of the registered owner 2)information on whether the current land occupant is the registered land owner 3)placed caveats 4)disputes involving the land parcel
- Provide actual values of the percentage parts of the parcels affected basing the values between a scale of 30 – 95% of the total market value of land ,where : 30% or less is for the large parcels with very minimal impact /effect while up to 95% being for the parcels that are severely or totally affected. (The valuation estimates should be based on locational registration areas)
- Provide maps of affected areas showing strips of affected areas.
- For each parcel of land affected, plot the transmission line wayleave on its cadastral map.

Note that eligibility of affected land must be confirmed by legal documents of ownership (squatters are not eligible for land compensation, but will be compensated for structures they may have put up and /or crops and trees they may have planted)

Task 3: Carry out a detailed survey on the structures to be affected by the proposed line

- Total number of structures to be affected by the proposed line
- Baseline description of structures affected including permanent and semi-permanent structures
- For each parcel of land affected, provide the total number and type of structures to be affected by the proposed transmission line
- Provide total number of public institutions/community structures to be affected by the proposed line
- Provide description of structures affected – Plinth area and construction materials
- Provide detailed values/estimation of structures to be affected accompanied by pictures of the affected structures and measurements
- Provide detailed values/estimation of structures to be affected accompanied by pictures, measurements and geographical positions (inscribed as a foot note of the pictures) of the structures affected. (using coordinates)
- Establish names of true owners of structures and include the names in each caption of picture taken for each structure
- Provide type and methodology of compensation, preferred method of valuation with justification and the compensation framework including country laws and regulations.
- Prepare an inventory of loses and a detailed Entitlement Matrix that will be used for compensation

  Note that all owners of structures are considered eligible including squatters

Task 4: Carry out a detailed census/count of trees affected by the proposed line

- Provide the 1) number 2)type 3)breast-height diameter of mature trees affected per each parcel affected
- Provide assessment of trees /crop damage estimate values of the trees/crops affected

  Note that the rates of computation should be based current rates as guided by on Kenya Forestry Service and Ministry of Agriculture

Task 5: Prepare an inventory of losses and a detailed Entitlement Matrix that will be used or compensation

Task 6: Prepare livelihood restoration strategies and measures necessary to assist people affected by the project improve or restore their living standards

Task 7: Prepare a detailed organizational arrangement for delivery of entitlements, including; Livelihood restoration measures, preparation and review of cost estimates, the flow of funds; and contingency arrangements

Task 8: Prepare a detailed description of the implementation process, linking resettlement implementation to civil works

- Initiate stakeholder involvement and come up with specific stakeholder committees either locational or sub-locational in areas affected that will ensure smooth implementation of the RAP

Task 9: Prepare a detailed grievance redress mechanism including concise procedures for dispute resolution taking into account traditional dispute settlement measures and judicial recourse

Task 10: Prepare a detailed description of mechanisms for consulting with, and participation of, displaced persons in planning, implementation and monitoring

Task 11: Prepare a detailed description of arrangements for monitoring by the implementing agency and if required, by independent monitors

Task 12: Prepare a detailed estimated budget cost for the whole resettlement action plan inclusive of costs of structures, land, contingencies and monitoring of the project

6.6.4; Staffing

The team proposed for the assignment shall comprise of the following key experts but not limited to:

Team leader
Socio-Economist
Valuation expert
Environmental Expert
GIS Expert/Surveyor

The consultant shall also submit the list of any other staff proposed for the assignment; with their CV's as follows:

Team Leader

General Qualification

Minimum requirement:

- Master's degree in Sociology/Social Sciences or any related field
- 10 years' experience in studies of this nature
- 5 years in inter-disciplinary team management
- Experience of at least two projects of similar scope and nature

Socio-Economist

General Qualification
Minimum requirements

- MA Degree in Sociology/Community Development or any social science discipline
- 5 years' experience in socio-economic surveys in similar scope and nature.
- Experience of at least two projects of similar scope and nature

Land Economist

General Qualification
Minimum requirement:

- Degree in land economy/valuation from a recognized University
- 10 years' experience in valuation
- Certificate of registration/professional certificate
- Registration and/or membership of professional field and valid annual operating licence will be an added advantage

Environmental Expert

General Qualification
Minimum requirements

- B.Sc. Degree in Environmental Studies/Planning and Management/Science/ or Natural Resource Management
- 5 years' experience in ESIA studies
- Experience of at least two projects of similar scope and nature
- Registration and/or membership of professional field and valid annual operating licence will be an added advantage

GIS Expert/Surveyor

General Qualification

Minimum requirements

- B.SC Degree Survey
- At least 5 years' experience in survey works / mapping exercises.
- Registration and/or membership of professional field and valid annual operating licence will be an added advantage

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 Embu, Kirinyaga, Muranga, and Kiambu Counties. The County at the moment is fed by a 33kV distribution line, and can not host heavy industries that are power intensive. With a potential for heavy industries in the county due to its proximity to the LAPSET project, the need for adequate, reliable, and secure power can not be overemphasized. The project will also help meet the increasing demand for power supply and minimize the frequency of power outages.

7.2.2; Contribute towards reduction in Greenhouse Gas emission

Current electricity power transmission mode in the four Counties is mainly through 33 and 66kV distribution lines. Studies show that, the 33 and 66kV distribution lines loose upto 30 per cent of the power they transmit. High voltage transmission lines on the other hand are efficient and hardly loose 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; 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.

7.2.4; 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

7.2.5; 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.

7.2.6; 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.

7.2.7; 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.

7.2.8; Security

With increased lighting in the 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 (mixers, tippers, drilling etc) and incoming vehicles to deliver construction materials to site or take away debris.

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

7.3.3; Dust Emissions

Dust emission is likely to occur during the site clearance, excavation and spreading of the topsoil during construction of the substations and excavation of foundation for steel towers. They are also likely to occur during the decommissioning phase. Motor vehicles accessing the site may also lead to dust emissions.

7.3.4; Solid and Liquid Waste Generation

It is expected that solid waste will be generated in all phases of the project. The generated waste will include; drums, paper, plastic, cables, metal, transformers, capacitors, drywall, wood, glass, paints, adhesives, sealants, fasteners, wastewater etc

7.3.5; Oil Spill Hazards

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. There is also a potential for oil spills and accidents during oil transportation, storage and operations of the transformers and batteries.

7.3.6; Destruction of Existing Vegetation and Habitats

The project will require a way-leave of 30 meters width for the 310km. 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.

7.3.7; Disturbance of Faunal Species

The potential impacts to faunal species are restricted to disturbance of their habitats, their feeding, breeding and general movements. Disturbance could also be caused by presence of labour force, poaching, noise and vibration. Overall, the impact on wildlife during construction is considered low to insignificant.

7.3.8; Avifauna Mortalities

During the assessment, various types of avifauna were recorded. The transmission line therefore, is quite likely to the birds. 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. Bird strike by the conductors is however, likely and in a few circumstances may lead to mortality.

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 including falling from height during construction of towers (may lead to fatality), falling objects, collapsing of excavations, road accidents, slips and trips, flammable and explosive substance, electrical shocks, dust, noise and vibrations, poor hygiene, fire, bruises and cuts, etc

7.3.10; Soil Erosion

There are possibilities of soil erosion occurring during the construction stage of the project especially during rainy and windy seasons. Where the transmission line pass near wetlands, soil erosion may lead to deposition in the watercourses and other wetlands causing siltation.

7.3.11; Visual and Aesthetic Impacts

The physical presence and profile of the proposed project will alter the visual and aesthetic effects of the surrounding area.

6.3.12; Incidences of Electrocution

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 from climbing, and should a tower collapse or a conductor snap, a signal is sent in seconds which results in an immediate shut down.

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 30 m 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.

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. Resettlement for this particular project will not be extensive since the project area is sparsely populated and the way of live in this region is nomadic pastoralism.

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. 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.

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 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;
- 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;
- 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, the proponent will;

- 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.
- specify locations for trailers and equipment, and areas of the site which should be kept free of traffic, equipment, and storage;
- 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 conservancy owners to advice on construction timings to avoid disturbing wildlife.

7.4.8; Avifauna Mortalities

To minimize bird collisions leading to their mortality, 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

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 substations workers and the general public during construction, operation and decommissioning of the proposed substations as stipulated in the Occupational Safety and Health Act, 2007

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;
- 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

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.

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 @1000 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			10,000
	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 Removed wooden poles,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	30,000

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	0
	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	5,000 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
	3. Designate access routes and parking within the site.			0
	4. With Assistant from community, KWS and KFS, initiate a tree planting exercise		Entire construction period	50,000
	5. Design and implement an appropriate landscaping programme for the substations site.			50,000
	6.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 to 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.			5,000 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	Conduct consultation meetings with Project Affected Persons and 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	KETRACO	Continuous	To be determined

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			30,000 /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		Continuous	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			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 substations workers and the general public during operation of the proposed substations 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				
Increase 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 substations 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	20,000

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: RECOMMENDATIONS AND CONCLUSION

10.1: 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 132/33 kV transmission 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.

10.2: 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 EMP
- The proponent to conduct and implement a detailed and elaborate Resettlement Action Plan
- The proponent to monitor implementation of the EMP using the developed EMoP
- 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

10.3: 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 EMP

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