5.0 Legal and Administrative Framework

Legislative and regulatory framework that governs Environmental Impact Assessment (EIA) studies is contained in the Environmental Management and Co-ordination Act, 1999. Electrical infrastructure is covered in part 10 of this schedule and this includes electricity generation stations; electrical transmission lines; electrical sub-stations; and pumped storage schemes. The Act provides for the National Environmental Management Authority (NEMA) whose object and purpose is to exercise general supervision and coordination over all matters relating to the environment and to be the principal instrument of the Government in the implementation of all policies relating to the environment. This IEA study is also based on the World Bank Operational Policies (OP) and Bank Procedures (BP) Environmental Assessment - BP4.01 and OP 4.01 (January 1999) all of which require environmental assessment of projects proposed for World Bank financing to help ensure that they are environmentally sound and sustainable.

6.0 Baseline Environment

Various baseline environmental characteristics observed in the target areas earmarked for the new line routes, substation sites and transformer stations were recorded. The environmental characteristics discussed have been categorized under biophysical and social-cultural environments.

6.1 Biophysical Environment

Most of the biophysical environments in the proposed sites have already been disturbed by human activities for a long time e.g. the Nairobi and Coastal project sites are major urban areas and the Western Project sites are mostly within town councils. For example Jevanjee substation is within the heart of the City of Nairobi where there are no animals or plants to be affected and Makutano substation is to be situated within the Makutano trading centre. Most of the other areas where overhead electrical cables will pass will be above farmlands. Moreover the physical size of land needed for each proposed project site is quite small (ranging from 0.5 – 2 acres).

6.2 Social – Cultural Environment

The socio-cultural environment will not be interfered with much because the proposed new substations will either be built on existing KPLC land or in the case where land will have to be acquired, it will be existing public land, or land that is already developed. Where people will have to be moved adequate compensation measures will be put in place. There are no known historical, archeological or contemporary socio-cultural resources existing on the proposed project sites that could be disturbed, displaced or destroyed by the proposed project activities.

7.0 Potential Impacts

The proposed project will have implications which are summarised below that are both positive and negative. The negative impacts are short term and easy to mitigate. The long term benefits of the project are crucial for the socio-economic development of the country.
7.1 Positive Benefits (long term)

- Increased supply of electricity
- Enhanced stability of electric power supply
- Increased economic output through expanded business activities
- Better provision of basic services such as health, education e.t.c.
- Enhanced information flow and public awareness through electronic media and the internet
- Better public safety through enforcement of safety regulations and monitoring of sites

7.2 Adverse Impacts During Reinforcement and Upgrading

- Temporary disturbance of immediate surrounding by noise and dust during ground preparation
- Interruption of power supply to current consumers
- Displacement of people for construction of the new substations
- Destruction of vegetation including crops in some sites
- Risk/Exposure to electric shock/electrocution when work is in progress
- Movement/transportation of heavy equipment to the sites that may pose some danger to the public in the immediate vicinity
- Damage to crops in rural agricultural areas
- Cutting down trees to create way for electric wires

8.0 Mitigation Measures

- KPLC to adhere more closely to set standards, rules and procedures, where appropriate
- Conduct civil works during times that provide least disturbance to the public
- Provide advance notice to power consumers before embarking on the work
- Put in place a mechanism to minimize power cuts when work is in progress
- Provide financial compensation to individuals who will be displaced from land that they are currently using
- Pay the market rate for the land acquired
- Strictly adhere to known safety procedures, when work is in progress
- Ensure that existing substations and identified sites have a secure perimeter fence/wall
- Transportation of heavy equipment to the site must be accompanied by the mandatory public warning and precautions such as labels, sirens etc

9.0 Analysis of Alternatives

The proposed reinforcement and upgrading works have no viable technological/engineering alternative that would lead to the same or better realization of the stated goals/objectives of increased supply of electricity, reduction of power losses
and stabilization of power supply. It also meets the broader national objectives of employment generation, wealth creation and poverty reduction. The adverse impacts of the proposed project are minimal and can easily be mitigated as has been outlined above.

The no-action alternative leads to decreased welfare of the people because both the short term (immediate increased access to electric power) and long term (multiplier effects of improved basic services and increased economic activities). Moreover, with demand increasingly stripping supply, there will be rapid deterioration in the quantity and quality of supply of this vital energy source and thereby further impoverishment of Kenyans.

Those project sites that are either existing or new sites that will be acquired will have to be those that can easily be connected to the existing routes. These are mainly located on public lands. There are no better alternatives to such site selection considerations made in the project design.

10.0 Environmental Management and Monitoring Plan (EMP)

The EMP is one of the requirements of the EIA reporting. According to the World Bank, it provides an essential link between the impacts as operational and implementation activities (WB, 1999). Environmental Management Plan is important in order to assign various responsibilities to particular individuals and institutions to ensure that mitigation measures are put in place and enforced given that the project will involve acquisition of land damage to the property, crops and trees. Therefore assessment and valuation of the damages have to be carried out for compensation of the affected population.

11.0 Conclusion

Both in the short term as well as in the long term, we do not envisage any adverse changes that would warrant the non-implementation of the project. The long term benefits of the project justify its commission. Such benefits are mainly in the form of the increased supply of electricity to the wider population and the attendant effects of this for domestic and commercial use of electricity and the resulting improvement of the welfare of Kenyans.
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<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EIA</td>
<td>Environmental Impact Assessment</td>
</tr>
<tr>
<td>EMCA</td>
<td>Environmental Management Coordination Act</td>
</tr>
<tr>
<td>EMP</td>
<td>Environmental Management Program</td>
</tr>
<tr>
<td>ERSWEC</td>
<td>Economic Recovery Strategy for Wealth and Employment Creation</td>
</tr>
<tr>
<td>GoK</td>
<td>Government of Kenya</td>
</tr>
<tr>
<td>KENGEN</td>
<td>Kenya Electricity Generating Company</td>
</tr>
<tr>
<td>KPLC</td>
<td>Kenya Power and Lighting Company</td>
</tr>
<tr>
<td>KV</td>
<td>Kilovolts</td>
</tr>
<tr>
<td>KW</td>
<td>Kilowatt</td>
</tr>
<tr>
<td>KWh</td>
<td>Kilowatt hour</td>
</tr>
<tr>
<td>MCC</td>
<td>Mombasa City Council</td>
</tr>
<tr>
<td>MLS</td>
<td>Ministry of Lands and Settlement</td>
</tr>
<tr>
<td>MoA</td>
<td>Ministry of Agriculture</td>
</tr>
<tr>
<td>MoF</td>
<td>Ministry of Finance</td>
</tr>
<tr>
<td>MTC</td>
<td>Ministry of Transport and Communication</td>
</tr>
<tr>
<td>MVA</td>
<td>Mega Volt Amperes</td>
</tr>
<tr>
<td>MRPWH</td>
<td>Ministry of Roads, Public Works and Housing</td>
</tr>
<tr>
<td>NCC</td>
<td>Nairobi City Council</td>
</tr>
<tr>
<td>NEAP</td>
<td>National Environment Action Plan</td>
</tr>
<tr>
<td>NEMA</td>
<td>National Environment Management Authority</td>
</tr>
<tr>
<td>OP</td>
<td>Operational Policies of World Bank</td>
</tr>
<tr>
<td>PRSP</td>
<td>Poverty Reduction Strategy Paper</td>
</tr>
<tr>
<td>REF</td>
<td>Rural Electrification Fund</td>
</tr>
<tr>
<td>WB</td>
<td>World Bank</td>
</tr>
</tbody>
</table>
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Figure 1: Electricity Utility Network – High Voltage Lines

Figure 2: Electricity Utility Network – Low Voltage Lines
1.0 INTRODUCTION

1.1 Background

Kenya is located in Eastern Africa astride the Equator between 5 degrees North and 5.5 degrees South. It has a total land area of 582,684 sq km. It obtained its independence from Britain in 1963. Administratively, Kenya is divided into 8 provinces that include Nairobi, Coast, Rift Valley, Western, Nyanza, Central, Eastern, and North Eastern) the Capital City. The provinces are in turn divided into districts, divisions, locations and sub-locations, each of the administrative unit headed by a government official who reports to the Minister of Internal Security within the Office of the President. Kenya has a multi-party parliamentary system with elected members of parliament representing constituencies that are generally based on population and ethnic distribution. The country is currently reviewing its constitution with the objective of having a new constitution by the end of the current government term in 2007.

Kenya's economy is predominantly agricultural with over 80% of its population of about 30.5 million people, living and earning their livelihoods in rural areas and engaged in subsistence agricultural activities. Although agriculture plays a critical role in the economic growth and development of the country, its overall contribution to the Gross Domestic Product (GDP) has progressively declined from 37% in the early 1970's to about 25% by the end of 2000 (Table 1). Among the reasons that have contributed to this declining growth have been declining farm sizes arising from rapid population growth (2.4 per annum), declining use of appropriate technology, unreliable rainfall, limited access to credit, poor market access and bad governance of the economy. It is also worth noting that most of Kenya's land (80%) is categorized as arid or semi arid areas (ASAL).

Kenya's energy sector is dominated by imported petroleum used mainly in the modern sector, and wood fuel which is largely used by rural communities, the urban poor and in the informal sector. In terms of energy supply, wood fuel provides about 68% of the total energy requirements, petroleum energy 20%, electricity 9% and other sources account for the remaining 3% (NDP, 2002-2008). Commercial energy consumption is also dominated by petroleum (70%), followed by electricity and coal accounting for the remaining total of 30% (ES, 2003).

Electricity in Kenya is produced from hydro, thermal and geothermal sources. Installed capacity and generation of electricity is shown in Table 1. The total installed capacity was at 1,155 MW in 2003. Total electricity generation however increased substantially in 2003 by at least 5.2% due to heavy rains during the preceding year that boosted hydro-generation.
Table 1: Installed Capacity and Generation of Electricity, 1998-2003

<table>
<thead>
<tr>
<th>Year</th>
<th>Hydro</th>
<th>Thermal</th>
<th>Geothermal</th>
<th>Total</th>
<th>Hydro</th>
<th>Thermal*</th>
<th>Geothermal</th>
<th>Wind</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1998</td>
<td>594.5</td>
<td>217.2</td>
<td>45.0</td>
<td>856.7</td>
<td>3497.6</td>
<td>672.2</td>
<td>386.6</td>
<td>0.2</td>
<td>4558.6</td>
</tr>
<tr>
<td>1999</td>
<td>594.5</td>
<td>290.7</td>
<td>45.0</td>
<td>930.2</td>
<td>3062.5</td>
<td>1136.1</td>
<td>383.0</td>
<td>0.2</td>
<td>4581.8</td>
</tr>
<tr>
<td>2000</td>
<td>674.5</td>
<td>427.9</td>
<td>57.0</td>
<td>1159.4</td>
<td>1793.8</td>
<td>2017.8</td>
<td>367.1</td>
<td>0.2</td>
<td>4178.9</td>
</tr>
<tr>
<td>2001</td>
<td>677.2</td>
<td>408.0</td>
<td>57.0</td>
<td>1142.2</td>
<td>2031.0</td>
<td>1965.4</td>
<td>455.6</td>
<td>0.1</td>
<td>4452.1</td>
</tr>
<tr>
<td>2002</td>
<td>677.2</td>
<td>408.0</td>
<td>57.0</td>
<td>1142.2</td>
<td>3070.9</td>
<td>1167.3</td>
<td>447.2</td>
<td>0.2</td>
<td>4685.6</td>
</tr>
<tr>
<td>2003</td>
<td>680.0</td>
<td>416.0</td>
<td>59.0</td>
<td>1155.0</td>
<td>4110.8</td>
<td>1867.30</td>
<td>455.6</td>
<td>0.3</td>
<td>6434.0</td>
</tr>
</tbody>
</table>

Total from: KenGen and IPP (independent Power Producers)

Table 2: Electric Energy Supply and Demand Balance, 1998-2003 (Million KWh)

<table>
<thead>
<tr>
<th>Demand</th>
<th>1998</th>
<th>1999</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic and Small Commercial</td>
<td>1212.6</td>
<td>1256.8</td>
<td>1,065.6</td>
<td>1,132.8</td>
<td>1,262.9</td>
<td>1,393.0</td>
</tr>
<tr>
<td>Large and Medium</td>
<td>2137.3</td>
<td>2180.8</td>
<td>2,061.8</td>
<td>2,167.5</td>
<td>2,777.9</td>
<td>3,388.3</td>
</tr>
<tr>
<td>Off-Peak</td>
<td>86.7</td>
<td>84.9</td>
<td>59.8</td>
<td>54.0</td>
<td>60.5</td>
<td>62.5</td>
</tr>
<tr>
<td>Street-Lighting</td>
<td>10.1</td>
<td>10.7</td>
<td>8.8</td>
<td>6.5</td>
<td>6.4</td>
<td>6.9</td>
</tr>
<tr>
<td>Rural Electrification</td>
<td>155.1</td>
<td>152.0</td>
<td>124.7</td>
<td>129.0</td>
<td>1,34.3</td>
<td>1,39.2</td>
</tr>
<tr>
<td>Total</td>
<td>3601.8</td>
<td>3685.2</td>
<td>3,320.7</td>
<td>3,489.8</td>
<td>3,742.0</td>
<td>3,994.2</td>
</tr>
<tr>
<td>Transmission losses</td>
<td>956.8</td>
<td>896.6</td>
<td>858.2</td>
<td>962.3</td>
<td>943.6</td>
<td>940.5</td>
</tr>
<tr>
<td>Imports from Uganda</td>
<td>138.9</td>
<td>149.6</td>
<td>220.5</td>
<td>113.7</td>
<td>238.4</td>
<td>363.1</td>
</tr>
<tr>
<td>Net generation</td>
<td>4419.7</td>
<td>4432.2</td>
<td>3,958.4</td>
<td>4,338.4</td>
<td>4,447.2</td>
<td>4,556.0</td>
</tr>
</tbody>
</table>

The overall demand for electricity has continued to increase as evidenced from the above tables. Demand by all categories has increased. Large commercial and industrial consumers continued to be the main users of electrical energy. Imports from Uganda have continued to increase after an agreement between KPLC and Uganda electricity Transmission Company (UETC) was signed. Power losses remain a big challenge to the energy sector as it accounts for over 20% of total generation.

Kenya’s power sector is managed by two separate entities, one for generation and another for transmission and distribution. The Kenya Electricity Generation Company Ltd.
(Kengen) is responsible for almost 80 percent of the electricity generated in Kenya, and has a total installed capacity of 950MW with 677MW hydro. The Kenya Power and Lighting Company (KPLC) is responsible for electricity supply through Power Purchase Agreements (PPA) from Kengen and a number of Independent Power Producers (IPPs), the latter with total installed capacity of 187MW.

The output from these plants is transmitted and distributed by the use of the following facilities owned and operated by KPLC. Transmission is effected through 941km of 220kV line to be increased by 360km upon commissioning of Olkaria II to Nairobi; 110km double circuit line and 140 km Kiambere-Nairobi line, and 2,035km of 132kV transmission lines; 580km of 66 kV sub-transmission lines; 58km of 40kV, 5,430km of 33kV and 13,879km of 11kV distribution lines. The corresponding substation transformer capacities are 2,462MVA for 220/132/66/33kV; 1,259MVA for 66/33/11kV distribution. The distribution transformer capacity (33/ 4kV and 11/ 4kV) in total is 2,546MVA, and is recorded to have increased at the compounded annual growth rate of 4.1% over the last five years ending 30 June 2003.

Total sales were 3,801GWh, with simultaneous peak demand of 786MW. The total losses as percent of net generation during the last six years (1997/98 through 2002/03) were 18.6%, 19.2%, 21.5%, 21.3%, 20.5% and 20.0% respectively. Initial steps in procuring metering for the segregation of losses between transmission and distribution systems have been taken.

Number of customers has, as at 30 June 2003, increased to 643,274, including 87,175 Rural Electrification Fund customers. This corresponds to an average increase of 6% during the last five years. Out of the total of 593,621 customers, the number of domestic customers is 430,580. This is an average annual increase of 6% during the last five years. Access to electricity stands at 9.5%. The high connection fees and relatively high tariff levels constrain access to the urban poor and are known barriers to the Poverty Reduction Strategy. A separate program funded in part by the Rural Electricity Fund (REF) is being implemented to provide wider access to electricity by the rural population.

The tables below give a summary of the average annual growth in the electricity power sector over the past five years between 1997/98 to 2002/2003.

Table 3: Regional Total Number of Customers

<table>
<thead>
<tr>
<th>AREA</th>
<th>1998</th>
<th>1999</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>Avg. Annual Growth over the last 5 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nairobi</td>
<td>221,603</td>
<td>230,074</td>
<td>250,533</td>
<td>270,580</td>
<td>286,004</td>
<td>308,056</td>
<td>6%</td>
</tr>
<tr>
<td>Coast</td>
<td>66,678</td>
<td>67,815</td>
<td>68,230</td>
<td>71,153</td>
<td>74,659</td>
<td>81,138</td>
<td>4%</td>
</tr>
<tr>
<td>Central Rift</td>
<td>29,733</td>
<td>32,059</td>
<td>35,048</td>
<td>37,066</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>West Kenya</td>
<td>32,399</td>
<td>33,268</td>
<td>34,667</td>
<td>35,858</td>
<td>98,112</td>
<td>106,438</td>
<td>26%</td>
</tr>
</tbody>
</table>
### Table 4: Transmission and Distribution Lines: Circuit Length (kms)

<table>
<thead>
<tr>
<th>VOLTAGE</th>
<th>AS AT 30TH JUNE</th>
<th>Avg. Annual Growth over the last 5 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>220kV</td>
<td>877 877 877 885 941 941</td>
<td></td>
</tr>
<tr>
<td>132kV</td>
<td>1,997 1,997 1,997 2,032 2,032 2,035</td>
<td></td>
</tr>
<tr>
<td>66kV</td>
<td>574 574 576 580 580 580</td>
<td></td>
</tr>
<tr>
<td>40kV</td>
<td>126 126 126 126 58 58</td>
<td></td>
</tr>
<tr>
<td>33kV</td>
<td>4,203 4,516 4,639 4,795 5,265 5,430</td>
<td></td>
</tr>
<tr>
<td>11kV</td>
<td>9,671 10,029 10,397 10,593 13,788 13,897</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>17,448 18,120 18,612 19,011 22,664 22,923</td>
<td>4.8%</td>
</tr>
<tr>
<td>% Increase P.A</td>
<td>1.0% 3.8% 2.7% 2.1% 19.2% 1.1%</td>
<td></td>
</tr>
</tbody>
</table>


1.2 Distribution Component

The distribution component of the Power Sector Recovery Project is designed to reduce losses in the distribution system, improve quality of electricity supply and increase access to electricity, and has the objectives outlined below.

(i) Reduction of the non-technical losses at the annual rate of one percent through effective inspection, and targeted improvement in collection rates;
(ii) Increasing access to electricity by accelerating connection rates and introducing a customer-friendly connection policy;

(iii) Improving system reliability and performance by replacing obsolete protection gear, installing auto-reclosers and auto load-break switches and sectionalizers in the distribution system;

(iv) Installing metering systems to segregate transmission and distribution losses.

1.3 Description of the Proposed Component

KPLC’s Proposal has identified priority programs for the reinforcement and upgrade of the transmission and distribution systems. These are grouped as follows:

1.3.1 Nairobi Area.

Table 5: Description of Proposed Component in Nairobi

<table>
<thead>
<tr>
<th>Group</th>
<th>New Line Routes &amp; Substation Sites</th>
<th>Distribution Systems Reinforcement and Upgrade</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Location</td>
<td>Description</td>
</tr>
<tr>
<td></td>
<td>Nairobi North</td>
<td>- Construction of 75 km of 66 kV new line route from Nairobi North</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Construction of 12.5 km of new lines</td>
</tr>
<tr>
<td></td>
<td>Athi River Quarries</td>
<td>Installing one (1). New 66/11 kV substation</td>
</tr>
<tr>
<td></td>
<td>Nairobi South</td>
<td>Reinforcement of 11 kV feeders through reconductoring a total of 57 km existing lines</td>
</tr>
<tr>
<td></td>
<td>Ngong Road</td>
<td>Installing one (1). New 66/11 kV substation</td>
</tr>
<tr>
<td></td>
<td>Ruaraka</td>
<td>Reinforcement of substation by replacing 35 panel 11 kV switchboard, modifying existing 66 kV busbar arrangement and installing 12 new 66 kV switch gear units</td>
</tr>
<tr>
<td></td>
<td>Karen</td>
<td>Reinforcement of substation by replacing 31 panel 11 kV switchgear board.</td>
</tr>
<tr>
<td></td>
<td>Karen substation</td>
<td>Replacing fault thrower switch with 66 kV circuit breaker</td>
</tr>
<tr>
<td></td>
<td>Westlands</td>
<td>Installing one (1). new 66/11 kV substation</td>
</tr>
</tbody>
</table>

5
<table>
<thead>
<tr>
<th>Location</th>
<th>Work Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thika Replacing fault thrower substation switch with 66 kV circuit breaker</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Limuru Replacing fault thrower substation switch with 66 kV circuit breaker</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Athi Replacing fault thrower substation switch with 66 kV circuit breaker</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Airport Replacing fault thrower substation switch with 66 kV circuit breaker</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Gigiri Installing one (1) new 66/11 kV substation</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Jeevanjee Upgrading 66/11 kV substation from 46 MVA to 90 MVA</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Donholm Replacement of 6 panel, 11 kV switchboard at Donholm switching station</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Cathedral to Nairobi West -Replacement of 3.7 km 66 kV cable</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>- Retrofit 11 kV metal clad, switchgear with SF6 circuit breakers</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>2B</td>
<td>Eastleigh Feeder from Parklands Construct new 2.8 km 11 kV line and reconductor 3.1 km 11 kV</td>
<td>- Installation of energy meters on 11 kV and 33 kV distribution feeders</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Replacement of 5,000 electromechanical phase energy meters with electronic ones</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Installation of Disaster Recovery Server</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Replacement of 33 kV oil circuit breakers with SF6 units</td>
</tr>
<tr>
<td>Embakasi Substation</td>
<td>Installing static var compensators</td>
<td>- Upgrade the SCADA system and replace related old and obsolete equipment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Carry out reinforcement of the Low Voltage Network by reconductoring and installing additional distribution transformers as required for the rationalization of the network supply coverage</td>
</tr>
<tr>
<td>All Areas</td>
<td></td>
<td>- Replace existing 11kV metalclad indoor oil circuit breakers (35 incomers, 17 bussections, 142 feeders and 93 metering) with more reliable vacuum or SF6 units</td>
</tr>
<tr>
<td>Kirinyaga Rd/Ngara Area</td>
<td>Establishment of one (1) New 66/11 kV substation</td>
<td>Cathedral/Ruaraka Refreshment of substation</td>
</tr>
<tr>
<td>Group</td>
<td>Location</td>
<td>New Line Routes &amp; Substation Sites</td>
</tr>
<tr>
<td>-------</td>
<td>----------</td>
<td>-----------------------------------</td>
</tr>
<tr>
<td>Kanamai/Watamu</td>
<td>Installation of new 33/11 kV substations (1 x 7.5MVA) Construct 6km of 33kV overhead lines</td>
<td>Location</td>
</tr>
<tr>
<td>Likoni</td>
<td>Reinforcement and upgrading the 33/11 kV substation from 8 MVA to 15 MVA.</td>
<td></td>
</tr>
<tr>
<td>Island</td>
<td>Installing one (1). New 33/11 kV substation (1 x 23MVA)</td>
<td></td>
</tr>
<tr>
<td>New Bamburi</td>
<td>Upgrading 1 No. 132/33kV substation from 45 MVA to 68 MVA</td>
<td></td>
</tr>
<tr>
<td>Kenya Petroleum Refineries (KPR)</td>
<td>Installing of 2 x 33kV circuit breakers Installing of 1 x 7.5MVA 33/11kV transformer</td>
<td>KPR</td>
</tr>
<tr>
<td>Mariakani</td>
<td>Installing one (1). new 7.5 MVA 33/11 kV substation</td>
<td>Kipevu</td>
</tr>
</tbody>
</table>

### 1.3.2 Coastal Area

**Table 6: Description of Proposed Component in Coast Region**

<table>
<thead>
<tr>
<th>Group</th>
<th>Location</th>
<th>Description</th>
<th>Location</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Kanamai/Watamu</td>
<td>Installation of new 33/11 kV substations (1 x 7.5MVA) Construct 6km of 33kV overhead lines</td>
<td>Likoni</td>
<td>Reinforcement and upgrading the 33/11 kV substation from 8 MVA to 15 MVA.</td>
</tr>
<tr>
<td>1</td>
<td>Island</td>
<td>Installing one (1). New 33/11 kV substation (1 x 23MVA)</td>
<td>New Bamburi</td>
<td>Upgrading 1 No. 132/33kV substation from 45 MVA to 68 MVA</td>
</tr>
<tr>
<td>2A</td>
<td>Kenya Petroleum Refineries (KPR)</td>
<td>Installing of 2 x 33kV circuit breakers Installing of 1 x 7.5MVA 33/11kV transformer</td>
<td>KPR</td>
<td>Replacing obsolete 7-panel 11 kV switchboard</td>
</tr>
<tr>
<td>2A</td>
<td>Mariakani</td>
<td>Installing one (1). new 7.5 MVA 33/11 kV substation</td>
<td>Kipevu</td>
<td>Replacing 33kV switchgear with an indoor 34 panel switchboard</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>2B</td>
<td>Voi</td>
<td>Diani</td>
<td>Upgrade 33/11kV substation from 15MVA to 23MVA</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Voi</td>
<td>Upgrading 132/33 kV substation from 5MVA to 10 MVA</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Rabai Substation</td>
<td>All Areas</td>
<td>- Installation of energy meters on 11 kV and 33 kV distribution feeders</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Replacement of 5,000 electromechanical 3 phase energy meters with electronic ones</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Installation of Disaster Recovery Server</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Replacement of 33 kV oil circuit breakers with SF6 units</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Kiambeni</td>
<td>All Areas</td>
<td>Installing a new 33/11kV substation</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Reconductor a total of 8km 33kV line to 300AAA conductor</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Galu</td>
<td>All Areas</td>
<td>Upgrade 33/11kV to 1 x 1.75MVA</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>All Areas</td>
<td>- Upgrade the SCADA system and replace related old and obsolete equipment</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Carry out reinforcement of the Low Voltage Network by reconductoring and installing additional distribution transformers as required for the rationalization of the network supply coverage</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>All Areas</td>
<td>Replace existing 11kV metalclad indoor oil circuit breakers (35 incomers, 17 bussections, 142 feeders and 93 metering) with more reliable vacuum or SF6 units</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Malindi</td>
<td>All Areas</td>
<td>Reconductor 15km overhead line feeders</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bamburi</td>
<td>All Areas</td>
<td>Reconductor 6km overhead line feeders</td>
<td></td>
</tr>
</tbody>
</table>
### Kwale
- Construction of 3km of 11kV overhead lines
- Reconductor 10km overhead line feeders

<table>
<thead>
<tr>
<th>Shanzu</th>
<th>Uprate 33/11 kV substation by replacing the existing transformer with 2 x 23MVA units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kipevu</td>
<td>Uprate 33/11 kV substation by replacing the existing transformer with 2 x 23MVA units</td>
</tr>
<tr>
<td>Miritini</td>
<td>- Uprate 33/11 kV substation by replacing the existing transformer with 7.5MVA unit</td>
</tr>
<tr>
<td></td>
<td>- Replace 3 obsolete auto recloser units</td>
</tr>
</tbody>
</table>

### Western Area

#### Table 7: Description of Proposed Component in Western Region

<table>
<thead>
<tr>
<th>Group</th>
<th>New Line Routes &amp; Substation Sites</th>
<th>Distribution Systems Reinforcement and Upgrade</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Location</td>
<td>Description</td>
</tr>
<tr>
<td>2B</td>
<td>Location</td>
<td>Description</td>
</tr>
<tr>
<td></td>
<td>Description</td>
<td>Location</td>
</tr>
<tr>
<td></td>
<td>Description</td>
<td>Description</td>
</tr>
<tr>
<td>3</td>
<td>Butere</td>
<td>Establish a new 2.5MVA, 33/11kV substation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Construct 10km of 33kv overhead lines</td>
</tr>
<tr>
<td></td>
<td>All Areas</td>
<td>- Installation of energy meters on 11 kV and 33 kV distribution feeders</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Replacement of 5,000 electromechanical 3 phase energy meters with electronic ones</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Installation of Disaster</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Recovery Server</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Replacement of 33 kV oil circuit breakers with SF6 units</td>
</tr>
<tr>
<td></td>
<td>Lessos</td>
<td>- Uprate 132/33kV substation by replacing existing unit with 23MVA unit and installing additional 23MVA unit</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Upgrade the SCADA system and replace</td>
</tr>
<tr>
<td></td>
<td>Location</td>
<td>Activity</td>
</tr>
<tr>
<td>---</td>
<td>----------</td>
<td>----------</td>
</tr>
<tr>
<td>4</td>
<td>All Areas</td>
<td>- Carry out reinforcement of the Low Voltage Network by reconductoring and installing additional distribution transformers as required for the rationalization of the network supply coverage</td>
</tr>
<tr>
<td>5</td>
<td>Makutano</td>
<td>Establishment of a new 23MVA 132/33kV substation</td>
</tr>
<tr>
<td></td>
<td>Cherangany</td>
<td>Establishment of a new 2.5MVA 33/11kV substation</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sondu, Cherangany, Eldama Ravine</td>
<td>Construction of 26km 33kV overhead lines</td>
</tr>
<tr>
<td></td>
<td>Various substations</td>
<td>Install 34MVA, 11kV shunt capacitors</td>
</tr>
</tbody>
</table>
### 1.3.4 Mt Kenya Region

Table 8: Description of Proposed Component in Mt. Kenya region

<table>
<thead>
<tr>
<th>Group</th>
<th>New Line Routes &amp; Substation Sites</th>
<th>Distribution Systems Reinforcement and Upgrade</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Location</td>
<td>Description</td>
</tr>
<tr>
<td>3</td>
<td>All Areas</td>
<td>- Installation of energy meters on 11 kV and 33 kV distribution feeders</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Replacement of 5,000 electromechanical 3 phase energy meters with electronic ones</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Installation of Disaster Recovery Server</td>
</tr>
<tr>
<td>4</td>
<td>All Areas</td>
<td>- Upgrade the SCADA system and replace related old and obsolete equipment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Carry out reinforcement of the Low Voltage Network by reconductoring and installing additional distribution transformers as required for the rationalization of the network supply coverage</td>
</tr>
<tr>
<td>5</td>
<td>All Areas</td>
<td>Replace existing 11kV metalclad indoor oil circuit breakers (35 incomers, 17 bussections, 142 feeders and 93 metering) with more reliable vacuum or SF6 units</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tana Embu area</td>
<td>Reconductor 30km of 33kV overhead lines</td>
</tr>
</tbody>
</table>
1.4 Construction Activities

1.4.4 Substations

There are different sizes of substations that will be constructed or upgraded. These substations will require different land sizes and equipment. The land sizes required are:

- 132/33 kV substation - 2 acres
- 66/11 kV substation - 1 acre (minimum 0.5 acre)
- 33/11 kV substation - 0.5 acres

The equipment in the substation will include transformers, bus bars, circuit breakers, isolators and switchgears.

The large transformers are shipped in with the main core and windings separated from the radiators and the cooling fans. The equipment is transported sealed and filled with nitrogen gas to preserve the transformer core and windings. The transformer assembly is done at the site when the gas is released and the assembled unit filled with oil.

Apart from the shipment of the equipment into the substation, most of the work takes place within the fenced substation compound with minimal interference from the local population.

The substations are designed such that any oil spills from the large transformer is contained within the containment pit.

Transformers are static equipment with no moving parts, with the exception of tap changing gear for voltage regulation and the cooling fans for forced air cooling in the large transformers.

The substations are fenced off using chain link or stone walling of two metres high with anti climbing barbed wire at the top and a high metal gate with a security lock to prevent any intruders accessing the substation’s live equipment there in.

The work in new substations will include the civil works namely the removal of the topsoil and filling with hardcore material before preparing the transformer plinth and the foundation for equipment bases. The fencing is usually done to secure the compound prior to the commencement of the construction works.

1.4.2 Power Lines

Most of the 66KV power lines are constructed on wooden poles although there is the tendency to install underground systems in crowded parts of the City and at the approach and entry into the sub-stations.

The wayleaves for the overhead powerlines is 5 meters on each side from the center of the poles.
Most of the overhead power networks at 11KV, 33KV and 66KV are constructed on treated wooden poles. The poles are treated with creosote, which is a petrol-chemical product. The use of wooden poles has been discouraged in certain quarters due to the depletion of the forests. Consequently the use of steel poles, towers and concrete poles is to be encouraged.

1.4.3 Objectives of the Environmental Impact Assessment

The Government of the Republic of Kenya represented by the Ministry of Energy intends to conduct an Environmental and Social Assessment (ESA) of the proposed project which has been classified as Category B. The main objective of the ESA is to assess potential environmental (socio-economic, cultural heritage and biophysical) impacts of the Distribution Component of the Power Sector Recovery Project, evaluate alternatives if any, and design appropriate mitigation, management and monitoring measures. This assignment shall be conducted in accordance with the World Bank guidelines.

The specific objectives include:

- Identification of potential environmental impacts and risks in the project's intervention zone;
- Assessment of potential social issues and impacts related to project's activities;
- Indicating ways, in which potential adverse environmental and social impacts, if any, can be avoided, minimized, mitigated or compensated;
- Formulation of environmental management and monitoring plans of the two project components taking into consideration the reviewed environmental policy framework and guidelines;
- Assess government and implementing agencies' capacity to manage project's environmental and social issues and provide measures on how to reinforce them.

1.4.4 Methodology

The initial step of the Environmental and Social Impact Assessment was done through review of the relevant documents on the regulations and guidelines relating to EIA. These included the various relevant WB operational policies, the GoK policy documents such as EMCA and NEAP as well as other relevant EIA references. Field visits were then made to all actual and potential physical sites of the project components, during which brief and quick on the spot consultations were made with stakeholders and local people who are likely to be affected by the project at the various sites. Data was collected from various sites and an analysis on the biophysical and social cultural environment was done.
2.0 BASELINE DATA

2.1 Introduction

This chapter discusses the various baseline environmental characteristics observed in the target areas earmarked for the new line routes, substation sites and transformer stations. The environmental characteristics discussed have been categorized under physical, biological and social and cultural environments. In physical environment, the site features of the targeted areas assessed include topography, geology, climate, meteorology and hydrology while biological environment covered mainly flora types and diversity as well as any endangered species and sensitive habitats. The social and cultural environment, issues that have been addressed include population, land use, planned development activities, cultural properties, etc. Meanwhile, the target sites have been grouped into three broad geographical areas of Nairobi, Western and Coast for ease of description and analysis as presented in the succeeding sections of the report.

2.2 Nairobi Area

Nairobi is situated quite close to the Equator and its altitude is about 5,500 feet (1700m). The main features of the climate are the existence of definite wet and dry seasons, and the absence of any large seasonal change in temperature. In a year there are four seasons as follows:

- Mid December – Mid March: warm, sunny and dry
- Mid March – Mid May: main rainy season
- June – Mid October: cool, rather cloudy and dry
- Mid October – Mid December: secondary rainy season.

In line with Kenya Power and Lighting Company’s Proposal that has identified priority program’s for the reinforcement and upgrade of the transmission and distribution systems, major components within Nairobi that have been assessed are as follows:

- Upgrading of Jevanjee 66/11 kV substation from 46 MVA to 90 MVA
- Installation of 69 MVA new 66/11 kV substation at Gigiri
- Installation of 69 MVA new 66/11 kV substation at Westlands
- Installation of 66/11 kV substation along Ngong Road (2x23 MVA)
- Installation of 66/11 kV substation at Athi River Quarries (1x23 MVA)
- Construction of a total of 75 km of 66 kV lines from Nairobi North

The environmental characteristics of the pre-project situation for the above mentioned places are presented below.

2.2.1 Jevanjee Substation

*Physical Environment*

Jevanjee substation is situated within the Central Business District (CBD) of the City of Nairobi. The substation site is enclosed by building walls from all sides with an exception of a high double steel gate facing Racecourse Road. Although the gate seemed to have
been intended for use as exit and entry point to the substation, it is presently not in use. Instead, the site is accessed from behind i.e. from the side facing Kenya Bus Central Station through a building. The general topography of the site is endemic of South East Nairobi which is fairly flat and lies at an altitude of about 1660 m above sea level.

**Biological Environment**

The substation is located within the heart of the city of Nairobi, and as such has no flora or fauna of any type. This is corroborated by the fact that the whole ground area at the site where present transformers are installed is made of concrete.

**Social and Cultural Environment**

The current substation is within a densely populated section of the city of Nairobi. However, the pattern of the population within the area is quite variable. During daytime, the population peaks with small-scale traders selling merchandise along Race Course Road as well as corridors between the building walls that enclose the site. At night, the population is near zero as most of the traders close businesses and depart for their homes in various estates within the city. This trend is bound to continue in the foreseeable future with a likelihood of more people joining the sector and thereby pushing up the population within the vicinity of the substation site.

Apart from the small-scale traders, no other development activities have been planned for the areas around the site as they are officially designated as road reserves and matatu terminus according to plans by Nairobi City Council who are stakeholders in the City Planning.

2.2.2 Site for New Gigiri Substation

**Physical Environment**

The current site for the proposed new Gigiri 66/11 kV Substation is located next to Nairobi City Council Gigiri Water Pumping Station on the North Western Suburbs of Nairobi at 1° South latitude and 36° 48’ East longitude. A part from maize crop that stands on the site plot presently, there is no other development on the land. The area has red volcanic soil and receives an annual rainfall of 1400 mm that occurs during the long and short rainy seasons of March to May and October to December respectively. The topography of the site is characterized by a ridge and valley landscape with steep slopes rising to an altitude of about 1700 m above the sea level.

**Biological Environment**

Apart from the maize crop on the proposed site plot, there are tick berry plants along the perimeter fence separating the Gigiri Water Pumping Station and the earmarked plot for the substation.

**Social and Cultural Environment**

As at present, the proposed site for the new substation is right in the middle of an up market residential area. The remaining undeveloped plots within the area are suitable for
putting up more residential houses and community facilities such as schools. It is highly likely that more residential buildings will be put up on the remaining undeveloped plots within the area due to pressure of increasing population within the City of Nairobi. Other than residential buildings, no major development activities are likely to occur within the surrounding vicinity of the proposed site for the substation.

2.2.3 Site for the New Westlands Sub Station

Physical Environment

The proposed site for the new Westlands Sub Station lies within Westlands Suburbs of Nairobi at approximate distance of about 7 km from the City Centre. This is an area which was originally a residential district but is fast becoming a commercial centre with emergence of various kinds of business activities around. The general climatic conditions of the area do not vary greatly with that of Nairobi although the altitude at approximately 1680 m above the sea level is higher than that of the South Eastern areas of Nairobi. Temperatures at the site are within the normal range of Nairobi City i.e. around 17°C during the months of July and August to about 20°C in March. The site plot on a hilly ridge has an old residential house that is not currently inhabited standing on it. The site area is about 0.5 ha and is owned by KPLC.

Biological Environment

The floral life present at the site includes umbrella and jacaranda trees, tick berry and unattended flower beds with various species of flowers. The existing floral life at the site obviously provides habitats for different types of animals including birds, insects etc.

Social and Cultural Environment

The neighbourhood of the earmarked site for the new substation comprise developed residential buildings already occupied, recently developed residential buildings yet to be fully occupied and undeveloped plots. From the foregoing, the area is generally a residential district with no foreseeable change in land use apart from construction of more residential houses on the undeveloped plots.

2.2.4 Site for the New Ngong Road Sub Station

Physical Environment

Although the exact area along Ngong Road for the planned substation is yet to be identified, it is generally agreed that the area will be within a distance of 1 km from either side of Uchumi Hyper Market situated along Ngong Road. The total area for the substation site is expected to be about 0.5 ha. Presently, the search for the plot for the envisaged substation along Ngong Road is ongoing. Geographically, Ngong Road lies on the South Western side of Nairobi at an altitude of about 1670 m above the sea level with a mean annual rainfall of about 1300mm. Temperatures of the area are within the normal range of Nairobi i.e. around 17°C during the months of July and August to about 20°C in March. The area has many buildings both residential and commercial. There is heavy traffic along Ngong road and it is normally congested during morning and late afternoon hours as people go to work and come from work.
Biological Environment

The biological environment along Ngong Road in terms of flora types and diversity, endangered species and sensitive habitats is less pronounced compared to that of the proposed site for the New Westlands Substation. This is attributable to intense human economic activity that has taken place along the road. This has been manifested in the form of buildings both commercial and residential as well as institutional that have been constructed along side the road. Presently, only few scattered trees and grass are found on the remaining road reserve that has been spared construction.

Social and Cultural Environment

As already mentioned, the area around Ngong Road has seen rapid development in commercial activities in the recent past. This trend is likely to continue with more businesses relocating from the City Centre to this area and the outlying suburbs. With the increase in commercial activities, the likelihood of construction of more residential houses along Ngong Road may not take place. However, the emergence of small-scale kiosks along the road will continue as it provides strategic customer base for the business people.

2.2.5 75 km of New 66 kV Lines from Nairobi North

Physical Environment

While the Sub Station is called Nairobi North, it is actually located in Kiambu District about 6 km from Karuri Township. It is a relatively new sub station having been commissioned in 2003. It lies on the Northern side of Nairobi City at an altitude of about 1800 m above the sea level. The site is characterized by red volcanic soil suitable for growth of coffee, maize and other horticultural crops. Two lines of 220 kV from Juja and Olkaria via steel pylons/towers supply the substation. The area is a high potential zone and receives an annual average rainfall of about 1600 mm. Temperatures are relatively low for most parts of the year and averages about 15°C. The topography consist of ridges and valley landscape with steep slopes. Meanwhile, the 220 kV supplied to the substation is stepped down to 66 kV that is proposed to further supply the existing Kikuyu Sub Station (SS), Kileleshwa SS, Karen SS and Kitisuru SS, proposed Gigiri SS, Westlands SS and Ngong Rd SS. The total length of the 66 kV feeder lines to all these substations is 75 km.

Biological Environment

The proposed 75 km of the 66 kV distribution line shall criss-cross an expansive agricultural farmland. This land has trees such as eucalyptus, field crops including coffee, maize, forage as well as buildings on it.

Social and Cultural Environment

This is a densely populated area that has increasingly had commercial and social interaction with the city of Nairobi. It is mainly a residential area with a few primary schools and churches.
2.2.6 Site for the New Athi River Quarries Sub Station

Physical Environment

The proposed site for the new substation is located within Athi Plains in the South Eastern side of the City of Nairobi. It is approximately 50 km from Nairobi and 10 km from the main Nairobi - Mombasa road turn off at Mlolongo Trading Centre. The area is generally flat and lies at an altitude of about 1500 m above the sea level. Soil type is black cotton/heavy clay that sticks during rainy season while dusty during dry weather conditions. The area experiences two marked seasons i.e. dry season that occurs from mid December to mid March and wet season between mid March to May. During the dry season, temperatures soar to as high as 35°C with strong easterly winds raising clouds of dust. The situation changes during the wet season when the heavy clay soil become sticky and inhibits accessibility in and out of the area.

Biological Environment

The area is a typical arid and semi arid land (ASAL). The vegetation is characterized by savannah grassland with scattered stunted thorn trees. This type of vegetation is unknown for providing habitat for any endangered species. However, the main activity that is sustained currently on the land is pastoralism although its future is becoming increasingly threatened as more and more settlements are springing up on the land.

Social and Cultural Environment

Although the land is increasingly being exploited through quarrying and construction of residential houses, it has been a traditional grazing field for the Maasai pastoralists. However, with the current rate of development taking place, it is highly unlikely that it will continue to offer pasture to the pastoralists Maasai community. In this regard, the pastoralist will be pushed out of the area as more and more land becomes private property. The consequence of this will be reduced grazing area for the pastoralist and a subsequent reduction in the number of herds of cattle owned which literally translates to reduced wealth or income for the Maasai people.

2.3 Western Area

Topography

The region has a varying topography with a few hills and valley dissected by a number of small streams. It has an extensive undulating peneplain that dips southwards from about 1,641m to 1500 m above sea level and to a further 1,250m to the west. The lowest part of the region stands at about 1,240 m above sea level.

Climate

The region has high rainfall almost all year round however this is less in intensity between December and February. The annual rainfall ranges from 1,597 to 2,873mm per year. This enables farmers to have two cropping seasons. The mean temperatures range between 29.8°C and 13.9°C.
**Socio-economic**

The region has very high population density of over 546 persons per square kilometer. Settlement patterns in the region are determined by several factors which include the fertility of soils, availability of productive resources such land etc.

The major food crops are maize, beans, sweet potatoes, cassava and sorghum, while the major cash crops are sugarcane, sunflower, tea and coffee.

Proposed line routes, substation sites and transformer stations assessed within Western Area include the following:

- Upgrading of 33/11 kV substation at Sondu by Installing Additional 2.5 MVA Transformer and Overhead Lines
- Reconductoring 11 kV Overhead Lines in Miwani Area
- Establishment of a New 2.5 MVA, 33/11 kV Substation at Butere and Construction of 10 km of 33 kV Overhead Lines
- Establishment of a New 2.5 MVA, 33/11 kV Substation at Cherangany and 33 kV Overhead Lines
- Establishment of a New 23 MVA 132/33 kV Substation at Makutano
- Construction of 33 kV Overhead Lines in Eldama Ravine Areas

The current environmental characteristics of the above pre-project situation are presented below.

**2.3.1 Sondu Substation**

*Physical Environment*

The present 33/11 kV substation to be upgraded via installation of additional. 2.5 MVA transformer and overhead Lines is located within Sondu Township at the border of Nyando/Kericho/Rachuonyo Districts. The township is situated on a relatively gentle stretch of land overlooking Nyabondo Plateau to the North West and Belgut Hills to the North East at an altitude of about 1835 m above the sea level. It receives an annual rainfall of 1630 mm that is distributed in two long and short rainy seasons occurring between April and May and August and September respectively. Temperatures are moderate and vary from 18°C to 25°C. The endemic loam soil coupled with adequate rainfall of the place support the growth of various crops including maize, beans, bananas, sugar cane and coffee on small-scale basis.

*Biological Environment*

The floral life at Sondu Township and its environs comprises mainly of field crops and exotic trees. Specifically, the field crops that are easily noticeable as one approaches the Township include bananas, maize and sugar cane. Meanwhile, the exotic tree species present include eucalyptus and cypress. In addition to these is grass that provides pasture for the livestock kept by the community surrounding the Township.
Social and Cultural Environment

The current site for the existing 33/11 kV substation is within one end of an open field used as cattle market on a specified day of the week as well as playing ground for the rest of the days. The plot on which the existing substation stands has an area of about 35m². Since Sondu Township falls on the boundary of Nyando and Kericho Districts, the land on which the cattle market/playing ground stands is jointly owned by the two county councils of Nyando and Kericho.

2.3.2 Miwani Substation

Physical Environment

Miwani substation is located next to Miwani Sugar Company within the vast Kano plains. The site has poorly drained black cotton soils that are generally deep and firm. This type of soil is characteristic of the entire Kano plains. Due to its poor drainage ability, the area is prone to frequent flooding immediately after heavy downpours. The altitude at the site is about 1,144 m above the sea level with a mean annual maximum temperature range from 25°C to 30°C. Meanwhile, the area receives a mean annual rainfall of about 1,290 mm.

Biological Environment

Miwani is generally a sugar growing area. In this respect, the surrounding flora is typical sugar cane with some food crops such as maize, beans, bananas and millet grown in between the sugar cane plantations on subsistence level. Some scattered eucalyptus trees are also found within the vicinity especially around institutions like schools and the sugar factory. Alongside swamps that are found within the area are aquatic plants and reeds. Nevertheless, none among these floral life within Miwani area provide habitat to any endangered species.

Social and Cultural Environment

The planned reconductoring of the existing line will essentially involve replacement of the current 25 mm wire with 75 mm wire but over the same path. It therefore follows that the reconductoring process will not result in any disruption to the population living around the present existing line routes. Neither will the process cause a change in the current system of land use as the existing line has its designated path quite distinct from other community development activities. Sample interviews conducted with some community members in soliciting for their views about the planned reconductoring, revealed that they viewed the process positively. Specifically, they expressed their full support for the process noting that it would end the persistent power fluctuations experienced.

2.3.3 New Substation at Butere Township

Physical Environment

Although actual site for the new substation planned for Butere Township has not yet been identified, it is generally believed that it would be around the site where the present transformer is located. The Township is situated at an altitude of around 1860 m above the sea level and receives a mean annual rainfall of 1900 mm. Temperature vary from 18°C to
24°C for most parts of the year. Coupled to these, the area has fertile red volcanic soils that support growth of sugar cane, maize, beans, bananas and various kinds of fruits and vegetables.

**Biological Environment**

Being a sugar-growing zone, the dominant flora in the area is sugar cane. However, other forms of flora found within the Township include eucalyptus and cypress trees, food crops such as maize, beans, bananas and vegetables.

**Social and Cultural Environment**

Butere is a typical rural township with a main market center comprising mainly of shops. There are government offices as well as other commercial organizations in the town. The areas surrounding the town are not crowded. There is sufficient land between the dwelling units.

2.3.4 New Substation at Cherangany

**Physical Environment**

A site for the new earmarked substation has already been bought and fenced off. In addition, a concrete slab for mounting the yet to be acquired 2.5 MVA transformer has already been built at the acquired site. The substation site has an area of about 0.5 ha and is located 13 km from Kitale Town at an altitude of between 1800 – 1890 m above the sea level. The site is situated on the slopes of Cherangany Hills, a high potential area that receives abundant rainfall of about 2000 mm annually. Moreover, the fertile red volcanic soil of the area combined with the adequate amount of rainfall has enhanced the growth of maize on large-scale basis within Cherangany area.

**Biological Environment**

Cherangany area is a traditional maize growing zone. Owing to this, the most conspicuous floral life is maize crop. However, other crops such as bananas, beans, etc are also grown but on a very small scale compared to maize. Also, within the area are planted trees which are found mainly around homesteads leaving large swathes of land for maize cultivation. Thus, the area has been predominantly used for agricultural crop production.

**Social and Cultural Environment**

The main activity in Cherangany area is maize farming. Most of the land area is therefore devoted to farming activities. In between the expansive maize farms are homesteads, and communal institutions such as market centers and schools.

2.3.5 New Substation at Makutano Township

**Physical Environment**

Makutano Township is located 40 km South West of Nakuru Town along the Nakuru – Eldoret Highway. The Township lies at the summit of the Mau escarpment and experiences cool temperatures of between 15°C and 23°C for most parts of the year.
the township, the undulating landscape gives way to the plains as one approaches Nakuru Town. Although the site for the proposed substation is yet to be identified, it is generally believed that it would be at a suitable site within the spacious Township as the current existing transformer site is very close to the road and neighbouring buildings to accommodate a large 132/33 kV substation. Meanwhile, the area has a characteristic red volcanic soil on which commercial wood trees are grown.

**Biological Environment**

Makutano area provides ideal agronomical conditions for commercial wood growing. As such, the floral life consists mainly of commercially planted trees and other food crops that are grown at subsistence level.

**Social and Cultural Environment**

Makutano Township is a typical rural township that is growing rapidly. The center is quite active with various traders operating from the shops there. There are a number of dwelling unit that are very well spaced out.

2.3.6 **Construction of 33 kV Overhead Lines in Eldama Ravine Areas**

**Physical Environment**

Eldama Ravine Township is located 17 km North of Makutano Township. As the name suggests, the Township lies within a ravine and is surrounded by forested hills all round. It receives an annual rainfall averaging between 1400 mm and 1650 mm with temperatures of about 26°C for most parts of the year. The soils in the area are mainly clay loam though some loamy soils are also found in certain sections.

**Biological Environment**

The general floral life in the area surrounding the Eldama Ravine Township consists mainly of planted forest. Within the Township, however, there are few scattered trees that are found in between the buildings. Some food crops like maize, beans and vegetables are also found in the small-cultivated gardens neighbouring residential buildings within Township.

**Social and Cultural Environment**

There are a few scattered homesteads in the general area within farmlands. The area is sparsely populated between Makutano and Maji Mazuri and between maji Mazuri and Eldama Ravine. Maji Mazuri is a small commercial center along the route of the overhead lines. The power line will mainly be on the road reserve. There are many trees along the route.
2.4 Coastal Area

Topography

The coastal plain lies below 30m above sea level with a few prominent peaks on the Western boundary. Across this plain runs several creeks and the estuaries of River Sabaki, resulting in excellent marine and estuarine swamps. These swamps are endowed with mangrove forests and presents great potential for marine culture.

To the west of the coastal plain lies a foot plateau which has undulating terrain. The plateau falls between 60m and 135m altitude and slopes towards the sea. The surface is traversed by a number of dry weather courses with underlying Jurassic sediments consisting of shells, sandstones and clays. In this zone grassland and stunted vegetation prevail.

Occupying the lower-lying ground along the western side of the region, is the Nyika Plateau. The plateau is sparsely populated and is covered by thin vegetation, shallow depressions and gently undulating terrain. This is an arid and semi-arid zone which is not suitable for rain-fed crop farming but mainly suited for livestock farming.

Climate

The average annual rainfall ranges from 400mm in the hinterland to 1,200mm at the coastal belt. The region has two main rainfall seasons in a year. The long rains start from April to June, with a peak in May while the short rains fall from October to December. The two seasons are more prominent in the south. In the hinterland or rangelands zone where rainfall is very unreliable, the seasonality is barely noticeable.

The annual mean minimum temperatures range between 22.5°C and 24.5°C in the months of April, May and June. The maximum temperatures vary between 26°C and 30°C in the coastal belt. Maximum temperatures in the hinterland ranges between 30°C and 34°C. The region is generally hot and humid all the year round with average relative humidity of 60% along the coastal belt.

Social-economic

The most important resources in the region are land and aquatic resources. Much of the economic activities of the people in the region are related to agriculture, livestock production and fisheries. Due to the long coastline tourism is flourishing and provides employment both directly and indirectly. Agriculture is the major economic activity and engages over 70% of the labour force.

The majority of those involved in agriculture and livestock production maintain small scale farms mainly for subsistence although a number of medium scale farmers are moving into commercial production. The predominant food crop is maize, followed by cowpeas and cassava. Coconut and cashewnut are the major cash crops. Others include mangoes, citrus fruits, pineapples and bananas.
2.4.1 Kipevu substation

Brief Description

This is an existing substation located to the West of the Mombasa Island next to the Kengen Power Plant. The substation is to be upgraded by replacing the existing 2 x 7.5 MVA transformers with 2 x 2.3 MVA units as well as replacing the outdoor 33 kv switchgear with indoor panels. These panels will be housed in the neighbouring Kengen building

Biophysical Environment

The substation is bordered by Kengen Offices, fuel tanks, bush thicket, a cliff to the ocean and KPLC offices buildings. There is a steep hill within the compound dividing the station into two namely: sea level (33/11 Km and hill top (132/33). The station is properly fenced and well protected. Most of the ground is paved with either tarmac or concrete. There is grass in the adjacent areas as well as a few trees within the compound.

Social-cultural Environment

The area around the substation is purely an industrial area. There are numerous employees of Kengen in the area. KPLC staff are not stationed at the site as the substation is monitored remotely from the Rabai station

2.4.2 Mariakani Substation

Brief Description

This is a proposed substation to be located within the compound of Mabati Rolling Mills in Mariakani, approximately 30 kilometres from Mombasa. The firm has agreed to give KPLC about 0.5 acres of land for this substation. They have done this willingly as they also expect to benefit from it.

Physical Environment

The land is flat and mainly covered by grass. It is currently used by staff to store seedlings for trees that they plant within the factory compound. There are a few housing units opposite as well as adjacent to the factory premises. The factory is just off the main Nairobi - Mombasa highway.

Social Cultural Environment

The area opposite the site is mainly residential. Those living in this area are employed in various places in the surrounding area. There is a school adjacent to the factory compound.

2.4.3 Island Substation

Brief Description

This is a proposed 33/11 kV substation to be located in Tudor, Mombasa.
Biophysical Environment

The land is flat, covered by grass and there are a few trees at the edge. The site is adjacent to the playground of Bahari Preparatory School. The surrounding area is mainly residential with a few shops. There is a temporary structure next to the site which serves as a food kiosk.

Social-cultural Environment

This is mainly a residential area with a school and shops in the surrounding area. The people residing in this area mainly work in the city center.

2.4.4 New Bamburi Substation

Brief Description

The substation is expected to be upgraded from 45 MVA to 68 MVA and reconductoring of 6 km overhead line feeders in the area will be undertaken. Additional 33kv lies from the station to the existing line will also be effected.

Biophysical Environment

This is an existing substation located about 20 km north of Mombasa Island. The surrounding area is a vast expanse of land with an abandoned quarry and thick vegetated area on one side. There is an upcoming residential estate about 1 km from the substation. The other residential dwellings are scattered at considerable distances from the substation.

Social Cultural Environment

The area is relatively uninhabited. There are a number of dwelling units a considerable distance away.

2.4.5 Kiembeni Substation

This is a proposed 33/11kV substation to be located within the compound of New Bamburi Substation. The description is as in 2.4.2 above.

2.4.6 Watamu Substation

Brief Description

This is a proposed 33/11kV substation located in Watamu, approximately 10 kilometers South of Malindi.

Biophysical

The land has a very gentle slope and the ground is very rocky. The client purchased this land a while back and it is now overgrown with shrubs. There are a number of trees in the surrounding compounds including coconuts and paw-paws.
Social-cultural
This site is in a residential area. The houses are within 20 metres of the fence on three sides. It is off the main road and is opposite some houses and a sports centre.

2.4.7 Kanamai Substation

Brief Description
This is a proposed 33/11kV substation. The client has not yet obtained land for this proposed substation. The preferred location is at a centre called Majengo, which is about 1 kilometre from Umoja Rubber Factory off the Malindi road.

Biophysical Environment
There is a pole mounted transformer at the preferred site. There are hardware shops adjacent to the transformer. There are shops and a farm on the opposite side of the road. There are stalks of harvested cassava in the farm.

Social Cultural Environment
Majengo is a busy centre with many residential houses and hotels. The main activities in the area are trading in different commodities including foodstuff and hardware.

2.4.8 Overhead Lines in Kwale

Brief Description
The existing lines pass through a forested section that is inaccessible to vehicles. It is proposed to relocate 3 km of this line to the road reserve. This section is close to the Diani substation in Diani. This substation feeds Kwale, Diani and Tiwi.

Biophysical Environment
There are a number of dwelling units nearer the main road but very few in the interior. There are wild animals in the forested area and the maintenance crew usually have to be escorted by game rangers when servicing the lines.

Social-cultural Environment
The area is mainly residential nearer the main road. The area about 3km from the main road is not inhabited.

2.4.9 Likoni Substation

Brief Description
This is an existing substation located in Likoni area less than 1 kilometer from the ferry crossing point.
Biophysical Environment

There are residential houses and shops adjacent to the compound of the substation. The land is flat and there are trees and grass in the compound adjacent to the substation. The station is properly fenced and well protected. There is grass in the adjacent areas as well as a few trees within the compound.

Social-cultural

It is located in a densely populated area and is surrounded by housing units. There are 2 staff KPLC quarters next to the station. People in the area have encroached on the wayleaves and have built their houses under existing power lines.

2.5 Mt. Kenya

Topography

The topography of the region is greatly influenced by the volcanic activity of Mt. Kenya. Numerous rivers which originate from Mt. Kenya Forest traverse the region and flow eastward as tributaries of Tana River which discharges into the Indian Ocean.

The altitude ranges from 5,200 m at the peak of Mt. Kenya to about 300 m in the dry lowlands of Tharaka divisions. A few isolated hills exist.

Climate

The region has a bi-modal rainfall pattern with the rains falling during the months of March to May and October to December with the highest precipitation being received in the latter months. The annual rainfall ranges from 2000 m in the Chogoria forest to below 700mm in the lower areas.

Temperatures are cool, moderate and hot for the highland, middle and lowland areas respectively. The temperature ranges between 17°C –14°C in the highland and 21°C –27°C in the lowland areas.

Socio-economic

Agriculture and livestock are the two major resources currently being exploited. The major food crops are maize, millet, sorghum, beans and cowpeas. The major cash crops are coffee, tea, cotton and tobacco.
<table>
<thead>
<tr>
<th>Project Site</th>
<th>Environment</th>
<th>Social - cultural</th>
</tr>
</thead>
</table>
| Jevanjee Substation | • Within the Central Business District (CBD) of the city of Nairobi  
• Surrounded by tall buildings  
• The topography is fairly flat and lies at an altitude of about 1660 m above the sea level  
• Has red volcanic soils  
• Annual rainfall of 1400mm occurs during the short and rainy the rainy seasons  
• Topography characterized by a ridge and valley landscape with steep slopes rising to an altitude of 1700m above the sea level. | • In a densely populated area with variable population pattern reaching peak during the day with small scale traders.  
• The area surrounding the site is designated as a matatu terminus. |
| New Gigiri          | • Located next to Nairobi City Council Gigiri Water pumping station at 1° South latitude and 36° 48’ East longitude.  
• Has red volcanic soils  
• Annual rainfall of 1400mm occurs during the short and rainy the rainy seasons  
• Topography characterized by a ridge and valley landscape with steep slopes rising to an altitude of 1700m above the sea level. | • The proposed site is in the middle of an upmarket residential area. |
| New Westlands       | • Lies within the Westlands suburbs of Nairobi about 7 kilometres from the town centre  
• The floral life present includes umbrella and jacaranda trees, tickberry | • The neighborhood comprise of residential houses already occupied. |
<table>
<thead>
<tr>
<th>Area</th>
<th>Details</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Ngong Road</td>
<td>- Along the busy Ngong road&lt;br&gt;- The area is expected to be about 0.5 ha&lt;br&gt;- Lies within the South Western side of Nairobi at an altitude of 1670m above the sea level and a mean annual rainfall of about 1300mm. Temperatures range between 17°C - 20°C&lt;br&gt;- There are many buildings both residential and commercial</td>
<td>- Grass and few scattered trees are found within the proposed site&lt;br&gt;- No endangered species of flora, fauna or habitats.&lt;br&gt;- Commercial activities taking place close to the site since there are many commercial buildings.&lt;br&gt;- The site holds no significant archeological, customary or traditional value due to its commercial and residential significance.</td>
</tr>
<tr>
<td>Nairobi North</td>
<td>- Located in Kiambu District about 6km from Karuri Township&lt;br&gt;- Lies on the Northern side of Nairobi City at an altitude of 1800 m above the sea level&lt;br&gt;- Characterised by red volcanic soil.</td>
<td>- Expansive agricultural farmland.&lt;br&gt;- Present are trees such as eucalyptus.&lt;br&gt;- The part of the proposed line will pass through a rural setting.&lt;br&gt;- The lines will pass through homes causing demolition and resettlement of people.</td>
</tr>
</tbody>
</table>
soils suitable for growth of coffee, maize and horticultural crops
- Annual rainfall is of about 1600mm and temperature averages 15\(^\circ\)C
- Topography consists of ridges and valley landscapes with steep slopes.

| New Athi River Quarries substation | Located within plains in the South Eastern side of the city of Nairobi. It is approximately 50km from Nairobi and 10 km from the main Nairobi – Mombasa road turn off at Mlolongo Trading Centre | The area is a typical arid and semi arid land (ASAL) and the vegetation is characterized by Savannah vegetation with scattered stunted thorn trees
- Vegetation is unknown for providing endangered species | The area is exploited for quarrying activities and construction of residential houses.
- The area is a traditional grazing land for the Maasai pastoralists |

| Miwani | Next to Miwani Sugar Company
- Flat topography
- Poorly drained cotton soils, hence constant flooding
- Altitude is about 1,144 m above the sea level
- Mean annual temperature range | Sugarcane is the main crop grown also maize, beans, bananas and millet
- Eucalyptus trees that are scattered are in the vicinity.
- Aquatic plants and reeds are found in the swampy | Population is sparsely distributed |

**Western Kenya**

- Mean annual temperature range
<table>
<thead>
<tr>
<th>Sondu</th>
<th>Cherangany</th>
</tr>
</thead>
</table>
| * Situated within Sondu township at the border of Nyando/Kericho/Rachuonyo districts*  
  * Situated on a relatively gentle stretch overlooking Nyabondo plateau to the North West and Belgut Hills to the North East at an altitude of about 1850m.*  
  * Receives an annual rainfall of 1630 mm with temperatures ranging from 18°C to 25°C*  
  * Field crops such as bananas, maize and sugarcane are grown*  
  * Exotic trees including eucalyptus and cypress*  
  * Site within a field used as market place on specified days and playing ground for children.*  
| * Occupies an area of 0.5 ha*  
  * Is located 13 km from Kitale Town*  
  * Located at an altitude of between 1800-1890m above sea level*  
  * Situated on the slopes of Cherangani Hills*  
  * Receives rainfall of 2000 mm annually*  
  * Has fertile red volcanic soils*  
  * It's a maize growing zone*  
  * Bananas and beans are also grown*  
  * Trees are planted around homesteads*  
  * No endangered species available due to agricultural crop production*  
  * Maize farming is the main activity in the area*  
  * Homesteads and communal institutions are between maize farms*  
  * The area is cosmopolitan*  

*Mean annual rainfall is about 1290 mm*

*Cherangany*
<table>
<thead>
<tr>
<th>Location</th>
<th>Characteristics</th>
<th>Additional Information</th>
</tr>
</thead>
</table>
| **Makutano**      | - Located along Nakuru - Eldoret Highway  
- Lies at the summit of Mau escarpment  
- Experiences cool temperatures of between 15°C and 23°C  
- Has red volcanic soils  
- Commercial wood trees are grown | - There is fast growth of the population                          |
| **Eldama Ravine** | - Located 17 km North of Makutano township  
- The township lies within a ravine  
- Receives an annual rainfall of between 1400 mm and 1650 mm  
- Experiences temperatures of about 26°C on average  
- Has clay loam soils | - Floral life consists of planted forests  
- Scattered trees are found in between the buildings  
- Food crops e.g. maize, beans and vegetables are cultivated in small scale | - Area is sparsely populated  
- There would be no cultural interference arising from the change in the land use system |
| **Coastal Area**  |                                                                                                     |                                                                   |
| **Mariakani**     | - Located within Kilifi district  
- Soils are well developed on fine sand stones and siltstones and | - Land covered with grass  
- Site currently used to store seedlings for planting | - There are people residing in the area working in various places |

32
<table>
<thead>
<tr>
<th>Island</th>
<th></th>
<th>Island</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Located in Tudor area within Mombasa city</td>
<td>• There are a few trees</td>
<td>• There are people residing in the area adjacent to the site</td>
</tr>
<tr>
<td>• The average annual rainfall is about 1200mm with temperature ranges of 24°C – 33°C and an altitude of about 57m.</td>
<td>• Land is covered by grass</td>
<td>• Adjacent is a playing ground for Bahari preparatory School</td>
</tr>
<tr>
<td>• Land is flat</td>
<td></td>
<td>• Commercial activities take place close to the area i.e. trading</td>
</tr>
<tr>
<td>• There are residential and commercial houses constructed near the site</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Annual average rainfall is about 850mm with temperature ranges of about 24°C – 28°C and an altitude of about 400m above the sea level
- Proposed site is within the compound of Mabati Rolling Mills approximately 30 km from Mombasa
- Land is flat
- There are a few housing units opposite as well as adjacent to the factory premises
- Near the main Nairobi-Mombasa highway
- There is a school in the vicinity
- Land is covered by grass
<table>
<thead>
<tr>
<th>Area</th>
<th>Description</th>
<th>Vegetation</th>
<th>Uninhabited Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kipevu</td>
<td>Located West of Mombasa Island next to the Kengen Power Plant.</td>
<td>There are bush thicket.</td>
<td>The area is purely industrial with numerous Kengen employees</td>
</tr>
<tr>
<td></td>
<td>Bordered by Kengen offices, fuel tanks before a cliff to the ocean and KPLC offices buildings.</td>
<td>There is grass in the adjacent area and a few trees within the compound</td>
<td></td>
</tr>
<tr>
<td>New Bamburi</td>
<td>There is an existing substation 20 km North of Mombasa island</td>
<td>Thick vegetated.</td>
<td>The area is uninhabited and there are scattered dwelling units but a distance from the station</td>
</tr>
<tr>
<td></td>
<td>The average annual rainfall is about 1200mm with temperature ranges of 24°C – 33°C and an altitude of about 57m.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>There is a vast land with an abandoned quarry</td>
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<tr>
<td></td>
<td>There are scattered residential buildings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kiembeni</td>
<td>Within the compound of New Bamburi substation</td>
<td>Thick vegetated.</td>
<td>The area is uninhabited and there are scattered dwelling units but a distance from the station</td>
</tr>
<tr>
<td></td>
<td>The average annual rainfall is about 1200mm with temperature ranges of 24°C – 33°C and an altitude of about 57m.</td>
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<tr>
<td></td>
<td>There is an existing substation 20 km North of Mombasa Island</td>
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<tr>
<td>Location</td>
<td>Description</td>
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</tbody>
</table>
| Watamu            | - Located 10 km South of Malindi  
- There are scattered residential buildings. The average annual rainfall is about 1100mm with temperature ranges of 23°C - 33°C and an altitude of about 67m.  
- Land is gently sloping and rocky  
- There are residential buildings close to the site | - There are shrubs growing in the area  
- There are a number of trees growing in the compound including coconuts and paw paws                                                                 | - There are people residing in the area                                                                                                                                                                      |
| Kanamai           | - Located within Kilifi district  
- The average annual rainfall is about 1200mm with temperature ranges of 22°C - 30°C and an altitude of about 120m.  
- There are pole mounted transformers in the proposed site  
- Commercial buildings are close to the site | - Cassava grown in the adjacent farms                                                                                                                                                                           | - The site is within a trading centre where there are also residential houses                                                                                                                                 |
| Kwale overhead power lines | - Dominated by a land of about 35 km from the sea to the hinterland  
- The average annual rainfall is                                                                                                                                                                           | - Lines pass through forested area  
- There are wild animals in the forested area                                                                                                                                                                | - Residential houses are constructed near the main road  
- An area of about 3 km                                                                                                                                                                                    |
about 800mm with an average altitude of about 24°C – 28°C and an altitude of about 420m above the sea level

- There are residential houses near the main road

| Likoni     | The land is fairly flat
|            | There are residential and commercial buildings
|            | Trees and grass are growing in the compound adjacent to the substation
|            | The site is within the densely populated area surrounded by several housing units
|            | People have encroached the wayleaves and have built houses under the existing powerlines

from the main road is inhabited
3.0 LEGISLATIVE AND REGULATORY FRAMEWORK

3.1 Introduction

The Environmental Management and Co-ordination Act, 1999, is the legislation that governs Environmental Impact Assessment (EIA) studies. The distribution component of the Power Sector Recovery Project is required to undergo an EIA as per the second schedule of the Act. This schedule lists the projects required to undergo EIA studies in accordance with section 58(1-4) of the act. Electrical infrastructure is covered in part 10 of this schedule and this includes electricity generation stations; electrical transmission lines; electrical sub-stations; and pumped storage schemes.

The Act provides for the National Environmental Management Authority (NEMA) whose object and purpose is to exercise general supervision and coordination over all matters relating to the environment and to be the principal instrument of the Government in the implementation of all policies relating to the environment. The Act also provides for the establishment of a committee of the Authority known as the National Environment Action Plan committee that will be required to prepare a National Environment Action Plan (NEAP) every five years for consideration and adoption by the National Assembly section 38 of the Act states that NEAP will among others set out operational guidelines for the integration of standards of environmental protection into development planning and management.

With the introduction of the Environmental Impact Assessment and Audit Regulations, 2003 issued through Kenya Gazette Supplement No. 56 of 13 June 2003, the submission of environmental reports became mandatory. According to these regulations no proponent shall implement a project likely to have a negative environmental impact or for which an environmental impact assessment is required under the act or these regulators unless an environmental impact assessment has been concluded and approved in accordance with these regulators.

As NEMA is still relatively new, it sets up technical advisory committees to advise it on environmental impact assessment related reports. The mandate of approval rests with NEMA

3.2 Overview of World Bank Policies

This EIA study is also based on the following World Bank Operational Policies (OP) and Bank Procedures (BP) Environmental Assessment - BP4.01 and OP4.01(January 1999). Requires environmental assessment of projects proposed for World Bank financing to help ensure that they are environmentally sound and sustainable and thus improve decision making. The EA evaluates a project potential environmental risks and impacts in its area of influence; examines project alternatives; identifies ways of improving project selection siting, planning, design and implementation by preventing, minimizing, mitigating or compensating for adverse environmental impacts and enhancing positive impacts.

There are four categories of projects depending on the type, location, sensitivity and scale of the project and the nature and magnitude of its potential environmental impact. The power
sector Recovery Project is classified under category B as its potential impacts are considered not to be adverse; They are site specific and few if any are irreversible. In most cases mitigatory measures can be readily designed.

3.2.1 Natural Habitats - OP 4.04 (June 2001)

Requires a precautionary approach to natural resource management to ensure opportunities for environmentally sustainable development. This would include identification of natural habitat issues as special needs for natural habitat conservation, including the degree of threat to identified natural habitats (particularly critical natural habitats) and measures for protecting such areas in the context of the country’s development strategy.

3.2.2 Cultural Property OP 4.11 (August 1999)

The policy regarding cultural properties is to assist in their preservation, and to seek to avoid their elimination. The United Nations term “cultural property” includes sites having archaeological (prehistoric), paleontological, historical, religious and unique natural values. Cultural property therefore encompasses both remains left by previous human inhabitants (e.g. shrines) and unique natural environmental features (e.g. Waterfalls).

3.2.3 Environmental Assessment - BP 4.01 (January 1999)

Provides a summary of WB procedures relating to EA. These are environmental screening, EA preparation, Review and disclosure, Project Appraisal, Documentation, Supervision and Evaluation and the role of the Banks Environment.

3.2.4 Involuntary Resettlement Instruments – OP 4.12

Provides the element of a resettlement plan where a proposed project leads to the displacement of people. Gives an outline of such a plan and the specific issues to be considered including the proposed resettlement and its impacts on the displaced persons and other adversely affected groups and the legal issues involved in resettlement.

3.2.5 Forests – OP. 4.36

The policy provides guidelines for assessment of projects that have or may have impacts on health and quality of forests or those that affect the rights and welfare of people who depend on or interact with forests. It also discusses projects that bring about changes in the management, protection, or utilization of natural forests or plantation, whether they are publicly, privately or communally owned.
4.0 ENVIRONMENTAL AND SOCIAL SAFE GUARD ISSUES

Kenya’s three main sources of energy are woodfuel, petroleum and electricity accounting for 90, 21 and 9 per cent respectively of all the energy consumed in the country. While the demand for electricity is high and has continued to grow electricity supply is lacking in most rural areas and market centers while in urban areas there is inadequate and unreliable supply (PRSP, 2001). The government is committed to the reforms in the power sector that would ensure a reliable supply of electricity at competitive tariffs through the expansion of the Rural Electrification Programme. (ERSWEC, 2003)

The increased provision of electricity has implication to the environment and social concerns, whose impact must be assessed and incorporated in project planning and implementation. The following safeguard issues have been observed in each of the project sites.

4.1 Jevanjee Substation

Environmental (Biophysical)

The physical environment of this substation is characterized by many buildings all around the site and the electric cables are underground below concrete slabs. The areas around the site are officially designated as road reserves and matatu terminus by the Nairobi City Council. The site has no floral life or neither does it have any fauna that would require an assessment of the impact of the proposed project on the (natural) habitat.

Social – cultural Environment

This site has a transitory and very variable population because it is a business area where mainly hawkers sell their merchandise during the day and leave the area at dusk. The upgrading of the current 66/11 kV substation from 46 MVA to 90 MVA will therefore not disrupt the social and economic activities of the small-scale traders operating within the surrounding environment. However, public safety measures must be put in place to ensure that the upgrading of the station does not pose increased danger to the public, notably access to the equipment should be possible only to authorised KPLC personnel. There will be no land use change.

4.2 New Gigiri Substation

Environmental (Biophysical)

The proposed site for this substation is a piece of land about 0.5 acre that is surrounded by residential homes with modern buildings although the particular plot has a maize crop but there is no other development on the land. The construction of the substation may interrupt or interfere with the peace of the neighboring homes for the duration of the work. The site has no other vegetation There are a few birds and insects.
Since the suburb where the site is located is essentially a residential district with modern buildings already in place, there is remote possibility of a current existing natural or sensitive habitat for any species of animals, trees, insects e.t.c.

**Social – cultural Environment**

The installation of a new substation at Gigiri will require an addition 0.5 acres of land, which will have to be purchased for the site, and the owner, compensated.

Because of its location within the upmarket and growing residential area of Gigiri, the substation will lead to a minor congestion in the area but at the same time will enable area residents to have an increased and more stable supply of electricity. Community facilities such as schools, churches and shopping centers will benefit from the new substation. This may however lead to increased population density and crowding which is socially undesirable. The site has no archeological or unique natural values neither does it have any natural habitats that might need preservation and protection.

### 4.3 New Ngong Road Substation

**Environmental (Biophysical)**

The exact site (one acre) for this new substation has yet to be identified. However, the general area is very busy and quite congested with both residential and increasingly, commercial buildings. Ngong road normally has heavy vehicle traffic during the morning and afternoon hours as people go to and from work. There are no empty or undeveloped plots of land along Ngong road and as such any piece if land purchased for the proposed substation will almost certainly have to be converted from an existing use. Only a few scattered trees and grass can be seen along Ngong road on the road reserves which may not provide habitats to any endangered species.. There is therefore no biophysical attribute of the proposed area that would require the assessment of items of natural value.

Public safety measures will need to be put in place. Fencing of the area using chain link or stone walling of 2m high with barbed wire on top to prevent climbing as well as high metal gate with security.

**Social – cultural Environment**

The installation of the substation will require the purchase of one acre of land and the compensation of the owner.

There is intense and increasing human activity along Ngong road ranging from vehicular and human traffic to construction of business premises. There are a number of residential apartments as well as church buildings and social facilities like hotels and nigh clubs. Due to its commercial significance, the proposed site may not hold any archeological, customary and traditional relevance to the active business community operating along side it.
4.4 New Westlands Substation

Environmental (Biophysical)

The plot earmarked for this substation site is on an area of about 0.5 ha with an old unoccupied residential house. The plot has umbrella trees, jacaranda trees and various kinds of flowers. These may provide a habitat for birds and insects and possibly some crawling animals but these are not critical natural habitats. None of these animals are endangered species whose existence will be greatly affected by intended activities to be undertaken at the site during construction of the substation. The construction of the new substation will therefore not lead to any significant conversion of the natural habitat from what it is now. However, the public safety issues described in 3.3.1 above also apply here.

Social – cultural Environment

The Westlands substation will be built on a piece of land that has no cultural or social value. There are no special groups or structures on the proposed site that would require further assessment. The old house belongs to the client, KPLC. In addition, being a cosmopolitan area, there are no indigenous people who may lay historical or traditional attachment to the land that the intended development is bound to interfere with.

4.5 Construction of 75km of 66kV Lines from Nairobi North

Environmental (Biophysical)

There will be distribution lines totaling 75km in length from an existing substation to various other substations in the north of Nairobi. There will be need for further or additional clearance of whatever lies on the identified route of the distribution lines. This land has trees such as eucalyptus, field crops including coffee, maize, forage as well as buildings on it. Whereas the crops and trees are not known to provide habitat for any endangered species now, the removal or cutting down of trees especially the eucalyptus along the proposed lines routes is likely to disturb the birds habitat provided by the trees. Nevertheless, the impact of the disturbance may be considered minor.

Social – cultural Environment

Over 80% of the 75km length of line will run along the road reserve. Only a small portion will pass through the peoples land and homes. These specific routes have not yet been decided on. It is however inevitable, given the available options, that some temporary structures will have to be demolished. Those affected will have to be resettled or compensated. This is bound to interfere with the social aspects of the family.
4.6 New Athi River Quarries Substation

*Environmental (Biophysical)*

This is an open plain with savannah type of the vegetation and short tree shrubs. There are no rare or endangered species of floral or faunal nature inhabiting the area.

*Social – cultural Environment*

This area has traditionally been used as free grazing area for Maasai pastoralists for their cattle. There are no historical / architectural / archaeological sites neither is there any known ecological or geological value inherent in the project area. The specific site when developed will limit/modify the grazing land of the pastoralists but with little or no impact to them because there is available alternative grazing land for them.

4.7 Sondu Substation

*Environmental (Biophysical)*

The upgrading of this substation by installation of a new transformer will be done on existing facility and will therefore not affect the bio-physical environment in any way.

*Social – cultural Environment*

Installation of additional transformer alongside the current one at the same site is not likely to interfere with the current social activities owing to the insignificant additional area that may be used up. A brief consultation with two members of the township during the site visit also confirmed that acquisition of the additional small area for the new transformer would not hinder their cattle trade and sports activities in any way. Moreover, they were more optimistic that the additional transformer would stabilize their power supply and minimize the black outs that were common in the area. Regarding culture, the two community members felt that the Township is cosmopolitan and that no particular tribe had vested interests in land use or development other than that prescribed by the County Councils owning it.

4.8 Miwani Substation

*Environmental (Biophysical)*

The bio-physical environment will not be affected by the reconductoring of the existing line, which essentially involves the replacement of existing wires over the same path as exists now.

*Social – cultural Environment*

The planned reconductoring of the existing line will essentially involve replacement of the current 25 mm wire with 75 mm wire but over the same path. It therefore follows that the reconductoring process will not result in any disruption to the population living around the
present existing line routes. Neither will the process cause a change in the current system of land use as the existing line has its designated path quite distinct from other community development activities. Sample interviews conducted with some community members in soliciting for their views about the planned reconductoring, revealed that they viewed the process positively. Specifically, they expressed their full support for the process noting that it would end the persistent power fluctuations experienced.

4.9 New Substation at Butere Township

*Environmental (Biophysical)*

Although the specific site has not been identified yet, the general location of the substation in this township will not in any visible way affect the bio-physical environment. However, owing to the existing human settlement that has been in place in the area for considerable period of time, the possibility of the present flora-providing habitat for any endangered species is unlikely.

*Social – cultural Environment*

The establishment of the envisaged substation in Butere Township may not adversely contribute to change in any form of land use or development earmarked for the Township. However, construction of the 10 km of 33 kV overhead lines may likely contribute to some changes in land use. In particular, these changes may occur in the form of farmers giving up some strips of land where the overhead line routes will pass. Whereas the affected farmers in most cases do not completely stop using the land as they can still cultivate it, major development on the land such as buildings are essentially not allowed along the overhead line route. This was the general fear expressed by an interviewee met during the field visit to the site.

4.10 New Substation at Cherangany

*Environmental (Biophysical)*

The biophysical environment will not be affected in any adverse way because it is already predominantly used in a maize growing area and is not a habitat for any known endangered species.

*Social – cultural Environment*

The use of land for the existing agricultural activities is likely to be affected, to small extent, by the establishment of a new substation and overhead lines as the lines will transect mostly the expansive farmlands. The land for the new substation has already been purchased and preliminary work, that is fencing and laying the foundation plinth for the transformer, has already been done. Holes for the poles that will bring in the power lines have been dug in the land opposite the site. Thus, since farming activities under the line paths are not restricted, farmers will continue growing as before. Additionally, the area is cosmopolitan consisting of
people from different communities without common tribal and cultural land attachments to proposed line routes.

4.11 New Substation at Makutano

*Environmental (Biophysical)*

The Biophysical environment will have to be screened once the site is acquired. The general indications in the area are that construction of the new substation will involve clearing of some trees that do not provide habitat for endangered species. In addition, public safety measures, as described in 3.3.1 will have to be incorporated.

*Social – cultural Environment*

Arising from consultations held with some Makutano Township Community Members regarding the proposed new substation, there was general consensus that the station was long overdue. Most of the members expressed their wish to get power into their buildings which however had not been possible owing to the low capacity of the existing transformer. Considering the fast growth in the population of the Township, they felt that it was only through the establishment of a new substation that the members could be assured of electricity. In general, they observed that putting up of the new substation would result in more thriving small-scale business and general fast economic growth of the Township.

Despite these sentiments, there will be need to purchase 2 acres of land for the site upon which the new substation will stand. The owner will have to be compensated for the land as well as for any crops or buildings on it.

4.12 Construction of 33kV overhead lines in Eldama Ravine Areas

*Environmental (Biophysical)*

The bio-physical environment will not be adversely affected by the overhead lines for they will pass over already cultivated land that is not habitat for endangered species of flora or fauna.

*Social – cultural Environment*

Construction of 33 kV overhead lines in Eldama Ravine areas is not likely to result in any significant disruption of current activities. This is more so considering that the Township and the surrounding areas are sparsely populated. From the community viewpoint, the installation of the overhead lines was not only viewed as a means through which more of them could access the much needed electricity but also a way of activating their nighttime activities. Further, they were in agreement that there was no cultural interference arising from the development of the envisaged lines as well as any change in the land use system.
4.13 Kipevu

Biophysical

The physical environment in this area is mainly an industrial set up. Upgrading the station will not significantly disrupt the natural habitat.

Social Cultural Environment

The KPLC staff are not stationed on site permanently. They only go there for routine checks and maintenance. The neighboring KenGen offices have permanent staff. The upgrading of the plant will not disrupt the activities in the neighbouring offices.

4.14 Mariakani

Biophysical

The site is located within the compound of a factory. Additional walls will be constructed. The seedlings stored in this site will be moved to a different location. A few of the trees in that section will be cut down. There will be a little disruption in the section but this will not be significant.

Social Cultural

The staff will have to get a new location to store their seedlings. This disruption is however not considered significant.

The people in the neighbourhood hope that they will be considered for connection when the substation is put up. They do not perceive any negative impact from the project because they have seen substations and transformers in the nearby areas.

4.15 Island

Biophysical

There is mainly grass in the area. There are no trees on the proposed site. Therefore there will be little disruption of the natural habitat.

Social Cultural

The land required which is 0.25 acres is small and this will be catered for by the existing wayleaves. It will not encroach the playground. Construction is likely to interfere with the activities at the neighbouring school, as well as the houses and business premises in the short term. These will however be minimal.
4.16 New Bamburi and Kiembeni

**Biophysical**

The site is mainly covered with ballast and there is a little grass at the edges. The upgrading will be done within this area. There will be no disruption of the natural habitat.

**Social Cultural**

The area is largely uninhabited and will therefore not cause any disruption in the short term. However, the area has potential for growth and could become densely populated in the medium and long term as evidenced by the construction of a residential estate approximately 1 kilometer away.

4.17 Watamu

**Biophysical**

The site will have to be cleared. The shrubs will probably be burnt. These have grown since the site has been left unattended from the time of fencing. This will have little effect on the natural habitat.

**Social Cultural**

There will be a disruption, mainly due to noise resulting from construction. The neighbouring houses are close to the site. These effects can however be considered minimal and will only be in the short term.

The people in the neighbouring houses have no objection to the substation being located next to their homes. They are looking forward to its completion. It is their expectation that their clinic, which collapsed due to lack of electrical connections, will be revived. They expect to also get power in their houses. Their only concern was that they should be educated on any safety precautions required on their part.

4.18 Kanamai

**Biophysical**

The exact site is yet to be established. However the general area has a lot of activity. There are a number of shops. The acquired site will have to be screened.

**Social Cultural**

The establishment of the envisaged substation in Kanamai may not result in any adverse change in land use or development earmarked for the area. However, this will depend on the location of the site which is yet to be determined.
4.19 Kwale

**Biophysical**

3 km of lines will be recovered. Wooden poles will be cut. A new line will be constructed along the road reserve. The areas have minimal vegetation and the natural habitat will not be affected significantly.

**Social cultural**

The new line will be constructed on the road reserve and this will have minimal effect on those living close by. The area is moderately populated. There will be little disruption in the section where the existing line will be reconducted as it is largely uninhabited.

4.20 Likoni

**Biophysical**

This is an existing substation and the exercise of upgrading this station will not disrupt the habitat significantly.

**Social Cultural**

The area is densely populated to the extent that locals have constructed houses on the wayleaves of the lines that exit the station. They are not only exposing themselves to danger but also make it difficult for KPLC to service the lines. They have done this in violation of the law, which is well known to them.

4.21 Screening Guidelines

The construction activities shall involve the survey of the power line routes and the proposed substations. This shall be followed by the acquisition of land for the substations and wayleaves consent, from the landowners, before the commencement of any of the works.

The designed power systems will depend on the acquisition of land for the substations and also the wayleaves consents for the power line routes.

Damage to property, crops and trees may occur and will require assessment and valuation of the damages for compensation. The damages shall occur at the substation site, along the power line route and along access routes during the construction period.

Schedule for the construction activities shall take to account the disturbances and interference with the activities of the local population. There will be interference with movement especially where demolition is involved underground systems are preferred and at road crossings. The works schedule must take this interference into account and ensure the adequate safety measures and notices are given to the affected group of people.
In reinforcement projects, electricity supplies to a large number of consumers may be interrupted. The consumers must be taken into account and advised accordingly of the scheduled interruption.
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<thead>
<tr>
<th>Project site</th>
<th>Physical</th>
<th>Biological</th>
<th>Socio-cultural</th>
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*These are mainly short term impacts—those that arise from displacement of people from land, construction, and installation of equipment. Longer term impacts are addressed elsewhere and relate mainly to project benefits.*

**Note:**

+ve: Positive
-ve: Negative
5.0 ANALYSIS OF ALTERNATIVES

5.1 The No-Project Option

The no-action alternative is often defined by the baseline information and is crucial in the assessment of impact because other alternatives are weighed with reference to it.

From the qualitative analysis and the summary of all the proposed sites for the project, there will not be any significant negative effect on either the bio-physical or the socio-cultural environment of the proposed project. Without the project, the environmental situation will neither improve nor can we say that it will necessarily deteriorate. In the short run, disruptions of the lives of people to be affected by the project through purchases of minor pieces of land and construction work during installation of equipment and lines will occur. However, these are of insignificant effect to the environment and the people given the very small pieces of land (2 acres or less) that are involved as well as the fact that overhead lines will be placed away above the ground. Moreover, compensation for these will eliminate the undesirable short-term impacts.

The no-project option also means that there will be no occurrence of harmful incidents arising from malfunction or interference with the normal working of such electric power. Cases of lightening striking transformers and causing fires or trees falling on live electric wires are not unknown.

The no-projection option will however lead to the following (general) major negative and long term impacts:

- The targeted populations (of electricity) consumers will continue to suffer from shortages of electricity and unstable supply of the same especially as population grows and demand increases supply

- Generation of employment opportunities through expansion of business activities that would have been spurred by availability of electric power will occur

- Institutions such as schools, hospitals, churches, mosques etc will not function well without electric power

- Information flow and public education awareness through electronic media, especially the television, will have been hampered

- The government will be seen to have reneged on its promise to provide electric energy to more of its citizens through its rural electrification programme
There will be loss of productivity and reduced ability to create wealth

Comparison of the negative as well as the positive impacts of the proposed project clearly therefore indicates that the long term positive effects of the proposed project would far outweigh the negative ones. Whatever the negative effects arising from the project can easily be mitigated, as will be outlined later.

5.2 Alternative Project Sites

The selection of sites for the substations and power lines has been on electrical power requirements and existing land uses. Most of the power lines are located along the road reserves, which is the best possible alternative. The location of substation sites has mainly been subject to land availability (or willingness to sell) in the preferred area, which is determined by the existing land use.

The KPLC identifies the areas and the individual registered land owner whom they approach and negotiate the land price based on the existing market value. If the plot belongs to the City Council or is public land (government), the KPLC makes a formal request and the former does the allotment while the latter grants the land through the Commissioner of Lands, as the case may be. KPLC also approaches its sister companies (parastatals) for land where relevant.

5.3 Alternative Technology

In general there is no better engineering alternative to those proposed in this distribution component of the Power Sector Recovery Project. The reinforcement of the existing substations shall involve the removal of existing overloaded equipment and installation of equipment such as transformers, bus bars, circuit breakers and isolators on 33KV and 66KV as well as the 11KV switchgear which shall either be indoor or outdoor; and replacing with higher capacity or with a more technically advance equipment.

The stressed or obsolete oil filled circuit breakers for example shall be replaced by SF$_6$ circuit breakers or vacuum circuit breakers. The SF$_6$ gas is an inert gas with superior insulation capacity, which renders the circuit breakers much safer for the operational personnel and environment since the likelihood of spillage or pollution is entirely eliminated. The vacuum type circuit breakers are also sometimes used at 11KV. These latter circuit breakers, as the name suggests, contain neither liquid nor gaseous substances and can therefore be considered to be very environmental friendly. Their only disadvantage is operational difficulties encountered in the efforts to maintain the vacuum.

5.4 Other (Alternatives) Fuel Sources

Kenya’s three main sources of energy are woodfuel, petroleum and electricity accounting for 90, 21 and 9 per cent respectively of all the energy consumed in the country. While the demand for electricity is high and has continued to grow electricity supply is lacking in most rural areas and market centers while in urban areas there is inadequate and
unreliable supply (PRSP, 2001). The government is committed to the reforms in the power sector that would ensure a reliable supply of electricity at competitive tariffs through the expansion of the Rural Electrification Programme. (ERSWEC, 2003)

Although electricity accounts for only 9% of all the energy sources consumed in the country, it has a unique and important use for domestic as well as commercial purposes that cannot be provided by the other known and more commonly used energy sources. Woodfuel, although more commonly used, is a very poor substitute for electricity and has many negative environmental and health effects on users. In fact the increased use of woodfuel in the country has lead to the near total destruction of forest cover, with its attendant consequences of desertification and increased poverty. Petroleum is the next most commonly used energy type. It is mainly used in the transport sector and is wholly imported since Kenya does not have any known reserves of petroleum of its own. Although petroleum is of complimentary use relative to electricity, it is however of inferior value for commercial/industrial purposes when compared to electricity. Other energy alternatives e.g. biogas, are far less common and almost negligible in terms of their domestic and commercial utility in the country.
6.0 ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN

The EMP is one of the requirements of the EIA reporting. According to the World Bank, it provides an essential link between the impacts as operational and implementation activities (WB, 1999). In chapter 3 we discussed the environmental and socio-cultural issues highlighting the anticipated impacts and in chapter 4 the relevant mitigation means were discussed. In this chapter, we present the EMP including a summary of the predicted adverse environmental and social impacts for which mitigation is required, description of the mitigation plan, description of a monitoring plan, institutional arrangements and an implementation schedule and reporting procedures. The presentation is based on project sites/areas as defined by KPLC.

For the Jevanjee site, there are no adverse impacts because the site already exists and the work on this site will only involve upgrading the 66/11 KV substation from 46 MVA to 90 MVA. In Westlands and Gigiri, two new 66/11 KV substations will be built (a total of 69 MVA). The Westlands plot where a new substation will be installed belongs to KPLC and such no paid purchase will be made, no relocation or displacement of people involved. The Property and Wayleaves Department of KPLC will ensure that before work starts, the sites are secure and the construction team is fully aware of the physical characteristics of the sites and have taken the necessary precautions to minimize exposure of the public to the activities on the site. The KPLC construction crew will be well-briefed on the safety standards, codes to be followed while carrying out such work. They will also be supervised on a daily basis to ensure compliance with the environmental and public safety measures. A monitoring Team consisting of NCC/NEMA/KPLC/MRPW be created to: coordinate implementation of recommended mitigation measures; serve as the mediating forum between KPLC and the public and to liaise with MENR on mitigation and monitoring. For Gigiri and Athi River Quarry sites where new 66/11 substations will located, the owner of the maize crop on the Gigiri plot and those that use the Athi River site for livestock grazing will be compensated. The total market value of the maize crop will have to be determined for compensation and a warning provided to the people to leave the land.

The Nairobi North site consists of clearing a path for electrical lines for a distance of about 75 km. This route will pass through farmlands and will therefore require that land sizes and values be determined for the entire route of the lines. The Survey Department of the Ministry of Lands and Human Settlements in conjunction with the Kiambu County Council through which most of the lines will pass should be asked to value the entire route. The WayLeaves Department of KPLC will need to engage a socio-economic consultant to conduct a survey of the proposed power route to determine the nature and magnitude of the property loss the local people will incur as a result of the project.

In Western area of Kenya, the Sondu pole-mounted substation will be expanded by the acquisition of additional land (about 0.125 acres) on which the new transformer will be placed. Most likely, the piece will be acquired from the adjacent public land for which there will be no need to make compensation. The WayLeaves Department of KPLC will
liase with the Survey Department of MLHS and the Mapping section of MRPW to acquire and regularize ownership of the land. In Miwani, only re-conductoring of the existing wires will be done as such there will be no visible impact on the site or its adjacent environs.

In both Butere and Makutano, project sites have yet to be identified. For the former, 1 acre of land will be needed for the new 2.5 MVA, 33/11 KV substation, while for the latter 2 acres will be needed for the larger. The Cherangany site is already secured since the land has been purchased fenced and the owner paid. The overhead line will run from the new substation to feed into the existing lines across the road. In Eldama Ravine, new lines running along the road reserve will be erected coming from the new Makutano substation. The road reserve does not have any human activity and as such there will be no need for consideration of adverse impact on anyone.

The island substation in Mombasa has been identified on a road reserve and negotiations are going on with the Mombasa City Council with a view to formal acquisition by KPLC. It is situated near the Bahari Preparatory School. The New Bamburi substation is an existing one that will be expanded to include the Kiambenii substation. They both will be situated on public land. In Kwale, the existing line will be re-located onto public land for a distance of about 3 km. to avoid the existing problem whereby KPLC has had to seek both the permission and security escort from KWS in order to do routine maintenance of the lines because the lines passed through a wildlife corridor. In Kipevu and Likoni, the existing facilities will need upgrading and re-conductoring, respectively. Such operations do not have any negative effects. The Mariakani substation will be housed within the compound of Mabati Rolling Mills Ltd who will therefore have the responsibility to maintain the facility.

Table 11: Summary of Environmental Management and monitoring Plan

<table>
<thead>
<tr>
<th>PROJECT SITE</th>
<th>SUMMARY OF ENV/SOC IMPACT(S)</th>
<th>MITIGATION MEASURE(S)</th>
<th>MONITORING PLAN</th>
<th>RESPONSIBLE INSTITUTION</th>
<th>COST/SOURCE OF FUNDS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NAIROBI AREA</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Jeevanjee</td>
<td>Existing KPLC plot, No risk or exposure to the public, no impact</td>
<td>Walled-up all round on concrete, only authorized KPLC personnel have access</td>
<td>Regular weekly site visits by NCC/KPLC after construction; monthly inspection</td>
<td>KPLC NCC Local Contractor</td>
<td>N/A</td>
</tr>
<tr>
<td>2. Westlands</td>
<td>Plot and house belong to KPLC, no discernible impact</td>
<td>None</td>
<td>Regular weekly site visits by NCC/KPLC after construction; monthly inspection</td>
<td>KPLC KPLC BANK MLHS</td>
<td>N/A</td>
</tr>
<tr>
<td>Location</td>
<td>Activity Description</td>
<td>Financial Compensation to</td>
<td>Reduce Effects of Congestion</td>
<td>KPLC/Bank/MLHS</td>
<td>Half an acre of land in the area costs</td>
</tr>
<tr>
<td>------------------------</td>
<td>---------------------------------------------------------------------------------------</td>
<td>---------------------------</td>
<td>-------------------------------</td>
<td>-----------------</td>
<td>--------------------------------------</td>
</tr>
<tr>
<td>3. Gigiri</td>
<td>Sharing compound with water treatment works; additional piece of land to be acquired</td>
<td>Financial compensation to owner</td>
<td>Reduce effects of congestion, clearly separate the two utilities</td>
<td>KPLC/MLHS</td>
<td>Kshs. 2,000,000</td>
</tr>
<tr>
<td>4. Nairobi North (75km)</td>
<td>Clearing of land; alienation of land; exposure to electric wires</td>
<td>Financial compensation to land owners; public safety measures</td>
<td>Complete land Survey and write report; Cash payment to land owner; transfer of ownership certificate before construction</td>
<td>KPLC/NCC/MLHS/Local Contractor</td>
<td>Kshs. 65,000,000 KPLC/WB</td>
</tr>
<tr>
<td>4. Athi River Quarry</td>
<td>Alienation of land; Reduced area for livestock grazing;</td>
<td>Financial compensation to land owners; public safety measures</td>
<td>Land Survey report; Cash payment to land owner; transfer of ownership certificate before construction</td>
<td>Landowner; Pastoralists KPLC Athi River Town Council MLHS</td>
<td>Price of one acre of land is Kshs. 250,000 KPLC/WB</td>
</tr>
</tbody>
</table>

**WESTERN AREA**

<table>
<thead>
<tr>
<th>Location</th>
<th>Activity Description</th>
<th>Financial Compensation to</th>
<th>Reduce Effects of Congestion</th>
<th>KPLC/Bank/MLHS</th>
<th>Cost of one acre is Kshs. 40,000 KPLC/WB</th>
</tr>
</thead>
<tbody>
<tr>
<td>5. Sondu</td>
<td>Alienation of land of 0.125 acre of public land</td>
<td>public safety measures to be in place</td>
<td>Land Survey done; Cash payment to land owner; land title obtained</td>
<td>KPLC/MLHS/Landowners Contractor</td>
<td>Kshs. 25,000 KPLC/WB</td>
</tr>
<tr>
<td>6. Miwani</td>
<td>Re-conductoring works to be done, no impact</td>
<td>None</td>
<td>Weekly site visits to check on wires</td>
<td>KPLC/MLHS</td>
<td>NONE</td>
</tr>
<tr>
<td>7. Butere</td>
<td>Alienation of land, site to be identified</td>
<td>Financial compensation to land owners; public safety measures</td>
<td>Land Survey done; Cash payment to land owner made; land title issued construction</td>
<td>KPLC/MLHS</td>
<td>Cost of one acre is Kshs. 80,000 KPLC/WB</td>
</tr>
<tr>
<td>8. Makutano</td>
<td>Clearing of land; alienation of land</td>
<td>Financial compensation to land owners; public safety measures</td>
<td>Land Survey done; Cash payment to land owner made; land title issued construction</td>
<td>KPLC/MLHS</td>
<td>Two acres of land Kshs 80,000 KPLC/WB</td>
</tr>
<tr>
<td>9. Cherangany</td>
<td>Land already purchased</td>
<td>Financial compensation to land owner done; public safety measures</td>
<td>Weekly site visit to monitor progress</td>
<td>KPLC/MLHS/Landowners Contractor</td>
<td>N/A</td>
</tr>
</tbody>
</table>

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<p>| | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>10. Eldama Ravine</td>
<td>New lines running along road reserve</td>
<td>none</td>
<td>Agreement with MRPW</td>
<td>KPLC MLHS Landowners Contractor</td>
<td>N/A</td>
</tr>
<tr>
<td>11. Island</td>
<td>Site identified along road reserve</td>
<td>Negotiation with MCC, public safety measures</td>
<td>N/A</td>
<td>KPLC MCC MLHS</td>
<td>N/A</td>
</tr>
<tr>
<td>12. New Bamburi</td>
<td>Dust and noise during construction</td>
<td>Construction to be done during off-peak hours; public safety measures</td>
<td>Supervision of construction by GOK agent; public safety measures; fencing off monthly site-inspections</td>
<td>KPLC Contractor MCC</td>
<td>Kshs. 150,000 KPLC/WB</td>
</tr>
<tr>
<td>13. Kiembeni</td>
<td>Land belongs to KPLC; Dust and noise during construction</td>
<td>Construction to be done during off-peak hours; public safety measures</td>
<td>Supervision of construction by GOK agent; public safety measures; fencing off monthly site-inspections</td>
<td>KPLC MCC Contractor</td>
<td>N/A</td>
</tr>
<tr>
<td>14. Kanamai</td>
<td>Site to be identified; Acquisition of land; Noise during construction</td>
<td>Financial compensation to land owners; public safety measures</td>
<td>Land surveyed; Cash payment made; title granted</td>
<td>KPLC MLHS Kwale County Council</td>
<td>Cost of one acre of land Kshs. 100,000 KPLC/WB</td>
</tr>
<tr>
<td>15. Kwale</td>
<td>Relocating line to road reserve</td>
<td>Safety measures during relocation/construction</td>
<td>Enhance public safety on existing site; have monthly site-inspection visits</td>
<td>KPLC KWS MTC</td>
<td>N/A</td>
</tr>
<tr>
<td>16. Kipevu</td>
<td>None</td>
<td>None</td>
<td>Enhance public safety measures; weekly site-inspection visit</td>
<td>KPLC MTC KENGEN</td>
<td>N/A</td>
</tr>
<tr>
<td>17. Likoni</td>
<td>Eviction of squatters and destruction of houses on line route</td>
<td>Prior eviction warning and Financial compensation</td>
<td>Financial compensation; enhance public safety</td>
<td>KPLC MCC Local Administration</td>
<td>Kshs 50,000 lumpsum KPLC/WB</td>
</tr>
<tr>
<td>18. Mariakani</td>
<td>None</td>
<td>Safety measures for factory workers</td>
<td>Monthly site visit</td>
<td>KPLC Mabati Rolling Mills</td>
<td>N/A</td>
</tr>
</tbody>
</table>

NOTES: KPLC=Kenya Power and Lighting Company; MLHS=Ministry of Lands and Settlement; NCC=Nairobi City Council, MTC=Ministry of Transport and Communication KENGEN=Kenya Electricity Generation Company, MCC=Mombasa City Council
6.1 Capacity Building for EMP

The project does not have a capacity-building component to finance, develop and strengthen the public and private services sector linked to the attainment of the objectives of the project. Proposal is made here for the need to identify and train members of the various stakeholder organizations involved in the implementation of the project.

As the main stakeholder, KPLC has limited ability to monitor and evaluate environmental aspects of its work and more specifically of this project. It needs to build its capacity by training selected members of staff in broad environmental management issues including EIA. It also needs to set up a unit within the Way leaves Department or other relevant department that would be responsible for environmental management of its specific activities.

With the operationalization of district environment committees by the Ministry of Environment and Natural Resources as well as through NEMA, some of the skills-building activities relating to the stakeholders in this sub sector can be done at the district or lower levels. In fact, building the capacity of the communities on environmental matters that are specifically related to the project activities would go along way in facilitating the monitoring and evaluation of project activities at the community level. Such capacity building efforts could range from short term training of 2-3 days to longer term trainings of up to six months, depending on the need and the individuals background and responsibilities. Such courses could be taken locally within Kenya or in the region e.g. ESAMI (Eastern and Southern Africa Management Institute) courses wherever they are held in the region.
7.0 LIST OF REFERENCES


8.0 APPENDICES

8.1 Team Composition and Tasks Assigned

Table 12: Technical/Managerial Staff

<table>
<thead>
<tr>
<th>Position</th>
<th>Firm</th>
<th>Staff</th>
<th>Tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Director</td>
<td>Log Associates</td>
<td>Prof. Lawrence Gumbe</td>
<td>Client consultant liaison</td>
</tr>
<tr>
<td>Social Environmentalist/Team Leader</td>
<td>Log Associates</td>
<td>Dr. Samson Wasao</td>
<td>Examine social impacts and establish baselines for future monitoring</td>
</tr>
<tr>
<td>Social Economist</td>
<td>Log Associates</td>
<td>Hesbon Gondi</td>
<td>Examine social, cultural and economic impacts</td>
</tr>
<tr>
<td>Environmental Policy Expert</td>
<td>Log Associates</td>
<td>Dr. Albert Mumma</td>
<td>Assessment of policy, legal and institutional framework</td>
</tr>
<tr>
<td>Technical Expert/Physical Environmentalist</td>
<td>Log Associates</td>
<td>Dr. Michael Okoth</td>
<td>Assessment land use, air quality, emission, oil spillage, visual imparts, waste quality, solid and liquid waste management</td>
</tr>
<tr>
<td>Technical Expert/Physical Environmentalist</td>
<td>Log Associates</td>
<td>Fanuel Odhiambo</td>
<td>Review of issues concerning flora and fauna, biodiversity, ecology, nurture, conservation, water quality etc.</td>
</tr>
<tr>
<td>GIS Expert</td>
<td>Log Associates</td>
<td>Esther Muigai</td>
<td>Development of GIS Maps showing general facilities layout</td>
</tr>
</tbody>
</table>

Table 13: Support Staff

<table>
<thead>
<tr>
<th>Position</th>
<th>Staff</th>
<th>Firm</th>
<th>Tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical Assistant</td>
<td>Dickson Biketi</td>
<td>Log Associates</td>
<td>Data Entry</td>
</tr>
<tr>
<td>Technical Assistant</td>
<td>Enos Amimo</td>
<td>Log Associates</td>
<td>Data Collection</td>
</tr>
<tr>
<td>Technical Assistant</td>
<td>George Mwangi</td>
<td>Log Associates</td>
<td>Data Collection</td>
</tr>
<tr>
<td>Technical Assistant</td>
<td>Jane Njeru</td>
<td>Log Associates</td>
<td>Data Entry</td>
</tr>
<tr>
<td>Technical Assistant</td>
<td>Gordon Nyakiti</td>
<td>Log Associates</td>
<td>Data Collection</td>
</tr>
</tbody>
</table>
8.2: People Contacted

Table 14: List of People Contacted

<table>
<thead>
<tr>
<th>Name</th>
<th>Institution</th>
<th>Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Mrs. Salome Munubi</td>
<td>KPLC</td>
<td>Property Officer</td>
</tr>
<tr>
<td>2. Mrs. Esther Ruto</td>
<td>KPLC</td>
<td>Distribution Engineer, Nairobi</td>
</tr>
<tr>
<td>3. Mr. J.K Marete</td>
<td>KPLC</td>
<td>Principal Wayleaves Officer</td>
</tr>
<tr>
<td>4. Mr. Adhiambo</td>
<td>KPLC</td>
<td>Distribution Engineer, Kisumu</td>
</tr>
<tr>
<td>5. Mr. Haid Yusuf</td>
<td>KPLC</td>
<td>Distribution Engineer, Eldoret</td>
</tr>
<tr>
<td>6. Mr. Mwalalwa</td>
<td>KPLC</td>
<td>Mombasa</td>
</tr>
<tr>
<td>7. Mr. Walter Kaguchia</td>
<td>KPLC</td>
<td>Distribution Engineer, Nakuru</td>
</tr>
<tr>
<td>8. Mr. Njuguna</td>
<td>KPLC</td>
<td>KPLC employee</td>
</tr>
<tr>
<td>9. Mr. Onzumu</td>
<td>KPLC</td>
<td>KPLC employee, Kisumu</td>
</tr>
<tr>
<td>10. Mr. MacOwenga</td>
<td>KPLC</td>
<td>KPLC employee</td>
</tr>
<tr>
<td>11. Mr. Malava</td>
<td>KPLC</td>
<td>KPLC employee, Watamu</td>
</tr>
<tr>
<td>12. Mr. Chama</td>
<td>KPLC</td>
<td>KPLC employee, Diani</td>
</tr>
<tr>
<td>13. Mr. Peter (Mohammed) Opiya</td>
<td>Resident opposite the proposed site</td>
<td>Resident of Mariakani near Mabati Rolling Mills</td>
</tr>
<tr>
<td>14. Benjamin Kaingu</td>
<td>Resident adjacent to the site</td>
<td>Resident of Watamu in Coast region</td>
</tr>
</tbody>
</table>

*Others were interviewed but preferred not to reveal their identity

8.3 Terms of References

Environmental impact assessment, outlined in the Terms of Reference herein, is urgently needed to ensure the presentation of the Project to IDA’s Board of Directors during this Fiscal Year ending June 30, 2004. Because of its urgency, the Borrower represented by the Ministry of Energy intends to coordinate the carrying out of this task with the help of a local consultant to work under the direct guidance of a Task Force comprising professionals from the Department of the Environment, the Ministry of Energy and KPLC.
8.3.1 Distribution Component’s Objectives

The project shall have the following objectives:

(i) Reduction of the non-technical losses at the annual rate of one percent through effective inspection, and targeted improvement in collection rates;

(ii) Increasing access to electricity by accelerating connection rates and introducing a customer-friendly connection policy;

(iii) Improving system reliability and performance by replacing obsolete protection gear, installing auto-reclosers and auto load-break switches and sectionalizers in the distribution system;

(iv) Installing metering systems to segregate transmission and distribution losses.

A main subsidiary objective is supporting KPLC’s strategic short term approach focusing on internal restructuring through setting up business units of its operations and eventually unbundling them into commercially viable units.

8.3.2 Description of the Proposed Component

KPLC’s Proposal has identified priority programs for the reinforcement and upgrade of the transmission and distribution systems. These are grouped as follows:

Group 1 Priority sub-components (tentative estimate US$20 million)

In Nairobi area: (i) Construction of a total of 75 km of 66kV lines from Nairobi North; (ii) Reinforcement of 11kV feeders through reconductoring a total 57km existing lines and construction of 12.5km of new lines; (iii) Reinforcement of Nairobi South Substation by replacing 35 panel 11kV switchgear board, modifying existing 66kV busbar arrangement and installing 12 new 66kV switchgear units; and (iv) Reinforcement of Ruaraka Substation by replacing 31 panel 11kV switchgear board. (v) Substation reinforcement and upgrade of Karen 66/11kV substation from 30MVA to 46MVA; (vi) Installing two new 66/11kV substations at Athi River Quarries (1 x 23MVA) & Ngong Road (2 x 23MVA);

In Mombasa area: (i) Upgrading one 132/33kV substation - from 45MVA to 68MVA; (ii) Reinforcement and upgrade of Likoni 33/11kV substation from 8MVA to 15MVA; (iii) Installation of 3 new 33/11kV substations at Kanamai (1 x 7.5MVA), Watamu (1 x 7.5MVA) (includes 6km of 33kV o/head line construction), & on the Island (1 x 23 MVA), (iv) Installation of 2x 33kV circuit breakers, 1x7.5MVA 33/11kV transformer and replacement of obsolete 7-panel 11kV switchboard at KPR substation.
Group 2A Priority Program (valued at US$ 10 million)

In Nairobi area: (i) Replacing at 5no. Substations fault throwers (a total of 14no.) with 66kV circuit breakers (ii) Installing a total of 69MVA new 66/11kV substations at Westlands and Gigiri;

In Mombasa area: (i) replacing 33kV switchgear at Kipevu substation in Mombasa, with an indoor 34 panel switchboard, (ii) Upgrading of Diani 33/11kV substation from 15MVA to 23 MVA; and install a new 7.5MVA 33/11kV substation at Mariakani.

Group 2B Priority Program (valued at US$ 10 million)

In Nairobi area: (i) Upgrading Jeevanjee 66/11kV substation from 46MVA to 90MVA (ii) Construct new 2.8km 11kV line and reconductor 3.1km 11kV; (iii) Replacement of 6 panel, 11kV switchboard at Donholm switching station; (iv) replacement of 3.7km 66kV cable from Cathedral to Nairobi West substations; and (v) Retrofit 11kV metal clad, switchgear with SF6 circuit breakers.

In Mombasa (Coastal) area: (i) Upgrading of Voi’s 132/33kV substation from 5MVA to 10MVA;

In Nakuru (Western) area: (i) Rehabilitate Naivasha and Lanet substations by the installation of a total of 8No. 132kV Circuit Breakers (4No. at each station).

Group 3 Priority Program (valued at US$ 20 million)

In all areas: (i) Installation of energy meters on 11kV and 33kV distribution feeders, (ii) Replacement of 5000 electromechanical 3phase energy meters with electronic ones, (iii) Install Disaster Recovery Server at Electricity House Nairobi (iv) Replace 33kV oil circuit breakers with SF6 units.

In Nairobi area: (i) Install Static Var Compensators at Embakasi Substation.

In Mombasa (Coastal) area (i) Reconductor a total of 8km of 33kV line to 300 AAA conductor(ii) Uprate 33/11kV station at Galu to 1 x 7.5 (iii) Install new 33/11kV substation at Kiembeni (iv) Install Static Var Compensators at Rabai substation.

In Western area: (i) Uprate 132/33kV substation at Lessos by replacing existing transformer with a 23MVA unit and installing an additional 23MVA unit. (ii) Establish new 2.5MVA, 33/11kV substation at Butere. (iii) Construct 10km of 33kV overhead line in Butere.

In Mt Kenya area: (i) Uprate Kamburu 132/33kV substation by 23MVA and Embori 33/11kV substation to 2.5MVA (ii) Install Radio System able to cover region and thereby replace limited, old and obsolete existing system
Group 4 Priority Program (valued at US$ 20 million)

In all areas: (i) Upgrade the SCADA System and replace related old and obsolete equipment (ii) Carry out reinforcement of the Low Voltage Network by reconductoring and installing additional distribution transformers as required for the rationalisation of the network supply coverage.

Group 5 Priority Program (valued at US$ 25 million) – Other Additional Projects

In all areas: (i) Replace existing 11kV metalclad indoor oil circuit breakers (35 incomers, 17 bussections, 142 feeders and 93 metering) with more reliable vacuum or SF6 units.

In Coast area (i) Reconductor totals of 15km, 6km and 10km of 11kV overhead line feeders in Malindi, Bamburi and Kwale areas. In Kwale area, construction of 3km of 11kV O/H line will also be required. (ii) Uprate 33/11kV Substations at Shanzu, Kipevu and Miritini by replacing existing transformer units with 2 x 23MVA units each at Shanzu and Kipevu, and by adding a 7.5MVA unit at Miritini.(iii) Replace 3 obsolete auto recloser units.

In Mt Kenya Region: (i) Reconductor a total of 66km of 11kV overhead lines in Makuyu and Chinga areas and 30km of 33kV overhead lines in Tana Embu area.

In Nairobi area: (i) Establish new 66/11kV substation along Kirinyaga Rd/ Ngara area. (ii) Refurbish Substations at Cathedral and Ruaraka by installing breakers and creating a double 66kV busbar arrangement at Ruaraka. (iii) Replace 13 panel 11kV switch board at Athi River Substation. (iv) Install at total of 5 new feeders and construct a total of 25km of new 11kV overhead lines in Gigiri and Dandora areas (v) Reconductor a total of 59km of 11kV O/H lines in Gigiri, Outering Rd/Mombasa Rd, Dandora/Kariobangi and City Center areas.(vi) Purchase cable diagnostic equipment (vii) Reinforce the LV network in Marsabit by uprating conductors.

In Western area: (i) Establish new 23MVA 132/33kV and 2.5MVA 33/11kV substations at Makutano and Cherangani respectively. (ii) Uprate 33/11kV substations at Lessos and Sondu by installing one additional 2.5MVA transformer at each station.(iii)Reconductor a total of 238km of 33kV O/head lines in Naukur, Naivasha, Kisii, Sondu, Bondo areas; Reconductor a total of 117km of 11kV overhead line in Nakuru, Miwani, Naivasha and Njoro/Molo areas; Construct a total of 26km of 33kV O/head line in Sondu, Cherangani and Eldama Ravine areas. (iv) Install a total of 34MVA, 11kV shunt capacitors at various substations (v) Replace 22No. unserviceable autoreclosers.

8.3.3 Objective of the environmental and social assessment

The Government of the Republic of Kenya represented by the Ministry of Energy intends to conduct an Environmental and Social Assessment (ESA) of the proposed project which has been classified as Category B. The main objective of the ESA is to
assess potential environmental (socio-economic, cultural heritage and biophysical) impacts of the *Distribution Component of the Power Sector Recovery Project*, evaluate alternatives if any, and design appropriate mitigation, management and monitoring measures. This assignment shall be conducted in accordance with the World Bank Operational Policies OP 4.01, BP 4.01 and the environmental policy guidelines of the government of the Republic of Kenya. More details of the specific tasks accorded to the consultant is elaborated below. The specific objectives include:

- Identification of potential environmental impacts and risks in the project's intervention zone;
- Assessment of potential social issues and impacts related to project's activities;
- Indicating ways, in which potential adverse environmental and social impacts, if any, can be avoided, minimized, mitigated or compensated;
- Formulation of environmental management and monitoring plans of the two project components taking into consideration the reviewed environmental policy framework and guidelines;
- Assess government and implementing agencies' capacity to manage project's environmental and social issues and provide measures on how to reinforce them.

8.3.4 Scope of the Assignment

The ESA work will take into account all project intervention zones pertaining to the Distribution component. All new substation sites and new line routes will need to be visited. However for a detailed social and environmental assessment of pole mounted transformer stations, sample existing stations in Nairobi and in Coastal Area shall be selected for purposes of overall evaluation.

8.3.5 Documents to be reviewed

The Team shall explore and identify regulations and guidelines, which will preside over the conduct of the assessment. These include but not limited to the following:

- World Bank operational policies (OP 4.01)
- Bank procedure (BP 4.01)
- World Bank OP 4.04 - National habitat
- World Bank OP -11 - Cultural properties
- National Environment Management Plan
- National Biodiversity and Combating Desertification Action Plans, Regional and Municipality policies, Environmental Assessment Regulations

8.3.6 Main Tasks of the Services

**Task 1. Description of the Proposed Project:** The consultant is to concisely describe the project and its geographic, ecological, general layout of facilities including maps at appropriate scale where necessary. Additional information on size and capacity of pre-construction activities, construction activities, schedule, staffing and support, facilities and services, operation and maintenance activities are imperative.
Task 2. Description of the baseline environment:

The consultant is required to collect, collate and present baseline information on the environmental characteristics of the pre-project situation of the target areas. This description involves, a) the physical environment (topography, geology climate and meteorology, hydrology etc., b) biological environment (i.e., flora types and diversity, endangered species, sensitive habitats etc.) Social and cultural environment, including present and projected, where appropriate (i.e., population, land use, planned development activities, community structure, employment and labour market, sources and distribution of income, cultural properties - such as historical and archaeological significant sites, indigenous people, and traditional tribal lands and customs). The team is also required to identify the stakeholders and hold consultations with them in order to produce participation strategy.

Task 3. Legislative and Regulatory Framework:

The consultant shall identify and describe the pertinent regulations and standards governing the environmental quality, health and safety, protection of sensitive areas, land use control at the national and local levels.

Task 4. Determination of potential impacts of the project:

The consultant will analyze and describe all significant changes likely to come about by the project. These would encompass environmental and social impacts, both positive and negative, as a result of the project interventions that are likely to bring about changes in the baseline environmental and social conditions discussed in Task 2. It is important in this work to differentiate between short, medium and long term impacts (i.e., industrial expansion, increased urbanization, sustainable natural resources management, etc.).

Assessment of the environmental and socio-economic benefits, awareness and commitment of implementing agencies and participatory modalities for the beneficiaries is important to the success of the project. The consultant has to make efforts to collect primary data in the case where information gaps are identified and/or identify and outline terms of reference for further studies to bridge the information gaps.

Task 5. Public consultation process:

The consultant will:
- Consult and garner recommendations from government departments, local administrations, NGOs and agencies that may have a stake in the project, including consumers representatives where feasible.
- Provide an opportunity for the relevant authorities to raise issues and concerns pertaining to the proposed electrification line routes and substations, and allow the identification of additional alternatives and recommendations.
Task 6. Analysis of Alternatives of the proposed project:

This task involves the systematic comparison of feasible alternatives to the proposed project site, technology, design and operation - including the 'without project' situation - in terms of their potential environmental impacts; the feasibility of mitigating these impacts; their capital and recurrent costs; their suitability under local conditions; and their institutional training and monitoring requirements. For each of the alternatives, the consultant should quantify the environmental impacts to the extent possible, and attach economic values where feasible.

Task 7. Development of management plan to mitigate negative impacts

The development of a management plan would entail recommending a set of mitigation, monitoring and institutional measures to be taken during implementation and operation to eliminate, minimize or reduce to acceptable levels of adverse environmental impacts and/or maximize socio-economic benefits. The consultant should provide cost outlays for the proposed measures as well as their institutional and financial support.

Task 8. Development of monitoring plan

The consultant is required to give a specific description, and technical details, of monitoring measures, including the parameters to be measured, methods to be used, sampling locations, frequency of measurements, definition of thresholds that will signal the need for corrective actions as well as deliver a monitoring and reporting procedures.

Task 9: Presentation of Environmental and Social Assessment Report:

The main output will be an Environmental and Social Assessment Report that focuses on the significant environmental and social issues of the project where its scope and level of detail has to be commensurate with the project's potential impacts. The report shall be in the English Language and presented in draft and final versions to the client, the World Bank and other co-financiers of the project. The report has to be clear and concise focusing on findings, conclusions and recommendations leaving the detailed, interpreted or raw data to the appendices or a separate volume. The general outline should include the following:

a. Executive summary
b. List of acronyms and abbreviations
c. Table of contents
d. List of tables and figures
e. Description of the project
f. Baseline data
g. Environmental and social safeguard issues
h. Legislative and regulatory framework
i. Analysis of alternative
j. Environmental management plan
k. Monitoring policy
l. List of references
m. Appendices
8.4 Photographs Taken at Various Sites

The pictorial view of the various sites visited during the exercise is shown. The photographs clearly show the biological and physical environment.
Proposed Site for Athi River Quarries
Sub-station

Jeevanjee Sub-station Site

Transmission Lines to be Upgraded in
Miwani Area

Proposed Site for Makutano Sub-station

Sondu Sub-station Site
Proposed Site for Gigiri Sub-station

Site for Cherangany Sub-station

Mariakani within Mabati Rolling Mills

Kanamai

Diani Sub-station from where the Kwale Line Originates

Island Sub-station at Tudor