

**Language : English**

**Original : English**



## **AFRICAN DEVELOPMENT BANK GROUP**

**PROJECT : THIKA THERMAL POWER PROJECT**

**COUNTRY : KENYA**

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### **SUMMARY OF THE ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT**

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September 2011

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## LIST OF ACRONYMS

AfDB	African Development Bank
EMCA	Environmental Management and Coordination Act
EIA	Environmental Impact Assessment
ESAP	AfDB Environment and Social Assessment Procedures
ESIA	Environment and Social Impact Assessment
ESMP	Environmental and Social Management Plan
HFO	Heavy Fuel Oil
IFC	International Finance Corporation
KPLC	Kenya Power and Lighting Company
NEMA	National Environmental Management Authority
RAMSAR	The Convention on Wetlands of International Importance
SCRP	A Site Clearance and Restoration Plan
SEP	Stakeholder Engagement Plan
TPL	Thika Power Limited

## **Environmental and social impact assessment (ESIA) Summary**

Project title : **THIKA POWER PLANT PROJECT**  
Country : **THIKA, KENYA**  
Project reference : **P-KE-FAA-001**

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### **1. INTRODUCTION**

This document is a summary of the Environmental and Social Impact Assessment (ESIA) reports prepared for the proposed Thika Power Plant Project (TPP). Two independent ESIA reports have been prepared: one by a local consultant Enviroplan, which was completed in December 2010 and submitted to the National Environmental Management Authority (NEMA) in May 2011 from which an environmental licence was delivered in July 2011; the second report was finalised by Environmental Resources Management Limited (ERM) in August 2011.

This ESIA was prepared in accordance with the African Development Bank's (AfDB) 2001 Environmental & Social Impacts Assessment Procedures (ESAP) and the IFC procedures.

Specifically, this summary provides information on project activities; anticipated impact of the project activities; measures to be put in place to mitigate identified adverse impacts; and institutional arrangement to facilitate implementation and monitoring of the environmental management plan.

The project proponent is Thika Power Limited, a company registered in Kenya and established to develop and implement the proposed project.

### **2. PROJECT DESCRIPTION & JUSTIFICATION**

#### **2.1. Project Description**

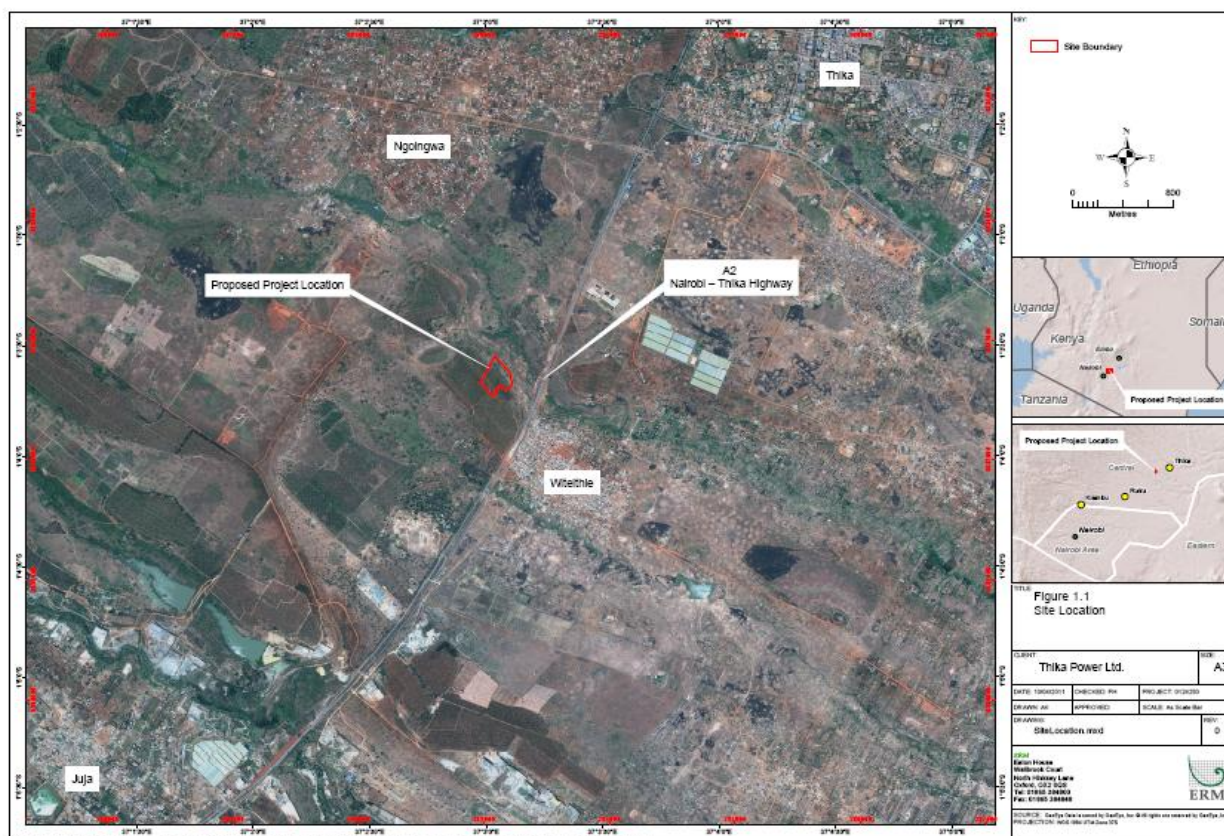
The proposed TPP, a Heavy Fuel Oil (HFO) powered Thermal Power Plant, will be located in Thika district in Kenya on a purchased plot approximately 8 acres in area, adjacent to a coffee farm. Project activities will include: clearance of approximately 8 acres of land for construction; construction of a powerhouse (to house the diesel engines and a chimney of 65-70 metres height) - installation of boilers and condenser, diesel tanks, switchgear; and construction of water treatment and pump house, and ancillary buildings. The power house will generate 60-80 Megawatts of power; and will be connected to electricity transmission network via an existing substation. Once operational the plant will run continuously; decommissioning is estimated at more than 30 years into the future. Key project components are itemised in Table.1.

**Table 1: Key project components**

Component	Details
Power House	Containing five 4-stroke MSD engines 18.9MW, and a steam turbine 7MW
Tank farm	3 x 4700m <sup>3</sup> HFO tank 1 x 560m <sup>3</sup> DFO tank 1 x 560m <sup>3</sup> HFO service tank 1 x 75m <sup>3</sup> Sludge tank 1 x 75m <sup>3</sup> Lubricant oil storage tank 1 x 50m <sup>3</sup> Maintenance lubricant oil storage tank
Pump House & Water Treatment Plant	Fire fighting and raw water tank (1096m <sup>3</sup> ) and demineralised water tank (65m <sup>3</sup> )
Diesel Combined Cycle Heat Recovery System	5 boilers, a condenser etc
Medium and High Voltage Switchgear	
Transformers	Step-up transformers (15kV/132kV) and 2 auxiliary transformers (15kV/0.4kV)
Ancillary Systems and Facilities	Loading area, fire protection system, administration buildings, workshop, store, laboratory etc

Up to 500 people will be employed during construction. However, once operational, only 40 to 50 persons will be permanently employed.

The proposed project site is located adjacent to the Nairobi – Thika highway, approximately 30 km north of Nairobi city centre and 5 km south - west of Thika town (Figure1).



**Figure 1: Proposed project location**

## 2.2. Project Justification

The level of economic growth predicted in Kenya's Vision 2030, suggests that the electric power generation system's capacity will be outstripped by demand, unless the development of additional (and cost-effective) energy generating resources is fast-tracked.

Historically the sector has been reliant on the development of hydro power, however increasing climate variability, especially increased prevalence of drought, has brought into question the reliability of supply from hydropower. Power shortages have resulted in various impacts, including increased cost of consumer goods resulting from the inflationary pressure on prices (as oil supplies are diverted for emergency power generation).

Diversifying power generation sources is necessary; and fossil-fuel powered plants are considered viable options, whilst the further development of hydro power resources is assessed. The proposed power plant at Thika is included in Kenya's Least Cost Power Development Plan, one among three plants which are to contribute to increasing the availability of electricity on the national grid – complementing the Kenya Power and Lighting Company's (KPLC) transmission and substation project that is under construction (independently of this proposed project).

## 3. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

The TPP ESIA studies have been carried out in accordance with the Environmental Policy, the Environmental and Social Assessment Procedures and Guidelines of the AfDB and have also taken in to account the requirements of the International Finance Corporation (IFC). The ESIA also conform to the national regulations of the Government of Kenya.

### 3.1. Legislative and Institutional Framework

ESIA in Kenya is governed by the provisions of the Environmental Management and Coordination Act (EMCA) of 1999. The implementation of the project requires administrative clearance from the Ministry of Environment and Mineral Resources (MEMR), in conformity with the provisions of the Act. Under the MEMR, the National Environmental Management Authority (NEMA) is mandated to manage all environmental issues across all the sectors. Specifically the NEMA has developed a number of quality standards, including: *EIA and Audit Regulation, 2003*; *Water Quality Regulation, 2006*; *Noise and Excessive Vibrations Regulation, 2006*; *Waste Management Regulation, 2006*; and *Draft Air Quality Regulation, 2008*.

It was agreed that the primary standards to be used for this project are the European Union (EU) air quality standards (Reference Document on Best Available Techniques for Large Combustion Plants; European Commission. May 2005). In addition, consideration will be made of the draft Kenyan air quality standards (2008) for residential standards. The EU standards apply equally at all off-site locations.

International conventions and protocols of relevance include: *The Vienna Convention for the Protection of the Ozone Layer*; *The Montreal Protocol on the Substances that Deplete the Ozone Layer*; *United Nations Framework Convention on Climate Change*; *Stockholm*

## **4. DESCRIPTION OF PROJECT ENVIRONMENT**

### **4.1. The bio-physical environment**

*Geography:* Thika District lies between latitudes 3°53' and 1° 45' south of the Equator and longitudes 36° 35' and 37° 25' east. The landscape is generally flat, at an elevation above 1,500m, with a few ridges and depressions in wetland areas. To the west, the area is characterised by escarpments and a series of hills; the highest, Ol Doinyo Sabuk, is 2,144m above sea level. These western highlands form the catchment areas for most of the rivers flowing into the south-eastern parts of the District. The proposed project site is on the north-facing, gently-sloping, valley side of a seasonal watercourse, between 1,508m and 1,528 m above sea level.

*Geology and Soils:* The geology of Thika District mostly comprises volcanic rock Tertiary to Pleistocene, underlain by ancient (i.e. Pre-Cambrian) Basement rocks that are mostly gneisses. Key geological features at the Project site are tertiary volcanic rocks, i.e. pyroclastics, a thin basalt flow and Kapiti phonolite.

The soils are stable and rich in organic matter. Black-cotton soils occur in poorly drained areas while sandy soils and murrums characterise well drained areas. Soils in the highland areas are of moderate to high fertility, whereas soils in the lowland areas tend to be sandy and less fertile, but suitable for cattle rearing. Red soils also occur, suitable for agriculture and for brick making. At the Project site, the soils are lateritic, with some small outcrops of underlying rock.

*Hydrology:* Most rivers in the Thika region flow from the highlands in the west towards the lowlands in the southeast of the District, where they join the River Tana and form part of the Tana and Athi river drainage system. The nearest permanent watercourse to the proposed project site is the Ndarugo River, located 3.5km from the site, which originates in the Aberdare Mountains to the west; however, the Project site is in the valley of a seasonal water course, the River Komu, which at its closest is 250-300m distant.

The main groundwater resource in the area occurs as shallow aquifers at the contact zones between the Tertiary volcanic sediments and the Basement rocks, with deeper aquifers possibly occurring along fault or fracture zones. A significant number of boreholes have been identified within a 1- 5Km radius of the project site, with yields of between 0.4 and 27 m<sup>3</sup>/hr.

*Meteorology:* Average minimum and maximum temperatures are 11.5 and 28°C respectively. Rainfall is highly variable, but typically ranges between 500 to 1,500mm per year. Precipitation falls during two distinct rainy seasons: the 'long rains', driven by the south-easterly monsoon, usually between March and May; and the 'short rains', driven by the north-easterly winds that predominate towards the end of the northern monsoon, typically occur from October to December.

*Terrestrial habitats:* Vegetation typically corresponds to climatic conditions. The Thika region is characterised by woodland and shrub grassland, comprised of semi-evergreen and

deciduous bush lands. However, the area is also identified as a semi-humid agro-climatic zone, with relatively high agro ecological potential; as such the habitats of the Project area and its surroundings have been disturbed and significantly modified. No evidence gathered to date has indicated the presence of rare or protected plant or animal species within, or close to, the Project site.

*Protected areas and RAMSAR sites:* The nearest National Park or other major protected area (e.g. National Reserve) is Ol Doinyo Sabuk National Park, more than 20km to the east of the Project site.

*Air quality and ambient noise:*

*Air quality:* The Project site environs are generally agricultural-rural and there are no significant industrial or commercial enterprises within a radius of several kilometres, with the exception of the neighbouring Agro Tropical coffee farm and a large flower farm approximately 1.5 km to the north-east. The major localised source of air pollution in the vicinity of the site is the Nairobi-Thika highway which runs 200-300m to the north and east of the Project site.

A limited ‘spot check’ survey was undertaken in the vicinity of the Project as part of the EIA process. General assumptions have been made as follows (Table.2):

Table 2: Assumptions on ambient air quality

Particulate matter (PM10, PM2.5 and TSP)	The baseline concentrations of particulate matter will be elevated compared to the Kenyan and EU air quality standards; associated with natural sources, as the area is semi-arid and therefore likely to generate elevated emissions from sources such as fields and open land as a result. Emissions arising from traffic on the nearby highway will also contribute to the baseline.
Sulphur dioxide	Low concentrations, as the major sources of would be industrial, and to a lesser extent road vehicles. There are few significant industrial sources (none within 4-5 km of the Project site), and whilst there is a major highway adjacent there are very few other traffic sources.
Nitrogen dioxide and oxides of nitrogen	Low concentrations, apart from in the immediate vicinity of the highway where concentrations would be expected to be somewhat higher.
Carbon monoxide	Low concentrations, there are no industrial sources in the vicinity and the contribution from road traffic is unlikely to be substantial.

*Ambient noise:*

Based on a survey conducted as part of the EIA the following baseline levels have been recorded for significant sites within the project area of influence (Table.3).

Table 3: Baseline noise levels

Noise Sensitive Receptor	Baseline Noise Level dB LAeq, 1 hour	
	Day	Night
1 – Agro Tropical Staff Accommodation	42	40
2 – Mang’u High School Teacher Accommodation	47	35
3 - Nearest Houses to Site – Building 1 (NE Facade)	62	50

3 - Nearest Houses to Site – Building 1 (SW Façade)	61	49
3A - Second Nearest House to Site – Building 2	63	51
4 - Kanyire Farm	51	52
5 - Witeithie Estate	67	61
5A - Witeithie Estate Further From Road	47	41

Kenyan regulations state the following general thresholds for noise levels: 60dB during day time; and 35dB during night time.

#### 4.2. Socio-economic context

*Population:* The population of Thika District is estimated at 472, 334 (2010). Approximately 50% of the population is of working age (15-64), with 31% of people falling into the 15-30 age brackets. Women make up approximately 50% of the population. 80 % of the population in the vicinity of the project site (housing estates) have been in residence for less than ten years; proximity a major transport route and the establishment of a number of commercial and industrial operations in the area have catalysed in-migration.

*Settlement pattern, land tenure and land use:* Thika District is one of the industrial areas in Kenya, it also supports large and small-scale agriculture. The district is also highly urbanised.

Land ownership in resides with the State. Under the Government Lands Act, the Commissioner of Lands grants leases of town plots for terms up to 99 years and agricultural land for terms up to 999 years in duration.

*Local economy:* Approximately 43% of households in Thika District rely on agriculture. The sector employs an estimated 189,072 people directly or indirectly, 70% of them are women. The main cash crops are coffee, tea, pineapples and macadamia nuts; coffee and pineapples are grown on a large-scale for export. Animal husbandry is also practiced. Fish farming is also an important activity, employing an estimated 67,700 people and producing 65.5 m tonnes of fish per year. The trade and industrial sectors also provide an important source of employment; According to the Thika District Development Plan, a total of 31 agro-based industries, 16 chemical and 15 engineering industries are operating, while commercial trading employs roughly 3,000 people.

However, although the total productive labour force in Thika District is approximately 267,000 people or 56% of the population, an estimated 170,000 people (37%) live in absolute poverty.

*Public social services:* Infrastructure in the District is relatively poor. Road coverage is considered fairly low, with 1,339 km of classified and 123 km of earth roads for the entire District. Poor access to road networks in the interior of the district makes it difficult for farmers to bring products to market, and contributes to higher poverty levels.

As of 2008, approximately 14,000 households (12%) in the district had access to piped water, and another 11,500 (10%) had access to potable water. Approximately 83% of households have latrines, with pit latrines in the majority of households (75%), the remainder being uncovered pit latrines. At the district level, electricity accounts for 21% of energy use, while kerosene accounts for 75.6% of use.

The District has 317 primary schools, with a net primary school enrolment rate of 80% for both boys and girls. However, the teacher to pupil ratio is 61:1.

Most of the population has poor access to health facilities. There are approximately 105 health facilities. However of these only one is a hospital, and on average patients travel 5km to reach a health facility. The doctor; patient ratio is estimated at 1: 11,620.

*Areas of cultural significance: heritage:* Thika District currently does not have any documented heritage sites.

## **5. PROJECT ALTERNATIVES**

### **5.1. Justification on the Choice of Technology**

#### **5.1.1. Energy options**

Technically, electricity can be generated from nuclear, geothermal, hydro, solar, wind, coal, oil, gas sources or combinations of them. However, currently there are factors limiting their development in the short to medium term in Kenya. For example: nuclear power requires sophisticated infrastructure and cautionary planning; geothermal potential is still exploratory; 70% of electricity is already generated through hydropower, the viability of further potential is being explored; wind power development requires large capital outlay and characteristically requires long rollout periods and is viable in the medium to long term; and solar power development is expensive.

The preferred technology, thermal power can be generated through the burning of fossil fuels such as diesel, heavy fuel oil (HFO) and natural gas. Coal and natural gas are unavailable in Kenya, however liquid fuels are imported either as crude oil or refined fuel. Although HFO thermal plants produce greenhouse gases (CO<sub>2</sub>) and high levels of sulphur, and could potentially incur higher operational costs than other energy sources - projects are compact, reliable and can be installed within short timeframes. (Furthermore in Kenya, thermal plants have the added advantage of being able to mobilise expertise and funding from independent power producers).

#### **5.2. Technical Alternatives**

Water source: based on hydro-geological and geophysical studies, ground water is the preferred option as opposed to piped water (the municipality is currently challenged by low flow pressure and frequent interruptions are anticipated ) or surface water (abstraction from the most viable source entails substantial costs related to the installation of piping and dumping).

In addition, as a result of the EIA process and associated discussion, one of the design alterations proposed is an increase of the stack height to improve dispersion of emissions to air.

#### **5.3. No Project Alternative**

From a national perspective, demand for energy currently outstrips supply; current supply is also unreliable and subject to frequent interruptions. The Kenyan economy is thus being undermined by the lack of adequate energy – due to the limited development of power

sources. The Ministry of Energy plans to construct three 60-80MW power plants by 2013 to address this problem, in line with Kenya's energy policy and strategy. Without the project the wider benefits to the national economy would not be realised, the 'no project' alternative is thus not considered a viable option.

At more local level, in the absence of the project the proposed site would either remain empty or be converted to farm coffee.

## 6. POTENTIAL IMPACTS AND MITIGATION/ENHANCEMENT MEASURES

### 6.1. Impact Periods

The main impact periods have been defined as: *construction* – site clearance and works; *operation* - fuel supply and consumption, water supply and consumption, plant emissions and waste; and *decommissioning* – demolition and site clearance. The key negative impacts and associated mitigation measure are described below<sup>1</sup>. The proposed project does not result in any resettlement.

### 6.2. Impacts on the ambient environment

#### Air quality

During *construction*, the main impact variables are dust and emissions. Dust will be generated by the traffic, particularly during the dry season; while emissions (PM<sub>10</sub><sup>2</sup>, NO<sub>2</sub>/NO<sub>x</sub>) will also mainly arise from vehicular activity onsite. However, these impacts have been assessed as insignificant, they are also temporal.

During *operation*, emissions (SO<sub>2</sub>, NO<sub>2</sub>, PM<sub>10</sub>, PM<sub>2.5</sub> and CO), dust, and odours (mostly anticipated to arise from the burning of fuel oil and operation of vehicles) are anticipated to be insignificant but effects are long-term. Furthermore, the burning of heavy fuel oil has been classified as an impact of moderate significance as the activity in itself is unsustainable. Additionally, the emission of greenhouses gases throughout the life of the plant has been assessed as significant.

The negative impacts anticipated during *decommissioning* and site clearance are mainly associated with the generation of dust and have been assessed to be of moderate significance but short-term; and emissions from vehicles, are considered insignificant and also short-term. A Site Clearance and Restoration Plan (SCRCP) will be implemented to manage anticipated impacts during decommissioning.

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<sup>1</sup> For purpose of this EIA: *Negligible impacts (or 'insignificant impacts')* are where a resource or receptor (including people) will not be affected in any way by a particular activity or the predicted effect is deemed to be 'negligible' or 'imperceptible' or is indistinguishable from natural background variations; *An impact of minor significance (a 'minor impact')* is one where an effect will be experienced, but the impact magnitude is sufficiently small (with or without mitigation) and well within accepted standards, and/or the receptor is of low sensitivity/value; *An impact of moderate significance (a 'Moderate impact')* is one within accepted limits and standards. Moderate impacts may cover a broad range, from a threshold below which the impact is minor, up to a level that might be just short of breaching a legal limit; and *An impact of major significance (a 'Major impact')* is one where an accepted limit or standard may be exceeded, or large magnitude impacts occur to highly valued/sensitive resource/receptors.

<sup>2</sup> Particulate matter

As described above, impacts on ambient air quality associated with project activities are anticipated to occur during all phases of the project life.

- Climate Change:

The proposed facility will contribute to greenhouses gases through the emission of fossil fuel derived carbon dioxide (CO<sub>2</sub>) to the atmosphere. The main source of CO<sub>2</sub> emissions during operation being from the combustion of HFO to generate power.

The following calculation has been undertaken to quantify CO<sub>2</sub> emissions:

- total HFO usage: 470m<sup>3</sup>/day;
- emissions of CO<sub>2</sub> from HFO combustion: 2596 kg/m<sup>3</sup> (cited in reference as
- 11.8kg CO<sub>2</sub>/ gallon HFO) (1);
- total emissions of CO<sub>2</sub>: 1220000 kg/day; or
- total emissions of CO<sub>2</sub>: 445000 tonnes/year.

The total Project operational emissions are estimated as 445 kt eq CO<sub>2</sub>/y so the Project constitutes a significant impact to GHG emissions.

However, the project facilitates the retiring of inefficient emergency diesel plant and actually benefits the environment by producing less CO<sub>2</sub> per kWh. The Thika plant is 45% efficient as it has a steam cycle and big low speed engines, whereas the small diesels are high speed engines and only about 35% efficient. Thika power plant saves about 85,000 tonnes of CO<sub>2</sub> / year if we assume that it is entirely for retirement of diesel plant and about 40,000 tonnes CO<sub>2</sub> if we consider 50% for retirement of diesel and 50% for new capacity.

### Noise

The main noise sensitive receptors in the project area of influence include a coffee farm, a housing estate and a high school (Table.3).

The sources of noise will include localised and temporal noise from *construction* activities – site clearance, piling, and concreting and equipment installation. Construction will take place during daytime hours only.

Based on Kenyan regulation<sup>3</sup>, changes in ambient noise levels for sensitive receptors within the project area of influence are likely to be *negligible*; with the exception of the housing nearest to the project site (receptors' 3) which will experience *minor* impacts of short duration.

The construction noise impacts assessed as minor are not elevated enough to warrant changes in project design, however 'good practice' will be employed to minimise noise levels, and will comprise the following measures: selection of low noise equipment; temporary screening of the equipment; switching equipment off when not in use; and Construction of on-site buildings first, to act as noise screens.

*Operational* noise is expected to be generated on a 24 hour basis during the project life; mainly as a result of the operation of plant equipment (radiator fans, engine room, ventilation

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<sup>3</sup> Kenyan regulation thresholds are 60dB during the day and 35 dB at night: (Low magnitude Impact) *Minor* if 1 to 5 dB above regulations; (Moderate Magnitude Impact) *Moderate* if >5 to 10 dB above regulations; and (High Magnitude Impact) of *Major* impact if > 10 dB above regulations.

units, and air cooled condensers). Based on Kenyan<sup>4</sup> regulations and also taking into consideration IFC standards<sup>56</sup>, changes in ambient noise levels are anticipated to be: *negligible* for the farm and furthest parts of the housing estate (receptors 4, 5); *minor* for the nearest parts of the housing estate and school accommodation facilities (receptor 5A, 2); and *moderate* with regards to the coffee farm accommodation facilities, and nearest housing to the site (receptors 1, 3,3A).

The mitigation measures to be implemented to reduce noise levels of *minor* significance at the nearest receptors (housing facilities, receptors 3) include installation of quieter equipment and provision of onsite barriers to screen noise from key equipment items.

The *decommissioning* of the project is likely to result in localised and temporal noise impacts similar to those generated during construction. *Minor* impacts are predicted for the nearest housing facilities (receptor 3). Mitigation measures similar to those for construction will be used to reduce noise levels. A SCRPs will be implemented.

**Water resources**

Impacts on water resources during the *construction, operation and decommissioning* of the Project will arise in two main ways: exploitation of local water resources to provide water during construction and operation; and contamination of water resources from construction, operation and decommissioning activities.

The *major* potential impacts during *construction* include: pollution of surface water through accidental spills, and the pollution of groundwater through infiltration. During *operation* the major impacts also relate to the pollution of waters sources through various plant activities. During *decommissioning*, impacts are similar to those anticipated during construction.

Adverse impacts can be mitigated through industry- standard good management practice (Table.4).

**Table 4: Impact on water resources**

	<b>Impact</b>
Construction	<ul style="list-style-type: none"> <li>• Pollution of surface water from run off and accidental spills</li> <li>• Pollution to groundwater from infiltration, and via new path ways</li>   <li>• Poor yield from borehole</li>   <li>• Drawdown of groundwater</li>   <li>• Management of wastewater</li> </ul>

<sup>4</sup> Kenyan regulation thresholds of 55dB during the day and 35 dB at night for residential receptors; and 40 dB during the day and 35 dB at night for the high school.

<sup>5</sup> IFC thresholds of 55dB during the day and 45 dB at night for residential, institutional and educational receptors; and 70 dB for both day and night for industrial and commercial receptors.

<sup>6</sup> (Low Magnitude Impact) Minor if exceeds Kenyan regulations, but plant levels meet or are below IFC criteria; (Moderate Magnitude Impact) Moderate if exceeds IFC performance standards by less than 10 dB; and (High Magnitude Impact) Major if exceeds IFC performance standard by more than 10 dB).

Ops	<ul style="list-style-type: none"> <li>• Pollution of surface water and groundwater from: process water and chemicals leakage; fuel oil leakage; fuel oil delivery; from surface water management; storage and handling of waste; fire water and major uncontrolled releases of fuel oil and chemicals.</li> <li>• Damage to crops and increased soil erosion form increased surface water run off</li> <li>• Water supply conflicts from borehole use</li> </ul>
Decom	<ul style="list-style-type: none"> <li>• Pollution of surface water and groundwater from: dismantling fuel storage tanks, fuel delivery area and associated pipe work; dismantling of effluent treatment plant; removal of diesel engines and transformers; draining of water systems and water treatment chemical storage; surface water management; refueling of plant and equipment; storage and handling of waste; creation of new pathways from the removal of piles and foundations.</li> </ul>

**Traffic and transport**

Impacts associated with traffic during all three phases of the project life have been assessed to be of *minor* significance (Table.6). However, a Traffic Control Management Plan (TCMP, annex to EIA) will be implemented.

Table 5: Impacts arising from traffic

	<b><i>Impact</i></b>
<i>Const</i>	<ul style="list-style-type: none"> <li>• Road User Delay</li> <li>• Road User Safety               <ul style="list-style-type: none"> <li>○ Pedestrians/Community Safety</li> <li>○ Increased volume</li> <li>○ Overtaking</li> <li>○ Highway infrastructure Degradation</li> <li>○ Noise, vibration and air pollution</li> </ul> </li> </ul>
<i>Ops</i>	<ul style="list-style-type: none"> <li>• Pedestrians/Community Safety</li> </ul>
<i>Decom</i>	<ul style="list-style-type: none"> <li>• Road User Safety</li> </ul>

**Waste**

Waste generated during *construction* is likely to consist of: excavation spoil, construction waste, general waste, and sewage and wastewater. During *operation* most waste generated will be process waste and a range of other wastes from transport and administration associated with the project. With regards to *decommissioning* the range of wastes will comprise machinery, metal (mostly ferrous) and demolition waste.

**Landscape and visual**

The construction of the power plant will introduce changes to the existing landscape and view both that are both temporal and permanent. Mitigation will be embedded within the design where possible, for example orientation of the new facilities to match landscape characteristics. Furthermore, an appropriate landscape plan will be developed and adopted that uses tree belts and buffer screenings to provide visual relief and shade. Standard best practice will apply.

Given the rural location of the site, and absence of any areas designated as of cultural or touristic interest, the significance of the impact is considered minor.

### 6.3. Social and socio-economic impacts

The Key social and economic issues anticipated relate to: impacts on employment and the local economy during *construction*; impacts on employment and the local economy during *operation*; impacts of a new workforce on community health and wellbeing during *construction* and *operation*; and employment legacy issues associated with a change in land use.

It is expected that up to 500 workers (skilled and unskilled) will be recruited during *construction*. The large labour pool which exists in Thika District will allow for recruitment locally. Furthermore, indirect job opportunities will be available to local people through the requirement for local goods and service; construction will take place over a 2 year period. In the short term, those employed will have greater ability to invest in education and health care. Postive impact is assessed to be minor to moderate. To enhance benefits, on-the-job training will be provided, contracts will be required, workers will be provided with certificates upon completion of their contracts and a grievance mechanism will be put in place.

During operation however, skilled labour will be required and recruitment locally will mostly be limited to fewer semi-skilled and unskilled positions (drivers, cleaners). Positive impacts are assessed as of minor significance and enhancement measures will be similar to those described under construction.

An influx of workers from outside the locality is likely to result in the introduction of new norms and values. The risk of spread of communicable diseases is also likely to increase. However, as the majority of workers will be recruited locally, there are no plans for on-site accommodation facilities. The magnitude of anticipated negative impacts is low. However, a health risk assessment and workforce management plan will be implemented to mitigate the risks.

With regards to legacy issues, the project site was previously a portion (5%) of a still existing coffee plantation which provides only seasonal employment opportunities for the local communities. Relatively few jobs were lost as a result of the land take. The impact is assessed to be insignificant; anticipated benefits will be enhanced through implementation of an employment policy that will look to recruit locally and also implementation of a Social Investment Strategy to support social development initiatives.

### 6.4. Cumulative Impacts

The impacts of developments already underway or committed (such as the highway upgrading, and the neighbouring KPLC substation and transmission project) have been taken into account by including them in the future baseline for the project within this impact assessment.

Although there is a general aspiration that Thika District should develop economically – and that industry will be a part of that development – no specific developments have yet been proposed. Nor is there any indication that the area south of Thika close to the project site would be favoured over other areas for any such developments in the future. Therefore, it is concluded that there are no significant future developments for which this ESIA should consider cumulative impacts.

## 6.5. Mitigation/Enhancement measures

An ESMP has been developed to meet international standards on environmental and social management and performance, specifically those set out by the IFC and the AfDB.

The main mitigation measures adopted in this ESMP :

- Air : The mitigation measures proposed are itemised in Table.6.

Table 6: Mitigation measures for air quality

Construction	<ul style="list-style-type: none"> <li>• Upon completion of finish grading, earth firebanks and slopes that will remain unseeded will be temporarily protected against erosion by applying a coat of liquid asphalt to the surface, as indicated: Tightly bonded surfaces: 1.4 litre/sq. meter of MC-30; Loosely bonded fine- grained surfaces: 2.3 litre/sq.meter of MC-70 or SC-70; and Loosely bonded coarse- grained surfaces:3.6 litre/sq. meter of MC-250 or SC-250.</li> <li>• Natural binder material extracted from plants, as manufactured by Roadbind Inc. will also be used for erosion and dust control, if required, for example on long term exposed surfaces, or on long term stockpiles. These products are environmentally safe, non-toxic, and biodegradable. The spraying rate shall be per manufacturer’s recommendation.</li> <li>• All materials with the potential to lead to dust emissions will be transported in sheeted trucks.</li> <li>• Wash down of dirty equipment, such as excavators, dump trucks and drilling equipment will be undertaken as required, to avoid excessive build up of dirt and mud on equipment.</li> <li>• Water suppression or dust extraction will be fitted where possible to construction equipment that has the potential to generate dust, e.g. during drilling, excavating, etc.</li> <li>• Surfaces that are to be excavated or cleared will be dampened prior to clearing or excavation where there is potential for excessive dust to be created.</li> <li>• In the event that there is a buildup of dirt or mud on access roads of the highway, this will be cleaned to remove this build up.</li> <li>• On-site vehicle speeds on unhardened roads and surfaces will be limited to less than 15 kph.</li> <li>• Drop heights for material transfer activities such as unloading materials will be minimized.</li> <li>• Bowsers (water tankers) or similar equipment will be available for use to wash down surfaces and roads and damp down surfaces.</li> <li>• Drains and guttering on site will be maintained in a clean state to reduce the potential for materials to become dry and friable.</li> <li>• Bitumen will not be overheated and where possible, bitumen will not be heated with open flame burners.</li> <li>• Pots and tanks containing hot bitumen will be covered to minimize fume production.</li> </ul>
Ops	<p>The main mitigation measure during operation is to ensure that the sulphur content of the heavy fuel does not exceed 2%, so as not to increase SO<sub>2</sub> emissions from the plant</p> <ul style="list-style-type: none"> <li>• Emissions monitoring for SO<sub>2</sub>, NO<sub>x</sub>, PM and CO</li> </ul>
Decom	<p>Mitigation measures are similar to those identified under the construction phase. Implementation of SCRP.</p>

- Water resources:
  - Implementation of appropriate operational controls and monitoring of water quality
  - Installation of appropriate screening filters in the pumping system
  - Channeling and discharge of surface water runoff to ground in unused parts of the project site. Via soakaways or reticulated drainage
  - Siting of soakaways/drainage areas, and their design, will take account of the risks of runoff affecting any sensitivities such as the railway line and agricultural plots that lie downstream.
  - All wastewater on site that will have the potential to become contaminated either because it is directly used as process/contact water, or because rainwater has collected in an area such as the tank farm where the presence of contaminants is possible, will be collected, channeled and processed through the Effluent Treatment Plant (ETP).
  
- Fuel delivery, fuel oil and chemical storage
  - appropriately design of storage facilities, including bunds and impervious services for any hazardous materials (fuels, lubricants, water treatment chemicals);
  - covering all stockpiles to avoid rainwater ingress and runoff, including process waste residues;
  - regular inspection and maintenance of all vehicles, equipment and storage facilities (including integrity checks for all underground fuel tanks); and
  - appropriate spill response and cleanup strategies, and regular training and instruction of staff in their implementation
  
- Traffic management
  - Implementation of TCMP which will address: access to construction areas; routing of construction traffic;
  - temporary traffic control and management;
  - road crossings;
  - parking facilities;
  - keeping highways clean of mud and dust;
  - driver training;
  - road safety and awareness training for school children; and
  - reducing the probability of traffic accidents
  - Regulations regarding transportation of heavy loads
  
- A Waste Management Plan was prepared adopting the waste minimisation; reuse and recycling, waste treatment; and waste disposal principles. TPL will contract a certified private operator with similar experience in Kenya.

This ESMP will be incorporated into TPL's Environmental Management System (EMS), which TPL will develop before the Project becomes operational. The ESMP will be a living document, and will continue to develop during the design and construction phase to enable continuous improvement of the Project's environmental and social performance. The plan details the mitigation and enhancement measures TPL has committed to implement through the life of the Project and includes desired outcomes, performance indicators, targets or acceptance criteria, timing for actions, responsibilities, and associated costs. TPL will have principal responsibility for all measures outlined in the ESMP, but may delegate responsibility to its contractor(s), where appropriate. In cases where other individuals or organisations have responsibility for mitigation measures, this is clearly indicated within the ESMP. The ESMP Unit will consist of one or more qualified staff, with experience

appropriate to oversee the implementation of the ESMP. Initial and ongoing training will be provided as necessary to strengthen the capacity of the individual(s) in the Unit. The functions the Unit will provide via its staff will be:

- Environmental management and monitoring, including capability to task and manage the work of sub-contracted environmental technical specialists as necessary;
- Environmental auditing and reporting; and
- Community liaison.

The ESMP Unit will report directly to Plant Manager.

## 7. ENVIRONMENTAL RISK MANAGEMENT

The risks linked to public safety and staff welfare mainly stem on-site; for example, accidents during construction, operation and decommissioning, and exposure to various hazardous (process wastes) and non-hazardous (packaging) materials.

An Occupational Health and Safety Management Plan (OHSP, annex to EIA) and Unplanned Events and Emergency Response Plan (UERP, annex to EIA) are among the mechanisms through which such risks will be managed. In summary, the safety programme will include: training; inspection and testing; accident investigation and reporting.

## 8. MONITORING PROGRAMME

As part of the ESMP, several Management Plans were prepared and will be implemented and monitored:

- Construction Management Plan;
- Traffic control Management Plan;
- Construction Spoil and Waste Management Plan;
- Unplanned Events and Emergency Response Plan;
- Occupational Health & Safety Management Plan.

The main activities of the monitoring program include:

- **Air Quality** : Visual assessment of dust: routine and, if necessary, in response to a complaint through the Grievance Mechanism, Continuous monitoring of air quality during plant operation (NO<sub>x</sub>, SO, PM, CO) against EU / Kenyan standards, Monitor sulphur content of heavy fuel oil to ensure it does not exceed 2%.
- Noise
- Water resources
- dust control and visual screening
- Monitor requirements laid out in the specific management plans
- Monitor issues raised through the Grievance Mechanism
- Monitor numbers of local people being recruited during construction and operation.

The costs of implementing the ESMP are estimated to be around \$ 361, 360.

**Table 7: Breakdown of ESMP costs**

CAPEX (one off equipment purchases / plans)	Cost, US\$
Air quality equipment	\$75,000.00
Met equipment	\$30,000.00
One off AQ set up and install	\$20,000.00
Noise equipment	\$3,200.00
Conceptual landscape plan (initial cost of conceptual plan only)	\$2,500.00
<b>Total \$130,700.00</b>	
OPEX (one off costs during construction / commissioning phases only)	
Noise monitoring during construction (ambient and then construction monitoring)	\$8,000.00
Noise monitoring during commissioning (ambient)	\$860.00
TPL staff training	\$10,000.00
<b>Total \$18,860.00</b>	
OPEX (additional costs predicted over assumed 25-year project lifetime)	
Noise monitoring during operation (over project lifetime of 25 years)	\$4,300.00
Implementation of mitigation in the traffic management plan	\$50,000.00
Air quality and met monitoring - maintenance, periodic data validation as required (contingency)	\$100,000.00
Safety programme implementation	\$7,500.00
Summary	
CAPEX	\$130,700.00
OPEX (one off construction/commissioning phase)	\$18,860.00
OPEX (additional costs predicted over assumed 25-year project lifetime)	\$211,800.00
<b>TOTAL (over lifetime of project, i.e. CAPEX, OPEX construction, OPEX annual + additional lifetime costs)</b>	<b>\$361,360.00</b>

Note 1: these are only the additional material costs above costs or resources that are assumed to fall within general TPL staff job requirements

Note 2: this does not cover any costs related to the Stakeholder Investment Strategy

## 9. PUBLIC CONSULTATIONS

Stakeholder have been identified and engagement as part of the ESIA process. The first phase of the consultation was undertaken between October 2010 and March 2011; and has been recorded in a Stakeholder Engagement Plan (SEP, annex to the EIA). Consultation will be ongoing over the life of the project.

The project information brief was circulated in both English and Kiswahili.

The stakeholders identified include - affected households and villages, traditional leadership, civic organisations, local authorities and Non- Governmental Organisations (NGO).

Key areas of discussion during consultations included: details of the proposed project; potential positive and negative impacts; community expectations and concerns regarding the project; potential benefits to the local area; community health and safety issues; wages, timings, access to work occupational health and other livelihood matters; indigenous people and culture and heritage sites within the potential areas of influence. Provisions have been put in place to manage grievances.

Furthermore, in order to fulfil the requirements of the Bank's Information Disclosure and Public Consultation Policy, the summary will be posted on the Bank's website at least 60 days prior to presentation of the investment proposal for Board approval.

## 10. COMPLEMENTARY INITIATIVES

The magnitude of the project will result in co-benefits, the creation of employment opportunities for both unskilled and semi-killed labour in the local communities; although these will be mostly short-term. TPL has committed to collaborate with the local authority and the population's representatives through the following plans and strategies:

- **Stakeholder Engagement Plan:** a process of sharing information and knowledge, seeking to understand and respond to the concerns of others, and building relationships based on collaboration. The management of grievances is therefore a vital component of stakeholder management and an important aspect of risk management for a project.
- **Worker Management Plan:** TPL and their contractor(s) will implement this WMP with reference to the International Standards, a commitment to Transparency, Non-discrimination and Equality; Optimisation of Local Content; and Commitment to Health and Safety.
- **Social Investment Strategy:** This document presents an outline Social Investment Strategy to guide the work of TPL (and of other organisations such as CBOs with whom it may partner) through the development of a Social Investment Framework and Plan. Further, it will inform the development of individual Social Investment projects and activities, and ensure effective engagement of communities through all stages, from identification of activities through to monitoring and ex post evaluation.
- **A Grievance Mechanism** specific to the Project has been developed by TPL.

## 11. CONCLUSION

The impact assessment has demonstrated that the impacts likely to arise during the project life cycle are various and of varying significance. Comprehensive monitoring will be required to ensure impacts are managed.

The project proponent needs to comply with Kenyan Authority regulations and guidelines as well as the various DFI requirements. The requirement to submit Environmental and Social Monitoring Reports will be stated. However, good working practice, health and safety, are usually components of company procedures.

## 12. REFERENCES AND CONTACTS

The documents reviewed by the AfDB include the two Environmental and Social Impact Assessment Studies drafted by Enviroplan and Environmental Resources Management Limited respectively.

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