EXHIBIT 1.1

ENVIRONMENTAL ASSESSMENT REPORT

ENVIRONMENTAL ASSESSMENT
REPORT -- FINAL

KIPEVU II 74 MW POWER PROJECT
MOMBASA. KENYA

Prepared for:

Tsavo Power Company Limited
Mombasa. Kenya

Prepared by:

ESG International
361 Southgate Drive
Guelph. Ontario CANADA
N1G 3M5

In association with:

RWDI
Guelph. Canada

Gibb (Eastern Africa) Ltd.
Nairobi. Kenya

Approved:

Date: July 13/99

July 1999
98160.final report.doc

EXECUTIVE SUMMARY

The Project

Tsavo Power Company Limited (TPC) proposes to build, own and operate a 74 MW engine-driven power plant in an industrial area of Mombasa, Kenya at an approximate cost of US$ 84 Million. The electricity will be sold to the Kenya Power and Light Company (KPLC). The proposed plant, known as Kipevu II, will be located on the West Mainland overlooking the Port of Mombasa, near KPLC's existing Kipevu power station. The site is vacant, undeveloped industrial land. Immediately adjacent will be Kipevu I, a similarly sized engine-driven plant to be owned and operated by KenGen (formally the Kenya Power Company Limited).

TPC, the sponsor of the project, is a special purpose company established by Wärtsilä NSD Power Development of the UK and Wärtsilä NSD Eastern Africa Ltd. The Government of Kenya (GOK) issued a competitive tender for 75± MW in late 1996. Wartsila NSD Power Development was deemed to have offered the best price and was subsequently invited to negotiate the power purchase agreement (the "PPA"). The PPA was eventually executed on November 3rd, 1998. The project is part of an overall plan to expand generation capacity to meet current and projected shortages.

Kenyan and IFC Environmental Review Requirements

The project is being designed to address all applicable Kenyan environmental, land-use and occupational health and safety laws and regulations as well as the relevant policies and guidelines of the International Finance Corporation (IFC).

The Government of Kenya has not established environmental legislation, environmental assessment guidelines, or environmental quality guidelines specific for thermal power plants. The government does however recognize international accepted guidelines such as those of the World Bank. The PPA as executed requires that the project adhere to the "1997 World Bank guidelines" with a number of specific exceptions. Based on the requirements of the PPA and the desire of the project sponsors to use multilateral financing for the project, the Environmental Assessment Report (EA) has been prepared in a format and with a content consistent with that suggested by IFC's guidance documents.

It is anticipated that the project will be required by the IFC to comply with the requirements of the "World Bank Pollution and Abatement Handbook – Part III, Thermal Power Generation for New Plants", dated July 01, 1998. In recognition of the anticipated economic benefits to Kenya from the project using 2.5% fuel oil supplied by the Mombasa refinery, IFC has indicated that an exception to the specific stack SO_2 emission rate requirements of the 1998 Guidelines is appropriate. IFC has indicated that as an alternative it would accept compliance with the SO_2 stack emission limit specified in the 1997 draft version of the World Bank's Pollution Prevention and Abatement Handbook, provided that the project complies with the ambient air quality guidelines. The specific reasons for this exception, and the details of how the project complies with it, are detailed later in this report. In brief it is based on the facts that the draft PPA was initialed in December 1997 and the final PPA initialed in July 1998 on the basis of the 1997 draft guidelines.

The Kipevu II project is a category B project according to IFC's environmental review procedure since the specific impacts of the project can be avoided or mitigated by adhering to generally recognized performance standards, guidelines or design criteria. Environmental issues associated with this project and which have been addressed by the Environmental Assessment (EA) Report include: air emissions and ambient air quality impacts including cumulative ones of the Project and the neighboring plants; noise from plant operation; water supply and liquid effluents; fuel transportation and spill control; liquid and solid waste disposal; fire protection and emergency response; and general workplace safety.

Methodology of the EA

The Canadian-based firm ESG International (ESG) led the preparation of the environmental assessment. ESG coordinated input from subconsultants specializing in the areas of air dispersion modeling and noise assessment (RWDI Inc, Guelph, Canada) and Kenya environmental permitting (Gibb Consultants, Nairobi, Kenya).

The specific methodologies included specialized computer-based modeling of air emissions; the application of the professional judgment and experience of the study team members; and site and area specific sampling programs for data to input to the process. Overall, the EA process included describing the baseline conditions, assessing potential impacts, identifying mitigation measures, and assessing net effects. The inventory, or baseline, phase of the EA consisted of assembling and reviewing all relevant, available published background information and collecting primary data, as required. The EA process was also guided by public and agency consultations to assist in the identification, scoping and resolution of issues.

Site Description and Baseline Environment

The proposed site is at the top of a hill nearby an existing power station in the West Mainland area of Mombasa, just across from Mombasa Island. The general site area is a point of land bounded by inlets on three sides. At the time of the fieldwork for the Environmental Assessment the site was primarily vegetated -- all of the flora and fauna present at the site were considered to be common. Subsequently, the site was cleared and leveled by the contractor building Kipevu I. This work was the responsibility of KPLC as part of the project agreements.

Also on the site was relic stonework dating to the British colonial period. These features were considered worthy of documentation but not preservation and were subsequently removed during the grading of the site.

The general site area is in an industrial zone with port facilities, rail lines and existing power generation plants among other activities in the vicinity. There are a small number of nearby roadside vendor stalls or kiosks that service truck traffic and workers in the harbour area. The low-income residential area of Changamwe starts about 500 metres northwest.

Also nearby the site is the Kenya Oil Refinery, which serves Kenya, Tanzania and Uganda.

Use of the proposed site was specified by KPLC. Although the site is somewhat small in land area it was found to have the following desirable attributes:

- The site is on a hill facilitating dispersion of air emissions;
- The site is surrounded by industrial and vacant land and is therefore not in conflict with potentially sensitive land uses;
- No resettlement of residents is required as the site is vacant. The site is owned by the GOK, which has leased the land to the Export Processing Zones Authority (EPZA) under a 99 year lease. EPZA has given KPLC a 92 year lease and KPLC has inturn provide a 21 year lease to TPC;
- Since the site is directly adjacent to the main power station serving the Mombasa area, it is a simple matter to connect into the existing power grid; and
- The site has excellent access for delivery of equipment and fuel.

Data on background concentrations of SO_2 and NO_2 were collected. The data indicate that air quality in rural and suburban/industrial areas is good. Air quality in the urban core is considered to be moderately degraded.

Power Plant Description

The plant will comprise 7 diesel engine-generator (DG) sets burning heavy fuel oil (HFO) at a proposed maximum sulfur content of 2.5% (as specified in the project fuel supply agreement). At present the local refinery produces residual fuels typically with a sulfur content of less than 2.5% but is capable of processing fuels of up to 3.7% sulfur. When the Kipevu II project is commissioned it has been reported that the refinery will guarantee a maximum 2.5% sulfur fuel oil for use in Kipevu II. This will then ensure that the Kipevu I plant also is limited to 2.5% sulfur rather than the 3.2% it is understood would otherwise be used in that facility. This fuel will then be the lowest sulfur HFO fuel economically available in Kenya. The fuel will be provided to the plant via an existing pipeline that passes in close proximity to the plant boundary.

Connection to the power grid will be via a single 132 kV underground cable, which will link Kipevu II to a 132 kV switchyard being constructed by KPLC as part of its Kipevu I project. A second underground cable will be constructed to the vicinity of the site boundary. This cable will connect to a proposed transmission line to be constructed by KPLC from the Kipevu area to a substation in Rabai, about 14 km to the west. It will be possible to supply power to the grid through either connection, depending on the operational requirements of KPLC.

The power plant will include the following:

- a power house enclosing the 7 engines and generators;
- a closed loop cooling water system with fin-fan radiators for heat exchange to the ambient air;
- facilities for the transfer and storage of fuels and lubricants;
- systems for handling and treating sludges and oily wastes
- switchgear and transmission facilities;
- fire fighting equipment;
- site drainage and pollution control systems; and
- miscellaneous maintenance, office and security facilities.

Potential Impacts and Proposed Mitigation.

Local Economic Benefit

The primary benefit of the project will be production of reliable economically priced power required for the continued economic development of Mombasa and Kenya. The project will create construction jobs over the 10 to 12 month construction period, as well as a permanent job force of about 100 persons to run the plant. The project will also create a spin-off effect from increased demand for local goods and services. A social goodwill fund will be established (about US$ 50,000 per year) to sponsor social and environmental development projects in the local community. The 2.5% sulfur limit will also ensure that the fuel requirements for the Kipevu I and II projects is met by the Mombasa refinery thereby providing the refinery the opportunity to operate economically.

Stack Height

An Environmental Review Report prepared for Kipevu I in 1996 recommended that the stack height of Kipevu I should be 50 m with a multi-flue stack configuration, and that the stack height of Kipevu II should be identical provided that the design of Kipevu II will be the same as Kipevu I or better. Although the Kipevu II power house is shorter (13 m high) than the Kipevu I power house (20 m high), it was determined that the stack height should equal the height of the stack for the Kipevu I plant. The ground level for Kipevu II is 5 m higher than Kipevu I, and therefore, the stack height of Kipevu II will be 45 m with single cluster configuration. This complies with the World Bank Group environmental guidelines for stack height.

Plant Air Emissions

In accordance with 1998 World Bank guidelines, TPC plans to use the cleanest HFO economically available in Kenya. This corresponds to HFO produced by the Kenya Petroleum Refinery with a maximum sulfur content of 2.5%.

Plant SO_2 emissions of 1450 mg/Nm^3 when using 2.5 % sulfur fuel will meet the guideline applicable for the sulfur emissions of 2,000 mg/nm^3 as set forth in the World Bank's Draft Pollution Prevention and Abatement Handbook dated September 01, 1997. The September 1997 guidelines were the most updated version available to the public during the time period when the power purchase agreement was negotiated. The 1998 version of the Handbook will not be applied for sulfur emissions as those guidelines were only available at a relatively late date in the project development schedule (July 01, 1998).

The plant will also meet the World Bank emission guidelines for NO_2 and PM. There are no applicable Kenya regulations for emissions from power plants.

Ambient Air Quality

The maximum predicted ambient concentrations of air pollutants associated with the operation of the power plant, including background levels and including the effect of the emissions from Kipevu I meet the World Bank guidelines for ambient air quality.

In the urban core of Mombasa, the background 24 hr level of SO_2 exceeds the World Bank guidelines of 150 µg/m^3. In this area the combined effect of Kipevu II and Kipevu I (4 µg/m^3) meet the World Bank's guideline of a maximum increase in the annual average of SO_2 of 5 µg/m^3. Moreover, the maximum effect from the plants in the urban area (and indeed in the airshed as a whole) will occur on only about 5 or less days per year.

Noise

The power plant will meet World Bank guidelines for environmental noise. Exhausts and air intakes will be equipped with silencers to reduce the noise level at source by 35 dB(A). In order to minimize effects on the nearest residential area (about 450 m northwest of the Plant) the power house and facilities have been laid out with the quietest side facing north. Further noise reduction will be achieved by use of low noise radiators for the cooling system to ensure nighttime noise in the residential area meets World Bank guidelines.

Liquid Effluents and Waste

The power plant will be designed to meet the World Bank guidelines for liquid effluents from power plants. All process water and oil water from operations will be treated in an oily water treatment unit to ensure the resultant effluent meets World Bank guidelines for oil and grease and all other parameters listed in the guidelines. The dewatered sludge will either be incinerated on-site or taken off site for use or disposal in an environmentally sound manner.

Any stormwater potential contaminated by oil and grease will be diverted through an oily water separator prior to discharge to the environment.

Fuel Delivery and Storage

Fuel will be delivered to the site through a spur line to be constructed to an existing pipeline that runs approximately 50 m from the north side of the project site. All on site bulk storage tanks will be built to current industry standards and will be within impermeable dyked enclosures which would prevent any spilled oil from escaping into the environment.

Occupational Health and Safety
An occupational health and safety manual specific to the project will be drawn up prior to the power plant entering service. The manual will be based on generic safety manuals developed by Wartsila NSD Corporation based on international standards.

Fire Prevention and Emergency Response
Emergency preparedness plans specific to the project will be drawn up according to model plans developed by Wartsila NSD Corporation for this type of power plant. These include plans for spill prevention, control, and contingency, civil unrest and riots, fire emergencies, and natural disasters.

Environmental Action Plan

An environmental action plan (EAP) has been developed to reduce or eliminate the environmental effects of the project. Environmental management requirements will be specifically addressed in contractual agreements, and TPC will implement oversight procedures to ensure compliance. The monitoring program to be followed by TPC will focus on compliance with environmental terms and standards, environmental incidents, air quality, water quality, noise, socio-economic conditions and employee health and safety.

Public Consultation

There is flexibility in the nature and extent of public consultation for Category B projects. In the case of Kipevu II, where there was limited potential for affecting residents in the immediate vicinity of the power plant, consultation efforts focused on national and local government authorities and the scientific community. As part of the Electrical Power Production Licensing procedures the sponsor places ads in Kenyan newspapers notifying the public about the project, indicating detailed information about it was available for review, and inviting comments and questions.

Summary

The Kipevu II power plant has been designed to address, and can be operated within, all applicable World Bank and Kenyan environmental and social guidelines. The project will be monitored to demonstrate it's ongoing compliance with World Bank environmental, health and safety policies and guidelines.

TABLE OF CONTENTS

Section Page

Table Page

Figure Page

Photograph **Page**

Appendix

1. INTRODUCTION

Tsavo Power Company Limited (TPC) proposes to build, own and operate a 74 MW engine-driven power plant in the vicinity of Kenya Power & Lighting Company Limited's existing Kipevu Power Station in Mombasa, Kenya (Figure 1.1). The proposed plant, known as Kipevu II, will be located on the West Mainland overlooking the Port of Mombasa (Figure 1.2). The site is on undeveloped industrial land bordering the port area.

Two power stations are planned for the general site. Kipevu I, an engine-driven power plant of approximately 75 MW capacity will be owned and operated by KenGen (formally know as the Kenya Power Company Limited). Kipevu II, the project addressed by this environmental assessment, is an independent power project.

To avoid confusion between the existing Kipevu Power Station and the proposed Kipevu I and II, the former will be called the "existing KPLC power station" in the remainder of this environmental assessment.

TPC is a special purpose company established, under the laws of Kenya, to build, own and operate the Kipevu II power plant. Wärtsilä NSD Power Development of the UK and Wärtsilä NSD Eastern Africa Ltd. are presently the only shareholders of TPC. It is the intention to introduce as soon as possible two new corporate shareholders, the Commonwealth Development Corporation (CDC) and Cinergy Power Limited. Cinergy power limited is a local company formed through a joint venture of Cinergy Corporation from the USA and Industrial Promotion Services (IPS), a local company that is part of the Aga Khan Fund for Economic Development. It is also expected that the International Finance Corporation will take an equity position in the project. It is planned to finance the project by non-recourse debt and equity, in the ratio of 70:30.

1.1 Need for the Project

The Government of Kenya projects the maximum national demand for electricity to increase from 621 MW to 1837 MW over the 20-year period from 1993 to 2013. The corresponding energy demand is projected to rise from 3,735 GW_{hr} to 10,339 GW_{hr}. To satisfy this demand, generating capacity will have to increase from 784 MW to 2004 MW over the 20-year period of the projections.

The required expansion of electrical generation capacity can be achieved in a timely manner only by developing a judicious combination of geothermal, thermoelectric and hydroelectric generating stations. Both the public and private sectors will have to participate in this endeavour.

In 1996, 87% of Kenya's power was generated by hydroelectric installations constructed between 1968 and 1991 on the Tana River and in the Kerio Valley. In addition about 45 MW of geothermal power generation capacity was in place in the Olkaria area of Kenya, and thermal projects totaling 64 MW were under development in the same area.

Conventional thermal or engine-driven power plants currently generate only a small percentage of Kenya's power. Most of these facilities are in Mombasa. A summary of the status of power generation facilities in Mombasa as of February 1999 is provided in Table 1.1.

Mombasa and environs suffer from insufficient power generation capacity, particularly during extended dry periods when the supply of electricity from up-country hydroelectric sources is reduced. Under these circumstances, the region becomes increasingly reliant on its thermal (steam turbine and engine-driven) power generation units. Because there is little reserve capacity for peak power generation, power rationing occurs when units are taken out of service for maintenance or repair.

Table 1.1 Existing Power Generation Facilities in Mombasa

Plant	MW	Type	Fuel	Comments
KPLC Power Station				
Units 1, 2, 3, 5 & 6		Steam Turbines	HFO (max. 3.5% S)	Out of Service
Combined Units 4 & 7	26	Clark-Chapman steam turbine	HFO (max. 3.5% S)	To be retired upon KI and KII entering service
Gas Turbine	31.6	GE Frame 6 gas turbine	Kerosene (max. 0.15% S)	Serviceable until circa. 2003-2004
Westmount Power Barge				
Gas Turbine	43.5	gas turbine	Kerosene (max. 0.15% S*)	Commissioned in 1997; located in Mombasa Harbour

*Assumed to be same as maximum specified sulfur content of fuel for gas turbine unit at existing KPLC station
Source: F. Konuche, Chief Engineer, Kipevu Power Station, personal communication

Many manufacturing, food storage and tourism facilities in the Mombasa area do not possess significant standby power generation capacity. Power outages are frequent and unpredictable. They can cause significant direct loss (e.g., of perishable foodstuffs) and foregone economic output.

To alleviate the problem of power interruptions, KPLC has embarked on a program to significantly expand power generation capacity in the Mombasa area. KenGen is currently constructing Kipevu I, an engine-driven power plant comparable in size to Kipevu II, which it will operate on a site nearby the existing power station. At the existing KPLC power station KPLC is also installing a second 31.6 MW gas turbine unit. TPC's proposed Kipevu II falls within the Utility's plan to improve the power supply.

1.2 Power Plant Fuel

Both Kipevu I and Kipevu II will operate on heavy fuel oil (HFO). Agreements regarding the supply of the HFO have yet to be finalized. Kipevu I will obtain fuel from an independent fuel supplier. Currently fuel suppliers can obtain HFO produced by the Kenya Oil Refinery or from offshore sources.

Scenario 1: Fuel From Kenya Oil Refinery

The Kenya Oil Refinery is presently heavily under utilized and operates at a reported 55% capacity. The primary reason for this is reportedly the lack of a market for residual fuel oil. At present the refinery is capable of processing crude oil to produce up to 3.7% sulfur fuel which is the maximum sulfur content allowed for HFO in Kenya. However, on average, the residual fuel produced by the refinery has been below 2.5%. The Kipevu I project will most certainly obtain fuel from this refinery.

Refinery management have indicated that the current 55% capacity level of production may eventually lead to the closure of the refinery and the refinery needs to contract with Kipevu I and Kipevu II to improve its economics. The Kipevu I project will almost certainly obtain its fuel from the refinery, however, if the Kipevu II project were to adhere to the 1998 guidelines for stack emissions (0.2 tpd/MWe the refinery would have to guarantee a fuel of maximum 1.9% sulfur. Discussions with the refinery indicate that this is not practical nor economical considering the available crude supply to the refinery.

Following discussions with the refinery management, Tsavo Power concluded that most logical and economical approach to the fuel supply issue is to specify 2.5% maximum sulfur fuel for the Kipevu II project thereby ensuring that the fuel supply would be available from the refinery and additionally ensuring that the most economically available supply for the Kipevu I project was also 2.5% rather than the 3.2% limit presently set. Use of refinery produced 2.5% HFO by Kipevu I and Kipevu II would allow the refinery to economically market all of the HFO produced at 100 % capacity. This would create the economic

conditions needed for continued operation of the refinery as well as allow the refinery to proceed with its planned Quality Improvement Project (Appendix A). While the refinery maintains a simple process the facilities are well maintained and operated entirely by a state-of-the-art computer control system.

Currently gasoline in Kenya is leaded, and diesel oil contains up to 1% sulfur. The Quality Improvement Project of the refinery is an investment in technology that would allow the refinery to produce unleaded gasoline and low (.05 %) sulfur diesel oil. A reduction in the levels of these contaminants in motor fuels would have substantial environmental and human health benefits for high population density areas of the country such as Mombasa and Nairobi.

By specifying a 2.5% sulfur fuel oil limit, the Kipevu II project will :

- Comply with the September 01 1997 Draft World Bank Pollution Prevention and Abatement Handbook for stack emissions.
- Comply with the July 01 1998 World Bank guidelines for ambient air quality.
- Practically limit the Kipevu I fuel to 2.5% sulfur rather than 3.2%.
- Provide the refinery with an opportunity to operate economically and prevent its imminent closure.
- Provide the refinery an opportunity to implement the Quality Improvement Project plan thereby improving the quality of gasoline and diesel and hence reduce automotive emissions of lead and SO_2.
- Ensure that the electricity cost to KPLC consumers is the lowest possible.

Scenario 2: Fuel From Offshore Suppliers

In order to comply with the SO_2 emission rates set out in the 1998 World Bank guidelines, Kipevu II will have to procure fuel from offshore sources with a maximum sulfur content of 1.9 %.

The management of the Kenya Oil Refinery has indicated that under this scenario the refinery would be forced to close. This would require Kipevu I to also procure fuel from offshore suppliers. For economic reasons this would probably result in the purchase of low cost/high sulfur (3.2%) fuel. This would negate the benefit of Kipevu II using the 1.9% sulfur fuel and lead to an overall increase in the cost of energy to KPLC consumers. The refinery may close with the resultant loss of jobs, negative impact on the Kenyan GDP and associated collateral impacts. The benefits of reduced lead and sulfur in motor fuels may also be lost.

Tsavo Power has no economic incentive or benefits from using 2.5% sulfur fuel. All fuel is a 'pass through" and the cost of fuel is borne by KPLC. Notwithstanding this TPC supports modernizing and upgrading the Kenya Oil Refinery because of its considerable potential benefit to the Kenyan economy. The company also supports the potential long-term environmental benefits resulting from reductions in the sulfur content of diesel and lead in gasoline, produced by the upgraded refinery. For these reasons the project has been planned assuming use of fuel produced by the refinery.

The IFC has indicated during its review of the project that use of 2.5% S HFO is acceptable as it meets the guidelines specified in the PPA, provided however that the overall ambient air quality guideline limits specified in the 1998 guidelines are not exceeded.

1.3 Key Features of Wärtsilä NSD Power Plants

Over the past decade, use of diesel engines in power plants has evolved from small-scale applications, such as emergency power generation, to large-scale, base load power production. Today, base-load diesel power plants with an output of up to 150 MW are common, and even larger plants are being proposed.

The 18V38, medium speed diesel engine has been a popular choice for power plant applications for a number of reasons:

Low fuel consumption (i.e., high thermal efficiency): The 18V38 engine provides the highest energy output at the lowest possible fuel consumption and emission levels for simple cycle power plants. An advanced fuel injection system and a specially designed combustion chamber have achieved this. The high efficiency results in lower emissions of SO_x, particulates and CO_2 than other simple cycle prime movers

Low NO_x emissions: The optimized combustion process of the 18V38 has the positive benefit of substantially reducing NO_x emissions in comparison to diesel engines of earlier design.

Short construction time: The power station will be completed and in full commercial operation within 20 months of the signing of the Power Purchase Agreement and within 13 months of start of on-site construction activity.

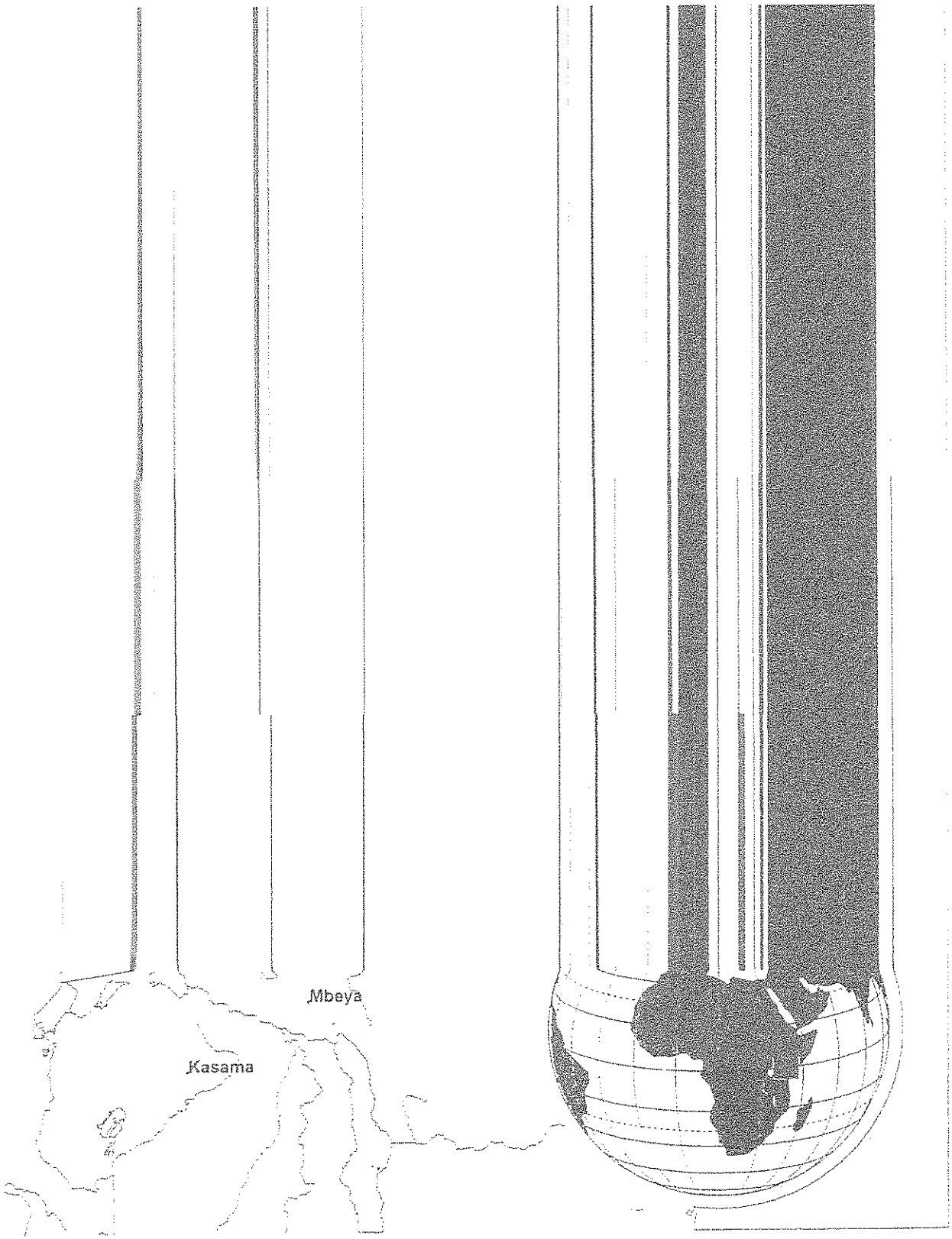
Practicality of on-site maintenance: The 18V38 engine has 40% fewer parts than the previous generation of engines of its class. All parts are easily accessible, minimizing the complexity and extent of maintenance required. Local personnel can be trained to operate and maintain the plant.

Attractive capital and operating costs: Diesel power plants are based on proven existing technology and do not require extensive site-specific engineering. The 18V38 engine is "short and low" helping to minimize space requirements and the costs of transportation, site development, and plant construction. Automated systems can control and monitor all engine and plant functions, as well as provide operational alarms and protection from hazards to plant. These systems greatly increase plant reliability and security while freeing operating staff to perform other important duties.

1.4 Project Status

In November 1996, Wärtsilä NSD Power Development Ltd. submitted a proposal in response to the Government of Kenya's (GOK) *Request for Proposals for a Diesel Power Plant at Kipevu II*, dated July 5, 1996. Following protracted discussions, PPA negotiations commenced in July 1997 and a draft Power Purchase Agreement, Security Agreement and Land Lease Agreement were initialed on July 22, 1998. The final agreements were signed on November 3rd, 1998.

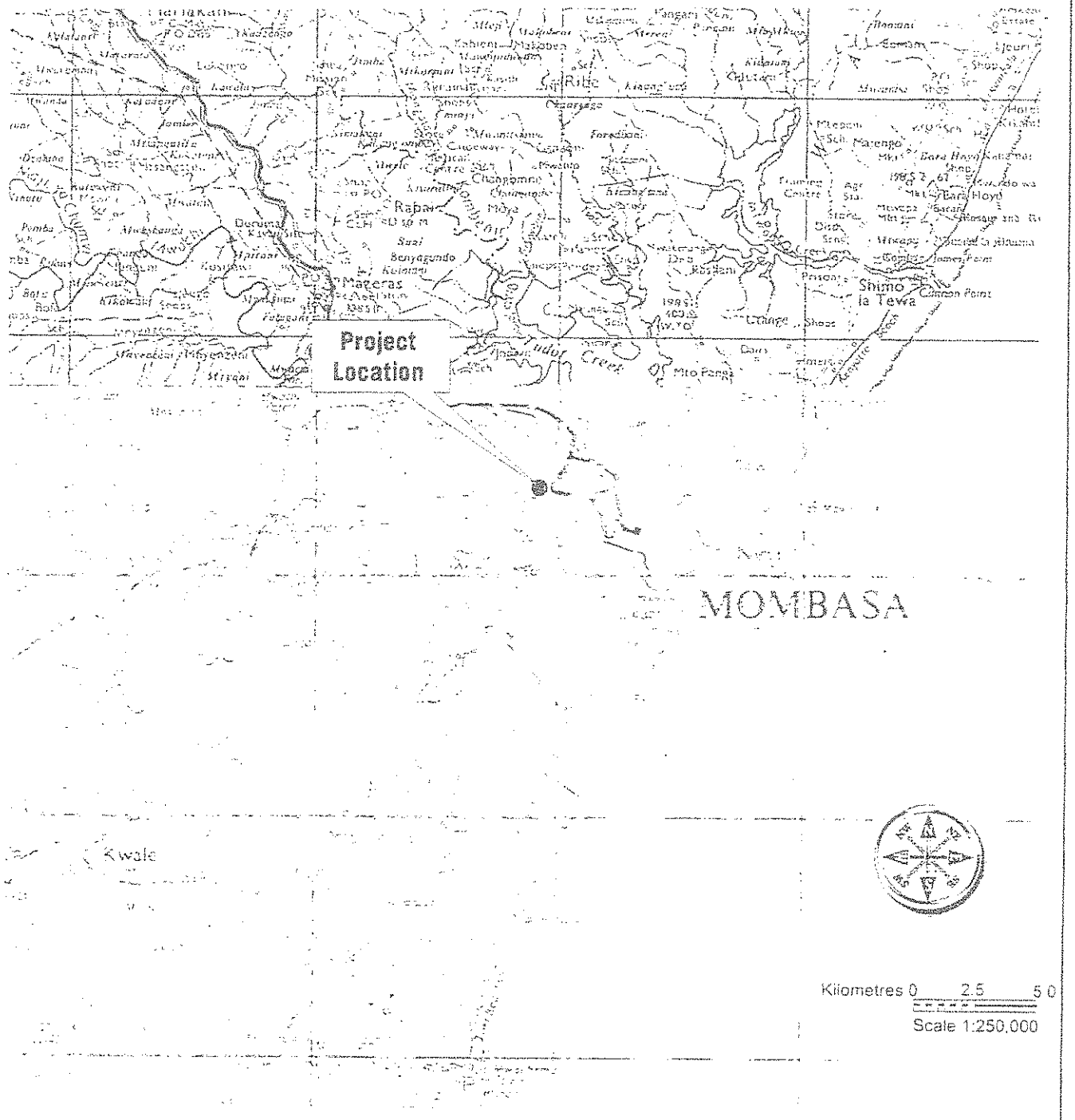
The fuel supplier will be selected on a competitive bid basis in accordance with the requirements of the Power Purchase Agreement. The choice of fuel supplier will be subject to the approval of KPLC.



ESG INTERNATIONAL

PREPARED FOR
TSAVO POWER COMPANY LTD.
KIPEVU II 74MW POWER PROJECT

Date: April 1999	FILE: 98160_01	Figure 1.1
Revised		Location of Proposed Project in Kenya
Revision No.1		



ESG INTERNATIONAL

Project Name: KIPEVU II ENVIRONMENTAL ASSESSMENT	Date: April 1999	FILE: 98160_09	Figure No. 1.2
Prepared for: TSAVO POWER COMPANY LIMITED	Revised:	LOCATION OF THE PROJECT IN MOMBASA	
	Revision No		

2. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

This environmental assessment has been prepared with a view to meeting the requirements of the World Bank Group as interpreted by the International Finance Corporation (IFC) and the Commonwealth Development Corp. (CDC). The requirements of each of these organizations are set out in the following subsections.

2.1 World Bank/IFC Requirements

This environmental assessment has been designed to meet World Bank/IFC requirements for a Category B project. Category B projects involve relatively routine environmental and social considerations that can be addressed by standard mitigative measures. Such projects typically do not result in significant irreversible impacts.

Kipevu II fits this profile. The proposed plant will be located on an unoccupied site in an existing industrial area and so effects on people, such as resettlement, and on natural habitats will be minimal.

There is flexibility in the nature and extent of public consultation for Category B projects. In the case of Kipevu II, where there was limited potential for affecting residents in the immediate vicinity of the power plant, consultation efforts focused on national and local government authorities and the scientific community. A list of the individuals and organizations contacted is provided in Appendix B. Also included in Appendix B are copies of the ads that were placed in newspapers by the project sponsor notifying the public about the project and indicating information about the project (which included the Draft Environmental Assessment Report) were available for public review.

During the initial phases of project planning and negotiation of the Power Purchase Agreement, environmental assessment activities were developed in accordance with the guidelines applicable at the time, namely, the *World bank Environment, Health and Safety Guidelines for Engine Driven Power Plants*, dated October 23, 1996. The study team also kept current with evolving guidelines, as set out in the Pollution Prevention and Abatement Handbook, Annual Meetings Edition, September 1997.

On July 1, 1998, the World Bank issued the finalized version of its Pollution Prevention and Abatement Handbook. IFC indicated to TPC that the guidelines applicable to Kipevu II are those set out in the 1998 Handbook. For Kipevu II the key guidance document, set out in Part III of the Handbook, is entitled "Thermal Power – Guidelines for New Plants" (Appendix C). An exception, however, was provided for the emission of sulfur -- as much of the project planning was completed on the basis of earlier versions of the guidelines IFC indicated it would allow the project to proceed using the sulfur emission rates set out in the 1997 draft guidelines. For all other parameters the currently applicable guidelines apply.

In addition to the guidelines mentioned above, projects are also required to address the relevant Operational Polices (OPs) of the IFC. A list of these is provided in Appendix C.

2.2 Commonwealth Development Corp. Requirements

In addition to its assessment of the financial viability of an investment, CDC gives careful consideration to social and environmental impacts. Their objective is to invest only in projects where the social or environmental risks have been mitigated through appropriate project design.

CDC, unlike the World Bank, has not developed its own set of environmental guidelines, but instead expects the projects it finances to follow "internationally accepted environmental good practice". A project that meets World Bank guidelines would clearly meet the above criterion.

The CDC's operational policies, which are quoted below from their 1997 Annual Report, reflect the investment criteria outlined above.

In broad terms: CDC's policy is to promote socially and environmentally responsible business through an open and responsive approach to all those affected by, and able to affect, our operations. We aim to interact and adapt in order to develop mutually beneficial relationships. While every investment must meet certain criteria, we recognise that our role will vary across the diverse countries and sectors in which we operate and that we have different levels of influence according to the nature of our involvement.

- *Where CDC manages a business, we aim to provide our employees with a fair reward; a safe, healthy environment; access where appropriate to basic services and facilities; and opportunities for the development of their skills and talents.*
- *Where CDC is a minority shareholder or a lender, we aim to use our influence to encourage partners to follow our basic social and environmental objectives and adopt all relevant procedures.*
- *Where CDC establishes funds as intermediaries for investment by CDC and other parties, we aim to ensure that the fund's own principles and procedures give proper weight to social and environmental issues.*

In all of our investments, our social policy is to:

- *make investments in projects where the positive social impact outweighs any negative effects;*
- *identify any negative aspects of an investment and address the ways in which these might be mitigated;*
- *identify potential benefits and determine how they might be enhanced to the mutual advantage of company and community.*

In all of our investments, our environmental policy is to:

- *encourage the efficient and sustainable use of natural resources;*
- *seek investment opportunities where sound economic development is coupled with the protection and improvement of the environment;*
- *require all businesses in which we invest to be designed and operated using internationally accepted environmental good practice;*
- *require all businesses in which we invest to be designed and operated with due and explicit regard to both public and occupational health and safety."*

2.3 Government of Kenya Requirements

The Government of Kenya has not established environmental legislation, environmental assessment guidelines or environmental quality guidelines. The government does however recognize international accepted guidelines such as those of the World Bank. In accordance with it's tender TPC contractually committed to the meeting of "The parts of the 'World Bank Pollution, Prevention and Abatement Handbook Part III, Thermal Power – Guidelines for New Plants' dated September 1 1997 which are relevant to diesel or engine driven power plants" (pg. 69 of Schedules to Power Purchase Agreement for Kipevu II Diesel Plant).

The project will meet all existing laws that touch upon environmental and health and safety issues. Table 2.1 lists the key aspects of the environmental related legislation of Kenya.

Table 2.1 Key Environmental Legislation of Kenya

The Public Health Act (CAP 242), revised edition, 1986

- All land owners or occupiers are compelled to avoid nuisance or any situation that can be injurious to health (art. 115)
- Air pollution is a manifestation of nuisance. Therefore, factories are required to avoid emitting substances that can cause injury or damage to health, into the atmosphere (art. 115)
- The Public Health Rules stipulates that the connection to a public sewer require at least three days notice on a prescribed form prior to the connection (art. 72).
- Connection to the public sewers may be made only if a written permit authorizing the construction of the sewer is authorized by the local authority (art. 75).

The Water Act (CAP 372), revised edition, 1972

- Industries that intend to execute, construct, erect or employ works for the diversion, obstruction, abstraction or storage of water from a body of water require a water permit (art. 36)
- Whenever water is used or proposed to be used, in any process whatsoever which in the opinion of the Water Apportionment Board may cause pollution, may be required to submit the following information (General Rules, art. 48):
  - A plan showing the proposed or existing works for disposal or purification of effluent; and
  - A detailed description or specification of the works, methods or processes used or to be used in the purification of the effluent
- The quantity of water granted or specified has to be used for the specified purpose and during the specified period of time stipulated in the permit. If the permit holder desires to use the water for another purpose, he has to make an application to the Water Apportionment Board (art. 102)
- It is prohibited to cause pollution to any source of water supply used for human consumption, domestic purposes, or for the manufacturing of food or drinks (art. 158)
- The following is a list of requirements set for effluent from any factory:
  - Effluent has to be returned to the body of water from which it was diverted or abstracted, unless otherwise authorized;
  - It has to be in such a degree of purity as approved by the board;
  - It should not contain any poisonous matters or otherwise likely to be injurious directly or indirectly to public health, livestock or crops irrigated with such waters or to any product for which such water is used in any process whatsoever;
  - It should not contain a burden of silt, gravel or boulders; and
  - Effluent shall be purified to a degree that is satisfactory to the Water Apportionment Board. This board has the authority to determine whether or not discharge is harmful to the public.
  - All industrial facilities should avoid discharge of harmful substances or effluent deposited in any water body or tributary identified by the Water Apportionment Board which is harmful for the fish in that water body (Water General Rules, art. 77)

The Petroleum Act (CAP 116) revised edition, 1972

- No petroleum shall be allowed to escape into any drain, sewer, harbour, river or watercourse (The Petroleum Rules, art. 18(6)).
- The rules apply only to petroleum having a flashing point below 150°F (art. 3)
- Licenses are necessary for storage of petroleum of Class A or B and exceeding specific volumes (art. 13)
- Methods of storage and forms of licenses (art. 14; 21).
- Fees for licenses (art. 15)
- Applications for licenses (art. 16)
- Conditions applicable to all storage sheds and installations (art. 19)
- Minimum distance between tanks and between boundaries of installation or buildings (art. 22)
- Construction of tanks (art. 24)

The Physical Planning Act (Supplement No. 61, Acts. No. 6), 1996

- If in connection with a development application a local authority is of the opinion that proposal for industrial location, dumping sites, sewerage treatment, quarries or any other development activity will have injurious impact on the environment, the applicant shall be required to submit together with the application an environmental impact assessment report (sec. 36)

The Factories Act (CAP 514, revised edition, 1972

- A general register has to be kept in each facility, in which the following has to be entered or attached:
- The certificate registration of the factory;
- Every other certificate issued by the Chief Inspector with regard to the factory;
- The prescribed particulars regarding the washing, white-washing, colour washing, painting or varnishing of the factory; and
- The prescribed particulars of every accident and occupational disease of which notice is required to be sent to the Labour Officer.

The Electric Power Act, 1997 (gazetted on 09/01/98)

- Part I consists of definitions and lists the application to the Act.
- Part II details licensing restrictions, applications, and associated information are stipulated in this part
- Part III consists of the supply of electric power. Information is provided on supply line planning, locations, construction, repairs, modifications, tariffs, inspections, safety provisions, testing, connection, rule formation and other relevant information
- Part IV establishment of the Electricity Regulatory Board – describes the objectives & the function of the Board
- Part V provides additional information not covered in the other parts.

3. DESCRIPTION OF THE PROJECT

3.1 Overview

The proposed project entails construction and operation of an engine-driven electrical power generating plant of approximately 74 MW capacity (79.0 MWe gross; 74.0 MWe net) in the west mainland area of the municipality of Mombasa. Kipevu II is essentially a mid-peak power plant, intended to provide power locally and to act as a backup for Kenya's hydroelectric generating system. The plant will be constructed on a site to be prepared by KPLC and provided to TPC under a 22-year lease agreement. The plant will comprise 7 diesel engine-generator (DG) sets burning heavy fuel oil (HFO) at a proposed maximum sulfur content of 2.5%.

Connection to the power grid will be via a single 132 kV underground cable, which will link Kipevu II to a 132 kV switchyard being constructed by KPLC immediately east of Kipevu I (Figure 3.1). A second underground cable will be constructed to the vicinity of the site boundary. It will connect to a proposed transmission line to be constructed by KPLC from the Kipevu area to a substation in Rabai, about 14 km to the west. The route of the proposed line in the vicinity of the site is shown on Figure 3.1. A map showing the general route of the line between Kipevu and Rabai is provided as Appendix D.

It will be possible to supply power to the grid through either connection, depending on the operational requirements of KPLC.

3.2 Site Description

The sites of KPLC's Kipevu I and TPC's Kipevu II are located adjacent to each other on a prominent hill in the West Mainland area of Mombasa, overlooking the Port of Mombasa (Figure 3.1). Kipevu I, currently under construction, is located immediately west of the existing KPLC power station. Kipevu II will be located immediately west of Kipevu I.

The existing KPLC Power Station is situated about one half kilometre from the western tip of Mombasa Island, adjacent to the western end of the Kipevu Causeway, which links port facilities on the Island with those on the Western Mainland. The outer harbour where the Island facilities are located is called Kilindini Harbour and the inner harbour is called Port Reitz.

The power plant site is bounded on the south by dock facilities, warehouses and associated rail sidings. Just west of the site, a major arterial road carries a heavy volume of truck traffic into and out of the port area. West of the port access road (from the waterfront northward) are a large container terminal, a sewage treatment plant (under construction at the time of writing), and the extensive residential district of Changamwe.

The land immediately north of the power plant site is largely vacant. It contains the main railway lines serving the port area, transmission lines, and several pipelines.

Use of the proposed site was specified by KPLC. Although the site is somewhat small in land area it was found to have the following desirable attributes:

- The site is on a hill facilitating dispersion of air emissions;
- The site is surrounded by industrial and vacant land and is therefore not in conflict with potentially sensitive land uses.

- No resettlement of residents is required, as the site is vacant. The site is owned by the Export Processing Zones Authority who will provide a 92 year lease to KPLC, who will in turn provide a 22 year sub-lease to TPC ;
- Since the site is directly adjacent to the main power station serving the Mombasa area, it is a simple matter to connect into the existing power grid.
- The site has excellent access for delivery of equipment and fuel.

3.3 Description of the Power Plant

3.3.1 Diesel Generator Sets

The Kipevu II power plant will incorporate 7 DG (diesel-generator) sets powered by Wärtsilä NSD model 18V38 engines. The engines incorporate Wärtsilä's latest low NO_x combustion control technology. Each DG set will have a net output of about 10.5 MW.

The 18V38 is a four-stroke, direct injected, turbocharged and intercooled engine. It has 18 cylinders in a V configuration and operates at a nominal speed of 600 rpm. It is designed to run on HFO in normal operation, including starts and stops. Light fuel oil (LFO) is used, as needed, for flushing the fuel treatment and delivery systems of HFO. Flushing HFO may be needed prior to engine shutdown to prevent fouling of the fuel system by cooled (and thus more viscous) HFO.

3.3.2 Structures and Equipment

The power plant will comprise the following main elements:

- a power house enclosing the 7 DG;
- a closed loop cooling water system with fin-fan radiators for heat exchange to the ambient air;
- facilities for the transfer and storage of fuels and lubricants;
- systems for handling and treating sludges and oily wastes;
- switchgear and transmission facilities;
- site drainage and pollution control systems; and
- miscellaneous maintenance, office and security facilities.

These facilities will be accommodated within an approximate 140 by 200 m site. A preliminary master layout of the site is provided on Figure 3.2. The salient aspects of the facilities are described below.

3.3.2.1 Power House

The power house will be a single large building about 115 by 40 m in size. The individual exhaust stacks from the seven engines will be bundled together within an external, supporting framework. The stack bundle will discharge at an elevation of 45 m above ground level (ground level 47 m above sea level). This standard Wärtsilä design has been proven to be both technically and economically feasible in previous, comparable projects. Existing installations have withstood strong winds and earthquakes.

A section view of the proposed power house is shown in Figure 3.3

Both the air intake structures for the engine charge air system and the exhaust stacks will be fitted with silencers to achieve a noise reduction of at least 35 dB(A).

3.3.2.2 Engine Cooling System

Each diesel engine will have separate, high and low-temperature cooling circuits. The high- temperature circuit will cool the charge air (first stage), cylinder heads and cylinder liners. The low- temperature circuit will cool the charge air (second stage) and the lubricating oil.

The engine cooling water will circulate within closed loops. The cooling water will be circulated through radiators installed outdoors, where heat will be transferred from the water to the ambient air. Fans will assist this heat exchange.

Because the cooling water will circulate within closed loop systems, ongoing water requirements will be minimal. Only about 1 m^3/day of water will be needed to make up for system losses. This relatively small amount of make-up water will be obtained from a city water main that runs past the plant site.

3.3.2.3 Facilities for Transfer and Storage of Fuels and Lubricants

HFO will be delivered via the existing KPRL pipeline, which connects the Kenya Oil Refinery with oil storage facilities in Mombasa Harbour and/or via tank trucks. The right-of-way of the pipeline is directly adjacent to the road forming the northern boundary of the site (Figure 3.1). The connecting pipeline to the plant's storage tanks is expected to be less than 50 metres in length.

HFO will be the principal petroleum product stored in bulk on site. Substances to be stored in lesser quantities include LFO, engine lubricating oil and sludge. The various fuels, lubricants and sludges will be stored in two separate areas.

The main fuel storage area will house two 6,250 m^3 storage tanks for HFO, suitable for 30 days of operation at full load.

A much smaller containment area, located directly adjacent to the fuel treatment building will house the following storage tanks:

- 2 x 50 m^3 HFO settling tanks;
- 2 x 50 m^3 HFO day tanks;
- 1 x 50 m^3 day tanks for light fuel oil;
- 1 x 50 m^3 storage tanks for fresh lube oil;
- 1 x 30 m^3 storage tanks for used lube oil; and
- 1 x 15 m^3 storage tank for sludge.

All vertical storage tanks will be designed to API 650 standards; horizontal tanks will be designed to the DIN 6616 standard. Storage tanks and their secondary containment structures will meet applicable earthquake design criteria.

3.3.2.4 Systems for Handling and Treating Sludges and Oily Wastes

Sludges and oily wastes will be generated within both the fuel oil and lubricating oil systems.

Fuel Oil System

In the fuel system, the following sludge will be generated:

- dirty fuel from the DG-sets;
- dirty fuel and sludge collected by the drip pans of the booster units;
- dirt and water separated from the fuel oil by the fuel oil separators;
- sludge and dirty fuel collected manually from the drip pans of outdoor units; and

- sludge and dirty fuel collected manually during cleaning and service and maintenance operations.

The dirty fuel from the DG-sets and the dirty fuel/sludge collected by the drip pans of the booster units will be piped to the sludge tank of the lubricating oil separators.

Particles separated from the fuel in the automatic back-flushing filter on the booster unit will be collected by a washable safety filter. The backflushing oil will be recirculated to the buffer tank (settling tank).

Lubricating Oil System

In the lubricating oil system, the following sludge will be generated.

- dirty lubricating oil and sludge collected by the drip pans of safety filters, automatic filters and coolers;
- dirt separated from the lubricating oil by the lubricating oil separators; and
- sludge and dirty fuel collected manually during cleaning and service and maintenance operations.

Dirty lubricating oil collected by the drip pans of filters and coolers will be piped to the sludge tank of the lubricating oil separators.

The used engine lubricating oil will be collected in a waste oil tank.

Particles separated from the lubricating oil by the automatic back-flushing filter will be collected on a washable safety filter. The back-flushing oil will be recirculated to the lubricating oil system.

Sludge Treatment and Disposal

The contents of the sludge tanks of the fuel and lubricating oil separators, and sludges that have been collected manually, will be transferred to a common sludge storage/settling tank before receiving further treatment. The rate of sludge generation from all sources is anticipated to be 0-10 tonnes per day.

The oily water that separates from sludge in the sludge tank will be directed to the oily water settling tank, along with any oily drainage water from powerhouse floor pits, fuel unloading areas and storage tank areas.

Dewatered sludge will be sent to a high-temperature incinerator located on the plant site. Ash will be landfilled at the nearby Makupa landfill site or an equivalent facility designed to handle this type of material. A certificate of compliance for use of this type of incinerator on board ships is provided in Appendix I.

Oily Water Treatment

The sources and qualities of wastewater that will require treatment are shown on the Water Balance line diagram provided in Appendix E. The oily water stored in the oily-water settling unit will be transferred for treatment in a wastewater treatment system. The treatment system will also accept boiler water blowdown.

The wastewater treatment system will consist of a treatment unit where oil is separated and removed from the water by means of a flocculation chemical and a pH adjuster. The oily-residue that is removed will be transferred to the sludge tank. Before discharge the cleaned water will be polished in a filtering unit to ensure that the concentration of oil and grease meets the World Bank guideline of 10 µg/l. The effluent will also meet all other World Bank guidelines for effluent from power plants.

The cleaned water will be released into the plants storm-water drainage system.

3.3.2.5 Site Drainage and Pollution Control Systems

Storm-water from the tank yards, fuel unloading facility and fuel treatment buildings will discharge to an oil/water separator located outside the diked enclosures. The discharged water will meet the World Bank guideline of 10 $\mu g/m^3$ for oil and grease. No other contaminants are expected in the runoff.

All plant storm-water will be conducted to a natural drainage channel that is located north of the plant site and which drains eventually into Makupa Creek. The system will be designed according to good engineering practices to ensure that storm-water flows do not result in degradation of the natural channel.

3.3.2.6 Human Sanitary Waste

Human sanitary waste will be treated in an on-site septic system. The resulting effluent will be discharged into an appropriately sized onsite leaching field or pit (Figure 3.2). This system is not expected to result in any offsite or groundwater contamination.

3.3.2.7 Switchgear and Transmission Facilities

The power plant will have two connections with the KPLC transmission grid. The normal connection will be via a single 132 kV underground cable to a 132 kV switchyard to be constructed as part of the Kipevu I project. An alternate connection will be provided via an underground cable to the plant boundary at which point a connection will be made to a new transmission line to be constructed by KPLC. It will be possible to export power through either connection according to the operational requirements of KPLC.

All electrical equipment will be free of PCB dielectric fluids.

3.4 Power Plant Development

The schedule for power plant development is provided in Figure 3.4. A total of 20 months will elapse between the date of the signing of the Power Purchase Agreement and the date of full commercial operation. The first seven months will be required for detailed planning and design; negotiation of various agreements and contracts; setting up of financing; and obtaining permits and approvals. Actual on-site construction activity will occur over a period of 13 months.

Because the project is located in a large urban area and is close to all forms of housing and commercial accommodations, there is no anticipated need for a construction camp.

3.5 Operational Personnel: Requirements and Training

Around-the-clock operation of the power station will require a personnel complement of approximately 80 to 100 persons. The plant will be operated on a rotating three-shift basis by a mixed staff of operators and maintenance technicians.

The operations and maintenance (O&M) contractor for the project will be Wärtsilä NSD Nederland B.V. or its affiliates, with support technical field services provided by Wärtsilä NSD Operations (WNSDOps). Recruitment and training of operating personnel will be carried out by the O&M Contractor.

Operational mobilization will start about six months prior to the start of commercial operation. It will include establishing an early local presence and conducting local hiring. (It is anticipated that Kenyan citizens will fill most positions in the plant.) Operating personnel will be hired in "mobilization groups", starting with the key operating and management staff.

All initial operating personnel will be oriented and trained by the WNSDOps mobilization team. WNSDOps will also provide on-going operational support for the power plant once it is in commercial operation. This support will include staff training and skill upgrading, as well as periodic unannounced audits of plant operation.

3.6 Operation Control Systems

The control room, which will be manned at all times, will be the central point from which essential plant functions can be monitored and controlled. A comprehensive PLC-based monitoring system will enable the control room operator to monitor fuel supply and transfer, inventory status, and power generation system status. Control functions will include remote operation and monitoring of tank levels and essential pumps, and remote starting and stopping of diesel generators.