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5. Project Description

The ESIA for which this report has been prepared focuses on the development of and 80MW thermal power plant in the Athi River area in Mavoko municipality. The proposed power plant will run on ten generating sets each having a capacity of 8MW. The fuel type proposed for this power plant is heavy fuel oil having a maximum sulfur content of 2.0%.

The power generated from the thermal power plant will be evacuated via two 66KV sub-stations connected to two step-up transformers.

5.1 Project timing

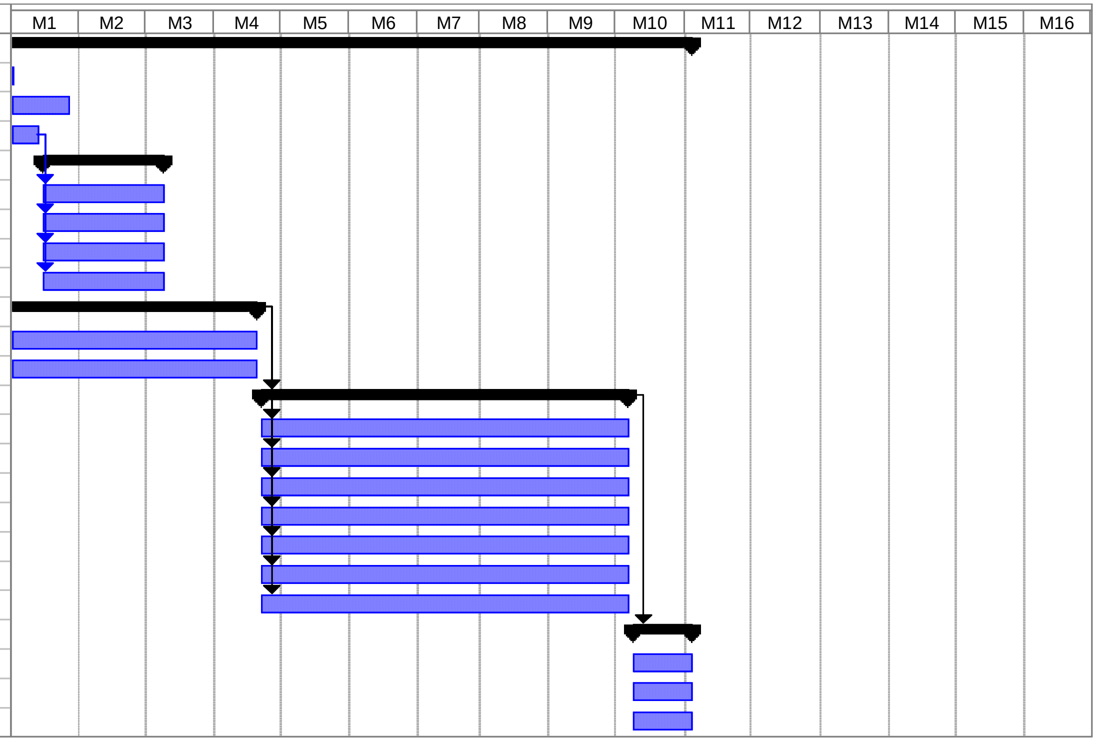
The following project program is envisaged for the proposed project:

Activity	Start Date	Duration
Undertaking the ESIA	Commenced February 2010	4 months
Submission and review of draft ESIA report by Proponent	June 2010	2 weeks
Submission of final ESIA report to the NEMA	June 2010	-
NEMA/lead agencies to review ESIA Study	June 2010	30 days
Approval to advertise in the Kenya Gazette and Newspaper	June 2010	30 days
NEMA decision	July 2010	45 days after submission
Planning and design	Underway. To be completed in March 2011	
Raw materials and equipment order	May 2011	
Construction phase	June 2011	Approx. 12 months
Operational phase	June 2012	

Given below is the timeline for the construction and commissioning phase of the project which is approximately 11 months. The project cost is anticipated to be US$ 125 million.

Figure 5-1: Timeline for proposed MSD power plant

ID	Task Name	Duration
1	**Gulf Power 80mw Power Plant**	**220 days**
2	Down Payment	1 day
3	Project Engineering Activities	1 mon
4	Site Handover	0.5 mons
5	**Procurement Activities**	**40 days**
6	Power Generation Systems	2 mons
7	Mechanical Systems	2 mons
8	Electrical Systems	2 mons
9	Transportation, Customs& Receipt on Site	2 mons
10	**Construction Activities**	**80 days**
11	Construction Activities	4 mons
12	Civil Works	4 mons
13	**Installation Activities - Equipment**	**120 days**
14	Power Generation Systems	6 mons
15	Mechanical Systems	6 mons
16	Electrical Systems	6 mons
17	Mechanical Systems	6 mons
18	Electrical Systems	6 mons
19	Instrumentation Works	6 mons
20	Bulk Storage Tanks	6 mons
21	**Commisioning Activities**	**20 days**
22	Pre-Commisioning	1 mon
23	Commisioning & Start-Up	1 mon
24	Ready for Operaton	1 mon



5.2 Technical description

The power plant is designed by Wärtsilä Finland Oy. A preliminary layout plan of the power plant is shown in Figure 5-2 while Figure 5-3 shows a 3D model of a typical MSD power plant. The proposed power plant will principally consist of the following project components:

- Power house (containing ten Wärtsilä MSD engines);
- Waste heat recovery system;
- Medium voltage switchgear;
- Step-up transformers 11/66KV;
- High voltage switchgear;
- Transportation and delivery to site;
- Mechanical and electrical works;
- Civil and structural works;
- Installation activities;
- Commissioning and start-up; and
- Testing.

The proposed project will be designed in accordance with codes of practice and standards developed by the following international bodies:

Acronym	Definition
ANSI	American National Standards Institute
DIN	Deutsches Instituit fur Nomung, e.V.
NEMA	National Electrical Manufacturer's Association (USA)
IEEE	Institute of Electrical and Electronic Engineers (USA)
IEC	International Electric Code
ISO	International Standards Organization
NEC	National Electric Code (USA)
ASTM	American Society for Testing and Materials
VDE	Information Technologies (Germany)
ASME	American Society of Mechanical Engineers
ACI	American Concrete Institute
AISC	American Institute of Steel Construction
ICBO	International Conference of Building Officials
AWWA	American Water Works Association
IAPMO/UPC	International Association of Plumbing and Mechanical Officials, Uniform Plumbing Code

Acronym	Definition
API	American Petroleum Institute
AWS	American Welding Society
UL	Underwriter's Laboratories (USA)
ISA	Instrument Society of America
SSPC	Steel Structures Painting Council (USA)
HEI	Heat Exchanger Institute (IEC)
CIMAC	International Council on Combustion Engines

Figure 5-2: Proposed site layout plan of proposed MSD power plant

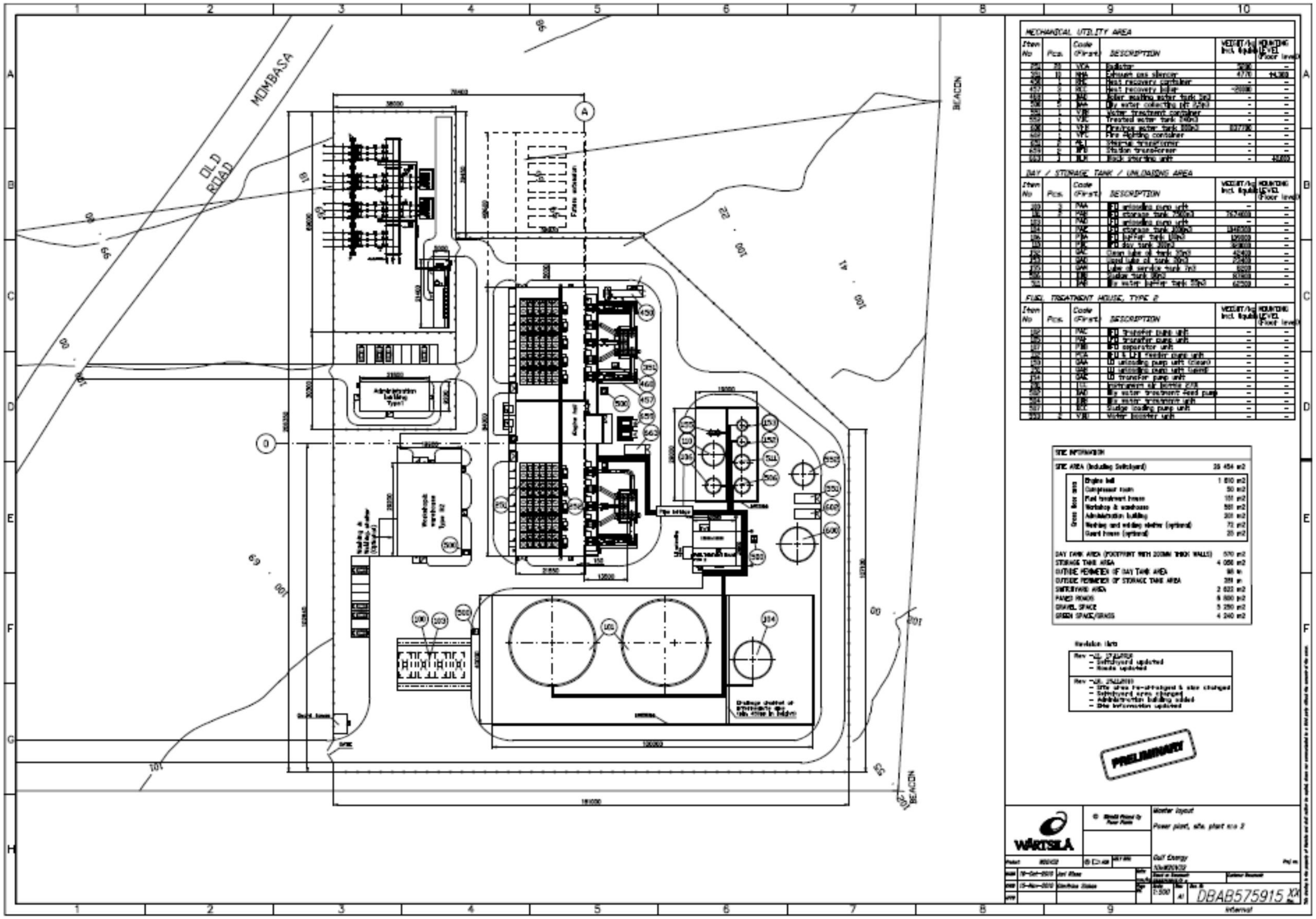
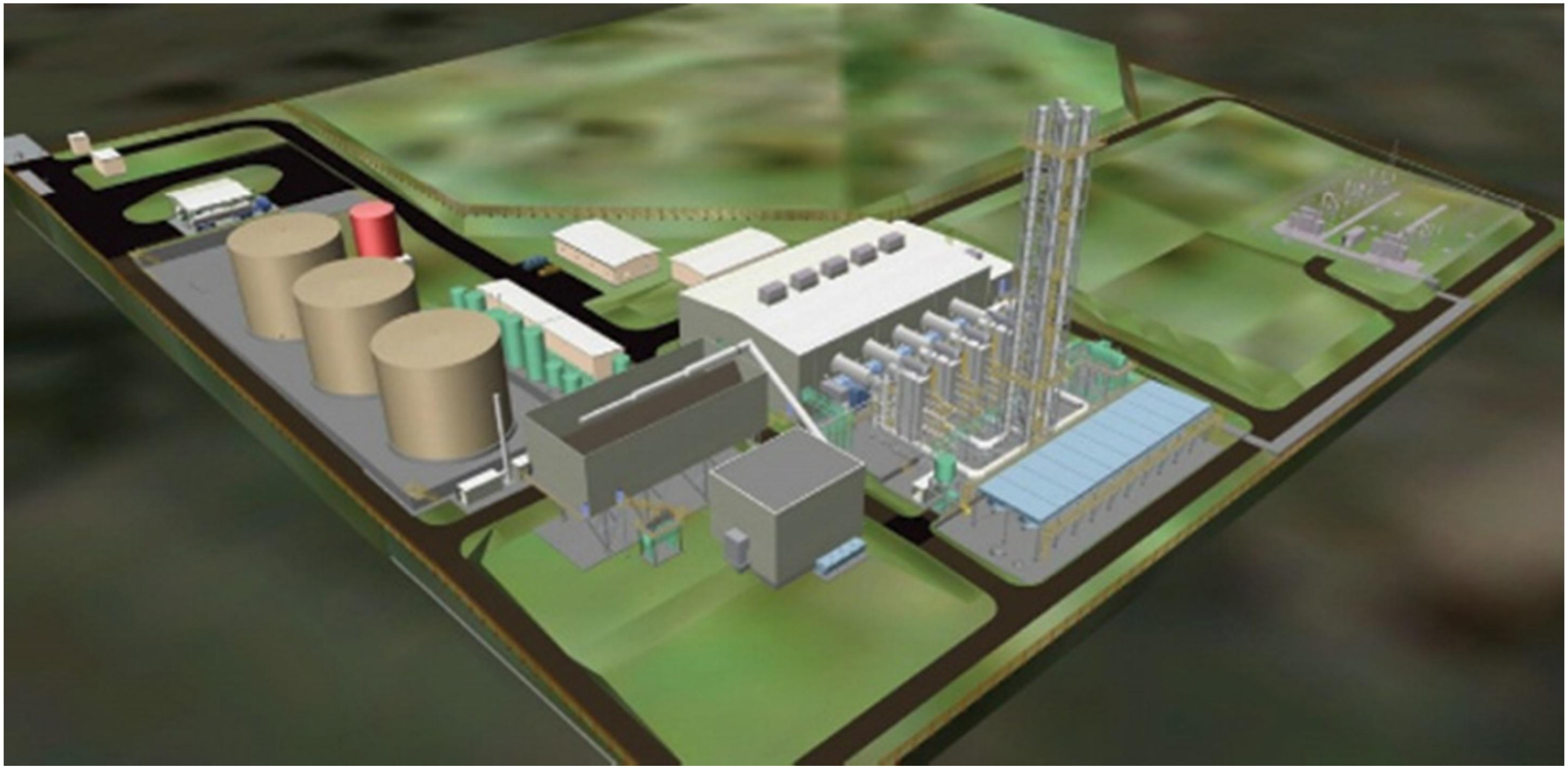


Figure 5-3: Typical 3-D model of an MSD power plant



5.2.1 Mechanical Specification

The mechanical specification of the power plant will comprise three primary components namely the Wärtsilä engines, engine accessories and mechanical auxiliaries.

Engine and generator

The proposed power plant will comprise ten generating sets; the specific model of each generator set proposed for the power plant is Wärtsilä model 20V32. This type of engine is a 4-stroke, direct injected, trunk piston turbocharged and intercooled diesel engine. The dimensions of each generating set is approximately 4400mm high x 3670mm wide x 12535mm long; each generating set weighs approximately 130 metric tons . Each generating set will be manufactured as a complete unit overseas and shipped to Mombasa.

The engines will be run on heavy fuel oil (HFO) having a maximum sulfur content of 2.0%. The HFO will probably be imported into Kenya in bulk as the local refinery may be unable to cost effectively produce HFO having a maximum sulfur content of 2.0%.

Waste heat will be generated during the combustion process of the HFO in the MSD engines. This waste heat will be recovered and used for internal processes such as the boiler and other parts of the system that require heating. An image of a typical generator set is indicated in Figure 5-4.

Figure 5-4: Typical image of power house with generator sets installed

Engine accessories

The engine accessories will include a system for diesel engine diagnostic and predictive maintenance. This system is a software based system that continuously monitors various engine parameters during operations.

The engine accessories will also include coupling assemblies for the generator and engine. Additionally it will include spring element mountings for direct elastic mounting of the engine to the foundation block.

5.2.2 Mechanical auxiliaries

The mechanical auxiliaries associated with the power plant will comprise the following elements:

- Compressed air system;
- Combustion air system;
- Exhaust gas system;
- Fresh cooling water system;
- Light fuel oil (LFO) and heavy fuel oil (HFO) system;
- Lube oil system;
- Steam system/thermal oil system;
- Ventilation system; and
- Waste disposal system.

Compressed air system

The compressed air system in the power plant will compress, store and deliver medium pressure (30 Bar) compressed air to start the diesel engines. Through a pressure reducing station, low pressure (8 Bar) air will be delivered for various utility services and instrument requirements. The compressed air system will be designed to provide starting for the engines, control air for the engines and auxiliary systems, and working air for operating cleaning and maintenance tools. There will be two air compressors installed at the power plant for providing compressed air, one driven by electricity and the other by diesel.

Combustion air system

Each of the ten engines will require combustion air for its operation. The combustion air intake system, which is not combined with the powerhouse ventilation system will provide ambient, clean air to the diesel engine for combustion while minimizing inlet air pressure loss to the turbocharger. Subsequently each engine will be provided with its own combustion air system to provide filtered air to the engine for combustion.

Exhaust gas system

An exhaust system for each engine will convey engine exhaust gases through a thermal oil heat recovery unit, then through a silencer, and finally out to atmosphere through a stack. Expansion joints, supports and insulation will be furnished as required. The combustion of HFO in the ten engines will be expelled through an exhaust gas system. A portion of the energy carried by the exhaust gases will be converted to mechanical energy for compressing the charged air which will be generated by the turbo chargers mounted on the MSD engine. Each of the ten MSD engines will have two turbochargers connected to it.

The exhaust gas system will also be fitted with an exhaust gas silencer for each of the ten MSD engines.

Cooling system

The power plant will include a fresh cooling water system for cooling the engine cylinder jackets, cylinder heads and turbochargers, as well as to cool the lubricating oil and charge air entering the cylinders after it has been compressed by the turbocharger.

As fuel burns inside the engine, various engine parts become hot. The cooling water system pumps water through the engine to a radiator where the heat is dissipated to the atmosphere. Cooled water from the radiator is then returned to the engine. The radiators are self-contained horizontal units mounted outdoors on structural steel legs. Multiple fans draw cooling air up through the radiators. Aboveground supply and return piping connects the radiators to the engines. An image of a typical radiator setup is shown in Figure 5-5. The cooling water system will further be used to cool the charge air and lube oil used in the engines.

Figure 5-5: Typical image of radiators

Bulk liquids storage tank farm

The power plant will have a bulk liquids storage tank farm for storing fuel oil. The floors and walls of the bulk liquids storage tank farm will be constructed out of reinforced concrete; it will be 100m long x 40m wide x 2.3m high. The volume of the tank farm storage area is designed to retain a minimum of 110% of the volume of the largest storage tank. A typical bulk liquids storage tank farm under construction for an MSD power plant is shown in Figure 5-6.

Figure 5-6: Image of a bulk liquids storage tank farm under construction

The tank farm will contain a number of aboveground bulk storage tanks made out of steel for storing various types of petroleum products. These tanks will be designed to the Deutsche Industrie Norm (DIN) "**4119-2: Above-ground cylindrical flat-bottom tank structures of metallic materials; Calculation**" which is a German standard for above ground storage tanks and API 650. The HFO service tanks (2 x 100m^3) will be jacketed as the HFO will be required to be pre-heated prior to it being treated and used in the power plant. The sizes of the various tanks and the products they will store are given below.

Table 5-1: Capacities of bulk liquid storage tanks

Product	No. of tanks/capacity (m^3)
HFO storage tanks	2 x 7,500m^3
HFO service tank	2 x 100m^3
HFO buffer tank	1 x 100m^3
HFO day tank	1 x 300m^3
Light fuel oil (LFO) storage tank	1 x 1000m^3
Lube oil storage tank	1 x 35m^3
Waste oil disposal tank	1 x 20m^3
Lube oil service tank	1 x 7m^3
Sludge tank	1 x 80m^3
Oily water buffer tank	1 x 55m^3

An image of a bulk liquids storage tank under construction is shown in Figure 5-7.

Figure 5-7: Image of typical aboveground HFO storage tanks under construction

HFO fuel system

The HFO system will be designed for storage and treatment of HFO in the power plant. The HFO will be the primary fuel for running the ten engines at the required degree of purity, viscosity and pressure.

A tank truck HFO off-loading station will be constructed at the location shown in Figure 5-2. The tank-truck off-loading station will have the capacity of simultaneously off-loading three HFO laden tanks trucks into the large 7,500m^3 storage tanks. The tank truck off-loading station will be made out of reinforced concrete and will have a concrete berm around it to contain any fugitive spills. The drainage system from the bermed area will be connected to a sump and subsequently to an underground drainage pipe system leading to an oil water separator for treatment prior to discharging into the environment. A typical image of an HFO tank-truck off-loading station is shown in Figure 5-8.

Figure 5-8: Image of a typical truck off-loading station

HFO conditioning system

The purpose of the HFO Conditioning System is to deliver clean, heated fuel to the engines at the proper temperature and pressure. The entire HFO conditioning system will be a closed system thereby minimizing fugitive emissions. Conditioning of the HFO will be accomplished through a series of pumps, heaters, separators, day tanks and filters.

The process of conditioning the HFO for use in the engines will include the following steps:

a) HFO will be pumped from the bulk storage tanks to an HFO Separator Module. This module includes a heater (the Separator Heater), pumps and a Fuel Separator. The Fuel Separator is a standard centrifuge that uses centrifugal force and water to wash dirt and contaminants from the fuel.

b) The fuel will flow to a heated Service Tank. This tank will be able to hold enough fuel for 6 hours of plant operation, in case of minor upstream fuel supply interruptions.

c) From the Service Tank, the fuel will flow to an HFO Pre-pressure Module. This module includes an HFO Pre-pressure Pump and an HFO Automatic Filter that back flushes and self-cleans as required.

d) Finally the fuel will flow to an HFO Circulating Module. This module boosts the fuel pressure and precisely heats the fuel to the optimum viscosity for delivery to the engine fuel injection system.

The HFO conditioning system will be housed in a Fuel Treatment building. All tanks in and around the building will be mounted in spill-retention dikes with drains to an oil-water separator.

Lube oil system

The purpose of a lube oil system is to deliver clean, cool lubricating oil to the engines at the proper pressure and temperature. Lube oil will be off-loaded into a dedicated bulk lube oil storage tank (35m^3 capacity) from tank-trucks. For each of the ten engines, the lube oil system will comprise:

- a main lube oil pump;
- a water cooling module; and
- a lube oil separator;

In addition to these, the lube oil system will have a lube oil maintenance tank and other associated pumps and strainers.

Steam system/thermal oil system

The hot exhaust gases generated from the MSD engines will be used to generate steam which in turn will be used to operate boilers. Steam generated from the boilers will be used to heat the HFO tanks, to operate the trace heating system, to pre-heat the HFO and lube oil for separation and to maintain the required injection viscosity.

The thermal oil System will be designed utilizing the exhaust gas heat recovery system for the generation of heated thermal oil for HFO heating applications. Thermal oil will be the heating medium for the fuel pre-heating system. The heating system will also include heat tracing, piping and necessary insulation and controls. The system will be capable of maintaining HFO at proper temperatures over the full range of operating conditions.

Ventilation system

The power house will be connected to a ventilation system for provision of air of pure quality in it to cool the alternators. Additionally the ventilation system will endeavor to maintain a convenient operating temperature in the power house. Through a forced ventilation system, the pressure inside the power house will be slightly greater than the ambient to ensure that dust does not enter the building through open doors or other openings. The ventilation system will be equipped with acoustic louvers to maintain a tolerable noise level outside the power house.

Waste oil collection system

The power plant will be equipped with a closed waste oil collection system. This will comprise a bulk waste oil storage tank having a capacity of 20m^3 located in the main tank farm, a waste oil tank emptying pump, a power house drain pump, two mobile drainage pumps and an oil water separator.

Water systems

The power plant will require an adequate supply of fresh treated water for the following purposes:

- firewater capacity;
- Periodically washing down the equipment and floors; and
- Feed water for the process water treatment system.

Currently the Mavoko Water and Sewage Company is the main supplier of freshwater to the residents of Athi River. Subsequently the Proponent will liaise with this company to connect a water line to the power plant. In the absence of this, the Proponent will sink a borehole within the power plant after acquiring the necessary permit and treat the water prior to it uses as outlined above. The proposed project will lay fresh water distribution pipelines underground to buildings and equipment. Hose bibs will be provided at all buildings and near tanks and equipment as required.

Process wastewater systems

Process wastewater may be generated from the following primary areas of the power plant:

- Washing down equipment and floors;
- Tank-truck off-loading station;
- Bulk storage tank farm;
- Regeneration brine from the process water treatment system; and
- Washing down paved vehicle parking areas in the power plant.

All process wastewater will be channeled through a properly designed oil water separator for primary treatment. Prior to being discharged to the environment, the Proponent will ensure that the treated wastewater is in compliance with L.N. 120: Water Quality Regulations, 2006.

Sanitary wastewater system

Sanitary sewage will be collected from sinks, toilets, showers and other sources. In order to discharge this type of waste in an environmentally sound manner, the Proponent could either connect to the Mavoko Water and Sewage Company's main line sewer or build a conservancy tank.

Fire protection system

The power plant will contain an elaborate fire protection system designed in accordance with relevant international institutions such as the National Fire Protection Association (NFPA) of the USA. The fire protection system will comprise the following components:

- Addressable fire alarm system made up of photoelectric and heat sensors, call points, alarm bells and strobe lights;
- Fire extinguishers including 50kg wheeled dry chemical powder (DCP) type, 12kg portable DCP extinguishers, 6kg carbon dioxide extinguishers and 90liters mobile foam units;

- Fire hose cabinets complete with hose reel hydrants (30m long each);
- An electrical fire pump approved by Underwriters Laboratories (UL) of the USA, an electric motor and pump controller. The system will also include a jockey pump and all other pump room accessories. The fire protection system will include a dedicated fire water tank having a capacity of 700m^3.

5.2.3 Electrical system

Electric power will be required to drive various electrical systems that make up the power plant. Subsequently the electrical specification of the power plant will include the following types of voltage systems:

- Low-voltage 0.4kV system for plant auxiliary loads;
- Medium voltage 11kV system including generator and generator bus;
- High voltage 66kV sub-station;
- Convenience voltage 400/230V distribution system for lighting and convenience outlets; and
- Control voltage 24V DC and 110/125V DC.

The purpose of the electrical system will be to:

- Export net electrical generation from the power plant;
- Distribute electrical power within the power plant for internal loads when the plant is operating; and
- Import electrical power during plant outages.

Low voltage system

The low voltage system will be made up of a switchboard that will be designed to match the required auxiliary power of various electrical consumers of the entire power plant. The AC switchgear operating within and up to 1kV is known as low voltage switchgear. The number of switching operations demanded from low voltage switchgear is expected to be high. The low voltage system will include the following:

- Motor control centers with breakers, motor starters, pushbuttons and indicating lights;
- Power wiring to various internal motors and loads;
- Busbar;
- Switching devices such as ACB, MCCB, MCB;
- CT's and PT's;
- Station Service Transformer;
- Measuring instruments and relays;
- Cable termination for incoming and outgoing cables;
- Electrical and mechanical interlocking facility.

Medium voltage system

The medium voltage system is designed to convey power from the engines to the high voltage system for evacuation from the power plant and will be located in an electrical room in the main building. The switchgear will be specific for power plants, industrial and distribution sub-stations; it will be metal clad and designed to operate within the range of 1kV – 36kV. The medium voltage system will be designed to automatically:

- Switch on/off during normal operations; and
- Operate during abnormal operations.

An image of typical low voltage and medium voltage switchgear is shown in Figure 5-9.

Figure 5-9: Image of typical LV switchgear (right) and MV switchgear (left)

High voltage system

The high voltage system will be used to evacuate electricity generated by the power plant to the transmission lines situated outside the battery limits. The proposed location of the power plant sub-station (high voltage system) is indicated in Figure 5-2. The high voltage system will include conversion of 11kV electrical power from the medium voltage system to 66kV for onward transmission. There will be two 11/66kV step up transformers within the sub-station that will be used to step up the voltage from 11kV to 66kV. There will be an outdoor high voltage circuit breaker for installation on the high voltage side of the 11/66kV transformers. Additionally there will be primary and back-up power export metering equipment installed at the high voltage side of the step up transformers.

5.2.4 Civil/structural specification

The power plant is divided into various areas as outlined below.

- Power house which will include the engine hall, mechanical auxiliaries area, and the loading bay area for maintenance and overhauls;
- The electrical building which includes the switchgear room, control room, LV switchgear, the motor control center room, the DC system room, the batteries room, toilets, administration office, canteen and workshop;
- Fuel and lube oil treatment house;
- Tank farm and unloading station;
- Pump station area and water tank area.

Power house

The power house building shall be designed to contain the ten engines and one loading bay area. It will be a pre-engineered building designed and constructed to the local and international building codes. The powerhouse building will be approximately 8.25m high and will be constructed out of a steel structure having mineral wool insulated sandwich panels; the roof of the power house building will be made out of steel sheets.

The power house building shall be insulated for noise abatement to attain the maximum allowable noise levels at the property fence line.

The power house will include the following features:

- Engine hall with 2-ton maintenance crane;
- Open bay for maintenance;
- Reinforced concrete floor, independent of engine-generator foundations;
- Control Room;
- Water closet (in control room);
- Electrical room;
- Equipment annex with raised steel grate floor for equipment access;
- One (1) overhead, electric, coiling door shall be provided in the loading/staging bay;
- Forced ventilation; and
- Lighting and convenience outlets.

Typical images of a power house building under construction and one that is complete are shown in Figures 5-10 and 5-11 respectively.

Figure 5-10: Typical image of power house under construction

Figure 5-11: Image of typical completed power house

Other buildings and civil/structural works

In addition to the power house, there will be a compressor room, fuel treatment house, workshop & warehouse and an administration building within the power plant. These buildings will be made out of masonry stone walls laid on a reinforced concrete floor slab. The height of each of the buildings will be 3 – 4m and the roof will be made out of a reinforced concrete slab. The buildings will contain appropriate doors, windows and staircases.

Other civil/structural works that will take place at the power plant include:

- A site chain link fence 2.5m high all-round the power plant;
- Guard house;
- Radiator foundations;
- Boiler stack foundation;
- Exhaust muffler stack foundation; and
- Landscaping for the fenced area.

5.3 Construction Phase

5.3.1 Construction Process

Materials needed for the construction process include brick, cement, steel, pipelines, sand, gravel and wood. The required supplies will be transported to site by truck. Sand and cement will be sourced from existing local and/or national commercial suppliers.

Necessary equipment includes cranes, bulldozers, excavators, front-end loaders and electric welding machines. The need for blasting will be determined based on final geological investigations. Low-bed trucks will be used for transporting equipment.

Most of the mechanical, electrical and, instrumentation and control infrastructure required for the power plant will be imported. The raw materials to be sourced locally include backfill material, cement, sand, aggregate and masonry stone, which will all be required for the civil/structural specification of the power plant.

Wärtsilä is in the process of appointing their nominated sub-contractors for civil/structural works, mechanical works and electrical works respectively. The Proponent will make arrangements to provide a laydown which will be used by them and their nominated sub-contractors. There will be 24-hour security at the site throughout the construction phase of the project.

The baseline noise level survey undertaken in February 2010 at the project site and its vicinity exceeds the nationally stipulated permissible noise levels at some receptors. This is a short term impact which is primarily due to the on-going upgrade of the main Nairobi – Mombasa highway to dual carriageway status. The power plant construction plant and equipment will cumulatively add on to the existing noise levels around the project site and its vicinity.

Exact daytime and night-time period continuous equivalent sound pressure levels are not possible to calculate with certainty at this stage as the final construction site layout, work program, work *modus operandi* and type of equipment have not been finalized. However during the construction process, it will be incumbent on Wärtsilä to ensure that they pragmatically implement corrective actions within their span of control to reduce noise levels to ALARP.

5.3.2 Water requirements during construction

During construction, water will be required for mixing of concrete. This water will be sourced from the Mavoko Water and Sewage Company Ltd.

Hydrostatic testing will be used on the pipes. Water used for this purpose will need to be tested and approved as per local effluent discharge standards before discharge takes place.

5.3.3 Sewage, waste and storm water runoff

During construction, storm water will be controlled to minimize the risk of erosion and sedimentation and prevent water contamination. Contaminated storm water will be treated before being released.

5.3.4 Site management

Construction will only take place during stipulated hours on weekdays and weekends. During construction there will be 24-hour security onsite and no workers will be allowed to stay overnight at the site.

5.3.5 Staffing requirements

Job opportunities will be generated through the construction of the power plant. Both skilled and unskilled labor will be required in technical fields as well as in the facility operation and management. It is anticipated that about 150 to 190 jobs will be created during the construction phase.

5.4 Operational Phase

5.4.1 Water requirements

During the operational phase, water at the power plant will be required for processes, fire safety, drinking, toilets and showers. The source of water supply is expected to be the Mavoko Water and Sewage Company who currently supplies water to users in the Athi River area. During dry periods, there could be water rationing programs leading to intermittent supply of fresh water to the power plant.

Subsequently the Proponent will consider installation of a borehole at the power plant together with a water treatment system to supplement the inconsistent water supply from the Mavoko Water and Sewage Company.

An on-site water tank will hold water for cooling and fire-fighting purposes. The total firewater demand for the worst case scenario will be calculated by the Proponent's engineers and Wärtsilä on the basis of a full risk assessment.

5.4.2 Noise

All power plant facilities for this project will be designed to the requirements of ISO 15664: 2001 E titled "**Acoustics -- Noise control design procedures for open plant"**. All machinery and other noise emitters will comply with exposure limits of the workforce and a weighted basis as per the standard. The following measures will be implemented in order to prevent operational noise from affecting third party receptors.

Rotating machinery

All rotating machinery is purchased against a noise data sheet which will be required to specify a noise level of 85 dB(A) at a distance of 1 m from the machinery (L.N. 25: Noise Prevention and Control Rules, 2005). If this level cannot be met, then the noise level will be mitigated through the installation of a local acoustic enclosure or housing the equipment in a suitable building.

Transport and other equipment

As the project will require the regular use of road transport to deliver HFO to the power plant, measures will be implemented to control traffic movements to regular working (daylight) hours. Where considered necessary, the site will be screened by trees, natural obstructions or artificial constructions with suitable coverings e.g. berms with grass or bush coverings. Remedial measures will include the use of buildings or acoustic enclosures. Where individual items of equipment or operations cannot meet the stringent requirements of the open plant design, the noise shall be mitigated by use of silencers, acoustic enclosures, buildings or screening. The overall noise specification at the facility fence shall not be exceeded under any circumstances.

Personnel Protection

The following noise limits shall apply indoors in order to keep any disturbance of normal working activities within acceptable proportions (*See* Table 5-2):

Table 5-2: Noise limits in indoor locations

Area description	Maximum allowable sound pressure level dB(A)
• Areas in workshops and machinery buildings where communication is required • Workshops for light maintenance	70
• Workshop offices • Control rooms, not continuously manned • Computer rooms	60
• Control rooms, continuously manned Open plan offices • Changing rooms, wash places and toilets	50
• Offices and conference rooms	45

All facilities are to be designed to limit an unprotected operator to a maximum of 85 dB(A) over an 8 hour time weighted average exposure. Where the noise level exceeds this limit, relevant areas must be restricted. The most stringent noise limits shall be determined by the requirements of Kenyan national or local regulations. In the absence of such regulations, the requirements of relevant international standards shall be mandated. The final applicable noise limits shall be stated in the project design.

Noise impacts shall not exceed the World Bank guideline levels presented in Table 5-3, or result in a maximum increase in background levels of 3 dB(A) at the nearest receptor off-site.

Table 5-3: World Bank noise guideline levels

Receptor	One Hour Equivalent (dB(A))*	
	Daytime 07:00 – 22:00	Night time 22:00 – 07:00
Residential: Institutional; Educational**	55	45
Industrial; Commercial	70	70

* Guideline values are for noise levels measured outdoors.

** For acceptable indoor noise levels for residential, institutional and educational settings refer to WHO (1999).

5.4.3 Sewage, waste and stormwater runoff

During operation, sewage and waste will be dealt with in accordance with local authority by-laws and relevant environment regulations in Kenya. All areas of the power plant that can potentially generate hazardous waste will be bunded and provided with a closed system drain where the water will be treated via an oil water separator prior to release into the environment.

All hazardous waste generated by the project will be managed in accordance with the requirements of Legal Notice (L.N.) 121: Waste Management Regulations, 2006.

5.4.4 Site management

Due to the high value of the power plant, security measures will be stringent during the operation of the facility. On-site security of the premises will be engaged to maximize safety.

5.4.5 Staffing requirements

Job opportunities will be generated through the operation of the power plant. Both skilled and unskilled labor will be required in technical fields as well as in depot operations and management. There will be fewer jobs in the operational phase than the construction phase, but employment will be long-term. The power plant will be manned by a minimum of 38 people, some of whom will be management and administrative staff. There will also be a dedicated maintenance team for the power plant and other associated infrastructure.

5.5 Decommissioning Phase

It is envisaged that the power plant will be operational for a minimum of 20 years, and it is likely that this period will be extended.

There are currently no specific stipulated requirements for decommissioning under the EMCA for projects. However it would be prudent for the Proponent to set aside funds for the rehabilitation of the power plant and associated infrastructure. The funds if provided will cover:

- The decommissioning and final closure of the operation.
- Post closure management of residual and latent environmental impacts.

The funds should be reviewed annually to ensure that the value of the fund reflects the prevailing inflationary environment, changes to environmental legislation, new technologies for rehabilitation and, if necessary, unforeseen residual impacts. This will ensure that the financial provision remains sufficient to cover costs in the event of the above occurrences at any stage during the life of the project.