Environment Project Report Study for the Proposed 1050MW Coal Power Plant, Lamu County, Kenya

Report Prepared for

Amu Power Company Limited

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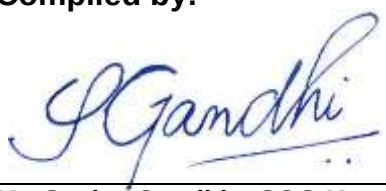

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Disclaimer

Acronyms

Acronym	Definition
AfDB	African Development Bank
ALARP	As Low As Reasonably Practical
APCL	Amu Power Company Limited
API	American Petroleum Institute
asl	Above Sea Level
BAT	Best Available Technologies
BMP	Best Management Practices
BSI	British Standards Institute
CLO	Community Liaison Officer
DB	Distribution Board
DOSHS	Directorate of Occupational Safety and Health Services
EDL	Effluent Discharge License
EMCA	Environment Management and Coordination Act, 1999
EPR	Environment Project Report
ERC	Energy Regulatory Commission
ESIA	Environment And Social Impact Assessment
ESMP	Environment And Social Management Plan
ESP	Electro-Static Precipitator
FGD	Flue Gas Desulfurization
FY	Fiscal Year
H&S	Health and Safety
Ha	Hectare
HIA	Heritage Impact Assessment

Acronym	Definition
HSD	High Speed Diesel
I&APs	Interested and Affected Parties
IFC	International Finance Corporation
IPP	Independent Power Producer
JSA	Job Safety Analysis
KenGen	Kenya Electricity Generating Company Ltd.
KETRACO	Kenya Electricity Transmission Company
Km^2	Square Kilometers
KP	Kenya Power
KTL	Kurrent Technologies Ltd.
kV	Kilovolt
kWH	Kilowatt Hour
L.N.	Legal Notice
LAPSSET	Lamu Port South Sudan Ethiopia Transport Corridor Project
m^2	Square meters
masl	Meters Above Sea Level
MCA	Member of the County Assembly
MCE	Member of the County Executive
MoEP	Ministry of Energy and Petroleum
MP	Member of Parliament
MPA	Mega Pascal
MSD	Medium Speed Diesel
MW	Megawatt
NEMA	National Environment Management Authority
NFPA	National Fire Protection Association

Acronym	Definition
NLC	National Land Commission
NMK	National Museums of Kenya
NO_x	Oxides of nitrogen
OEM	Original Equipment Manufacturer
OSHA	Occupational Safety and Health Act, 2007
OWS	Oil Water Separator
PM_{10}	Particulates with a diameter of 10µm or more
$PM_{2.5}$	Particulates with a diameter of 2.5µm or more
PPE	Personal Protective Equipment
ppm	Parts Per Million
PPP	Public Private Partnership
SCR	Selective Catalytic Reduction
SIA	Social Impact Assessment
SO_2	Sulfur dioxide
SO_x	Oxides of sulfur
STI	Sexually Transmitted Infection
ToR	Terms of Reference
UNFCCC	United Nations Framework Convention on Climate Change
VIA	Visual Impact Assessment
WHO	World Health Organization
WWTP	Waste Water Treatment Plant

Glossary of Terms

Term	Definition
Airshed	An airshed is a part of the atmosphere that behaves in a coherent way with respect to the dispersion of emissions. It typically forms an analytical or management unit and is also a geographic boundary for air quality standards
Baseload	Base load refers to the electricity generated to meet the continuous need for electricity at any hour of the day or night at all times and during all seasons
Environment	The surroundings (biophysical, social and economic) within which humans exist and that are made up of: i. The land, water and atmosphere of the earth; ii. Microorganisms, plant and animal life; iii. Any part or combination of (i) and (ii) and the interrelationships among and between them; and iv. The physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and wellbeing
Environment and Social Impact Assessment (ESIA)	A study of the environmental consequences of a proposed course of action
Environment Project Report (EPR) Study	A report assessing the potential significant impacts as identified during the Scoping phase
Environmental impact	An environmental change caused by some human act
Public Participation Process	A process of involving the public in order to identify needs, address concerns, in order to contribute to more informed decision making relating to a proposed project, program or development
Scoping	A procedure for determining the extent of and approach to an ESIA, used to focus the ESIA to ensure that only the significant issues and reasonable alternatives are examined in detail
Scoping Report	A report describing the issues identified

1 Details of Proponent and ESIA Team

Project Title:	Proposed 1050MW Coal Power Plant, Lamu, Kenya	
Client:	Amu Power Company Limited	
Issue Date:	April 23, 2015	
Issuing Office:	Nairobi, Kenya	
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	Visual Impact Assessment:	Aurecon South Africa

2 Introduction

This Environmental Project Report (EPR) Study relates to the proposed 1050MW coal fired power plant in the Kwasasi area, Hindi division, Lamu County. The power plant will be situated approximately 21km north of Lamu town as indicated in Figure 1. The project is to be undertaken within an area that the Kenya Ports Authority (KPA) is seeking to acquire for purposes of the Lamu Port South Sudan Ethiopia (LAPSSET) transport corridor project. According to the LAPSSET Study report dated June 2011, a coal fired power plant was envisaged as part of the transport corridor project.

The proposed project will be developed by Amu Power Company Limited, a project development company made up of two sponsors namely Gulf Energy Limited (lead sponsor) and Centum Investment Company Ltd. (co-sponsor). Gulf Energy Limited is a leading oil marketing company in Kenya and also owns an 80MW medium speed diesel (MSD) power plant in Athi River, Kenya. Centum Investment Company Ltd. is a Nairobi Securities Exchange listed company whose investments span real estate, shopping malls, etc.

Electricity consumption in Kenya is growing with additional demand emanating from proposed industrial parks, LAPPSET projects, resort cities, iron and steel smelting industry and, the standard gauge railway. Peak demand increased from 899MW in FY 2004/05 to 1470MW in FY2013/14 reaching 1512MW by December, 2014. The number of electricity consumers more than trebled from 735,144 in FY 2004/05 to 2,757,983 by June 2014 (Draft National Energy and Petroleum Policy, January 2015).

Peak demand is projected to grow from 1512MW as at December, 2014 to 3,400MW by 2016 and to 5,359MW by 2018. To meet this demand, an additional 5,000 MW of new generation is to be developed by 2017 to bring total installed capacity to at least 6,600MW. Annual energy consumption is projected to increase from 8,841GWh in 2013/14 to 32,862GWh in 2016/17. It is projected that by 2030, peak demand will be 18,000MW against an installed capacity of 24,000MW (Draft National Energy and Petroleum Policy, January 2015).

Figure 1: Map showing location of proposed coal fired power plant in Lamu County

As at December 2014, the installed capacity of electrical power was 2173MW. This power is generated by KenGen and Independent Power Producers (IPPs). As at June 30th, 2013, the energy mix in the country was made of renewable (69.1%) and fossil fuel sources (30.9%) as shown in Table 1.

Table 1: Energy mix in Kenya as at December 31st, 2014

Sources of electric power generation		Installed capacity (December 2014)		Annual generation (FY2013/2014)	
		(MW)	(%age)	(GWHr)	(%age)
Renewable energy	Hydro	81	37.8	3945	44.6
	Geothermal	593.5	27.3	2008	22.7
	Wind	25	1.2	18	0.2
	Cogeneration	38	1.7	57	0.6
	Imports	-	-	85	1.0
	Total	**1477.5**	**68**	**6112**	**69.1**
Fossil fuels	MSD	579.5	26.7	2533	28.6
	Gas turbines	60	2.8	41	0.5
	HSD	25.8	1.2	61	0.7
	Emergency Power plant	30	1.4	94	1.1
	Total	**695.3**	**32**	**2729**	**30.9**

The proposed power plant will use supercritical steam technology. The plant will be designed, constructed and operated to comply with stringent environmental standards and will meet all the required international air quality limits such as the World Bank Group's (WBG's) 2008 Environment, Health and Safety (EHS) Guidelines on thermal power plants. In order to achieve stringent environmental standards, the power plant will utilize clean coal emission control technologies namely:

- Low nitrous oxide burners;
- Wet Flue Gas Desulfurization (FGD) for removal of sulfur dioxide (SO_2); and
- Electrostatic Precipitator (ESP) for removal of particulates.

The new plant will require an application for consent to the National Environment Management Authority (NEMA) under Section 58 of the Environment Management and Coordination Act, 1999 (EMCA). In order to operationalize this section of EMCA, Legal Notice (L.N.) 101 titled Environment (Impact Assessment and Audit) Regulations, 2003 was promulgated by the then Minister for Environment and Natural Resources. This Scoping Report has been produced in accordance with the requirements of the above environmental subsidiary legislation. Planning is at an early stage, and this report sets out the proposals that Amu Power has for characterizing the existing environment and assessing the potential impacts of the development. This will ensure that the plant can be designed, built and operated in a way that minimizes its environmental impact.

3 Project description

3.1 Introduction

Electricity demand in Kenya is expected to increase especially with expanded economic activities in the counties. Such activities include mining, iron and steel smelting, irrigation of large tracts of land, etc. In order to provide affordable electricity for these and other activities, the Government of Kenya proposes to increase the generation capacity from 1664MW (in October 2013) to 6700MW (by October 2017). Through this plan, the Kenya Government intends to reduce the generation capacity cost from US cents 11.30 to US cents 7.41; indicative end-user tariffs are projected to reduce from US cents 14.14 to 9 for commercial/industrial customers and from US cents 19.78 to 10.45 for domestic customers.

This capacity of an additional 5000MW of power generation capacity will be developed by an energy mix comprising geothermal, coal, wind, solar, hydro sources. It is expected that this capacity will be generated by Independent Power Producers (IPPs) under the Public Private Partnership (PPP) framework.

The proposed project is a coal fired power plant which will generate a gross electrical output of 1050MW. The power plant will utilize 68.5MW for its own use and will export a total of 1050MW to the national grid via a 400kV overhead transmission line to be constructed by KETRACO.

Given in this sub-section is a description of the proposed coal fired power plant.

3.2 Project features

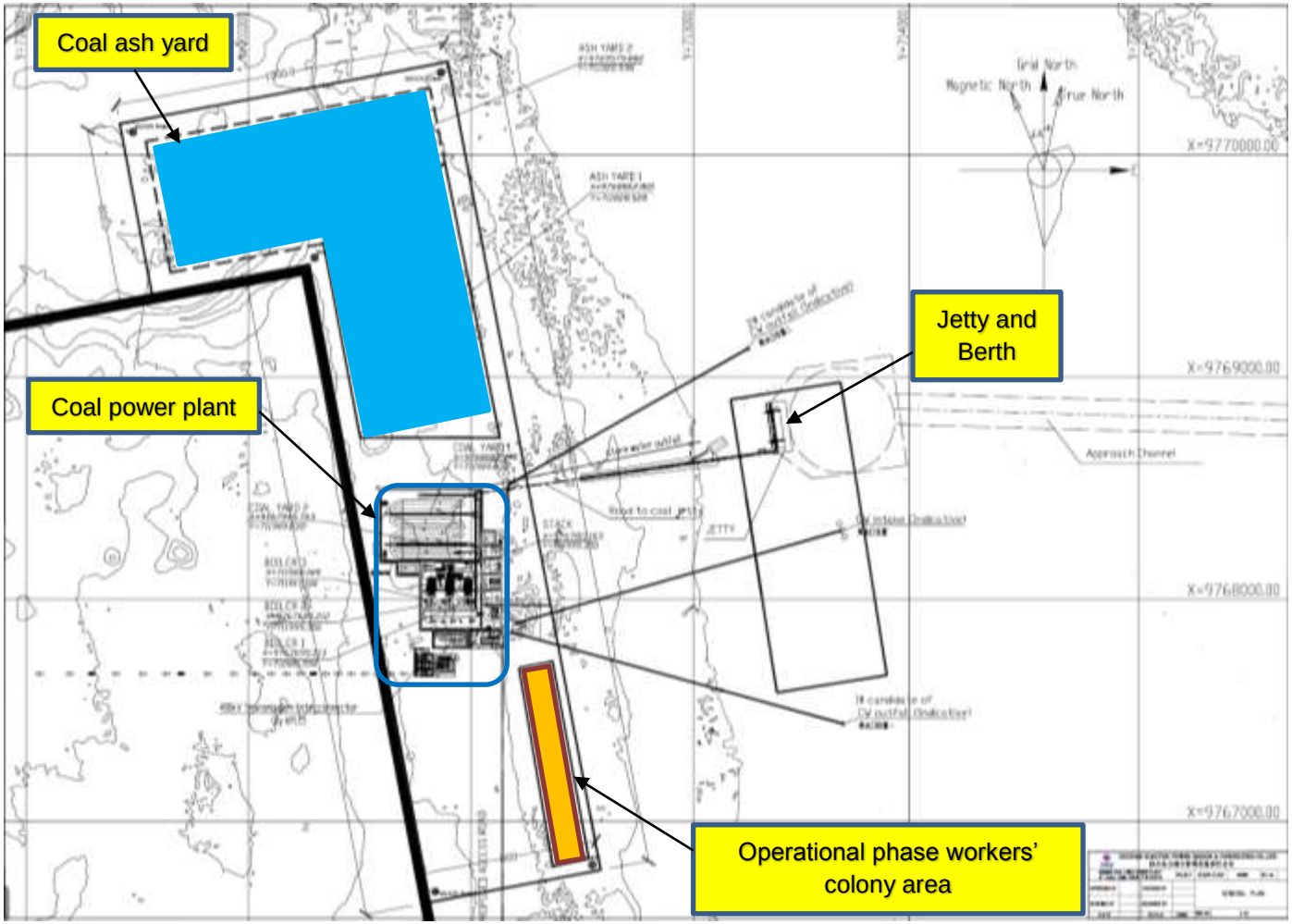
The project comprises the design, construction, commissioning, operation and decommissioning of a coal-fired power station and its associated infrastructure (also referred to as the balance of plant). The power station will comprise three boiler/turbine sets with a nominal electricity generation capacity of approximately 1050MW (350 MW per unit). Apart from the power station buildings themselves, the ancillary infrastructure may include the following:

- Coal and sorbent stock yards;
- A black start facility;
- A coal receiving jetty;
- Coal, ash, sorbent and gypsum conveyors;
- A High Voltage (HV) yard within the power station precinct;
- Water and wastewater treatment facilities;
- Ash and spent sorbent disposal systems and dump site;
- Gypsum storage facility;

- Access roads (temporary and permanent, and external and internal roads);
- Maintenance, medical, administration, services, control buildings;
- Water supply pipeline for construction phase;
- Borrow pits (on site and off site). These are yet to be identified by the Proponent;
- Communication mast/telecommunication facilities;
- General and hazardous storage and handling facilities (temporary and permanent);
- Batching plant (including concrete and asphalt);
- Construction worker accommodation and construction site offices; and
- A permanent colony for 250 – 300 operational phase workers.

A preliminary layout of the coal power plant is shown in Figure 2.

Figure 2: Preliminary layout of coal fired power plant



3.3 Project components

The principal components of the project will include a power plant area, a coal ash yard, a worker colony, a jetty and a berth. These components are described below.

3.3.1 Power plant

The principal components of the power plant are as follows:

Pulverized coal-fired boiler(s): Three supercritical pulverized coal-fired boilers will be constructed at the project site to produce steam for the steam turbine generator(s). The boilers would be designed to maximize efficiency and minimize air pollution during the combustion process.;

Steam turbine generator(s): Each pulverized coal-fired boiler would have a dedicated steam turbine generator. The steam turbine generators would use steam produced by the boilers to drive electric generators. Each steam turbine generator is expected to have a nominal generating capacity of 350MW. The maximum net generating capacity of the three combined steam turbine generators is expected to be approximately 1050MW. The steam used in the steam turbine generators would exhaust from the steam turbine generator into a condenser.

Condenser(s): A condenser would attach to each steam turbine to receive exhaust steam. Inside the condenser, the exhaust steam would condense to its liquid state for reuse in the boiler.

Plant electric switchyard: An electric switchyard will be located on the power plant site to step up the voltage of electricity produced to 400 kilovolts (kV). The switchyard may include circuit breakers, disconnect switches, generator step-up transformers, auxiliary power transformers, steel structures and a control building. KETRACO will build a 520km long double circuit transmission line from the power plant to the Kenya Power Nairobi Control Center (NCC) from where electrical power will be distributed to the country and beyond.

Water treatment: The power plant would include water treatment facilities for raw water, feed water to the plant, condensate and once through cooling water in order to maintain water quality for the process equipment. The water treatment facilities would include a desalination plant, water treatment building, water storage tanks, chemical storage tanks, clarifiers and demineralizers.

Additional facilities: the power plant area may also include various buildings to house equipment and conduct administration, operations and maintenance activities; warehouses; electrical switchgear buildings; various pumps, motors and fans; fuel and chemical storage tanks/areas; lime/limestone, ammonia and mercury sorbent storage and handling equipment; fire protection, security and safety systems; stormwater facilities; continuous emissions monitoring systems; and back-up electric generators.

3.3.2 Air pollution control equipment

The emissions control equipment for each pulverized coal-fired boiler would consist of low nitrogen oxide burners, wet flue gas desulfurization and electro-static precipitators. Exhaust gases from the boilers would flow through the emissions control equipment before being discharged to the atmosphere through the stack(s). The emissions control equipment is efficient in reducing nitrogen oxide, sulphur dioxide, particulate matter and hazardous air pollutants such as mercury. The systems would be designed to meet or exceed the World Bank Group's 2008 air emission guidelines stipulated within their document titled "EHS Guidelines for Thermal Power Plants".

Pulverized coal-fired boiler stack(s): The power plant will include a pulverized coal-fired boiler stack connected to each boiler; the three stacks will be contained within a reinforced concrete chimney whose height will be approximately 210m tall. Each of the pulverized coal-fired boiler stacks will be connected to a state-of-the-art Continuous Emissions Monitoring System (CEMS) for recording the exit concentration of pollutants of concern.

3.3.3 Coal unloading, storage and handling

Low sulphur coal from various collieries would be the primary fuel for the station and would be delivered to the power plant site by barges that will travel from the entrance to Manda Bay up to the project site. The proposed power plant is expected to use about 10,000 metric tons of coal per day when the power plant is at full operation.

A new jetty and berth is to be constructed for the power plant site. The length of the jetty will be based on a bathymetric survey and geotechnical investigation of the sea bed floor where it is proposed to be constructed.

Coal unloading: The coal unloading jetty will have one to two off-loading cranes. These cranes will off-load coal from the barges and place it on the conveyor belt system. The conveyor system would be designed with dust suppression systems to minimize dust emissions.

The design of the power plant includes a provision for receiving coal using rail cars. This will allow the power plant to utilize the coal discovered in various parts of the country when commercially viable to mine. The design of the rail system will be done in future.

Coal storage: Coal would be stored outdoors in designated coal storage areas. The coal storage yards would consist of approximately 16 Ha of property on site. The coal piles within the coal storage areas would be maintained using mobile equipment described below. Water sprays would be sued for dust suppression. A sewage treatment and coal settling pond will also be constructed within the coal stock pile areas.

Coal handling: Coal would be transported from the coal storage area by use of conveyor systems. The conveyors would be designed to minimize dust emissions. At the coal storage areas, equipment such as stackers, reclaimers, bulldozers and front end loaders may be used to manage the coal stockpiles.

Coal preparation equipment: Prior to consumption in the power plant, coal would pass through preparation equipment such as crushers and pulverisers'. These processes would take place in closed areas to minimize the release of dust.

3.3.4 Workers' housing

During the construction phase, it is anticipated that there will be 2000 – 3000 workers at the project site. Temporary worker accommodation will be provided for a significant number of these workers. Construction worker housing would include both onsite and offsite housing.

The power plant site would include an onsite construction worker housing area with the facilities necessary to support up to 1,000 workers during construction. The remaining 1000 – 2000 workers of the peak construction work force would reside in offsite housing.

The onsite construction worker housing facilities would be located within the power plant site. Onsite community facilities would include housing, kitchen/dining facilities, water and fire protection facilities, sanitary facilities, medical facilities, security and administrative facilities, recreational facilities, and parking. Recreational facilities may include indoor facilities such as TV rooms, game rooms, and gym area and outdoor facilities such as basketball courts and ball fields. Medical facilities would be limited to first response and will include an ambulance station onsite.

Modular, dormitory style community housing facilities would be used as the living quarters to accommodate 1000 or more workers onsite. Each dormitory would be prefabricated and erected on a concrete slab. Each dormitory would include private or communal wash/toilet areas.

The primary infrastructure to support the construction worker housing would be potable water systems, sanitary wastewater treatment, and electric power and communication lines. Potable water would be provided using the water supply system for the power plant. Sanitary wastewater would be collected and treated with an onsite package wastewater treatment plant.

Electric power would be established through the use of diesel generators, as required.

Parking areas would be provided throughout the construction area and surfaced with crushed aggregate or gravels. Refuse materials would be collected regularly and transported to an offsite, licensed landfill by a NEMA registered road contractor.

Upon completion of power plant construction, modular housing and buildings would be removed from the power plant site. Selected facilities used to support the onsite housing may be converted to permanent use to support the permanent operations and maintenance of the power plant. Depending on the size of the power plant initially built, future expansion of the plant would require the re-establishment of the construction worker housing on the power plant site.

During the operational phase, it is envisaged that there will be up to 500 workers who will be based within the power plant. An area of about 7 Ha within the project site has been set aside for housing the operational phase workers.

3.3.5 Jetty and berth

Coal will be offloaded from barges that will berth at a new jetty to be constructed as part of the project. The exact location of the berth and jetty will be based on the bathymetry survey and geotechnical investigation which is in the process of being undertaken. A coal study is currently being undertaken to determine the size of barges that will be able to off-load coal at the jetty.

3.3.6 Solid waste disposal

An on-site solid waste disposal facility will be constructed and operated for the disposal of coal combustion by-products including fly ash, bottom ash, economizer ash, scrubber by-products and coal rejects. Additionally, the solid waste disposal facility will treat inert, non-hazardous industrial wastes generated onsite including construction and maintenance debris.

Some types of waste (for example, office wastes, oil, liquids, etc.) would be hauled to an offsite disposal facility licensed by NEMA. Wastes generated during construction activities would be recycled to the extent practical.

The solid waste disposal facility would be designed in accordance with applicable international standards. The facility would include environmental protection measures to prevent the release of contaminants to the environment, including surface and ground water. Such measures would include a bottom liner and leachate collection and control system, a surface water runoff management system with a sediment retention basin, and a ground water quality monitoring program. The monitoring program will consist of wells located up-gradient of the solid waste disposal facility to obtain samples representative of background water quality, and other wells located down-gradient of the disposal facility to ensure the detection of potential contaminants. Samples will be collected quarterly at the wells during project operation and into the post-closure period and analyzed for a list of targeted elements of environmental concern associated with South African or Kenyan coal.

3.3.7 Water supply system

The power plant would require water for construction, process, cooling, potable, and fire protection purposes. Under normal operating conditions, the water use rates would typically be as mentioned below.

Table 2: Approximate water demand from various project sources

Type of water system	Approximate quantity generated
Maximum circulating water	42,168 m^3/hour

Type of water system	Approximate quantity generated
Make-up water flow	1,100 m^3/hour
Oily wastewater system	96 m^3/day
Coal wastewater system	192 m^3/day
Sanitary sewage system	96 m^3/day
Desulfurization wastewater system	480 m^3/day

3.3.8 Borrow pits

One or more borrow areas would be established to provide earth and rock materials during site preparation and throughout the construction process. The materials would be used for concrete and asphalt mixes, road base, lining of dikes, and rock surfaced areas. A fence, berm, or signs would be established at the borrow area entry to prevent public access. Upon completion of construction, the borrow area(s) would be re-contoured and reclaimed in accordance with good industry international practices.

The location of the borrow pit(s) will be based on lab tests to determine the suitability of earth and rock for construction of the power plant. This will be determined during the detailed engineering design phase of the project.

3.3.9 Construction schedule and workforce

Construction of the project is expected to commence at the beginning of 2016 subject to receiving all regulatory approvals and securing financing. The monthly worker strength will be provided in the ESIA Study to depict the estimated average number of construction workers per month needed to construct the power plant.

On a monthly basis, the average number of workers during the construction phase is expected to be about 2000 with the peak construction having up to 3000 workers.

It is envisaged that the first unit will be commissioned in 36 months from the construction commencement date, followed by the second unit in 39 months and the third unit in 42 months from the construction start date respectively.

Normal construction hours are expected to fall between 6:00am – 6:00pm Monday through Sunday. However, these hours may require adjustment because of scheduling constraints and other time-sensitive matters.

3.4 Construction activities

The primary components of the proposed project that would be constructed include the power island, coal storage and handling, waste handling and disposal, water supply system and access roads.

The power plant would include up to three generating units, which will be constructed sequentially. This section describes the activities that will be undertaken for constructing the proposed 1050MW coal fired power plant.

Construction activities at the power plant would include the following major phases:

- Pre-construction works;
- Surveying, site clearing, site preparation, and mobilization;
- Construction of foundations and below grade utilities;
- Building and equipment installation;
- Start-up, commissioning, and testing; and
- Site cleanup and project closeout.

3.4.1 Pre-construction works

Prior to initiating construction, a number of surveys will be required including but not limited to, geotechnical survey, topographical survey, bathymetric survey, and site survey to confirm exact location and size of the plot required for the project.

3.4.2 Surveying, site clearing, site preparation, and mobilization

Initially, the construction work will include surveying work, site clearing, site preparation, and mobilization. This work would include the use of heavy, diesel powered equipment such as scrapers, bulldozers, dump trucks, and front-end loaders. The site preparation work would provide necessary grading for the plant facilities, establish access roads and parking areas for construction workers, and establish construction lay-down areas on the site. Site mobilization activities would include the delivery and setup of office trailers, warehouses, mechanic shops, onsite housing facilities, and installation of construction utilities (water, power, sewer, phone) and security facilities (guardhouse, fencing).

Earth and rock materials would be used during site preparation and throughout the construction process. The potential offsite borrow area for sand, gravel, and

aggregate materials are yet to be confirmed. The earth and rock materials would likely be transported to the place of use by truck.

3.4.3 Establishment of contractor yard

As stated above, site preparation activities for the contractor's yard will include clearance of vegetation at the footprint of the project site, establishment of internal access roads and excavations for foundations. These activities will require stripping of topsoil which will need to be stockpiled, back-filled and/or spread on site.

3.4.4 Establishment of laydown areas on site

Laydown areas will need to be established at the project site for storage of construction plant and equipment. The laydown areas will need to accommodate materials required for the construction of various components of the power plant such as contractor's yards, buildings, camps, waste management area, fuel facility, etc. Laydown and storage areas will be required to be established for normal civil engineering construction equipment which will be required on site.

3.4.5 Access roads and site preparation

Access ROWs would be required to provide road access to the power plant site and KETRACO substation. Currently, the access road to the project site is a track which is about 2.5m wide.

The ROW for access to the power plant site would be about 12 – 15m wide; this would allow heavy equipment to be transported via road to the project site. The ROW for access would be approximately 14km long built to murram standards constructed over the existing dirt road; the ROW access road will begin at a point about 4km north of the Hindi – Bargoni road and go north-east to the south-western part of the project site.

A significant amount of imported equipment parts for the power plant will arrive via sea. These components will likely be off-loaded near the project site and subsequently would require a temporary landing area such as a jetty. It would be preferable to use an existing jetty available close to project area instead of developing a new temporary one. The exact location of the jetty will be known during the detailed engineering design phase of the project.

3.4.5.1 Construction utilities

During the construction phase, a significant amount of water will be required for the project. Water is a scarce commodity in Lamu County and specifically the Kwasasi area where the proposed power plant is to be built.

Water for construction will most likely be abstracted from boreholes that will be dug by the contractor. It is anticipated that two wells, and the associated ancillary facilities including pipelines, electric distribution lines, and water storage tanks, would be able to adequately provide the water needs during the construction

period. Water will be required to support construction activities including the need for potable water, sanitary facilities, fire protection, concrete production, and dust control. The primary source of construction water would be provided through a partial construction of the water supply system.

The construction phase of the project will require an adequate and reliable source of electricity for various construction and support activities such as worker housing facilities, water supply system, construction trailers and start-up, testing and commissioning of the power plant. The electrical source for the above activities will be diesel powered generators; the size of generator(s) required for the construction phase is currently unknown but will be in the order of tens of megawatts. Cables from the diesel powered generators will be laid in conduits which in turn will be placed within trenches and taken to where the power is required.

3.4.5.2 Security facilities

Construction security would be provided by the Administration Police and a private security company. The Proponent is in the process of undertaking a security risk assessment of the project area and its environs to determine the level of security required for the construction and operational phases of the project. There will be watch towers constructed at all corners of the power plant to be used during the construction and operational phases of the project.

Construction security would consist of a security office to provide space and facilities for security personnel, a guardhouse for security personnel at the entrance to the power plant site, security fencing around the power plant site, and security vehicles to patrol the site. Security personnel would be trained and uniformed with the primary responsibility of controlling access to the power plant site.

All construction personnel would be issued identification badges that would be verified on entry and exit from the power plant site.

3.4.6 Construction of foundations and below grade utilities

The next major step would be to begin major foundation work and installation of below grade piping and electrical utilities.

Reinforced concrete foundations will be constructed for most elements of the power plant. Foundations will be excavated mechanically to the structural engineer's detail. This work would involve heavy equipment such as excavators, dozers, loaders, concrete trucks, mixers, vibrators, pumps, trench digging equipment, and welding equipment. Concrete is proposed to be batched on-site for the foundations and ground slabs. All raw materials required for manufacturing the concrete will be procured from local distributors; the concrete will be mixed and poured and left for to cure.

Underground piping and electrical installation would begin in areas at or near foundations prior to the foundations being established. Foundations would be established including excavation, formwork, installation of steel reinforcement, anchor bolts and embeds, pouring of the concrete, and the concrete finish work.

3.4.7 Building and equipment installation

As foundation work is completed, erection of steel and equipment would begin. This would require the use of multiple cranes and equipment deliveries by ship and trucks.

3.4.8 Start-up, commissioning, and testing

Upon completion of the major components of the power plant, various subsystems would be tested, started up, commissioned, and prepared for operations. Initially, devices and pieces of equipment within a subsystem would undergo testing to verify they are in good condition and ready to be put in service. These tests may include insulation resistance, motor rotation checks, relay calibration, vibration readings, loop testing, functional testing, and instrument calibration. Upon completion of testing, the subsystem would be put into initial operations and closely monitored for any problems. Minor adjustments and subsystem flushes would be performed as necessary during initial operations including cleaning pump screens, checking and adding lubricants, tightening packing glands, etc. The Station would go through an extensive testing and commissioning regimen before becoming commercially operational.

Near the end of project construction, steam would be generated in the boiler and released to the atmosphere to clean the steam piping. This process typically occurs over several weeks and is called “steam blowout.” Approximately 30 to 50 steam blowouts, each lasting several minutes, are required for a typical plant before the boiler is operated.

3.4.9 Site cleanup and project closeout

The final phase of power plant construction would include clean-up of the site, landscaping, completion of miscellaneous tasks, and teardown and removal of temporary construction facilities; the site will be rehabilitated where practical and reasonable. On full commissioning of the project, any access points to the site which are not required during the operational phase, will be closed and prepared for rehabilitation.

3.4.10 Water supply system construction

Part of the water supply system would be constructed early in construction to support construction activities. The entire water supply system would be constructed prior to the start-up and commissioning of the project.

A desalination plant will be constructed for the operational phase of the project. During the construction phase, it is envisaged that the contractor will either sink

their own boreholes near the project site or truck water from existing boreholes. Whichever method is used, the contractor will have to acquire the appropriate permit from the Water Resource Management Authority (WRMA).

Construction of the water supply system would involve the installation of a borehole complete with a submersible pump and, underground water pipeline within the project area.

3.4.11 Waste management

Wastes generated during construction activities would be recycled to the extent practical. Any non-recycled wastes would be collected and disposed of at the onsite solid waste disposal facility or transported to a NEMA or County approved disposal facility, as applicable. The different types of wastes will be transported using carriers that are licensed by NEMA and who possess current licenses.

Portable toilets would be provided for onsite sewage handling during construction. Sewage would be pumped out and removed regularly and disposed of in compliance with waste regulations in Kenya (Legal Notice 121: Environment Management and Coordination (Waste Management) Regulations, 2006).

3.4.12 Safety, fire protection and emergency response

During the construction phase, the Contractor will comply with all applicable requirements of the Occupational Safety and Health Act 2007 (OSHA) and its subsidiary legislation especially Legal Notice 40 of 1984 titled “The Building Operations and Works of Engineering Construction (BOWEC) Rules”.

Employees and contractors would be required to report all safety-related incidents, including accidents or injuries, to a designated project representative. Corrective action would be taken as necessary based on the nature of the reported incident.

On fire safety and as a minimum, the contractor will comply with all applicable requirements of Legal Notice 59 of 2007 titled “The Factories and Other Places of Work (Fire Risk Reduction) Rules.

Employees and contractors would be advised of their responsibilities under the above regulation and be required to report any project-related fire to a designated project representative. If a project-related fire were to occur, immediate actions would be taken by the contractor to respond to the fire.

Contingency planning contacts would include the contractor’s construction manager, the County OSH officer, and the local County fire department.

3.5 Overview of the operational phase

3.5.1 Overview of operations and maintenance

During the operational phase, it is expected that there will be over 350 full-time workers who will manage various aspects of the power plant. Most of the jobs will be skilled and semi-skilled types. A housing estate for these permanent workers will be built within the project site. Daily activities would include operation of the equipment to produce electricity, handling of coal, disposal of coal combustion by-products, and routine maintenance of plant equipment. Water needs during operation would be supplied through sea water from the Manda bay which will be treated in an on-site desalination plant, demineralizer and disinfection system.

The power plant would be operated to serve base load electric needs, rather than intermediate or peaking electric needs, and would provide approximately 1050MW of new base load coal-fired electric generation capacity. Baseload facilities typically operate near full capacity 24 hours per day.

Maintenance outages would be scheduled on occasion to inspect, overhaul, and/or replace major equipment and/or components. These outages are anticipated to last up to 8 weeks and may require deliveries of heavy equipment. The power plant site would be maintained in a good and proper condition for the commercial life of the Station (expected to be 25 years or longer).

3.5.2 Access and traffic

Access to the power plant site would be from an existing dirt road that would be widened and covered with murram. Access roads during operation would be constructed and paved as needed on the power plant site to serve the project's needs.

Vehicle traffic during power plant operations would include employee vehicles traveling to the site, deliveries to the site, and onsite vehicles handling coal and coal combustion by-products. In addition, the power plant site would routinely receive lime and chemical deliveries via truck.

3.5.3 Safety, fire control and emergency preparedness

Public access to the power plant site would be restricted through the use of fencing and security gates. The site would be equipped with numerous fire suppression systems and Proponent would implement industry recognized standard procedures to minimize fire risks at the site. Examples include:

- Fire water loop and hydrant system around the perimeter of the power plant facilities;
- Water storage dedicated for fire water purposes;
- Chemical fire suppression systems for designated equipment;
- Regular compaction of coal piles; and

- Routine maintenance and repair of equipment.

Various fuels and chemicals would be stored and used onsite, including diesel fuel, gasoline, caustics, acids, and ammonia. The power plant site would be designed to include spill-containment dikes and collection systems around chemical storage areas and fuel tanks.

Storage and use of chemicals would be in accordance with the requirements of Legal Notice 60 of 2007 titled "The Factories and Other Places of Work (Hazardous Substances) Regulations".

3.5.4 Fencing and signage

The power plant site would be fenced to restrict public access for safety and security reasons. Permanent signage is expected to include a sign along Mokowe – Bargoni Road indicating the name of the project and signage directing traffic on the power plant site. In addition, posting may be made along the perimeter of the power plant noting that access to the project site is restricted.

3.6 Overview of the decommissioning phase

The project is anticipated to have a commercial life of 25 years or longer. At the end of its commercial life, decisions would be made regarding continuing to use the power plant site for electric generation purposes or another industrial use. Given that the property would have a significant infrastructure in place (water supply system, electric transmission facilities), the Proponent expects that the property would be ideal for continued use as a site for an electric generation facility or for another industrial use.

Upon determination to permanently cease operation of the power plant, the power plant footprint would be razed with foundations left in place, and the power plant site restored to a condition suitable for future industrial use.

Onsite electric transmission and water facilities would be left in place to support a future use of the property.

3.7 Project timing

In October 2013, the Government of Kenya received 26 responses to an EOI for the development of a 1050MW coal power plant in Lamu. Of these, 10 were short listed and provided with a Request for Proposal (RFP) for the development, commissioning and operation of a 1050MW coal fired power plant. Of the 10 bidders, only 3 submitted their bids to the Ministry of Energy and Petroleum. In September 2013, the Ministry of Energy and Petroleum awarded the contract for the 1050MW coal fired power plant to a consortium of Gulf Energy Limited and Centum Investments.

Subsequent to the above, one of the losing bidders took issue with the award of the contract to the consortium of Gulf Energy and Centum Investments and appealed to the Public Private Partnership (PPP) Petitions Committee to annul the process. However on January 13th, 2015, the PPP Committee upheld the decision to award the contract for developing the 1050MW coal fire plant to the Gulf Energy and Centum Investments consortium.

The environment and social impact assessment (ESIA) process commenced after January 13th, 2015. The initial activities included:

- Stakeholder mapping and analysis;
- Scoping phase public/stakeholder consultation meetings; and
- Visit to the project area to identify issues that would be studied in the detailed assessment phase.

Following the above, the anticipated timing of activities associated with the proposed coal fired power plant are outlined below.

Activity	Proposed timeline
Commencement of ESIA Study	January 15th, 2015
Submission of EPR Study to NEMA	May 31st, 2015
Submission of TOR for ESIA Study to NEMA	June 30th, 2015
Submission of ESIA Study to NEMA	July 15th, 2015
Publishing Gazette notice for public review of ESIA Study	August 30th, 2015
Issuance of EIA License to Proponent	October 15th, 2015
Commencement of construction	October 2015
Commissioning of Unit 1	October 2018
Commissioning of Unit 2 and 3	April 2019

4 Regulatory Framework for the Project ESIA Study

The proposed project will be undertaken in accordance with the legislative requirements in Kenya as well as international best practices. This chapter highlights the key pieces of legislation that the project will comply with as a minimum throughout its lifetime.

4.1 Kenyan legislative and regulatory framework

4.1.1 Constitution of Kenya, 2010

The Constitution of Kenya is the overarching legislation in the country by which the citizens wish to be governed. The design, construction and operation of the proposed coal power project will comply with applicable requirements of the Constitution of Kenya such as Chapter 5 on Land and the Environment.

4.1.2 Environment Management and Coordination Act, 1999

The proposed project is subject to the requirements of Legal Notice 101: Environment (Impact Assessment and Audit) Regulations, 2003 (EIA/EA Regulations) published in terms of Section 58 of the Environment Management and Coordination Act, 1999 (EMCA). This section provides a brief overview of the EIA Regulations and their application to the project.

EMCA is the national legislation that provides for the authorization of certain controlled activities listed in the Second Schedule of the Act. In terms of Section 58 of the EMCA, the potential impact on the environment associated with these listed activities must be considered, investigated, assessed and reported to the NEMA. The NEMA is the competent authority that will eventually issue an EIA License for the proposed project in consultation with other lead agencies.

The need to comply with the requirements of the EIA/EA Regulations ensures that decision makers are provided the opportunity to consider the potential environmental and social impacts of a project early in the project development process, and assess if environmental impacts can be avoided, minimized or mitigated to acceptable levels. Independent environmental studies are required to be undertaken in accordance with the EMCA and the EIA/EA Regulations to provide NEMA and other lead agencies with sufficient information in order for an informed decision to be made regarding a project.

An ESIA is also an effective planning and decision making tool for the project proponent. It allows the environmental consequences resulting from the technical facility during its establishment and its operation to be identified and appropriately managed. It provides an opportunity for the developer to be forewarned of potential environmental and social issues and allows for resolution of the issues reported on in the EPR and ESIA reports as well as dialogue with affected parties.

This report documents the scoping evaluation of the potential environmental impacts of the proposed construction and operation of the 1050MW coal power plant in Kwasasi area, Hindi Sub-county, Lamu County. This EPR Study forms part of the EIA process and has been conducted in accordance with the requirements of the EIA/EA Regulations in terms of the EMCA.

During the construction and operational phases, the proposed coal fired power plant will comply with applicable requirements of the following subsidiary environmental legislation in Kenya:

- Environment Management and Coordination (Water Quality) Regulations, 2006;
- Environment Management and Coordination (Waste Management) Regulations, 2006; and
- Environment Management and Coordination (Noise and Vibration Pollution) Control Regulations, 2009.

The Environment Management and Coordination (Air Quality) Regulations, 2009 are awaiting gazettement and will be complied with from the effective date.

4.1.3 Other legislative requirements

There are several laws and regulations that will govern the construction and operations of the proposed 1050MW coal fired power plant. Some of them include:

- Occupational Safety and Health Act, 2007 and its subsidiary legislation;
- County Governments Act, 2012;
- Energy Act, 2006 and its subsidiary legislation;
- Lands Act, 2012;
- Water Act, 2002;
- Public Health Act, 2012;
- National Museums Heritage Act, Chapter 216, 2009;
- Kenya Roads Act, 2007;
- Radiation Protection Act, 2012; and
- Any other existing or proposed legislation that would be applicable to the proposed project during the construction and operational phases.

4.2 African Development Bank requirements

The African Development Bank (AfDB) is envisaged to provide the Partial Risk Guarantee (PRG) for the proposed 1050MW coal fired power plant in Kwasasi, Hindi sub-county, Lamu County.

The AfDB has developed an Integrated Safeguards System (ISS) to promote growth that is socially inclusive and environmentally sustainable. Safeguards are a powerful tool for identifying risks, reducing development costs and improving project sustainability, thus benefiting affected communities and helping to preserve the environment. The ISS is operationalized through the following operational safeguards:

Table 3: Operational safeguards of the African Development Bank

Operational safeguard (OS)	Application to the project
OS 1: Environmental and Social Assessment	This overarching safeguard governs the process of determining a project's environmental and social category and the resulting environmental and social assessment requirements: the scope of application; categorisation; use of a SESA and ESIA, where appropriate; Environmental and Social Management Plans; climate change vulnerability assessment; public consultation; community impacts; appraisal and treatment of vulnerable groups; and grievance procedures. It updates and consolidates the policy commitments set out in the Bank's policy on the environment.
OS 2: Involuntary Resettlement: Land Acquisition, population Displacement and Compensation	This safeguard consolidates the policy commitments and requirements set out in the Bank's policy on involuntary resettlement, and it incorporates refinements designed to improve the operational effectiveness of those requirements. In particular, it embraces comprehensive and forward-looking notions of livelihood and assets, accounting for their social, cultural, and economic dimensions. It also adopts a definition of community and common property that emphasises the need to maintain social cohesion, community structures, and the social interlinkages that common property provides. The safeguard retains the requirement to provide compensation at full replacement cost; reiterates the importance of a resettlement that improves standards of living, incomeearning capacity, and overall means of livelihood; and emphasises the need to ensure that social considerations, such as gender, age, and stakes in the project outcome, do not disenfranchise particular project-affected people.
OS 3: Biodiversity and Ecosystem	The overarching objective of this safeguard is to conserve biological diversity and promote the sustainable use of

Operational safeguard (OS)	Application to the project
Services	natural resources. It translates into OS requirements the Bank's commitments in its policy on integrated water resources management and the UN Convention on Biological Diversity. The safeguard reflects the importance of biodiversity on the African continent and the value of key ecosystems to the population, emphasising the need to "respect, conserve and maintain [the] knowledge, innovations and practices of indigenous and local communities… [and] to protect and encourage customary use of biological resources in accordance with traditional cultural practices that are compatible with conservation or sustainable use requirements3
OS 4: Pollution Prevention and Control, Greenhouse Gases, Hazardous Materials and Resource Efficiency	This safeguard covers the range of impacts of pollution, waste, and hazardous materials for which there are agreed international conventions and comprehensive industry-specific standards that other multilateral development banks follow. It also introduces vulnerability analysis and monitoring of greenhouse gas emissions levels and provides a detailed analysis of the possible reduction or compensatory measures framework
OS 5: Labour Conditions, Health and Safety	This safeguard establishes the Bank's requirements for its borrowers or clients concerning workers' conditions, rights and protection from abuse or exploitation. It covers working conditions, workers' organisations, occupational health and safety, and avoidance of child or forced labour.

4.3 IFC Social and Environmental Performance Standards

In addition to national environmental legislation, AfDB's integrated safeguards system, the proposed coal fired power plant project should comply with the requirements of the International Finance Corporation (IFC) Performance Standards (PS) on environmental and social sustainability. Specifically, the air emissions guidelines included in the IFC's "EHS Guidelines for the Thermal Power Plants, 2008" should not be exceeded.

Subsequently the ESIA Study will be carried out in accordance with the IFC's applicable performance standards on environmental and social performance. There are a total of eight performance standards that the IFC released in January 2012.

An analysis of the HSE related legislation that applies to the proposed coal power plant will be discussed in detail in the ESIA Study.

5 The Environment Project Report

5.1 Objectives of the scoping phase

The scoping phase of the ESIA process refers to the process of identifying potential issues associated with the proposed project and defining the extent of studies required within the ESIA phase. This is achieved through an evaluation of the proposed project, involving the project proponent, specialists with relevant experience in ESIAs for similar projects and a public consultation process with key stakeholders that includes Members of Parliament, Senators, Lamu County Government, Members of the County Assembly, Council of Elders and the local community living in the project area.

In accordance with the Kenyan EIA/EA Regulations, the purpose of the scoping phase is to focus the environmental assessment in order to ensure that only potentially significant issues and reasonable and feasible alternatives are examined in the detailed ESIA phase.

5.2 Aims of the Environment Project Report

Subsequent to the above, the specific aims of the environment project report are to:

- Understand the proposed development with respect to the context of the overall project area;
- Set out the approach to the ESIA, including the proposed content and structure of the ESIA Study report;
- Summarize existing baseline information in relation to the project area and surrounding vicinity;
- Identify the issues which are to be assessed as part of the ESIA;
- Agree the general approach to the assessment and the methodologies that would be used; and
- Identify those issues which should be scoped out of the ESIA.

5.3 Preparation of the Environment Project Report

The scoping review and subsequent preparation of this EPR Study has comprised a number of key activities:

- Discussions with Amu Power and their technical and financial advisors regarding the scheme proposals;
- Preliminary site visit to familiarize the ESIA specialists on the terrestrial and marine conditions in and around the proposed project site; and
- An initial appraisal of likely environmental and social impacts of the project, the potential for mitigation and recommendations for the main ESIA study.

A range of information sources have been used to prepare this report and to undertake the initial appraisal work. These include:

- Literature review of the EMCA, AfDB policies and Integrated Safeguards System, and IFC's Environmental and Social Performance Standards;
- Meetings and teleconferences between Amu Power, their technical and financial advisors, and KTL;
- Stakeholder consultation meetings at various locations in the project area and its surroundings;
- Studying the topography map of the Mokowe area;
- Research on environmental and social aspects and impacts of the proposed project; and
- Review of past ESIA study reports.

5.4 Consultations

Consultation with stakeholders in the project area has been on-going since January 2015 and this dialogue will continue throughout the ESIA process. The NEMA for example, requires a minimum of three public stakeholder consultation meetings (Regulation 17(2)(b) of the EIA Regulations, 2003). The Firm of Experts has already undertaken ten public/stakeholder consultation meetings.

Public/stakeholder consultation is an on-going process which will continue during the design, construction and operational phases of the project respectively.

In order to meet the requirements of legislation and good international industry practice (GIIP), KTL conducted several public/stakeholder consultation meetings in Lamu Island, Kwasasi (project site), Bargoni, Hindi, Mokowe, Mtangawanda (Pate Island) and Pate (Pate Island) to engage the indigenous communities to seek their oral and written comments. The meetings were held on various dates on January 24th – 30th, 2015. Minutes were taken at each of the meetings and the issues raised will be addressed in the ESIA Study.

6 Approach to the ESIA process

The ESIA study for the proposed coal fired power plant is being undertaken in two phases; the scoping phase (the subject of this report) and a detailed assessment phase. The purpose of the scoping phase is to identify key project issues and alternatives through consultation with stakeholders associated with the project.

The Environmental Project Report is being made available to NEMA and includes:

- The issues raised during the scoping phase; and
- The scope for the detailed assessment phase.

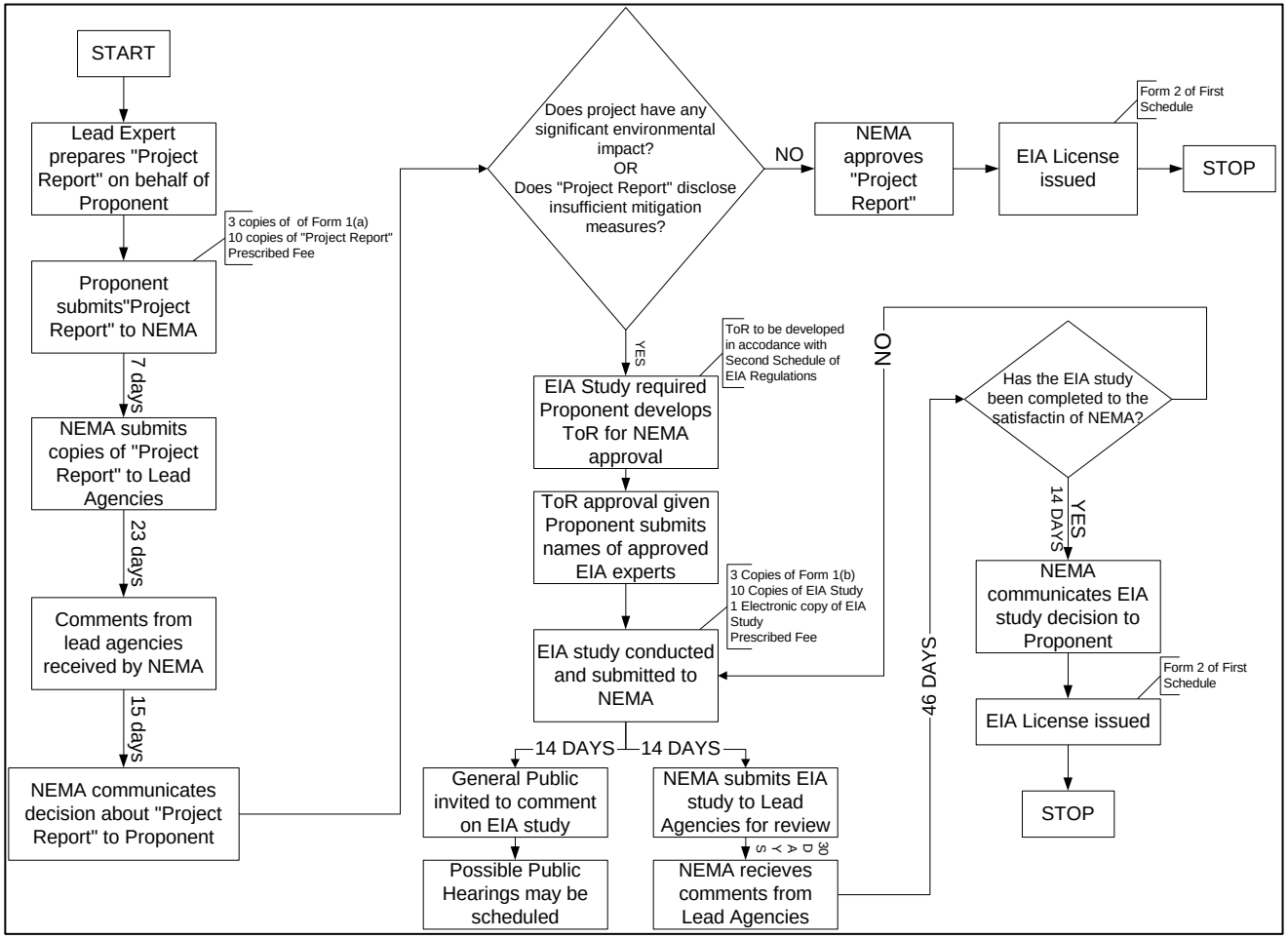
The ESIA work would comprise a series of specialist environmental studies which would be targeted to the potential significant impacts which are likely to be experienced as a result of the proposed development. Each topic would be included as a separate section in the main body of the ESIA Study report, or included as an appendix if the subject matter is deemed to be more specialist.

In accordance with best practices, each specialist chapter of the ESIA Study report would generally be constructed according to the following structure:

- Introduction;
- Methodology;
- Baseline Conditions;
- Potential Impacts;
- Mitigation Measures;
- Residual Impacts (impacts after mitigation); and
- Conclusion.

Figure 3 presents a flow chart of the EIA process in Kenya as stipulated in the Environment Management and Coordination Act, 1999 (EMCA) and its subsidiary legislation titled Environment (Impact Assessment and Audit) Regulations 2003. The flow chart shows the approximate timeframes for various activities that need to be undertaken by the Proponent or NEMA.

Figure 3: The typical ESIA Process in Kenya



7 Public engagement

Public engagement and stakeholder consultation is fundamental to an effective environmental and social impact assessment process and for the successful implementation of the proposed coal-fired power plant project. It serves to promote mutual confidence and trust between the proponent and project stakeholders.

Public engagement and stakeholder consultation is also requisite under the Constitution of Kenya 2010 as well as several laws and regulations. Public/ stakeholder consultation is strongly advocated by international best practice standards; for example, AfDB's Integrated Safeguard System (ISS) requires a proponent to conduct and provide evidence of meaningful consultation (i.e., consultation that is free, prior and informed) with local stakeholders and communities likely to be affected by environmental and social impacts. The International Finance Corporation's (IFC's) Performance Standard 1 (PS1) paragraph 30, calls for a public consultation process that provides project-affected communities with opportunities to express their views on project risks, impacts and mitigation measures and for the proponent to respond to them.

For the proposed coal power plant, the proponent's public engagement will be guided by AfDB's Integrated Safeguard System (ISS) 1 and 2 on environmental and social assessment and Involuntary Resettlement respectively.

Public engagement is an on-going process; for the proposed coal power plant, stakeholder consultation was initiated during the scoping phase and will continue throughout the detailed ESIA process, construction, operational and decommissioning phases of the project respectively. The approach to public engagement has been designed to promote meaningful, two-way communications between the proponent and the stakeholders.

7.1 Public engagement in the scoping phase

The scoping phase public meetings were conducted between 9th January 2015 and 1st April 2015. The engagements were conducted at the County and community levels. The objectives of scoping phase public meetings was to (i) inform the public about the project; (ii) receive their initial views with regards to the project; (iii) receive their input to the design of the stakeholder engagement process and; (iv) strengthen the base for future consultations.

To facilitate seamless and efficient engagements with the local communities, the project company appointed two Community Liaison Officers (CLOs) from Lamu to represent and communicate with the land owners, youth, women, men, opinion leaders, and the local communities.

A comprehensive stakeholder identification and analysis process was conducted where a stakeholder database was generated. This will form the foundation for planning and designing of successive stakeholder engagement activities. The stakeholder database was generated based on the identification of individuals, communities, groups and institutions who:

- Are most likely to experience, at significant levels, the negative and/or positive impacts of the proposed project;
- Have the mandate over the various elements of the project's activities (Such as Government ministries and leadership);
- Are considered vulnerable members of the community within the proposed project area; and
- Are considered the projects main supporters and opponents.

7.2 Key engagement activities

Engagement activities have been conducted with representatives from County Government, civil society, land owners as well as the public in the communities within the vicinity of the project area who are likely to feel most project impacts. The public engagements encompassed the following key activities:

- Distribution of the project Background Information Document (BID);
- One-on-one meetings with key stakeholder representatives;
- Formal meetings with civil society groups;
- Community public meetings; and
- Media briefings.

Additionally, the following support materials were prepared for stakeholder dialogue:

- Stakeholder invitation letters;
- Public meeting notices (English and Swahili);
- Stakeholder registration logs; and
- PowerPoint presentations of the proposed project.

Meetings were organized through official letters, emails and phone calls. Public meetings were publicized through Swahili and English public notice posters, local elders and CLOs. The public meetings were conducted in the Kiswahili language. The project company's directors and senior management accompanied KTL during all disclosure meetings to receive and respond to raised issues. Local leaders were invited to all public meetings.

The engagements were conducted in Lamu town as well as within communities neighboring the proposed project site. These included: Kwasasi (proposed project site area); Mtangawanda, Pate Island; Pate Town, Pate Island; Bargoni; Mokowe; and Hindi. The public meeting locations were selected based on the following factors:

- Proximity to proposed project site;
- Areas most likely to be adversely affected by the perceived project impacts;
- Areas of significant commercial, administrative, and social value;
- Areas recommended as convenient congregation points for majority of the targeted stakeholders; and
- Populated areas.

Table 4 below presents the public engagement log outlining the dates, location and stakeholders engaged.

Table 4: Scoping phase public engagement log

Date and Place	Stakeholder group and purpose of meeting
9th January 2015 Lamu	Village headmen and community leaders(from affected communities) Project Introductory meetings
9th January 2015 Lamu	National Museum of Kenya representatives (Lamu museum) Project Introductory meetings
9th January 2015 Lamu	Assistant County Commissioner, Lamu County Project Introductory meeting
9th January 2015 Lamu	Ward administrator, Hindi and Senior Chief Project Introductory meetings
24th January 2015 Lamu Island	Save Lamu Representatives Workshop
24th January 2015 Lamu Island	Lamu Youth Alliance Representatives Workshop
25th January 2015 Lamu Island	Male Opinion leaders Representatives Workshop
25th January 2015 Lamu Island	Female opinion leaders Representatives
26th January 2015 Bargoni Primary School	Bargoni and Ngini Residents Dissemination and consultation public meeting
26th January 2015 Mokowe Primary School	Mokowe Residents Dissemination and consultation public meeting

Date and Place	Stakeholder group and purpose of meeting
27th January 2015 Lamu	Lamu County Land Management Board Project Briefing Meeting
27th January 2015 Kwasasi	Kwasasi Residents Dissemination and consultation public meeting
27th January 2015 Hindi	Hindi Residents Dissemination and consultation public meeting
28th January 2015 Changa Chini, Mtangawanda, Pate Island	Mtangawanda residents Dissemination and consultation public meeting
28th January 2015 Pate town hall, Pate Island	Pate residents Dissemination and consultation public meeting
2nd February – 3rd February 2015, Nairobi	Lamu County Government workshop
12th February – 13th February 2015, Malindi	Lamu members of County Assembly workshop
Between February 2015 and March 2015	Varied Media Briefings
1st April 2015 Lamu Island	Lamu County Administration workshop

7.3 Key public views and concerns

During the scoping study, different views and concerns were expressed by the stakeholders consulted. These views were captured and recorded through meeting minutes and issues and response reports (IRR). Responses to the views and comments will be undertaken as part of the detailed environmental and social impact assessment. Table 5 shows a summary of the views expressed by various stakeholders during the public meetings.

Table 5: Key public views and concerns highlighted

Concern	Views/comments of the stakeholders
Access to potable water	• There is a lack of access to clean water for household consumption. Communities have to walk long distances to access water. They purchase water at expensive rates, forego daily routines on account of lack of water • Water quality is poor leading to disease
Education	• Inadequate number and distribution of schools • Lack of adequate infrastructure in the existing schools • Poor academic performance • Low education levels and high rates of school drop-outs • General concern expressed over the local youth's low education levels and lack of marketable skills. This was cited as a hindrance to accessing the project's employment opportunities • Need to establish and build capacity of tertiary level institutions
Health	• Inadequate number and distribution of hospitals • Lack of adequate infrastructure in the existing medical facilities • Need to provide ambulances to ease hospital transfers and referrals, with emphasis on maternity services • Need to rehabilitate and upgrade Mokowe hospital
Livelihoods	• Concern was raised over the potential loss of livelihoods as a result of project activities with emphasis on the fishing and agriculture industries • Project affected persons that will be compensated need financial literacy skills for prudent utilization of funds.

Concern	Views/comments of the stakeholders
Available employment and business opportunities for the local community	• There was a general expression of the need to clearly highlight the available employment and business opportunities that the project will present. • Need to ensure that information about available economic opportunities is delivered early enough for the community to prepare. Mediums for this information should be easily accessible to the community such as the use of local radio, local leaders and local notice boards. • A need to clearly outline the percentage of employment and business opportunities that will be dedicated to the local community. • A need to prioritize the local community in capacity building, employment and business opportunities • An expressed need to outline how APCL will empower the local community to participate in and benefit from the available opportunities • The community expressed a need to ensure equitable access to all available opportunities including consideration for the extremely poor and vulnerable groups
Resettlement and compensation	• General concern over the lack of title deeds by land owners • A need to understand the exact site and boundaries of the project site • Need to understand how the resettlement and compensation exercise will be implemented: who will compensate, the proponent or the government?; what compensation rate will be used?; will those displaced be allocated alternative land in another location; when will the compensation be implemented; how will the genuine project affected persons (PAPs) be identified? • General concern over fraudulent land grabbing activities by influential individuals from Mombasa, Malindi and upcountry
Poor road network	• Concern over the poor road network (only 6km of about 600km in the county is tarmacked) • Expressed need to develop the road networks in

Concern	Views/comments of the stakeholders
	light of project-induced traffic increase
CSR program and benefit sharing mechanism	• Expressed need for APCL to clearly outline: how APCL will undertake community development; how APCL will share revenue with the county government
Project related politics	• The community articulated fear of politicization of the project with emphasis on; the resettlement and compensation; equitable access to opportunities by the local community
Project related impacts	• General concern over the potential negative health impacts • Expressed need to be assured that the project will not be implemented should potential adverse impacts not be managed through adequate mitigation measures • Expressed need to be assured that the ESIA process will be transparent • Expressed need that the community should be actively engaged in the ESIA process
Commitment to CSR	• Locals wanted APCL to provide first opportunities for direct and indirect jobs to indigenous communities from Lamu County.
Unequal Opportunities	• Some locals claimed that the project will tend to favor a select few politically and economically affluent individuals, as this has been the case with past development projects of a similar nature
Vulnerable Groups	• Vulnerable groups in the society such as widowed women, orphans and people with disabilities should not be discriminated against during employment. Opportunities should be created for them in which they can take advantage of the project to better their livelihoods.

7.4 Ongoing public engagement

Further public engagements and stakeholder consultations will be conducted during the detailed ESIA phase, post ESIA phase, construction, operations and decommissioning phases of the project. The scoping consultations will form the basis for future engagements. APCL is in the process of establishing structures to facilitate effective public engagements including setting up an office in the project vicinity and populating the project website with appropriate information and social media presence.

A Stakeholder Engagement Plan (SEP) is presently under preparation. The plan will articulate the principles, procedures and approaches that will guide APCL's public engagement. It will define stakeholder engagement, public information disclosure and consultation processes that will be implemented throughout the project lifetime. The SEP will also highlight the methods that will be used by the Proponent to communicate with stakeholder groups who may be affected by or interested in the project operations and activities as well as outline the strategies that will be implemented to ensure inclusion of vulnerable stakeholder groups.

A formal Grievance Management (GM) procedure is also under preparation. The procedure will provide a step-by-step approach for receiving, acknowledging and registering, reviewing, investigating and resolving grievances from the public that could potentially arise from the implementation of the coal power plant project. The procedure sets out the steps to be taken to resolve grievances, role players involved in the process and timeframes to resolve grievances.

8 Affected environment

This section of the Environment Project Report provides a description of the environment that may be affected by the proposed 1050MW Coal Power project. Aspects of the biophysical, social and economic environment that could be directly or indirectly affected by, or could affect the proposed development are described. The information has been sourced from both existing information available for the area as well as collected field information, and aims to provide the context within which this ESIA Study is being conducted.

8.1 Pre-existing features

Amu Power is proposing to construct a 1050MW coal fired power plant in the Kwasasi area of Hindi sub-county, Lamu County, Kenya. The proposed project will be constructed over and area of about 360Ha which will be leased from the Kenya Ports Authority (KPA).

The project falls in the county of Lamu and has been identified for consideration within an Environmental and Social Impact Assessment (ESIA). The broader study area is characterized by pastoralist land use. No industrial processing or manufacturing plants, pollution, discarded materials or waste disposal were observed within the vicinity of the project site.

There are a few tracks within the 360Ha plot which were created by people accessing the site from time-to-time; these tracks will be upgraded for construction activities and transportation of equipment to site and will be maintained by Amu Power during operations.

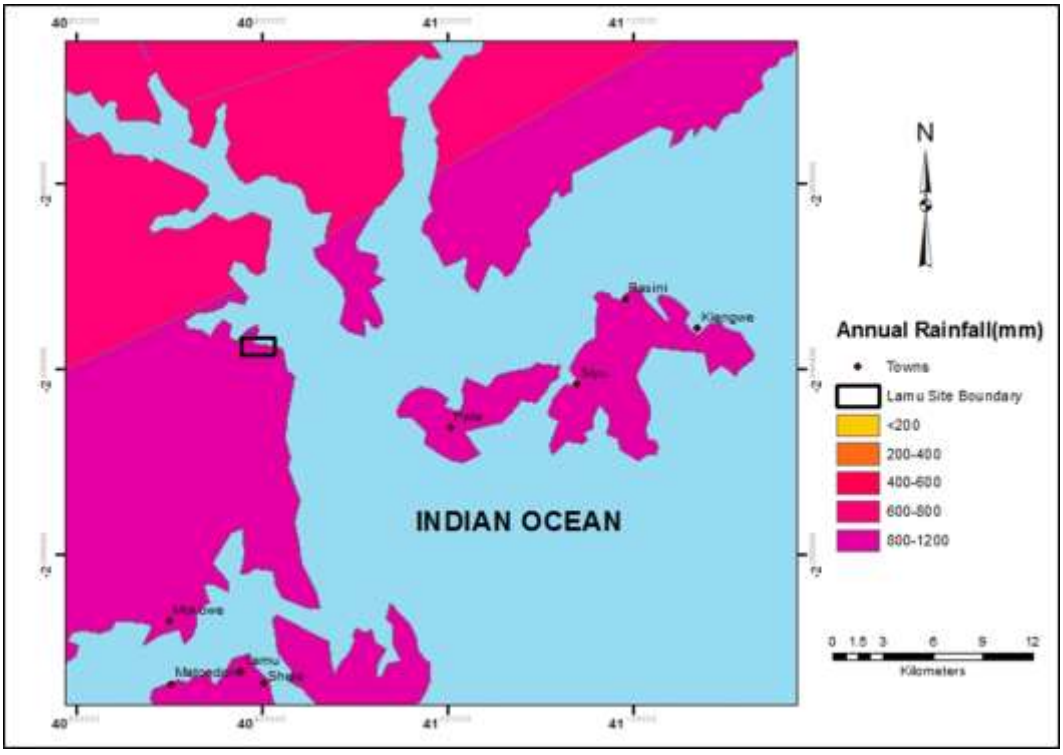
8.2 Description of the affected environment

8.2.1 Climate

Based on the Köppen-Geiger climate classification, Lamu County can be said to be between the Tropical Monsoon and Arid Steppe hot climate (Peel et al. 2007). The area is characterized by bimodal rainfall distribution of ca. 540 mm per year and a mean temperature of 28°C. The tides are semidiurnal, with a mean range of 2.5 m to 3 m and a maximum range of approximately 4 m (Church and Palin, 2003; Weru et al., 2001). The climate and weather patterns on the Kenyan coastline are dominated by large scale pressure systems of the western Indian Ocean (El Nino, Indian Ocean Dipole and the Madden Julian Oscillation) and two distinct monsoon seasons. This leads to a bimodal rain distribution throughout the year with annual averages of 500-900mm on the north Kenyan coast (Figure 6).

From November/December to early March, a predominantly dry system - the northeast monsoon (NEM or Kaskasi) - is prevalent in the coastal weather. During March and April, a transition period, the wind blows in an east-to-southerly direction with strong incursions of maritime air from the Indian Ocean bringing heavy rains (the “long rains”) from mid-April to the end of June. In the months of May to August, the South-Easterly Monsoon (SEM or Kusi) influence sets in and the weather becomes stable with cooler temperatures. Between September and December, the northeast monsoon, dominates again, bringing “short rains” from November to December. The rainfall pattern is greatly influenced by the Monsoon winds with the main rains coming between late March and early June and decreasing from August. The short rains come in November and December decreasing rapidly to a minimum in January and February. Temperatures are strongly related to rainfall patterns. The range of temperature is from 23ºC to 32ºC throughout the country, but highest temperatures are in spring, since rains tend to cause a reduction due to increased cloud cover and the latest heat of evaporation from moist surfaces. The mean temperature is 27.9ºC. The coldest months are May to July while the hottest months are December to April. Mean monthly evaporation ranges from 1,650 to 2,300 mm/year in the north. Wind speeds usually peak in Kusi (SEM) and drop in Kaskasi (NEM) and also show variability in direction.

Figure 4: Rainfall Patterns around the project site



8.2.2 Ecological profile of the project area

Vegetation varies with changes in soil types. Silt and sand support scrub bush, scattered palms and swamp grass. In areas less susceptible to flooding, the silty clays support thick bush consisting of palms, indigenous trees and scrubs. Grassy open swampy places dominate some parts that have drainage problems due to the low altitude. Common vegetation includes Saliconria spp and the succulent Sanseveri spp, stunted thorny bushes of Commiphora spp and Salvadora spp. The coastline has sandy beaches, some with mangrove swamps and a great variation of marine flora (including bivalves, snails, and other benthic invertebrates). Microscopic marine plants are absent from the upper part of the inter-tidal zone except for areas of Bostrychia spp. In the inter-tidal sand and mud, the finer sediments below water, which are subject to less wave action, have become fixed by growth of marine angiosperms and there are extensive areas of green algae and Zostera spp. Dwarf shrub thickets of halophytes typical of this region littoral zone are common on the mainland, and species include Ipomoea spp, Perus spp, Suaeda spp, and Tephrosia spp. The largest mangrove forest stands in Kenya are found in the Lamu land/ seascape (more than 30,000 hectares from Lamu to Kiunga), where protective islands, gentle relief and slightly estuarine conditions/sheltered tidal waters predominate.

In terms of fauna, notable mammals include elephant, giraffe, buffalo, antelope, members of the cat family, hippopotamus, Lamu topi, waterbuck, topi and gazelle among others. Marine fauna include sea turtles, numerous reef fish, lobster, cetaceans and invertebrates among others. The Lamu seascape is rich in biodiversity. Mangroves cover 345 km² that equates to about 60% - 70% of mangrove formations in Kenya (Kairo et al, 2002). It has extensive seagrass beds comprising eight main species (Gullström et al, 2002). In addition, there are patchy reefs with fringing reef in the northern part. Over 50 genera and 150 coral species have been identified in Lamu. Five sea turtle species forage here, together with; dugong, Humpback whales, and dolphins (Church and Palin 2003; Weru et al, 2001).

8.2.2.1 Vegetation Profile of the Project Site

Much of the study area is dominated by Zanzibar – Inhambane evergreen and semi-evergreen bushland and thicket (White, 1983). However, this is interrupted by pockets of woodland and scrub woodland with scattered trees (8m tall or more) including Adansonia digitata, Terminalia spinosa and Hyphaene compressa, Afzelia quanzensis and Tamarindus indica. Various types of bushland and thicket are found where unfavourable soil conditions prevent development of forests. In areas of seasonally waterlogged grassland which occupies part of the coastal plain, thickets are dominated chiefly by Dichrostachys cinerea, Stereospermum kunthianum, Capparis tomentosa, Euclea sp., Grewia spp., Dalbergia melanoxylon, Diospyros consolatae among other shrubs. Wetland vegetation is also extant in permanent and seasonal swamps such as Chomo, Doyo, Kosasi, among others. A mangroves strip along the shoreline dominated by Rhizophora mucronata and Avicennia marina. Over 700 plant species have been recorded in Lamu County, 80 of which are listed in the IUCN Redlist of Threatened plants.

Despite the species richness, almost all on the PLCPP site is cultivated land with Sesamum indicum the common crop amongst the households. Vegetation clearance through slash and burn is evident.

Figure 5: Cultivation of *Sesamum indicum* (Sesame)

Figure 6: Preparation of farmlands by burning

8.2.2.2 Terrestrial Invertebrate Fauna

Prior to the current survey, not much information is available on invertebrates of conservation concern in proposed site. However, there two species of Tiger beetles (Cicindellidae) only recorded from Lamu Island. These were reported in the sand dunes quite a distance from the proposed coal plant site.

8.2.2.3 Overview on Lamu's Avifauna

The proposed site for development of the PLCPP lies in a predominantly shrub savanna with open to closed canopy thorny bush of commiphora and salvadora persica. This is associated with the Somali-masai biome avifaunal assemblage. In Kenya, 92 bird species are known to belong to this biome of which 22 occur around Lamu area. The site also lies next to a sandy/muddy beach used for feeding and roosting by a number of shorebirds some in internationally important numbers. From records held at the National Museums of Kenya databases, there are over 300 species of birds known to occur in the vicinity of the PLCPP. Among these are 15 species listed in the IUCN Red list of threatened species (3 endangered; 4 vulnerable; 8 near threatened; see Table 6), and 62 palaearctic migrant species and 39 Afrotropical migrants. The current study has recorded a total of 114 bird species were recorded using a variety of methods, out of which 24 were palaearctic migrant birds and 7 afrotropical migrant birds. One of the species recorded Eurasian Curlew Numenius arquata, a palaearctic migrant is listed in the IUCN red list of threatened species as near threatened.

Table 6: Bird species Listed in the IUCN Red list of Threatened species (2014) occurring in the Lamu region

Species Name	Scientific Name	Status
Black-tailed Godwit	*Limosa limosa*	NT
Eurasian Curlew	*Numenius arquata*	NT
Eurasian Roller	*Coracias garrulus*	NT
Fischer's Turaco	*Tauraco fischeri*	NT
Great Snipe	*Gallinago media*	NT
Grey Crowned Crane	*Balearica regulorum*	EN
Lappet-faced Vulture	*Torgos tracheliotus*	VU
Maccoa Duck	*Oxyura maccoa*	NT
Madagascar Pratincole	*Glareola ocularis*	VU
Malindi Pipit	*Anthus melindae*	NT
Martial Eagle	*Polemaetus bellicosus*	VU
Southern Banded Snake Eagle	*Circaetus fasciolatus*	NT
Spotted Ground Thrush	*Zoothera guttata*	EN
White-backed Vulture	*Gyps africanus*	EN
White-headed Vulture	*Trigonoceps occipitalis*	VU
EN Endangered VU Vulnerable NT Near threatened		

In addition, the following species are not listed but are of conservation concern in the region:

a) **Roseate Tern *Sterna dougallii***- Upto 1200 pairs are known to regularly breed on islets near Kiunga. Over 5000 pairs were recorded in 1970.

b) **Crab Plover *Dromas ardeola***- This species breeds in the Gulf of Oman and Gulf of Aden in the Middle East. Most of the species global population winters on the Kenyan coast.

c) **Manda Island Boubou *Laniarius erlangeri/nigerrimus***- This species is endemic to the Lamu area of Kenya and extreme southern tip of Somalia. The Kenyan population of the species has always wrongly been identified as sub-species of the more common Tropical Boubou. A recent DNA study has shown that this is not the case and that the Kenyan birds are *Laniarius erlangeri/nigerrimus*, formerly a southern Somali endemic.

8.2.2.4 Mammals

The project site has been reported to be a ranging site for a number of large mammal species including the Topi, Buffalo, Elephant, Wild Dog, Giraffe, Buffalo, Hippopotamus, Lamu topi, Waterbuck and Gazelle have also been reported. Small mammals such as bats have been recorded including Tomb Bat *Taphozous spp.*, Heart-nosed *Bat Cardioderma cor*, Yellow-winged Bat *Lavia frons*, Epauletted Fruit Bat *Epomophorus sp.*, and Yellow-bellied House Bat *Scotohilus colias*. The poorly known and endemic Kenyan Wattled Bat *Glauconycteris kenyacola* is of particular importance, occurring only at the north coast. The species is only known from its type collection. The Kenyan coast is an important area for bats, which roost in Baobab trees and caves along the shores of the ocean. IUCN-listed species include the Globally Vulnerable marine mammal Dugong (*Dugong dugon*), which has been described as extremely rare, has been recorded in the Lamu archipelago (Wamukoya et al., 1997). Marine mammals include humpback whales, and dolphins (Church and Palin 2003; Weru et al, 2001).

8.2.2.5 Herpetofauna

The proposed site for construction is composed of a mixture of savannah bush land with open and bushy shrubs. Soils are sandy and bordering the Indian Ocean with farming activities taking place. Five study sites for herpetofauna sampling below were identified to cover the whole area earmarked for the project. The five habitat types were: farmland, woodland, grassland, mangroves and wetlands. These sites are home to different amphibians and reptiles which will be affected by the project.

The herpetofauna species found here are predominantly coastal species. Limited surveys been done in the area with the exception of sporadic collections but from literature review, six endangered coastal species have been known to occur in areas in neighboring counties.

Table 7: IUCN Red list of Threatened species of amphibians and reptiles occurring in the Lamu region

Species Name	Scientific Name	Type	Status
Olive ridley turtle	*Lepidochelys olivecea*	Reptile	EN
Loggerhead turtle	*Caretta caretta*	Reptile	EN
Hawksbill Turtle	*Eretmochelys imbricita.*	Reptile	EN
Green turtle	*Chelonia mydas*	Reptile	EN
Forest spiny reed frog	*Afrixalus sylavaticus*	Amphibian	EN
Shimba Hills Reed Frog	*Hyperolius rubrovermiculatus*	Amphibian	EN
EN Endangered	***VU Vulnerable***	***NT Near threatened***	

Figure 7: Left to right: Sampling during the survey, a well where frogs were found and a rubber frog found in the well

8.2.2.6 Wetlands and Coastal Marine Resources

Freshwater wetlands: Lamu East has very few freshwater surface wetlands, with most domestic water obtained from boreholes and djabiars. During this study, two man-made dams in Chomo and Ingine were sited. Mbele Mbele aquifer is the main source of water for Hindi and Mokowe towns. The seasonal Bargoni streams act as 'luggas' and along its channel has numerous permanent water pools that were important sources of freshwater for livestock and domestic use. Additionally, this freshwater acted as lifeline for wild animals as sources of drinking water and feeding areas. For instance Mbele-Mbele catchment area, which is approximately 100 acres supported large populations of Topis and Cattle Egrets; while the two man-made dams were inhabited with hippopotamuses and crocodiles. Fishing was also practiced in the two dams. A rapid assessment of aquatic macro invertebrates and a few water parameters shows their waters were of good quality. There was no freshwater wetlands within the area earmarked for the project, however all the wetlands mentioned herein were found within project zone of influence.

Marine Biodiversity: The proposed project will be located in the Manda Bay area. Manda Bay is sheltered from the open ocean. The area is in the Northern Monsoon Current Coast ecoregion, with closer ties to the Somali coast and northern locations, than to the East African Coastal Current (EACC) to the south. It experiences seasonal reversal in the flow of the two currents with the monsoon seasons. This affects the oceanography of the area, which is characterized by upwelling of cooler, nutrient rich waters. The upwelling results in a highly productive marine ecosystem with rich populations of fish, crustaceans and mollusks, and high abundance of migratory species such as seabirds and turtles. Marine habitats in this area are well represented by three major habitats that are strongly interlinked and dependent on each. The mangroves protect sea grasses and coral reefs from terrestrial natural and anthropogenic influences e.g., sedimentation and pollution while coral reefs protects mangroves and sea grasses from strong waves. Sea grasses filter sediments and take-up nutrients and in the process prevent them from reaching coral reefs, which are sensitive to sediments.

- **Mangroves:** Seven species of mangroves occur in the area. Mangroves of Lamu constitute 70% of mangrove forest cover in Kenya that is 64,426.9 ha (or 3%) of the forest cover. The intertidal environment of the creeks and basins supports significant area of mangrove forests. The forest are major sources of wood for construction of houses, making charcoal and boats.
- **Coral reefs**: There are approximately 180 species of corals, with a mix of East African and Gulf of Aden species adapted to the colder upwelling conditions. The coastline of Lamu acts as the meeting area of populations of East African and Gulf of Aden species. Indeed the area has mixed species assemblages comprising East African and Gulf of Aden species, representing a key locus of genetic interaction and biogeographic changes.
- **Sea grasses**: They represent important habitats that occur between mangroves and coral reefs zones. They act as important feeding and dwelling areas for many species of fish. Approximately 14 species of sea grasses are found along Lamu coastline.
- **Sandy beaches**: The beaches provide nesting sites for numerous bird species and three species of marine turtle. Also they are dwelling area for several species of crabs.
- **Fish:** All three marine habitats (mangroves, coral reefs and sea grass beds) support significant number and populations of fish. Indeed Lamu County is major source fish for the coastal region.
- **Turtles:** Three species are known to nest and feed in the area (green, hawksbill, Olive Ridley) whilst the leatherback has been sighted offshore.
- **Birds:** Mangroves and sand beaches support substantial number and population of bird species. (see the Bird Section).
- **Invertebrates:** Mangroves forest support large populations of crabs while sea grass meadows are preferred habitats of shrimps.

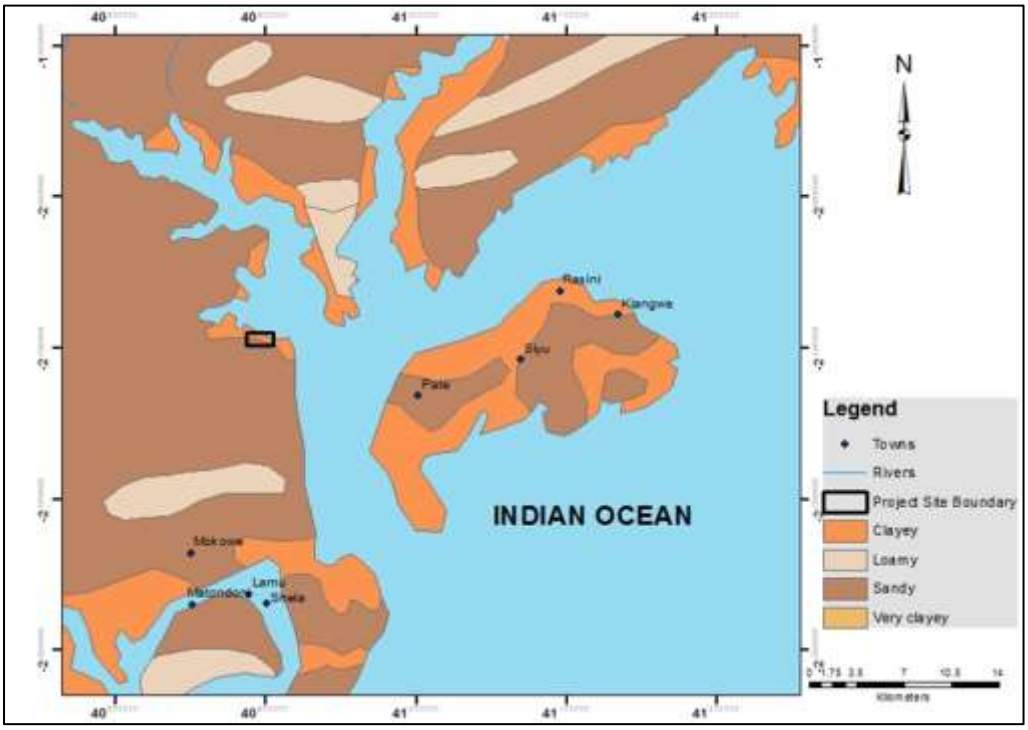
8.2.3 Geomorphology

The geology of the area is composed of the residual coral limestone and columns of sand. Rock outcrops occur in the islands of Manda and Kiwayu while sand dunes are found in Lamu Island and parts of Mkokoni in Kiunga Division. The tectonic processes that opened up the Indian Ocean resulted in the formation of sedimentary rocks, both along the coast line, into the ocean, and offshore. Much of the Kenyan coast is formed by low, about 4 to 6m high limestone coral cliffs. Fossil coral reef deposits form the Coastal Plain, with reef flats or gently sloping beach formations, while beaches sheltered behind fringing reefs typically are backed by one or a series of wind-blown sand dunes up to 30m in height (e.g. north of Kipini, Shela, Kiwayu and Mkokoni). River plumes reduce, and sometimes prevent, offshore coral growth, particularly in the south of the seascape from Kipini to Lamu. From Lamu Island all the way to Ishakani, the reef is discontinuous and broken into islands and patch reefs.

8.2.4 Soils

Soils of the coastal region of Kenya show considerable variety. The porous parent rocks of sedimentary origin generally give rise to soils of low fertility. However, patches of highly productive soils have been observed in areas of alluvial deposits. The principal soil types in the region include a narrow strip of coastal sands towards the north where it is permeated by narrow bands of grumosolis brown clay soils. The soil south of Lamu is composed of bi- alternate bands of loams beyond which the grumosolis are permeated by thick bands of ash and pumice soils. Figure 8 shows soil texture characteristics around the project site.

Figure 8: Soil texture characteristics around the project site



8.2.4.1 Hydrology

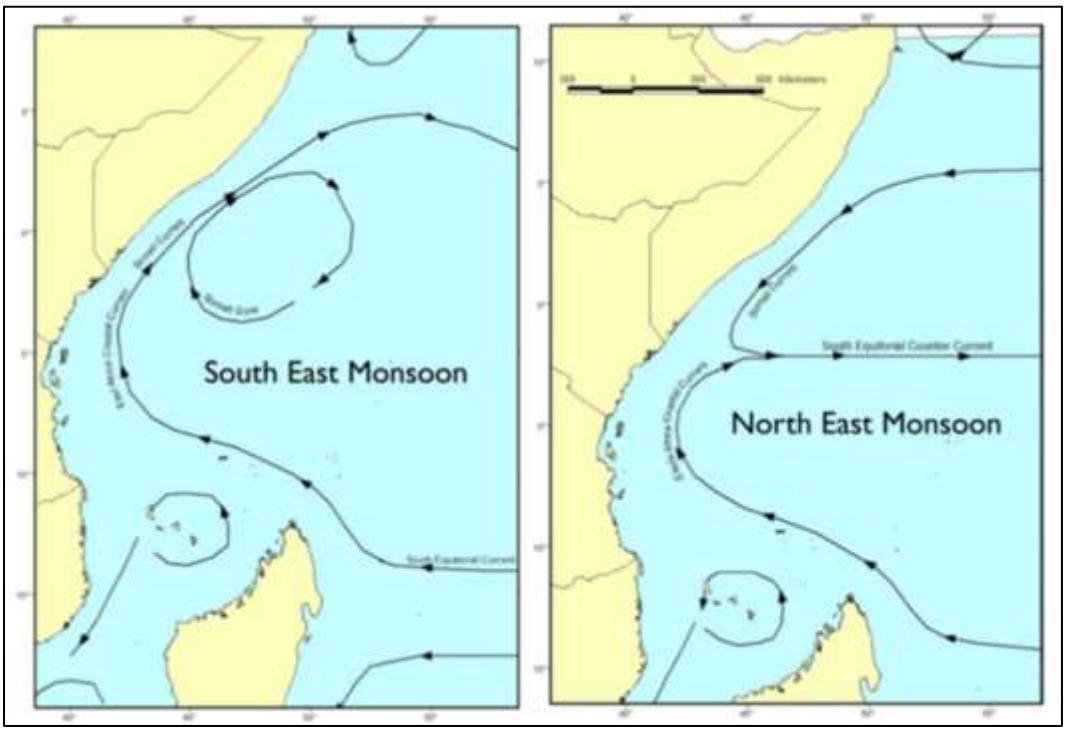
The underlying porous limestone makes surface water in Lamu to be scarce. Apart from the Dodori channel and river Mangai, there are only seasonal rivers such as Hadhi and Kibokoni Lake, which flow from the northwest to the southeast, none of which reach the Indian Ocean. There are a number of lakes in the Tana delta area. Most of these lakes are quite small and shallow and are typical oxbow lakes (including Moa, Kenyatta and Dide Waride), remnants of the various meanders of the Tana River. Some of the lakes, especially the smaller ones, show swampy characteristics. These lakes are either recharged through ground water seepage or by the periodic flooding. The Tana River itself meets the sea in an estuarine delta.

8.2.5 Oceanography

The Equatorial current is a major ocean current in Western Indian Ocean (WIO) and the Monsoon winds are influential in determining oceanographic conditions in WIO (Schott 2001; Spencer et al 2005). The Kenyan coast experiences two distinct monsoon seasons, the Northeast monsoon (NEM) locally referred to as Kaskasi and the Southeast monsoon (SEM) locally referred to as Kusi. SEM runs from May to September and NEM from November to March. In between the NEM and SEM, there is one to two months transition periods characterized by variable and lower winds locally referred to as matlai (Church and Obura, 2004) (the start and end of the two monsoon seasons varies for example in McClanahan (1988) SEM is March to October and NEM is October to March). The interplay of monsoon winds, the north flowing East Africa Coastal Current (EACC) and the

southwest flowing Somali current (SC) create unique conditions along the Kenyan coast (McClanahan, 1988; Obura, 2001; Benny, 2002; Spencer et al, 2005). These conditions are more pronounced on the northern coastline of Kenya (see figure 9). The area north of Lamu Archipelago is characterized by mild upwelling and eutrophic conditions. The Somali current (the only ocean current that changes direction) known for its high flow speed of up to 3.5 m/s on its top 200 meters reverses direction by 180º clockwise and emerges as a northward extension of EACC during the South East Monsoon (SEM) or South West monsoon or Summer monsoon as it may be referred to in literature (Gert 1989; Schott 2001; Spencer et al, 2005).

Figure 9: East African coastline, the ocean currents and the monsoon season



Sea surface temperatures are highest during the North-East Monsoon, averaging 28.4°C (maximum 29°C) and lowest during the South-East Monsoon, averaging 26°C (minimum 24°C) (UNEP, 1998; Obura, 2001). Seasonal temperature variations decrease with increasing water depth, with temperatures stabilizing at 6–7°C at 1000m and 2.5°C at 2000m depth respectively (Duineveld et al, 1997). Salinity variation of the EACC waters is low, ranging between 34.5 and 35.4 ppt (UNEP, 1998). This variation is primarily due to heavy rainfall between March and May and the associated terrestrial freshwater runoff, as well as input from rivers. The Kenya coast experiences mixed semi-diurnal tides, with approximately two tidal cycles every 24 hours. The reference port for tidal observations in Kenya is Kilindini (Port of Mombasa), where the maximum tidal range generally does not exceed 3.8 m.

8.2.6 Archaeology and cultural heritage

The known archaeology of Lamu archipelago begins from about 7th century. The earliest known archaeological remains were found in Manda town ruins where both local and imported items were excavated by Chittick (1974). Other pre nineteenth century sites include Shanga, Takwa, Siyu, Mkokoni, Mshundwani, Kililana and Ungu.

Archaeological reports show that the within the vicinity of the project area which is covered by Archaeological map sheet number 180/2, there are a number of Iron Age sites that include ruins, tombs and archaeological pottery.

Although no archaeological sites were found within the project area during the preliminary survey, some Iron Age sites, graves and mosque ruins were found within its vicinity.

8.2.6.1 Historical archaeology

The project site is located about 20km north of Lamu stone town and was inscribed in 2000 by United Nations Educational and Scientific Cultural Organization (UNESCO) in the list of world heritage sites due to its cultural heritage Outstanding Universal Value (OUV). Lamu has an intangible and tangible culture which has survived for over 700 years. Some of the tangible and intangible culture includes the Swahili architecture and the annual Maulidi and Lamu cultural festivals which attract visitors from all over the world.

There are concerns that due to the influx of people who will come to work in the coal power plant, the intangible heritage may get diluted, with the authenticity and aesthetic value of the architecture (which has remained unchanged for several centuries), gradually lost due to population pressure.

8.2.6.2 Cultural heritage

The population in Lamu County is made up of several ethnic groups with majority being the Bajun. The others include Pokomo, Mijikenda, Somali, Orma, Boni, Sanye and Kikuyu; the latter entered Lamu after Kenya's independence in 1963. Each of these communities have their distinct cultures and livelihoods.

Within the project area, the population consists of the Bajun, Mijikenda, Boni, Somali, Kikuyu and Sanye who practice farming, fishing, hunting/gathering and charcoal burning as their economic mainstays.

The area is prone to several health hazards including mosquitoes, snake bites, lack of clean drinking water among others which may be a result of environmental conditions. Due to these natural conditions, the inhabitants have kept a high degree of indigenous knowledge to deal with known and predictable illness since the nearest hospital is at Hindi which is about 18kms from the project site. In addition, the transport is unreliable and unaffordable due to the poor state of the roads.

8.2.6.3 Livelihoods

Farmers

Several types of crops are farmed during different seasons at Kwasasi. Farmers have traditional knowledge of suitable seasons for their crop and therefore, they practice rotational farming and intercropping. Most farmers are from Pate Island and Hindi and come to Kwasasi to undertake farming. However, some families relocated to Kwasasi and live there permanently.

Fishermen

Fishing is a mainstay for almost 20,000 fishermen in Lamu County. The fishermen carry out their activities in the Wange and Dodori creeks as well as the Manda bay and Siyu channel. The fishermen currently lack cold storage facilities and consequently, find it difficult to get a fair price for their daily catch. Some fishermen alluded that they fetch a higher price for small sized fish than the larger ones due to the lack of access to cold storage facilities.

Mangrove cutters

The western shoreline of Manda Bay has a high concentration of mangrove trees; these serve as a breeding area for some types of fish as well as breeding and spawning areas. Mangrove cutting is a managed activity undertaken under an association of mangrove cutters who are trained in cutting mangroves.

Mangroves have various applications, for example, the manufacture of dhows and structurally in homes as beams.

Pastoralists

The project area has a number of pastoralists that graze their livestock (mainly cattle). Most of the pastoralists come from Ijara, Garrissa and Wajir areas who are looking for better pasture and water for their livestock which is available in the project environs.

Hunter/gatherers

Until recently, the Boni community eked out their livelihoods through hunting and gathering. However, this form of livelihood was banned and they are currently trying to adapt themselves within farmlands; they continue to gather honey and to hunt small game.

They are concerned that they have used this part of the land for a long time and they keep losing it through displacement and being pushed out by other people. They suspect that there are graves of their ancestors in these areas although none was sure of where they could be found.

Boat operators

Boat operators inherit the skills and the boats from their families. They are mostly concerned about foreign boats being brought to Lamu, instead of the developer using the local ones.

9 Consideration of project alternatives

The following alternative aspects are ordinarily considered for all proposed developments:

- Location – what is the best site for a proposed development and any infrastructure associated with it?
- Activity – are there other means to achieve the same objective?
- Scheduling – relates to project development and potential time constraints.
- Technology – relates to improved efficiencies in an operation, e.g. sub-critical, super-critical and ultra-super-critical.
- No-go option – implications of not proceeding with the project.

9.1 Location alternatives

The location of the proposed coal power plant is determined by the Government of Kenya (through the Ministry of Energy and Petroleum) who are responsible for providing the land for constructing the power plant. Three alternative site locations were identified for the proposed power plant as described below.

All three options are located within the Manda Bay area and can be used as the power plant site. The important thing to note about coal power plants is that they need to be situated close to viable transport routes for supply of coal in bulk and secondly, require significant amounts of water for various purposes.

Option 1 (See Figure 10) was a location recommended in the 2011 LAPSSET Study, where the proposed coal power plant was to be situated on Shindakazi Island (part of Pate Island). This was a good location to build a coal power plant as it was situated at the entrance to Manda Bay where vessels could easily berth and offload the coal. However the fact that a sub-sea transmission line would have to be laid was impractical as any cuts to the cable could have adverse impacts on power availability to the entire country and potential safety consequences.

Option 2 (see Figure 11) was a location immediately after the proposed 32 berths. The size of land available was 205 Ha (500 acres) and was 2km long by 1km wide. This land had a buffer zone of 500m all-round the main plot size for security purposes. This option was a good option and has not completely been eliminated.

Option 3 (see Figure 12) was a location that is 360 Ha (870 acres) and is in the shape of an inverted “L”. This site has been identified as the most ideal out of the three as it allows for future expansion of the power plant. The frontage of the site is about 3.7km long facing the Manda Bay and the depth is about 800m.

Of the three alternatives, the Government of Kenya through the Kenya Ports Authority (KPA) has allocated 360 Ha of land to Amu Power for the construction of the 1050MW coal power plant.

Figure 10: Option 1: Location of Coal Power Plant according to LAPSSET Study (2011)

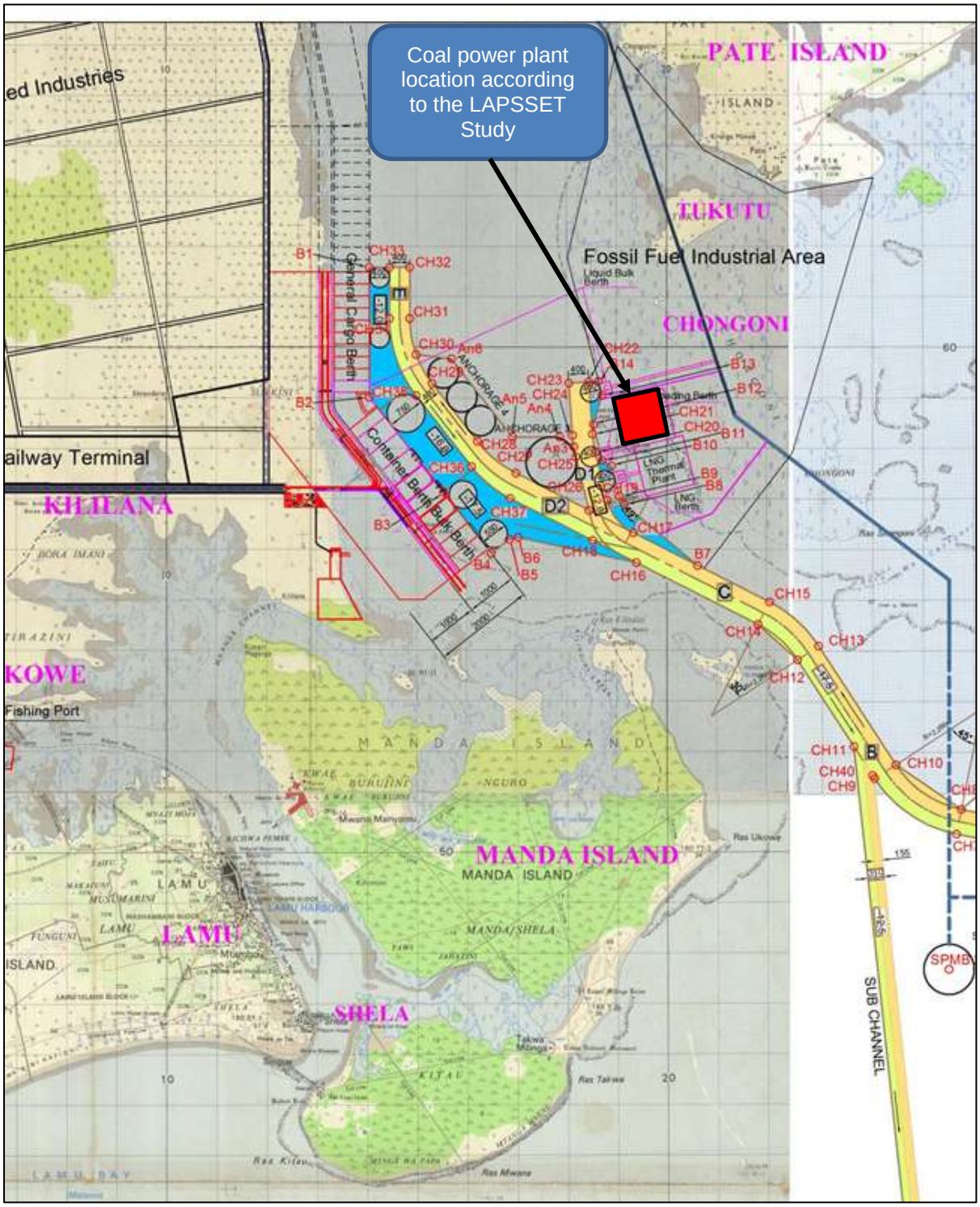


Figure 11: Option 2: Location of Coal Fired Power Plant (500 acres)

Figure 12: Option 3: Revised location of Coal Fired Power Plant (870 acres)

The final size and shape will be confirmed once all baseline geotechnical studies have been completed by the designers of the project in China.

9.2 Activity related alternatives

According to the draft Energy Bill 2015, the energy mix in Kenya as at November 2014 was as indicated in Table 6.

Table 8: Energy mix in Kenya as at November 2014

Sources of Electric Power Generation	Installed Capacity (November 2014)	
	MW	**Percentage**
Renewable Energy		
Hydro	821	37.8%
Geothermal	594	27.3%
Wind	25	1.2%
Cogeneration	38	1.7%
Total Renewables	**1,478**	**68.0%**
Fossil Fuels		
Medium Speed Diesel (MSD)	580	26.7%
Gas Turbines	60	2.8%
High speed diesel (HSD) – Isolated Stations	26	1.2%
Emergency Power Plant	30	1.4%
Total Fossil Fuels	**695**	**32.0%**
Installed Capacity	**2,173 MW**	

As at November 2014, the total installed power generation capacity in Kenya stood at 2173MW which comprised 68% renewable energy and 32% fossil fuels.

In order for Kenya to progress economically at high growth rates (>7% per annum), additional power is necessary.

In order to satisfy the above demand, the Government of Kenya came up with a blue print for the development of an additional 5000MW+ of new generation capacity to be developed in 40 months starting September 2013. Some of the reasonably foreseeable projects which require large amounts of power are given below.

Table 9: Energy demand drivers for the 5000MW+ program

Sector	Power needs (MW)
Iron & Steel smelting	~2000
Standard Gauge Railway & Light Rail	~1171
Information Communication and Technology (ICT) parks	~675
LAPSSET	~350

Apart from geothermal energy, the other renewable energy sources cannot provide Baseload capacity for the country. Given in Table 8 are typical capacity factors for various types of power generation plants; the information is based on 2009 data from the Energy Information Administration (EIA) of the USA.

Table 10: Capacity factors for various types of power plants

Type of power plant	Capacity factor (%)
Nuclear	90.3
Coal	63.8
Natural gas power plant	42.5
Hydroelectric	39.8
Other renewables (solar/wind/biomass)	33.9
Oil	7.8

Based on the above, it can be seen that apart from nuclear power, coal power plants are the most effective for Baseload capacity. A Baseload power station is an energy station devoted to the production of base load supply. Baseload plants are production facilities used to meet some or all of a given region's continuous energy demand, and produce energy at a constant rate, usually at a low cost relative to other production facilities available to the system, examples of Baseload plants are nuclear and coal.

While renewable energy power plants can be used as peaking plants, they are not useful as Baseload power plants. Secondly they are more expensive to operate than Baseload power plants. Thirdly, the fuel source for renewable energy sources such as solar and wind are inconsistent and cannot be relied upon for Baseload requirements.

9.3 Scheduling alternatives

The proposed coal power plant is part of the Government of Kenya's 5000MW+ program for generating electrical power in 40 months commencing September 2013. This is an ambitious program that seeks to provide electrical power to key energy demand drivers such as the iron and steel smelting industry, Standard Gauge Railway, ICT Parks such as Konza City and the LAPSSET projects in Lamu and elsewhere.

Given that in the period March 2013 to date, just over 500MW of new generation capacity has been realized, the Kenya Government needs to fast-track generation of another 4500MW+ of new power generation projects.

As stated previously, renewable energy sources such as geothermal, wind and solar usually take time to develop and their capacity factors are low compared to fossil fueled power plants such as coal and nuclear which can be developed in relatively shorter periods, have higher capacity factors and lower operating costs.

Consequently, in order for the Kenya Government to achieve its blueprint of 5000+MW of power, it would be prudent that the proposed coal power plant in Lamu County, be developed on a build, own, operate basis for the next 25 years.

9.4 Technology alternatives

9.4.1 Power plant technology

Several coal fired power plants in current operation employ pulverized coal combustion technology, which involves grinding coal into talcum-powder fineness and then burning it to heat water into high-pressure steam to drive an electrical generator.

There are three types of power plants that use pulverized coal combustion technology namely **subcritical, supercritical and ultra-supercritical**. The difference between subcritical, supercritical, and ultra-supercritical versions of pulverized coal combustion technology has to do with the steam pressure within the boiler. The proposed Lamu coal power plant will utilize supercritical technology which is described below.

In a **subcritical** plant, the main steam pressure is below the critical point of water. The steam conditions used in current subcritical units are up to 179bar/541ºC (2600 psia/1100ºF). Subcritical units have efficiencies of between 33% and 37%; i.e. between 33% and 37% of the energy in the coal is converted into electricity.

Supercritical technology involves increasing steam temperature and pressure and subsequently increasing efficiency of electricity generation. As the steam pressure and temperature increases to a critical point, the characteristics of steam are altered such that water and steam are no longer distinguishable. This is known as supercritical steam and is a more efficient technology.

Current supercritical steam cycles typically have main steam pressures of about 240 bar (3500psi) or higher and main steam and reheat temperatures of around 565ºC (1050ºF). At this higher pressure and temperature, water can be maintained as a fluid despite being above the atmospheric boiling plant, allowing greater efficiency. Efficiency ratings for supercritical coal plants range from 37% to 40%.

Ultra-supercritical technology is similar to supercritical generation, but operates at even higher temperatures and pressures. Steam conditions are defined as the main steam temperature of around 600ºC (1110ºF) and main steam pressure greater than 300 bar (4365 psig). While not common, these plants represent the highest efficiency in pulverized coal plants available today (up to 40%).

9.4.2 Clean coal technology

When coal is used as a fuel source, the gaseous emissions generated by the thermal decomposition of the coal include Sulphur dioxide (SO_2), nitrogen oxides (NO_x), carbon dioxide (CO_2) and other chemical byproducts that vary depending on the type of the coal being used.

These emissions can have potential adverse impacts on the environment, if appropriate emission control technologies are not employed. Clean coal technologies are being developed to remove or reduce pollutant emissions to the atmosphere. Some of the techniques that would be used to accomplish this include:

- Chemically washing minerals and impurities from the coal;
- Gasification (a process that converts organic or fossil fuel based carbonaceous materials into carbon monoxide, hydrogen and carbon dioxide) to form a mixture called synthetic gas (syngas);
- Improved technology for treating flue gases to remove pollutants to increasingly stringent levels and at higher efficiency using:
    - Wet Flue Gas Desulfurization (FGD);
    - Electrostatic Precipitator (ESP);
    - Low nitrous oxide burners; and
    - Selective Catalytic Reduction (SCR).
- Carbon capture and storage (CCS) technologies to capture the carbon dioxide from the flue gas.

Figures from the United States Environmental Protection Agency show that these technologies have made today's coal-based generating fleet 77% cleaner on the basis of regulated emissions per unit of energy produced.

For the proposed Lamu coal power plant, the clean coal technology to be deployed includes an FGD and ESP connected to each of the three stacks. Using such technologies, the EPC contractor will be able to comply with the World Bank

Group's latest (2008) stack emissions standards for thermal power plants. If required in future, an SCR unit can be added to manage the nitrous oxide emissions.

9.5 The "do-nothing" alternative

The do-nothing alternative is the option of not constructing the proposed 1050MW coal power plant. This alternative would result in no environmental impacts in the project area.

10 Construction materials and waste management

10.1 Introduction

This section provides an outline of the types of construction materials and waste management that may be generated by the proposed coal power plant. The project construction period is expected to be 21 months; due to the strict deadlines for completion of the project, it is envisaged that work will be carried out 24 hours a day 7 days a week. Given below are the types of materials that will be required for the construction of power plant infrastructure.

10.2 Materials of construction

10.2.1 Water

Lamu County is water scarce and people have to travel long distances to fetch this precious commodity. A significant amount of water will be required during the construction and operational phases of the project respectively. Water will be required for potable use and in the construction of the concrete foundations and reinforced concrete slabs. The water may be sourced from either of the following sources:

- Approved abstraction points (existing boreholes or shallow wells) at locations closest to the area of construction (NB, the EPC contractor shall not be allowed to dig a borehole within a radius of 1km of any school or hospital); or
- Construction of boreholes in the vicinity of the project area; or
- Abstraction of water from the sea and using it after desalination.

10.2.2 Sewage

During the construction phase, there may be between 2000 and 3000 workers at the project site; during the operational phase, there may be about 500 workers. These workers will require proper and adequate sanitation services such as sewage facilities for management and disposal of various types of wastes. The generation of sewage will occur for the duration of construction and operation of the coal power plant. During the construction phase, the EPC contractor will construct a properly designed sewage treatment plant whose effluent will comply with the requirements of *Legal Notice 120 titled Environment Management and Coordination (Water Quality) Regulations, 2006*.

10.2.3 Roads

Existing roads within and outside the project area will be utilised as far as possible during construction and operation. New access roads will be developed within the 360 Ha plot. The roads will be developed by the EPC contractor. The borrow pits that could be used for road building materials is yet to be identified by the EPC Contractor. Identification of borrow pits will be done when the EPC Contractor is awarded the contract for construction of the coal power plant.

10.2.4 Stormwater

Stormwater will be managed according to the provisions of the ESMP which will be compiled for the project. In general, the Proponent will develop the site drainage over the entire plot to prevent flooding of work areas and reduce erosion related risks. The EPC contractor will take advantage of the existing topography when designing the stormwater drainage channels within the 360 Ha plot.

10.2.5 Solid waste disposal

All solid waste will be collected at a central location at the construction site, and will be stored temporarily until removal for recycling or disposal by a NEMA approved waste handler. It will be the responsibility of each contractor to ensure that when disposing their wastes, they comply with the requirements of *Legal Notice 121 titled Environment Management and Coordination (Waste Management) Regulations, 2006*.

10.2.6 Electricity

During the construction phase, diesel generators may be utilised for the provision of electricity needs. During the operational phase, the coal power plant will require about 68.5MW of electrical power to run its own processes. This power will come from the generation of electricity by the coal power plant.

10.2.7 Human resources

The proposed coal power plant is envisaged to employ a maximum of 3000 workers during the peak construction phase of the project. On average, the coal power plant will require about 2000 workers a month for the 21 months construction period.

The majority of people living in Lamu County have a Standard 8 education; some people have gone up to Form 4 level; a fewer number possess tertiary qualifications.

During the construction phase, the EPC Contractor will require skilled, semi-skilled and unskilled labour. While there will be fewer skilled persons needed, the vast majority of workers required will be semi-skilled and will be required to possess a minimum amount of qualifications in order to be employed. Some of the skills set required during the construction phase include:

- Welding;
- Plumbing;
- Masonry;
- Carpentry;
- Steel fabrication, etc.

As these skills sets are not readily available among the workers in Lamu County, the Proponent has offered to sponsor 1000 young men and women to be trained at the National Youth Service (NYS) and those that qualify from there will be directly absorbed in the construction of the project. The onus is on the political leadership in the County to identify suitable candidates which can be presented to the Proponent. Armed with this, the Proponent will request the NYS through the Cabinet Secretary for Devolution and Planning for a special intake of the 1000 men and women from Lamu County that can be provided with requisite skills needed for the construction of the coal power plant.

It is important to note that the construction of some elements of the coal power plant are a specialised undertaking, requiring skilled people. It is probable that the appointed contractors will bring in skilled labour from other areas. By implication, job opportunities for local people will be limited to semi-skilled and unskilled jobs on site and in construction camps. Apart from direct employment, local people and businesses will benefit through the supply of goods and services to the appointed contractor(s).

10.3 Codes and standards

Except where otherwise stated, materials shall be designed, manufactured, tested and installed according to relevant Kenyan standards. Where no Kenyan standards have been issued to cover a particular subject, a recognised international standard shall be applied.

In case of conflict between national, international codes, standards or guidelines and/or the requirements specified in this document, the more onerous ones take precedence; provided always that the works comply as a minimum and in any event, with applicable law and the required Kenyan national codes, standards and guidelines.

Additionally, the EPC Contractor should demonstrate compliance with the following general standards and specification:

- ISO 9001 2000 Quality Management Systems or equivalent standard;

- ISO 14001 Environmental Management Systems or equivalent standard; and
- OHSAS 18001: Health and Safety Assessment Specification.

10.4 Waste management policy

In the case of hazardous wastes arising from construction, operation and/or decommissioning activities, it will be necessary that licensed waste disposal contractors approved by NEMA are used. It shall be necessary that the waste haulage contractors employed during the development are licensed to transport waste within the area in which they operate. All wastes are to be treated or disposed of by a NEMA licensed contractor at a licensed facility.

It is imperative that all hauliers engaged for the removal of waste material from site and each facility used for the consignment of Construction and Demolition waste possess the requisite authorisations and are adhering to the conditions imposed on their permits and licences as stipulated in *L.N. 121: Environment Management and Coordination (Waste Management) Regulations, 2006*.

10.5 Site maintenance/restoration

The EPC Contractor shall ensure that the project site is generally maintained in a neat and tidy condition for the duration of the construction works. All debris shall be cleaned up and removed on a regular basis. At the end of the Contract, the site shall be cleaned fully. All temporary works shall be removed at the completion of the contract. The Proponent shall ensure that no pollutant is discharged to surface drainage during the course of the works.

10.6 Pollution prevention and environmental protection

This sub-section applies to the construction phase associated with development of the coal power plant. All operations shall be arranged in such a way as to avoid causing nuisance and minimise disturbance to the users of public roads in the area and preserve the environment surrounding the site.

10.6.1 Sediment control

Particular care must be taken to prevent sediment gaining access into watercourses. This may be particularly applicable where water is pumped from excavations into the drainage network. Measures such as silting ponds and the use of geotextile materials may be required in order to remediate laden water.

10.6.2 Fuel storage and refuelling

All fuel required onsite to refuel construction plant and equipment must be stored in a bunded area and all refuelling must take place within this bunded area such that if a leak occurs, the fuel is suitably contained and cannot enter the sub-surface and groundwater.

All pumps and generators used on site must be placed on a drip tray. This drip tray must be large enough and lined to contain any waste from the proposed activities.

10.6.3 Dust suppression

Dust suppression shall be included as necessary on site. This shall take the form of mobile dust suppression unit to water down access tracks, borrow pits and hard standing areas to prevent dust clouds.

Prohibition of any activities which breach the spirit of this intention will be enforced. Particular care shall be taken with runoff from the site so as not to pollute watercourses.

10.6.4 Waste disposal

The Proponent shall make provision for the discharge or disposal of all water products or spoil howsoever arising and the method of disposal shall be in compliance with *L.N. 121: Environment Management and Coordination (Waste Management) Regulations, 2006*.

10.6.5 Sourcing of Materials

The proposed project will require a substantial amount of construction materials. In general these comprise, sand, ballast/aggregate, coral blocks, back fill materials, murram, limestone, etc. The EPC contractor is in the process of identifying relevant sites/locations where the above materials can be sourced from. Most sites will be located near the project site to avoid traveling long distances to obtain the construction materials. Whenever practical, stone fill material for the road works and hard standings shall be obtained from existing borrow pits if possible.

Some construction materials may not be available from Lamu such as cement, steel reinforcement, concrete blocks, etc. These will be sourced from other towns such as Malindi, Mombasa and beyond.

It is envisaged that about 60% – 70% of the materials and components required for the construction of the power plant will be imported. These components will arrive via ship and will be offloaded at a temporary jetty to be erected near the project site; some of the components may be shipped through the port of Mombasa and trucked to the project site.

10.6.6 Management of Domestic Waste

During the construction phase, waste materials generated at welfare facilities, will be consistent with those of domestic properties. These types of waste can be considered as two distinct streams; domestic refuse and sewage. All domestic wastes shall be managed in accordance with the relevant requirements of *EMCA and L.N. 121: Environment Management and Coordination (Waste Management) Regulations, 2006.*

10.6.6.1 Domestic Refuse

Domestic refuse will primarily include food waste, paper, plastics, glass and other typical domestic refuse. All such waste will be stored in an appropriate location within the project site, protected from wind, rain and wild animals. Facilities will be provided to segregate waste into appropriate waste streams and minimise volumes of material stored (e.g. for cardboard waste; folding and/or use of balers).

All waste will be transported from the project site at an appropriate frequency by a NEMA registered waste carrier to prevent overfilling of waste containment facilities and will be reused/recycled where practical.

10.6.6.2 Sewage

Disposal of sewage from the site will be carried out by methods recommended by county/national legislation and in their absence, international best practices. Serviced portable toilets will be provided.

10.6.7 Management of used oils

Storage of used oils will be undertaken in line with international guidance which will include storage in closed receptacles. Oil or fuel spills will be dealt with according to documented site emergency procedures.

The manufacturer's instructions and material safety data sheets (MSDSs) with regard to storage, handling, use and disposal must be complied with when handling greases, oils and other chemical substances.

10.6.8 Packaging materials

These may include paper, plastics and wood used for packaging construction related raw materials. It is expected that these materials will be recyclable. Indeed, it is likely that these materials will have some commercial value (and may not therefore be classed as 'waste').

10.6.9 Waste metals

All waste metals generated during the construction phase will be collected by a NEMA licensed transporter and shipped to steel smelting plants in Mombasa. The project site must be left clean and free of any waste metals.

The same process will be applied during the operational phase of the project.

10.6.10 Cleaning Activities

Cleaning activities (e.g. for plant, vehicles) can produce certain volumes of polluted water. All cleaning activities must therefore be carried out in an appropriate enclosed area and waste water captured for treatment and appropriate disposal. Where practical, recycled water (sometimes known as 'grey water') should be used for cleaning purposes.

All cleaning chemicals will be stored and handled according to *L.N. 60: Factories and Other Places of Work (Hazardous Substances) Rules, 2007* requirements as appropriate and a comprehensive file of all MSDS shall be held.

An emergency response protocol for pollution incidents will be established by the EPC contractor and regularly updated. This protocol will include containment measures, a list of appropriate clean-up materials and equipment, details on staff responsibilities and trained personnel and contact details for pollution clean-up companies and relevant Local Authorities.

11 Potential environmental and social impacts

11.1 Introduction

This section presents the findings of an initial appraisal of the likely environmental impacts of the proposed coal power plant on people, property, natural resources and the natural and cultural heritage. An overview of the baseline conditions on site is provided under each section, together with the potential effects as a result of the proposed development. Where further assessment is required as part of the ESIA process, this is identified and the assessment methodology outlined.

11.2 Terrestrial ecology

11.2.1 Potential impacts on vegetation

Given in Table 9, are the potential impacts on vegetation arising from the proposed coal power plant construction.

Table 11: List of potential impacts on vegetation

Activity	Potential impacts on vegetation
Site preparation, construction and operational activities e.g. land clearing, excavation, earthmoving, terrain shaping and landscaping	• Water released at elevated temperatures may affect aquatic plant species composition • Dust generation may affect plant physiology • Introduction of exotic plant species may occur either passively or by design
Construction of access roads	• Biodiversity loss & habitat size reduction, modification or fragmentation • Disruption of pollination patterns • Increased road access in remote areas may lead to unsustainable commercialization of plants in previously inaccessible areas • Dust generation may affect plant physiology • Invasive species may take advantage of habitat disturbances and establish themselves to the exclusion of some indigenous flora

Activity	Potential impacts on vegetation
Construction of housing facilities and human settlements	• Biodiversity loss & habitat size reduction • Dust may affect plant physiology • Overexploitation of ecosystem services e.g. wood fuel and charcoal, medicinal plants and wild fruits • Environmental pollution with non-biodegradable materials and domestic wastes may occur as a result of sudden influx of humans on the site, which may ultimately affect plant growth.

11.2.2 Potential Impacts of the project on invertebrate fauna

11.2.2.1 Destruction and loss of habitat

During the construction phase, large sections of the project footprint area will be cleared of natural vegetation to pave way for the coal stock piles, power plant structures, buildings ash yard and access roads. This will lead to a loss of host plant communities as well as breeding and nesting areas. During the field visits in January 2015, it was observed that the local communities in Kwasasi clear their land by burning the trees, shrubs and grasses which leads to loss of habitat and destruction as shown in Figure 13.

Figure 13: Typical habitat destruction effects on millipedes in project area

11.2.2.2 Interference with phytophagous (leaf feeding) invertebrates

An air dispersion modeling study has been commissioned for this project to characterize the ground level concentration of sulfur oxides, nitrous oxides and particulate matter. If contaminants such as particulate matter cover leaves and vegetation in general, this may have potential adverse consequences on invertebrates such as grass hoppers and beetles that feed off such vegetation and leaves. Figure 14 shows some invertebrates found in the Kwasasi area.

Figure 14: A blister beetle (left) and a caterpillar (right) feeding on plants in Kwasasi

11.2.2.3 Decline of pollinators

Pollinators such as the African honey bee (*Apis mellifera*) could potentially be affected by pollutants if they settle on plants used by such pollinators. Decline of these types of pollinators could potentially result in reduced pollination which in turn will affect the agricultural productivity of the local farming communities. The stress from the pollution may also lead to reduction in brood rearing, pollen collection, depressed flight and increased mortality. Figure 15 shows a water melon crop and cowpea pollinated by social bees.

Figure 15: A bee pollinated water melon crop (left) and cowpea (right)

11.2.2.4 Proliferation of undesirable species

The influx of workers for construction and operation of the proposed power plant and mushrooming of residential estates to accommodate the workers will result in the generation of tonnes of garbage and sewerage. This will attract undesirable invertebrate species such as house flies and *Culex quinquefascitus* mosquitoes which thrive in organically contaminated waters and are a great biting nuisance in urban areas.

11.2.3 Mammals

11.2.3.1 Overview of mammals found in the project area

The project site has been reported to be a ranging site for a number of large mammal species including the Topi, Buffalo, Elephant, Wild Dog, Giraffe, Buffalo, Hippopotamus, Lamu topi, Waterbuck and Gazelle.

Small mammals such as bats have been recorded including Tomb Bat *Taphozous spp.*, Heart-nosed Bat *Cardioderma cor,* Yellow-winged Bat *Lavia frons,* Epauletted Fruit Bat *Epomophorus sp.,* and Yellow-bellied House Bat *Scotohilus colias.* The poorly known and endemic Kenyan Wattled Bat *Glauconycteris kenyacola* is of particular importance, occurring only at the north coast. The species is only known from its type collection. The Kenyan coast is an important area for bats, which roost in Baobab trees and caves along the shores of the ocean.

IUCN-listed species include the globally vulnerable marine mammal Dugong (*Dugong dugon*), which has been described as extremely rare, has been recorded in the Lamu archipelago (Wamukoya et al., 1997). Marine mammals include humpback whales, and dolphins (Church and Palin 2003; Weru et al, 2001).

11.2.3.2 Potential Impacts on mammals

11.2.3.2.1 Habitat Alteration

Clearing of vegetation, soil excavation and construction of facilities will alter the habitat for flora in the area. The site will be stripped of vegetation to pave way for construction. As a result, an ecological impact will be realized as functional areas such as bushes will be destroyed. The largely fragile and dry climate will further be affected by human activity. As a result of occupation by facilities and people, the entire project site may pose a barrier effect and further alter dispersal patterns. The population of trees and other plant species will be reduced through clearing of vegetation to pave way for structures.

11.2.3.2.2 Disturbance of Faunal Movement and Animal Behavior

Mammals are sensitive to human occupation. Disturbances include flood lights, vehicle lights and noise from machinery and vehicles. This affects movement of animal species across the landscape, and may result in occasional road kills. Additionally, the entire project area will be fenced off, thereby limiting the movement of wildlife into or out of the site. This will reduce faunal foraging

options by barring the site as a foraging ground. Noise and vibrations from the heavy machinery may interfere with foraging, ranging, breeding and nesting behavior of fauna of the ecosystem in the project site and those in the larger ecosystem.

11.2.4 Herpetofauna

11.2.4.1 Key Habitats

The proposed site for construction is composed of a mixture of savannah bush land with open and bushy shrubs. Soils are sandy and bordering the Indian Ocean with farming activities taking place. Five study sites for herpetofauna sampling below were identified to cover the whole area earmarked for the project (see Figure 16). The five habitats types were: farmland, woodland, grassland, mangroves and wetlands. These sites are home different amphibians and reptiles which will be affected by the project.

11.2.4.2 Amphibians and reptiles of Lamu

The herpetofauna species found in Lamu County are predominantly coastal species. Limited surveys have been undertaken in the area and sporadic collections done, but from literature, six endangered coastal species have been known to occur in areas in neighboring counties as shown in Table 12.

Table 12: IUCN Red list of Threatened species of amphibians and reptiles occurring in the Lamu region

Species Name	Scientific Name	Type	Status
Olive ridley turtle	*Lepidochelys olivecea*	Reptile	EN
Loggerhead turtle	*Caretta caretta*	Reptile	EN
Hawksbill Turtle	*Eretmochelys imbricita.*	Reptile	EN
Green turtle	*Chelonia mydas*	Reptile	EN
Forest spiny reed frog	*Afrixalus sylavaticus*	Amphibian	EN
Shimba Hills Reed Frog	*Hyperolius rubrovermiculatus*	Amphibian	EN
EN: Endangered			

Figure 16: Left to right: Sampling during the survey, a well where frogs were found and a rubber frog found in the well



11.2.4.3 Potential impacts on herpetofauna

11.2.4.3.1 Habitat loss

During the construction phase, vegetation will be cleared around the power plant footprint area. This may result in the destruction of existing burrows for reptiles and amphibians. Mobile herpetofauna such as snakes will move to other sites.

11.2.4.3.2 Excavation and compaction

Excavation includes removal of top and subsoil during the construction phase. Some areas will have to be compacted after backfilling to make the ground firm enough to hold various types of structures. This may remove burrows for animals to hide and breeding sites of animals.

11.2.4.3.3 Establishment of new habitats

The establishment of construction camp sites with food waste disposal pits may lead to proliferation of vermin if managed incorrectly. The proliferation of vermin may lead to other reptiles such as snakes being present within the project site. Such reptiles being ectothermic could during the cold season establish their homes in human habited areas.

11.2.4.3.4 Spillages

Fugitive spills may occur from construction plant and equipment during the construction phase if such equipment is not maintained in a good state of repair. If such spills come into contact with surface water, the oil may coat skins of herpetofauna such as amphibians which breathe through their skin.

11.2.4.3.5 Introduction of exotic species

Construction plant and equipment will be imported into the project area from various parts of Kenya and other parts of the world. Such plant and equipment may have exotic species adsorbed on it in form of eggs or propagules. Such exotic species may establish new colonies which could end up predating on local species or killing them to reduce competition. This may also have the effect of increased competition and later become an environmental nuisance.

11.3 Avifauna

11.3.1 Overview of avifauna in in the project area

The proposed site for development of the Lamu coal power plant lies in a predominantly shrub savanna with open to closed canopy thorny bush of *commiphora* and *salvadora persica*. This is associated with the Somali-Maasai biome avifaunal assemblage. In Kenya, 92 bird species are known to belong to this biome of which 22 occur around Lamu area. The site lies next to a sandy/muddy beach used for feeding and roosting by a number of shorebirds some in internationally important numbers. From records held at the National Museums of Kenya databases, there are over 300 species of birds known to occur in the vicinity of the proposed project area. Among these are 15 species listed in the IUCN Red list of threatened species (3 endangered; 4 vulnerable; 8 near threatened; see Table 13), 62 palaearctic migrant species and 39 Afrotropical migrants. The baseline study of avifauna in the project area has recorded a total of 114 bird species using a variety of methods, out of which 24 were palaearctic migrant birds and 7 afrotropical migrant birds. One of the species recorded Eurasian Curlew *Numenius arquata,* a palaearctic migrant is listed in the IUCN red list of threatened species as near threatened.

Table 13: Types of avifauna found in the project area and its environs

Species Name	Scientific Name	Status
Black-tailed Godwit	*Limosa limosa*	NT
Eurasian Curlew	*Numenius arquata*	NT
Eurasian Roller	*Coracias garrulus*	NT
Fischer's Turaco	*Tauraco fischeri*	NT
Great Snipe	*Gallinago media*	NT
Grey Crowned Crane	*Balearica regulorum*	EN
Lappet-faced Vulture	*Torgos tracheliotus*	VU
Maccoa Duck	*Oxyura maccoa*	NT
Madagascar Pratincole	*Glareola ocularis*	VU
Malindi Pipit	*Anthus melindae*	NT
Martial Eagle	*Polemaetus bellicosus*	VU
Southern Banded Snake Eagle	*Circaetus fasciolatus*	NT
Spotted Ground Thrush	*Zoothera guttata*	EN
White-backed Vulture	*Gyps africanus*	EN
White-headed Vulture	*Trigonoceps occipitalis*	VU
EN Endangered	**VU** Vulnerable	**NT** Near Threatened

Additionally, the following species are not listed but are of conservation concern in the region:

a) **Roseate Tern *Sterna dougallii***- Upto 1200 pairs are known to regularly breed on islets near Kiunga. Over 5000 pairs were recorded in 1970.

b) **Crab Plover *Dromas ardeola***- This species breeds in the gulf of Oman and gulf of Aden in the Middle East. Most of the species global population winters on the Kenyan coast.

c) **Manda Island Boubou *Laniarius erlangeri/nigerrimus***- This species is endemic to the Lamu area of Kenya and extreme southern tip of Somalia. The Kenyan population of the species has always wrongly been identified as sub-species of the more common Tropical Boubou. Recent DNA study has shown that this is not the case and that the Kenyan birds are *Laniarius erlangeri/nigerrimus*, formerly a southern Somali endemic.

11.3.2 Potential impacts on avifauna

During the construction phase, the project is expected to attract a large workforce (c2000) on the site. Access roads will be built, traffic to the site will increase with associated waste disposal challenges. Impacts on the avifauna may potentially include:

a) **Loss of habitat-** the current habitat on the site will be cleared to give way to construction of the site with avifauna displaced from the site. Opportunistic species, e.g. scavenging birds may replace them. Already, evidence of people clearing and burning the habitat was recorded during the recent visit (see Figure 17) in anticipation of compensation by the project. Species of conservation concern such as Manda Island Boubou and Eurasian Curlew, are likely to be displaced and their numbers reduced.

Figure 17: Ongoing habitat clearance at the project site

b) **Invasive species**- the increase in human population and associated activities e.g. waste disposal could potentially attract and increase populations of scavenging and invasive bird species e.g. Marabou Storks and Indian House Crows. This will have direct effect on populations of indigenous species as well as risk to public health;

c) **Noise and vibration**- Noise and vibration during the construction phase could potentially disturb feeding and nesting birds;

d) **Loss of feeding habitat**- The proposed coal power plant will be located adjacent to sandy beaches and mud flats used regularly by shorebirds and waders for feeding (see Fig 18). These beaches and mudflats are likely to be destroyed and/or polluted by activities of the Lamu-CPP.

e) **Collision and electrocution**- There may be a potential risk that flying birds could collide with the smoke stack at the coal power plant. Electrocution may also occur with the power transmission lines.

Figure 18: Shorebirds/waders feeding on a mudflat near the project site

11.4 Wetlands and Coastal Marine Resources

11.4.1 Overview of wetlands and coastal marine resources

Assessment of coastal wetlands and marine habitats were made around a 25km radius of the project area. Four coastal wetlands visited were Mbele Mbele water catchment area, Ingine laga as well as Chomo and Ingine man made dams. For the marine environment, the assessment focused on Manda Bay where the coal jetty and berth will be constructed. Manda Bay is approximately 3 to 6 km wide and is reasonably sheltered due to the presence of Pate Island. The depth to water varies between 1.5m and 21m around the project area of Manda Bay.

Coastal freshwater wetlands

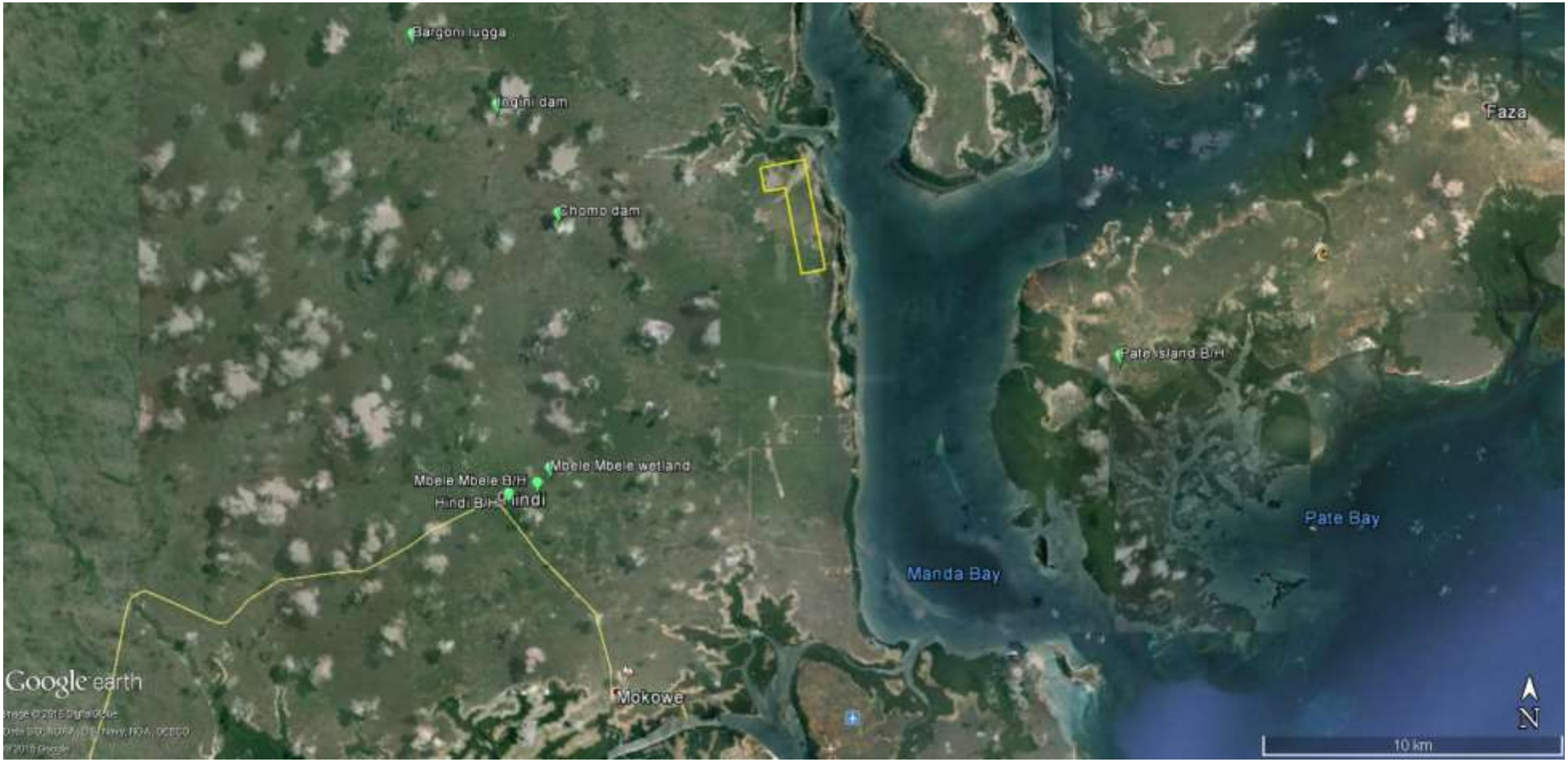
Coastal freshwater wetlands were few and scattered in Lamu. Important ones were Bargoni lugga, Mbele Mbele aquifer, Chomo and Ingine man-made dams (Table 14). All of them were important sources of water for domestic and livestock uses. Boreholes were the major sources water for domestic and livestock in the area. Three boreholes were sampled for establishing baseline water quality status in the area

Table 14: Important coastal freshwater wetlands and water sources

Site No.	Site Name	Latitude	Longitude	Characteristics
2	Baragoni lugga	-2.042561819	40.78765	Temporary river or lugga with pools of along the bend. Used as sources of water for domestic and livestock uses.
8	Mbele Mbele Wetland	-2.172364532	40.82898333	An aquifer covering an area of 5 km^2. A water catchment area that acts grazing areas for wild animals and birds. Sources of water for several towns and villages e.g., Hindu and Mokowe towns.
10	Chomo Dam	-2.096026667	40.83148333	Man-made dams approximately one hectare. Sources of freshwater for domestic use, livestock and wildlife. Supported substantial population of tilapia species that were locally exploited. Had crocodiles and Hippopotamuses
13	Ingini Dam	-2.063517639	40.81308333	Similar to Chomo Dam.
4	Pate Island Borehole	-2.138721856	40.99983333	Boreholes were major sources of water for domestic and livestock use
6	Hindi Bore Hole	-2.180100014	40.81651667	Boreholes were major sources of water for domestic and livestock use
9	Mbele Mbele Borehole	-2.176843	40.825118	Boreholes were major sources of water for domestic and livestock use

Figure 19 shows the locations of the coastal freshwater wetland resources in the vicinity of the project area.

Figure 19: Locations of important freshwater wetlands and water sources



The construction of the proposed power plant may have environmental impacts on wetlands and coastal marine resources if not undertaken sustainably. The impacts may be localized or widespread, the magnitude depending on the baseline wetland and marine geography, environment and demography.

Coal fired power plants generate steam that is used to turn turbines and generate electricity. The process of generating coal electricity has two major environmental concerns: (i) air emissions: as result burning coal, mainly particulates, sulfur oxides, nitrous oxides, heavy metals and CO_2; which may cause adverse health and environment damage as well as emissions of greenhouse gases if not regulated (IL&FS, 2010). (ii) Coal power plants generate sizable quantities of solid waste and process wastewaters that should be properly treated and disposed (WB, 1998). Meanwhile there are range of technological innovations that have been developed which can significantly reduce the impacts of pollutants and waste products associated with coal power plants.

The proposed coal power plant will have the capacity to produce 1050MW. A coal power plant of this magnitude may have significant impacts on the environment if not designed, built and operated sustainably. The impacts may occur during (i) the construction phase, and (ii) operational phase. As noted above the coal power plant could potentially generate significant amount wastes in form of gases, liquid and solids with traces of toxic substances depending on coal power plant design and performance specifications. Some of the potential environmental impacts associated with the proposed coal power plant include:

- Air quality: coal-fired power plants emit air pollutants such as particle matter, SO_2 and NO_x. When such pollutants at elevated concentrations come into contact with the ambient environment, they may be deposited on neighboring landscapes. High concentrations of SO_2 and NO_x could potentially contribute to acid rain which causes corrosion and degradation of buildings and installations.
- Water: coal-fired power plants utilize large quantities of water for cooling purposes. The proposed power plant is designed to use once through cooling water obtained from sea water in the Manda Bay. The once-through cooling water will be discharged back into the Manda Bay at an elevated temperature. International guidelines such as those recommended by the World Bank Group's 2008 Standards for thermal power plants state that the difference between the intake and outfall temperature of the abstracted cooling water should not exceed 3 degrees Celsius. If the difference is higher than this, there could be potential environmental impacts that affect marine life, particularly sea grasses and coral reefs.
- Waste management: one of the outputs of coal-fired power plants is a large quantity of solid wastes. The proposed power plant will generate fly ash, bottom ash. Such wastes require an appropriate disposal facility or recycling systems.

11.4.1.1 Thermal plume

Once through cooling water from the power plant will be released back to the Manda Bay causing a change in the temperatures of water there. Sea reptiles like turtles and sea snakes living in the sea will easily get affected by elevated

temperatures; the international guidelines for temperature rise of once through cooling water is 3 degrees Celsius.

11.4.1.2 Chemical threats

Coal fired power plant air emissions may release chemicals of concern to the environment through the stack. The concentration of such chemicals varies depending on the type of clean coal technologies used to scrub the exhaust gases prior to release. Some potential chemicals of concern that may have adverse impacts include:

- **Trace elements -**These include arsenic, selenium, cadmium, chromium and mercury which are heavy metals. These chemicals are known to modify hormonal responses of amphibians and reptiles thereby affecting breeding. In turtles these chemicals accumulate in embryos leading to deformations of the young. This trace elements accumulation in tissues also affects other reptiles and amphibians where poor and stunted growth occurs. For instance, in amphibians, the swimming ability of tadpoles is impaired if the trace elements are in water.
- **Oxides of sulphur and nitrogen (NO_x and SO_x)**- These two oxides combine with humidity and oxygen in the atmosphere to cause acid rain. A large number of studies conclusively demonstrate that low pH conditions have important ecological effects on amphibian communities. These effects vary developmentally and depend on complex interactions with other physical, chemical, and biological parameters. Acid sensitivity varies widely within and among species of amphibians. In spite of the importance of acidity to their reproductive success and the presence of many acidic amphibian habitats, there is, at present, little direct evidence that acid precipitation has produced widespread declines in amphibian populations. However, the potential role of sublethal effects of acidity on amphibian declines has not been studied thoroughly.

11.4.2 Ecological impact assessment

The project area will be surveyed to identify habitats, protected species and mammals as part of the detailed ESIA phase. The surveys will be undertaken using standard methodologies to identify any protected species. These surveys will form part of the baseline information for the detailed ESIA phase and would be utilized for any additional targeted surveys conducted as appropriate. An assessment on habitats and species would then be undertaken as part of the ESIA.

The presence of endangered habitats and species as listed in the IUCN Red Data Book would be identified as part of the ESIA process.

Potential mitigation measures would be drawn up in the ESIA Study to minimize damage and disturbance to habitats and species. Construction mitigation and environmental protection measures will be implemented via the environment and social management plan within the ESIA Study.

11.5 Surface water

Water is central to many critical environmental issues in Lamu. On the one hand, the aquifer system sustains the life and livelihoods of the majority of the population; on the other hand, shortage of water and the uncertainties of rainfall dictate the patterns of activity in most of the project area. Lamu faces serious deterioration of surface and ground water quality because of sea water intrusion.

Groundwater development and falling water tables and increasing salt contents in the hand-dug wells, attest that more expensive and poor quality groundwater will have to be used for various uses in future, which will have serious consequences for Lamu County capacity to feed its growing population. About 100% of the population in Kwasasi depends on groundwater for their daily domestic needs.

Local context confirms that Environmental Activities should have an equal focus on both, water availability and water quality at surface and underground level.

11.5.1 General construction related impacts

Run-off can carry sediments and other contaminants either attached to the sediment or in solution, including soil nutrients and lubricants, fuels and chemicals that may be spilled at the sites. Any source of soil contamination can be carried in run-off. If agricultural chemicals are used on farms or forests associated with biomass production or if herbicides are used during land clearing or to manage vegetation in right-of-ways, they can also become components of run-off. Depending on the local conditions and the distance to surface water, these contaminants can impact water quality in the surface waters that receive drainage from the affected areas.

The construction of the proposed coal power plant and associated infrastructure is a large undertaking and a number of potential impacts to surface water resources typically associated with construction of large infrastructure may result.

Some of the significant potential impacts relate to:

- A lack of or poor stormwater controls being put in place on the construction site. This may result in the creation of runoff containing pollutants such as cement and oils being transported by stormwater runoff into the subsurface and Manda Bay;
- The dumping of construction material, including fill or excavated material into, or close to the Manda Bay;
- Spills of hazardous materials, especially oils and other hydrocarbons that may be washed into, or infiltrate nearby surface water features; and
- The conducting of certain construction-related activities (such as cement batching) too close to surface water features or without the implementation of certain controls that may lead to the direct or indirect pollution of the surface water feature.

- The lack of provision of ablution facilities that may lead to the conducting of 'informal ablutions' within or close to a surface water feature that may lead to its pollution by fecal contaminants.

Most of these and other potential construction-related impacts can be minimized or adequately mitigated by controlling construction activities on the basis of an appropriately designed Environmental Management Plan (EMP).

11.5.2 Impacts associated with polluted run-off water

Runoff water, including stormwater that may be polluted could run off the site and into the Manda Bay. This polluted water could infiltrate the substrate within the drainage line thus potentially polluting shallow groundwater resulting in degradation of water quality and the pollution of downstream parts of the drainage system and even groundwater.

This scenario applies to runoff water from any areas in which the solid waste is stored such as the coal ash yard and process areas where fuels, lubricants and chemicals come into contact with surface water. This potentially contaminated wastewater may enter surface water run-off drains that could pollute surrounding drainage lines as well as soils and shallow groundwater.

The level of potential risk is dependent upon the proximity of the power plant to surface water resources, the interaction between groundwater and surface water features (i.e. whether there are any areas of groundwater discharge such as Manda Bay) and the nature and level of mitigation measures instituted at the power plant. Pollutants carried by runoff could ultimately be transported downstream into the Manda Bay.

11.5.3 Impacts related to water abstraction

Water needed during the operational phase of the coal power plant will be abstracted from the Manda Bay through a circulating water intake. It is envisaged that over 42,000m^3/hour will be required for cooling water purposes; nearly all of this water will be returned back to the sea as treated water.

Prior to its use, some of the abstracted sea water will go through a sea water reverse osmosis (SWRO) desalination to remove the salt content. Subsequently, it will go through a demineralization plant to remove any minerals from the water. Finally the water will be treated with a biocide to prevent fungus entering the water pipes within the cooling water system

The potential for the above impacts to occur will need to be further investigated in the ESIA-phase of the project.

11.5.4 Wastewater treatment plant

A wastewater treatment plant is envisaged for the coal power plant during the construction and operational phase of the project. The wastewater treatment plant will be designed for a capacity of about 3000 workers who will be expected to be working on the power plant at the peak construction phase.

The wastewater treatment plant may be associated with discharge of 'grey' water into the nearby Manda Bay. Should treated water need to be discharged into the Manda Bay, this may alter the hydrology and hydromorphology of the drainage line if the discharge was permanent. Owing to the seasonal nature and sandy substrate of the drainage lines in the area, it is possible that this discharge would be more likely to affect groundwater flow within the vicinity of the drainage line than surface water flow. This discharge could cause pollution of drainage lines and shallow groundwater by altering the hydrochemistry of the water if not treated to an acceptable quality, or if an accidental overspill of raw sewage occurred.

The risk in this instance would depend upon whether treated water was discharged directly to surface water features, and the mitigation measures implemented at the treatment plant to ensure that spillages or discharge of untreated water/water of unacceptable quality do not occur.

11.5.5 Concrete hardstanding areas

The proposed project will introduce hard surfaces to a portion of the plot where the power plant infrastructure and associated support facilities are to be constructed. This is likely to have an effect on the stormwater regime in the vicinity of the site as hard surfaces typically generate more runoff than the ground currently covered with natural vegetation into which infiltration is able to occur. The generation of extra runoff may have implications for potential erosion on the site.

Stormwater management is also important in the context of chemicals such as petroleum products (fuels and lubricants) that will be stored at the power plant site. Standard measures are typically accommodated in the design of the fuel storage area to ensure that should an accident occur which may cause spillage of this fuel, that it would not pollute the surrounding soils or any runoff from the tank farm area. The tank farm is typically housed within a concrete bund that would be linked to an oil water separator (OWS) within the footprint of the power plant. Should contaminated water enter the OWS, this would typically be removed from the site, and would be recycled off-site as part of the remediation process.

Stormwater should be carefully managed and should not be allowed to cause potential erosion which may lead to silt deposition in the nearby local drainage line. Stormwater management is important during the construction phase, as improperly controlled stormwater may potentially transport pollutants (such as hydrocarbons) within the construction site into surrounding areas or into drainage systems. The potential storage of hydrocarbon materials such as diesel, lubricants and chemicals during the operation will have to be well managed during operation and stormwater managed to avoid possible contamination.

11.5.6 Impact assessment

Impacts on surface water quality will depend on the quality of the water discharged from project activities and the assimilative capacity of the receiving water. Baseline water quality sampling and analysis will be undertaken at various locations in the vicinity of the power plant to characterize the existing quality of the receiving body.

Existing hydrological studies would be built upon to determine potential impacts of the proposed power plant on hydrology and ground conditions. Further assessment of potential impacts of the proposed development on hydrology and ground conditions would be undertaken as part of the ESIA with reference to relevant legislation, policies and guidance.

As a once through cooling system will be used for the power plant, the impact assessment will be done on thermal discharges using the CORMIX mathematical model which will be used to determine the maximum discharge temperature and flow rates that would meet the environmental objectives of the receiving water.

11.6 Land use and future planning

Land use is defined as current and future proposed occupation including public and private use of lands within and adjacent to the project. Specifically, it includes consideration of zoning, development plans, residential, commercial and industrial structures and activities. The County Government of Lamu is yet to develop a land use master plan for the County.

The proposed project will be constructed in the Kwasasi location of Hindi Ward, Lamu County; the distance between Hindi town and the project site is about 20km using the existing road. The nearest man made land mark to the coal power plant is the Kenya Navy base situated about 6km south of the project site.

Amu Power will lease land from the Kenya Ports Authority (KPA) for the proposed coal fired power plant. Consequently, it is expected that a resettlement action plan (RAP) will be developed and implemented by the National Land Commission (NLC) in conjunction with the Ministry of Energy and Petroleum, County Government of Lamu, National Administration and Amu Power.

The project area falls within a much larger area of land that was included in the LAPSSET Study of 2011 as shown in Figure 20. This larger area of land will be used for the construction of the 32 new berths, railway terminal, ship repair yard, etc. Land tenure in the project area is generally communal and based on information availed so far, most of the land earmarked for industrial development and urban growth is still public land.

Land in Kwasasi is used for subsistence farming with some farmers growing sim sim seed as a cash crop. Most farmers that till the land over the project area emanate from the towns of Faza, Chundwa, and Pate all of which are situated on Pate Island. These farmers do not have official titles to the land in Kwasasi but are known to traditionally have carried out farming within the project area.

Figure 20: Image showing land take needed for LAPPSET projects around Manda Bay

11.6.1 Potential environmental effects

The access road from Hindi town to Bobo Primary School (see Figure 17) is about 15km long and from Bobo Primary School to the project site, the access road is another 15km long. The existing access road between Bobo Primary School and the project site is less than 5m wide and is used predominantly by motor bikes (*boda bodas*) carrying passengers and sacks of produce. The section of road between Hindi and Bobo Primary School is in a poor state and is not designed to take heavy loads that will be transported from either the sea or land to the project site.

Subsequently these access roads will be upgraded to allow construction plant and equipment as well as heavy goods to be transported to the project site. The Bobo Primary School – project site section will need to be widened and upgraded to allow movement of heavy goods vehicles in both directions. Consequently, there may be disruption to this section of the road during upgrading activities. There are farms on either side of the road; it is not expected that the "owners" of these farms will be displaced.

Site preparation activities (e.g. clearing, grubbing, excavation, back-filling, compaction, etc.) may interact with the current land use as there will be an increase in traffic due to construction related activities. A modest buffer area around the project site is planned, subsequently no other land use interactions with site preparation activities are expected.

The proposed coal fired power plant may be visible from various locations such as Lamu town, Mokowe, Hindi, Bargoni, Shela and Mtangawanda. Of these, there may be a concern that the view of the chimney of coal fired power plant will not be aesthetically pleasing to visitors to the Shela beach, thus altering the natural beauty of the area and may detract from the overall enjoyment of the beach.

Maintenance and repairs to the new coal fired power plant and associated infrastructure will likely result in periodic and modest traffic increases along the upgraded access roads. The existing access roads are presently not designed to handle adequate quantities of traffic, consequently, this additional traffic may be a concern.

11.6.2 Impact assessment

An assessment will be done to establish the extent of development planning permission required after receipt of detailed engineering designs of the project to ensure that any adverse impacts on land use are kept to a minimum and that mitigation measures maximize the potential for any benefits arising from the scheme.

According to Section 114 of the County Governments Act, 2012, the design of the proposed coal power plant will need to be submitted to the County Assembly for consideration.

11.7 Noise

Sound quality in the outdoor environment may be adversely affected by unwanted sound emissions (noise). Outdoor noise is defined as unwanted sound and is usually present at several different frequencies. The audible frequencies for humans are in the range of 20 – 20,000 Hertz (Hz).

Sound quality in the outdoor environment can be influenced by a variety of natural and anthropogenic factors. Sound quality may be affected by stationary and mobile sources, such as noise from industrial equipment, vehicle traffic and the operation of construction equipment.

Generally, sound propagation and potential environmental effects of noise on receptors are influenced by weather conditions such as temperature, humidity and wind direction and speed. Local topographic features such as hills or wooded areas may serve to attenuate sound levels.

Minimal noise studies have bene undertaken in and around Lamu County and specifically in the vicinity of the project area. Despite this, it has been observed that there are no commercial or industrial activities within the project area and consequently, the existing sound levels are characteristic of a rural area. Sound pressure levels are the lowest during the night which is likely attributable to a lack of human activity and vehicle traffic in the area during these hours. At this time, receptors would be the most susceptible to project-related sound emissions.

11.7.1 Potential environmental effects

During construction, the potential exists for environmental effects on sound quality as a result of excavation activities, pile driving and operation of construction equipment and vehicles. Additionally, it is envisaged that construction work will be undertaken for 24 hours a day 7 days a week in order to meet the stringent deadline for completion, commissioning and operation of the power plant.

During operation of the project, the potential exists for environmental effects to result from sound emissions associated with the operation of the power plant increasing sound pressure levels in the project area.

11.7.2 Noise impact assessment

A baseline noise survey will be undertaken at various locations within the power plant boundaries and surrounding receptors during the detailed environmental assessment phase. This data together with noise characteristics of various power plant equipment will be fed into a noise model in order to predict the sound pressure levels at the boundaries of the project site.

The main source of noise impact during the construction phase is likely to be from increased traffic flows. The level and character of the construction noise will be highly variable as different activities with different plant/equipment take place at different times, over different periods, in different combinations, in different sequences and on different parts of the construction site. As no specific construction details or possible locations of major ancillary activity sites are available at this stage, the anticipated noise from various types of construction activities cannot be calculated accurately. Construction related noise is expected to be a temporal impact and will occur over the construction period.

Impacts from construction activities would be controlled by the adoption of best site management practices and all mitigation measures would be agreed with appropriate stakeholders, and imported into the Environmental Management System (EMS) used by each of the contractors who will be sub-contracted.

Amu Power will impose contractual obligations on the EPC contractor to ensure that construction noise is controlled in accordance with the relevant Kenyan and/or international noise standards.

During the operational phase, noise and vibration will be generated from the power plant and by the vehicles which will be traveling on the roads leading into and out of the facility. An area of influence having a radius of about 1.5km from the power plant will be used to determine the noise effects.

11.8 Air quality

Air quality is a measure of the constituents of ambient air and the presence of these constituents including air contaminants in the atmosphere. Air quality for purposes of the power plant will include sulfur oxides, nitrous oxides and particulates.

The area where the proposed power plant will be constructed is rural in nature with no commercial or industrial activities. Subsequently the air quality in and around the project area is currently good. With the LAPSSET projects commencing in the reasonably foreseeable future, the air quality may change.

Emissions of greenhouse gases (GHGs) to the atmospheric environment is believed to be a major factor contributing to global climate change. The main GHGs include carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) and may be emitted from a number of natural or man-made sources.

11.8.1 Potential environmental effects

The potential for interaction between construction activities and air quality exists during virtually every activity in the construction phase of the project, though proper mitigation and control devices will be employed to minimize potential environmental effects. During the construction phase, heavy equipment will be used to accomplish a number of construction-related activities which may result in emissions from fuel combustion. There is potential for environmental effects from fugitive particulate matter (dust) generated during the earth-moving activities.

Emissions from vessels and tugs/barges that are used to deliver equipment and materials to the site are likely, though limited in importance in general.

Potential environmental effects on air quality in the project area will occur during the operation of the power plant due to the emissions of air contaminants and greenhouse gases resulting from burning coal, ash yard operations, coal stock pile, vehicle traffic, marine vessel traffic and the operations of process equipment.

Air contaminant emissions have the potential to affect human health, marine environment, terrestrial environment, freshwater environment and wetlands. Environmental effects may include acute or chronic illnesses or conditions on human health, loss of fish habitat and/or direct mortality to fish, loss of animal and/or plant habitat and/or direct mortality thereof, and contamination of potable water sources, both groundwater and surface water.

The emissions of GHGs from heavy equipment during construction and from the coal power plant during operation will add to the existing emissions in the project area and Lamu County in general. These emissions may contribute to environmental effects on climate, including potentially micro-climate at the project site.

11.8.2 Air quality impact assessment

The assessment of air quality will be done by conducting dispersion modeling to predict the downward concentrations of air contaminants and comparing these predictions to Kenyan air quality standards and in their absence, the World Health Organization (WHO) guidelines.

The assessment of air quality for the project will generally consist of the following elements:

- Compiling emissions inventories for point and mobile sources in the air shed;
- Establishing the baseline ambient air quality conditions for chemicals of potential concern through setting up of diffusion tubes at several locations within the project site and area of influence; and
- Conducting a dispersion modeling assessment of the project during the operational phase.

11.9 Heritage resources

Heritage and archaeological resources are defined as any physical remnants found on top of and/or below the surface of the ground that inform us of past human use of and interaction with the physical environment. These resources may be from the earliest pre-historic times of human occupation within the area of the project or more recent time periods. Although more related to issues of evolution or biophysical heritage, paleontological resources or fossil bearing rocks are also included.

The known archaeology of Lamu archipelago begins from about 7th century. The earliest known archaeological remains were found in Manda town ruins where

both local and imported items were excavated by Chittick (1974). Other pre nineteenth century sites include Shanga, Takwa, Siyu, Mkokoni, Mshundwani, Kiliana and Ungu.

Archaeological reports show that the project area which is within map sheet 180/2 has several Iron Age sites which include ruins, tombs and archaeological pottery.

Although no archaeological sites were found within the project area during the preliminary survey some Iron Age sites, graves and mosque ruins were found within its vicinity.

Lamu population is made up of several ethnic groups with majority being the Banjuni. The others include the Pokomo, the Mijikenda, the Somali, the Orma, the Boni, Sanye and the Kikuyu. The latter entered Lamu after Kenya's independence in 1963. Each of these communities have their distinct cultures and livelihoods.

In the project area, the population consists of the Banjun, Mijikenda, Boni, Somali, Kikuyu and Sanye who practice farming, fishing, hunting/gathering and charcoal burning as their economic mainstays.

11.9.1 Potential cultural heritage impacts

Any below grade project related activities including both terrestrial and marine activities have the potential for interaction with heritage and archaeological resources. The construction phase of the proposed power plant represents the greatest potential for interaction with heritage and archaeological resources as it is during this phase that the majority, if not all of the groundbreaking and excavation activities will take place.

Potential cultural heritage impacts may occur as a result of interactions between the indigenous communities in Lamu and the in-migration of people from other parts of the country or internationally who would be seeking jobs within the power plant project area.

Lamu stone town is registered as a UNESCO World Heritage Site for its Outstanding Universal Value. The development of the proposed coal power plant will mean that the workers will have disposable income which they can partly spend at socio-cultural amenities such as bars, restaurants, hotels and resorts to name a few. These types of activities may potentially have an impact on the World Heritage Site status of Lamu town especially if there is increased demand for the above amenities.

11.9.2 Cultural heritage impact assessment

For the coal power project, a potential cultural heritage impact may be defined as a project-related disturbance to or destruction of all or part of an archaeological or heritage resource considered by Lamu Museum or the National Museums of Kenya to be of major importance or research importance due to factors such as rarity, undisturbed condition, spiritual importance or research importance, and that cannot be mitigated or compensated.

An assessment of the potential for the project area to contain archaeological and cultural sites was undertaken in February 2015 by a team of cultural heritage specialists from the National Museums of Kenya. Known archaeological and cultural heritage resources within a certain radius of the project area were determined. Field investigations were conducted in an attempt to discover those resources that may exist within the project area.

Typically, there are two methods for determining the existing conditions with respect to cultural heritage resources within the project area namely:

- Undertaking a desk-top review of available secondary literature such as archives, heritage records, documented archeological sites, NMK and Lamu Museum records and, community elders; and/or
- Undertake a physical search of those cultural heritage resources that exist, but of which there is currently no knowledge.

The above techniques were used for the baseline data collection of archaeological and cultural heritage in the project area and its vicinity. Baseline information will include an analysis of data from the above mentioned secondary literature available at the NMK and Lamu Museum; documented local histories; previous archaeological and cultural heritage studies undertaken in the vicinity of the project area; local informants; and information obtained during field investigations.

12 Accident prevention plan

This section describes the framework for managing incidents and near misses as well as communication of hazards associated with the proposed project.

It is therefore essential that the project is constructed and operated in a safe and incident free manner in compliance with the Occupational Safety and Health Act, 2007 (OSHA) and its subsidiary legislation particularly *Legal Notice No. 40: Building Operations and Works of Engineering Construction Rules, 1984*. Additionally, the project will need to be undertaken in accordance with the requirements of OHSAS 18001.

This section outlines an incident prevention plan for Amu Power and each of their contractors to implement prior to the construction phase of the project.

12.1 Incident Prevention – Construction Phase

Contractor health and safety is an essential component of incident prevention during the construction phase of the project. It is recommended that the EPC Contractor's formal HSE management system be implemented for the project containing some of the elements described below.

12.2 Safety and Health risk assessment

The EPC Contractor and their nominated sub-contractors will be required to undertake appropriate safety and health (S&H) risk assessments of the entire construction phase of the project and submit a report to the DOSHS for their review. Appropriate S&H risk assessments include job safety analysis (JSA), permit-to-work (PTW) system, use of safe work procedures (SWP), health risk assessment (HRA), fire risk assessment (FRA), safe systems of work, etc.

12.2.1 Responsibilities with regard to safety

The responsibilities with regard to safety must be documented by the EPC Contractor for all their sub-contractors to follow while working at the project site. The EPC contractor's responsibility is to issue procedures, safety rules and safety induction training for all sub-contractors working on site. It is the responsibility of all sub-contractors to strictly adhere to the Proponent's and the EPC contractor's HSE standards and to ensure that every person in the sub-contractor's employment observes the requirements of the EPC Contractor's regulations.

Each sub-contractor will be required to nominate a supervisor for their specific discipline of the project. This person will be responsible for all HSE compliance requirements of subordinates and will issue instructions regarding HSE which have to be carried out by all contract employees.

Each sub-contractor's supervisor will be responsible for training all new contractor personnel in HSE as well as the dangers inherent to the area where work is to be performed.

12.2.2 Designation of First Aiders

Each sub-contractor shall ensure that an adequate number of certified first aiders are available at the project site with properly equipped first aid boxes. First aid requirements are provided in Legal Notice 160 titled *The Factories and Other Places of Work (First Aid) Rules, 1977* and all contractors must comply with the requirements stated therein. There will be a requirement for a sick bay as required by these regulations fully staffed with a number of nurses.

12.2.3 Contractor Employee Responsibility with regard to Safety

Any sub-contractor employee who observes or is involved in an accident will immediately report such incident to the sub-contractor's supervisor who will record the details in a General Register as stipulated under the Occupational Safety and Health Act, 2007. This will be done after attending to the injured person. The sub-contractor's supervisor on site shall fill out an Accident Report Form known as DOSH 1 which is available for free from the local DOSHS office and submit it to the nearest county DOSHS office within 24-hours of the accident.

12.2.4 Temporary Buildings

During the construction phase the sub-contractors may erect temporary buildings for use during the construction period. The design of the buildings shall be approved by the Owner's Engineer before erection commences.

12.2.5 Safety Induction Training

The EPC contractor will arrange for HSE induction training of their sub-contractors prior to the ground breaking at the project site. All new employees shall undergo such training prior to being allowed to work on the project site. The EPC contractor's sub-contractor(s) shall also provide HSE induction training to all their workers including daily tool box talks.

12.2.6 Personal Conduct

It will be the responsibility of each sub-contractor to ensure that their employees do not engage in any of the following practices during the construction phase of the project:

- Horseplay;
- Personal business; and
- Misconduct.

12.2.7 Personal Protective Equipment (PPE)

Every employee of the EPC contractor and their sub-contractors working at the project site shall ensure that all their employees are provided with appropriate and adequate PPE. The EPC contractor and sub-contractors will be required to maintain a register indicating the issuance, control and use of PPE which includes the following:

- Safety shoes;
- Safety helmets (hard hats);
- Hand protection (gloves);
- Eye and face protection (safety glasses);
- Hearing protection (ear plugs, ear defenders); and
- Clothing (overalls).

12.2.8 Safety Procedures

The EPC contractor will be required to issue the Owner's Engineer with a comprehensive Safety Method Statement for carrying out each phase of the construction works. The EPC contractor will be expected to be certified to OHSAS 18001 and will localize the system for the proposed project.

12.2.9 Fire and Emergency Procedures

The EPC contractor, their nominated sub-contractors and all the employees working for them shall be required to be familiar with the applicable fire and emergency procedures. The HSE induction training to be provided by the EPC contractor for all their nominated sub-contractors working at the project site will include emergency and evacuation procedures.

12.2.10 Security Procedures

The nominated sub-contractors and their employees will be required to familiarize themselves with the EPC contractor's security procedures and shall ensure that all employees comply with those security procedures. Additionally, the security procedures in place within the boundary of the power plant shall be complied with.

12.2.11 Working Tools and Equipment

Each nominated sub-contractor will ensure that no unsafe tools are used at the project site. The sub-contractor will further ensure that all scaffolding and ladders, cranes, welding machines, compressors, etc. are in good serviceable condition at all times during the construction phase of the project and have been certified by DOSHS approved persons.

12.3 Incident Prevention – Operational Phase

12.3.1 O&M company HSE Management System

The Operations and Maintenance (O&M) company for the power plant will be required to develop and implement a Health, Safety and Environment (HSE) management system for the operational phase of the project.

Additionally, the O&M Company will need to develop and implement the ISO 14001 Environment Management System and the OHSAS 18001 Safety and Health management system. As a minimum, the O&M Company will comply with all applicable HSE related legislation in Kenya during the operational phase of the project.

12.3.2 Emergency Response Plan

An Emergency Response Plan (ERP) will need to be developed for the operational phase of the project. The ERP will be developed on the basis of the internationally recognized Incident Command System (ICS) model.

At a minimum, the ERP should include the following sections:

- Introduction;
- Purpose;
- Scope;
- Abbreviations;
- Definitions;
- Emergency response organization;
- Emergency notification system;
- Evacuation procedures;
- Emergency response plan activation;
- Contingency plans;
- Emergency management resources and logistics;
- Crisis control center;
- Deactivation and recovery plan;
- Training;
- Emergency response plan maintenance; and
- Emergency response plan distribution.

13 Health and safety management plan

13.1 Introduction

Health, safety and Environment (HSE) protection is fundamental as it forms an integral part of any company's HSE Management System. Amu Power is committed to the implementation of the requirements of an HSE management system that is consistent with national and international HSE standards for their facilities. As stated in section 11.3.1, the O&M Company will implement an HSE management system for the power plant during the construction and operational phases respectively.

The construction and commissioning of the power plant will be undertaken by an experienced company from China that has built coal power plants around the world. Prior to construction, the EPC Contractor will be expected to implement a site specific construction HSE plan which will outline the routine management of HSE aspects associated with the construction phase of the project.

During the operational phase, the O&M Company will implement a formal HSE management system for the proposed project.

This section outlines the framework of a construction HSE management plan that the EPC Contractor is expected to develop in constructing the proposed project infrastructure.

13.2 Compliance with HSE legislation

The EPC Contractor will ensure that each of its nominated sub-contractor's HSE management plan complies as a minimum with stipulated laws and regulations in Kenya on HSE. Some of the pertinent laws are referenced below.

- Environment Management and Coordination Act, 1999 and its subsidiary legislation;
- Occupational Safety and Health Act, 2007 and its subsidiary legislation;
- Energy Act, 2006 and its subsidiary legislation;
- County Governments Act, 2012;
- Land Act, 2012;
- Physical Planning Act, 1996;
- Public Health Act;
- Water Act.

13.3 Construction HSE management plan

13.3.1 Purpose of a construction HSE management plan

A construction HSE plan is management tool used to manage HSE activities associated with the construction of a project. It is a prerequisite for satisfying the Proponent that the successful contractor has implemented a management system for the safe operation of construction related activities in a project.

The construction HSE plan sets out the HSE management system as well as the resources required to implement it. It includes the minimum requirements for compliance with local HSE laws and regulations in order to prevent injuries to workers, damage to property or the environment. In the absence of relevant legislation, the EPC contractor and nominated sub-contractors will ensure compliance with international standards, guidelines and best practices in the safe operation of construction activities associated with the project.

13.3.2 Objectives of a construction HSE management plan

The principal objectives of a construction HSE management plan include:

- Prevention or limitation of injuries to workers, damage of property or the environment through an emergency preparedness and response plan;
- Prevention of recurring accidents or incidents through a program of root cause analysis;
- Ensuring that safe work practices and procedures are issued and understood by all construction workers;
- Verification through planned audits and reviews that procedures and instructions are complied with fully; and
- Counseling construction workers involved in near misses on better safe work practices.

In order to implement the construction HSE management plan, the EPC Contractor and nominated sub-contractors will implement the following strategy:

- The HSE goals/objectives of the project will be verified and commented upon in each HSE meeting;
- A monthly HSE theme relevant to the planned objectives will be issued;
- Monitoring and control of unsafe practices;
- Initiate an unsafe act/condition report system for conveying accountability to affected employees including a disciplinary action system for non-compliance;
- Initiate an HSE recognition and rewards program for good HSE behavior among construction workers;

- Organize HSE competitions to promote interaction of construction workers through direct involvement in routine HSE objectives.

13.3.3 HSE organization and responsibilities

HSE is a management responsibility. Subsequently construction management of the proposed project shall form part of the daily responsibility of each member of the EPC contractor's management team and the sub-contractors' they supervise.

The EPC contractor's organization structure should include persons who will have routine responsibilities for managing HSE aspects associated with the construction phase of the project. A brief outline of the roles and responsibilities of various persons in HSE management is given in Table 15.

Table 15: HSE roles and responsibilities of various persons working at the coal power plant

Position	HSE Roles and Responsibilities
Construction Manager	• Overall EPC contractor representative and retains HSE monitoring role over the project; • Ensures compliance with ESIA conditions set by NEMA and other HSE related laws associated with project construction; • Has overall responsibility for HSE associated with the project; • Promotion of HSE awareness by example (role model behavior); • Ensures sub-contractors comply with HSE rules and are trained in HSE; • Ensures that the project HSE plan is continuously maintained and updated.
Other supervisors and engineers	• They report to the Construction Manager; • Demonstrate their concerns for HSE compliance by good role model behavior; • Ensure that subordinates are aware of HSE hazards involved in their respective work tasks through training and work experience; • Ensure compliance with HSE legislation including conducting regular HSE inspections at the work site; • Ensure that construction plant and equipment is in a good state of repair and made available to the construction workers; • Reporting of any unsafe acts or conditions to the Construction Manager's attention for remedial action; • Ensuring that all accidents/incidents are reported immediately and appropriate investigations undertaken; • Plan, coordinate and participate in HSE toolbox

Position	HSE Roles and Responsibilities
	meetings for construction workers.
Employees	• Carry out their routine construction activities in a healthy, safe and environmentally friendly manner; • Use appropriate PPE provided to them by the contractor; • Ensure compliance with the contractor's HSE rules; • Be aware of the EHS hazards associated with the construction plant and equipment they will use; • Bring to the notice of their immediate management any EHS hazards identified during the construction phase.
HSE Supervisor	• Reports to the Construction Manager and is the primary advisor to the EPC Contractor on all HSE issues associated with the construction site; • Is empowered to halt construction operations if any unsafe acts or conditions are witnessed; • Ensures all supervisors and employees are aware of their HSE responsibilities; • Facilitates HSE risk assessments and JSAs; • Undertakes regular HSE inspections of the construction site in accordance with the contractor's HSE policy; • Provides HSE training for the EPC contractor's employees and nominated sub-contractors; • Undertakes accident/incident investigation to establish root causes of accidents/incidents; • Ensures statutory HSE audits and inspections are undertaken and reports filed appropriately; • Issues a construction HSE project report monthly; • Provides HSE documents requested by the Proponent or any HSE related lead agency.
HSE representatives	• Responsible for ensuring that relevant HSE work instructions are understood and fully implemented by fellow workers; • Reporting any accidents/incidents, unsafe acts or conditions to the HSE manager; • Reinforcing and encouraging the concept of individual HSE responsibility within their work teams; • Attend all HSE meetings and share proceedings with the rest of the work teams.
Sub-contractors	• Will be subjected to the EPC contractor's HSE appraisal;

Position	HSE Roles and Responsibilities
	• Compliance with HSE laws and regulations and EPC contractor's HSE policies.
Suppliers	• Comply with the EPC contractor's HSE policy which will be forwarded to them by the HSE Manager; • Provide relevant HSE information to the HSE Manager associated with storage, use and disposal of supplies.

13.3.4 HSE performance measurement

The EPC contractor will be required to develop and implement an HSE performance measurement system. The measurement system will be used to recalibrate the HSE performance of the project during the construction phase to ensure that there are no injuries to people, damage to property or the environment. Some of the performance measurement metrics that should be considered for tracking include the following lagging and leading indicators:

- No. of fatalities;
- Lost time incident rate (LTIR);
- No. of fire incidents;
- No. of environmental incidents;
- Equipment damage/minor injuries;
- No. of health and hygiene reports;
- No. of HSE meetings conducted;
- No. of HSE inspections undertaken;
- No. of HSE training courses conducted.

13.3.5 HSE interface between EPC Contractor and Proponent

Throughout the construction phase, there will be an interface between Amu Power and its Contractor on HSE management. An Owner's Engineer has been engaged as the Proponent's representative. The objectives of this activity are to ensure that:

- The EPC contractor achieves the same or higher HSE standards than those stipulated by the Proponent;
- All HSE related hazards of the construction phase are identified, evaluated and appropriate control measures implemented;
- The EPC contractor understands its obligations with respect to HSE associated with the project;

- HSE performance management arrangements are in place by mutual definition.

The interface on HSE management may be achieved by the Owner's Engineer and EPC contractor through meetings, reviews and audits during the design and construction phases of the project respectively. Some of the meetings may be defined as follows:

- HSE kick-off meeting;
- Weekly HSE progress meetings;
- Ad-hoc HSE meetings called by either the proponent or the EPC contractor to discuss specific HSE issues; and
- HSE reviews/inspections undertaken by either the Owner's Engineer or the EPC contractor or both.

13.4 Safety action plan

13.4.1 Construction phase

13.4.1.1 Safety hazards and critical areas

Prior to commencing construction, the EPC contractor will identify potential hazards to the safety of personnel associated with construction phase of the project. The EPC contractor and nominated sub-contractors shall also comply with relevant requirements of OSHA and its subsidiary legislation including *L.N. 40: Building Operations and Works of Engineering Construction Rules, 1984*. The list of potential hazards will be updated on-site at regular intervals. For each hazard identified, the EPC contractor will ensure that there is a documented risk assessment and safe work procedure that is developed, rolled-out and implemented for the project.

13.4.1.2 Safety procedures

As experienced sub-contractors may be engaged by the EPC contractor for this project, it is envisaged that they will already have safe work procedures developed for similar types of projects. These procedures will be customized for the proposed project and used throughout the construction phase. Examples of construction activities for which safe work procedures are required include:

- Cranes and lifting equipment operations;
- Electrical work;
- Confined space entry;
- Fire protection and prevention;
- Emergency response;
- Permit-to-work;

- Job safety analysis (JSA);
- Risk analysis;
- Root cause analysis;
- Safety incentive program; and
- Disciplinary system, etc.

13.4.1.3 Safety training

Health and safety training of workers is mandatorily required by Kenyan legislation under the Occupational Health and Safety Act, 2007 (OSHA). The EPC contractor will be required to train their sub-contractors on the safe work procedures some of which are identified in the previous section. Health and safety training needs will be identified by the contractor prior to commencement of the construction phase of the project.

Health and safety training associated with the project will be extended to all levels of management and workers who may potentially be exposed to health and safety risks during the construction phase of the project. Health and safety training records will be maintained on site by the EPC contractor for review by appropriate lead agencies and the Owner's Engineer.

13.4.1.4 Safety guidelines and rules of operation

The EPC Contractor should have a written PPE program that can be implemented for the proposed project. The PPE program will include instructions for:

- Selection of correct type of PPE based on the hazards at the job site;
- Issuance of PPE;
- Correct use of PPE;
- Inspection and maintenance of PPE;
- Replacement of worn out PPE.

In addition to the formal PPE program, the contractor will evaluate all risks associated with working at heights (1.8m above grade level). For such work, the construction workers will be provided with appropriate safety harnesses or safety nets. All construction vehicles will be fitted with seat belts that operators must wear while working and on-board computers to manage driver behaviors.

The construction site will contain appropriate signs, signals and barricades that are visible to the workers to protect them from potential hazards. Trenches and other excavation will also be provided with appropriate barricades, signs and signals. As construction will be performed day and night, the EPC contractor will ensure that there is sufficient artificial lighting to permit work to be carried out safely, efficiently and satisfactorily.

All tools and equipment deployed by the EPC contractor and their sub-contractors shall be free from defects, be in good operating condition and maintained in a safe condition. Any equipment that falls under the Examination of

Plant Order under the OSHA shall be inspected by a DOHSS approved person and a certificate issued prior to its use at the construction site. Some of the tools, equipment and plant expected to be used for the proposed project include:

- Hand and portable power tools;
- Scaffolds;
- Cranes and lifting equipment;
- Motor vehicles;
- Ladders.

In addition to the above, the EPC contractor will develop, rollout and implement the following health and safety rules for the construction site:

- Job site transportation;
- Daily construction plant inspection;
- Electrical operation;
- Floor and wall openings and stairways;
- Excavation and trenching;
- Steel erection;
- Confined space entry;
- Medical services;
- Fire protection and prevention;
- Alcohol and drug abuse.

13.5 Occupational health action plan

An occupational health plan is primarily concerned with identification, evaluation and control of environmental health exposure that results from construction processes. The stresses can be physical, chemical, biological, environmental and physiological and may cause sickness, impaired health or discomfort to employees.

An occupational health plan therefore addresses the above concerns as they apply to the project and to provide cost effective solutions to assure the health and well-being of project employees.

An occupational health plan commences with the identification of potential environmental health exposures that may be present during the construction phase of the project. This is known as an occupational health risk assessment (OHRA) which would then guide the depth of the occupational health action plan.

In order to evaluate the need for an occupational health action plan for the proposed project, the EPC contractor will engage the services of a medical practitioner(s) based in the vicinity of project with skills and competencies in clinical and occupational medicine, industrial hygiene, toxicology, epidemiology,

etc. to undertake an OHRA. If in the view of the medical professional, there are certain risks that require mitigation during the construction phase, a medical and health program will be developed and implemented by the EPC contractor for the construction phase of the project. Details of a typical medical health program are outlined below.

13.5.1 Medical and health program

The medical and health plan provides the necessary and important parts of a construction project medical and health program. The objectives of this program are to:

- Protect employees against occupational health hazards at the construction worksite;
- Facilitate placement of workers according to their physical, mental and emotional capabilities without endangering their own health and safety or that of others; and
- Ensure adequate medical care and rehabilitation of the occupationally injured or ill person.

If the results of an OHRA indicate that mitigation is required to prevent adverse environmental health exposure to workers, the EPC contractor will engage the services of a DOSHS approved Designated Health Practitioner (DHP) for undertaking the medical examinations in accordance with the Second Schedule of the OSHA and Legal Notice No. 24: Medical Examination Rules, 2005. For those occupations defined in the Second Schedule of the OSHA, the EPC contractor will avail their employees to a DHP for medical examinations throughout the construction phase of the project during the following occasions:

- Pre-assignment;
- Periodic;
- Post illness or injury; and
- Termination.

An occupational injury or illness will be diagnosed as promptly as practical and treated as appropriate within the capabilities of the workplace medical facility. The EPC contractor's occupational health program should include treatment of emergency conditions at the work site which may occur during the construction phase of the project.

Construction workers and other employees will be inducted on the potential occupational health hazards that they may encounter in their specific roles. The induction will include methods of recognizing and preventing adverse health and safety effects at the work place.

The occupational health program will also include training of construction workers on the correct use and maintenance of PPE issued to them. The site HSE Supervisor will periodically inspect and evaluate the workplace for potential adverse occupational health hazards.

Occupational health record keeping will be maintained by the site HSE Manager for all employees that are medically examined. The records will contain sufficient data to reproduce a chronology of an employee's medical occurrences, illnesses and injuries. All employee medical records will be maintained confidentially.

If the EPC contractor engages catering personnel for their staff, it will be mandatory for each food handler to be immunized every six months as required by the Lamu County Government and comply with the requirements of the Public Health Act on the numbers of ablution facilities required for each gender.

13.5.2 Record keeping requirements

Medical records will provide data for use in job placement, establishing health standards, health maintenance, treatment and rehabilitation, worker's compensation cases and assisting project management with program evaluation and management. The record keeping requirements will comply with Kenyan laws and regulations as well as the Proponent's insurance requirements.

The EPC contractor and their appointed DHP will maintain occupational health records of workers as required by Kenyan legislation (OSHA, WIBA and L.N. 24). The DHP will confidentially maintain health examination records of all employees that visit him/her. Examples of records that need to be maintained include:

- Physical examination reports;
- Clinical reports;
- Chest x-rays,
- Audiograms, etc.

The medical records shall be maintained in locked files and only authorized persons shall have access to them. In certain situations, requests for specified medical information may be sought by authorized Government officials. Additionally an employee or his/her designated representative may seek information about themselves or their environmental exposure. These requests shall be turned over to the project manager for handling.

13.5.3 Inspection program

The site HSE Supervisor will conduct sanitation and health inspections at the job site to ensure compliance with the Public Health Act. The sanitation inspections will cover the following areas:

- Drinking water;
- Control of vermin and pests;
- Toilet facilities;
- Waste disposal;

- Lunch areas.

Written reports will be issued having target dates for corrective actions to be taken by responsible supervisory personnel.

13.5.4 Training

During the construction phase, the contractor will be required to arrange for training on first aid, health and safety, security and fire safety.

13.5.5 Communications system

The EPC contractor will be required to develop, rollout and implement a rapid communications system to ensure fast and reliable emergency communications between the project site and crews at the scene of an accident.

13.5.6 Procurement and material control

The contractor's HSE Supervisor will develop a master listing of all medical and first aid materials, supplies and equipment that will be needed during the construction phase of the project. First Aid boxes will be stocked in accordance with L.N. 160: First Aid Rules, 1977.

13.6 Construction environment management plan

The purpose of a construction environment management plan (CEMP) is to specify environmentally sound working methods in order to minimize environmental impact of the construction works associated with the proposed project.

The CEMP identifies key environmental aspects and the related impacts which may occur and specifies methods, measures and controls that the EPC contractor will comply with during the construction phase of the project.

13.6.1 Key environmental positions

The beginning of this section identified the key HSE positions that will be used to manage health, safety and environmental aspects during the construction phase of the project. The primary persons from the EPC contractor's organization responsible for implementing the CEMP include:

- Construction Manager; and
- HSE Supervisor.

The Construction Manager will have overall responsibility for all aspects related to environmental issues and to ensure that the EPC contractor's environmental policy statement and objectives are complied with.

The Construction Manager will be responsible for developing, rolling out and implementing environmental procedures and work instructions in conjunction with the HSE Supervisor.

The HSE Supervisor will be responsible for environmental functions such as:

- Coordinating environmental inputs to the project and advising the Construction Manager on environmental matters;
- Coordinating the development, rollout and implementation of the EPC contractor's environment management system (EMS) for the project;
- Routine monitoring of implementation of the EPC contractor's EMS at the project site;
- Authority to halt any works where actions are found to be in contravention of particular environmental procedures, work instructions or legal requirements;
- Authority to amend work instructions and procedures as required by sound environmental management including amendments to the EMS as identified by audits.

13.6.2 Environmental training

The EPC contractor's management and their sub-contractors will receive environmental induction training prior to commencement of the construction phase of the project. The training will cover the contractor's EMS and environment work instructions relevant to the construction activities.

13.6.3 Environmental objectives

The EPC contractor will develop an environment management system (EMS) in order to comply with basic environmental objectives and targets set for the project. Environmental objectives for the construction phase will be discussed and agreed between the Owner's Engineer and the EPC contractor. The EMS will detail the environmental standards for the project and will include a number of environmental work instructions. The EMS will be implemented in conjunction with the EPC contractor's health, safety and environment action plan. Environmental activities will be audited regularly to ensure continued compliance with predetermined environmental objectives.

Environmental work instructions will be developed to comply with all legislative and regulatory requirements in Kenya as a minimum. The objective is to endeavor to minimize and prevent where possible, adverse environmental impacts. The environment work instructions will apply equally to all the EPC contractor's workers, sub-contractors, project consultants and suppliers.

The EPC contractor will provide environmental training for their workers in order to minimize the likelihood of environmentally damaging incidents occurring.

13.6.4 Environmental procedures

The EPC contractor will develop, rollout and implement environmental procedures for the construction phase of the project. The procedures will be organized under two categories namely:

- Management and Organization procedures; and
- Environmental Management Procedures.

The above types of environmental procedures will be developed jointly by the HSE Supervisor and construction team. Once drafted, the procedures will be discussed with the Construction Manager to ensure operability.

13.6.5 Environmental performance meetings

The EPC contractor will schedule regular meetings to discuss environmental performance of the project during the construction phase. The meetings will be attended by the Construction Manager, HSE Supervisor and the Owner's Engineer. Minutes of the meetings will be circulated to all employees and posted on construction site notice boards.

13.6.6 Environmental reviews

Environmental reviews include inspections to be conducted by the EPC contractor. Audits will be conducted by the external environmental auditors and will include monitoring results of construction phase environmental effects against identified performance targets. Findings and recommendations will be shared with the Construction Manager and the Owner's Engineer.

Inspections of working areas will be performed periodically using appropriate checklists. Inspections will be undertaken by construction supervisors and findings/corrective actions discussed in daily construction meetings. A tracking system will be employed for monitoring status of implementation of corrective actions. Records of inspections will be filed on-site and made available to relevant lead agencies and the Proponent.

13.6.7 Soil conservation and erosion mitigation

The EPC contractor will develop a soil conservation and erosion mitigation plan which will include details on how to perform clearing, grading, excavation, trenching and backfilling work at the project site.

During the construction phase, the EPC contractor will take adequate measures to prevent soil erosion especially during the rainy season. The integrity of soil

erosion mitigation shall be sufficient to provide continued protection against erosion until the site soils have stabilized and added protection is no longer necessary.

13.6.8 Site restoration

Prior to the use of the completed footprint, the EPC contractor will undertake a final cleanup of the project site including removal of all non-hazardous and hazardous waste or excess materials. Surface restoration and stabilization will be performed in accordance with environmentally sound practices.

13.6.9 Waste management

Immediately after award of the contract and prior to the commencement of construction, the EPC contractor will develop a waste management plan for the project. The waste management plan will be in compliance as a minimum with *Legal Notice 121: Environment Management and Coordination (Waste Management) Regulations, 2006*.

13.6.10 Spill response

During the construction phase, the EPC contractor will be required to develop, rollout and implement a spill response procedure for any spills that could potentially result from the EPC contractor's activities. The spill response procedure should be part of the EPC Contractor's overall Emergency Response Plan (ERP) for the construction phase of the project.

13.6.11 Work site controls

The EPC contractor through the HSE Supervisor and HSE representatives will monitor the project construction site daily for environmental non-conformances and submit written HSE reports to the Owner's Engineer weekly. Remedial action on environmental non-conformances will be implemented immediately they are observed.

Scheduled environmental inspections will be undertaken by the EPC contractor on a monthly basis and all reports filed on site for inspection by relevant lead agencies or the Owner's Engineer.

Construction workers will be provided with environmental induction training as well as on-the-job (OTJ) environmental training by the EPC contractor. On completion of the induction training, each employee will be required to sign a letter stating that non-compliance with the contractor's environmental policy shall be grounds for immediate dismissal.

13.6.12 Wastewater management and spill response

During the construction phase, there is a potential for effluent generation and fuel spills from a number of sources discharging into the Manda Bay. To minimize the likelihood of such adverse environmental impacts the EPC contractor will:

- Bund all on-shore fuel storage areas using impermeable materials; and
- Establish an early warning system and identification of contingency plans for spill response.

13.6.13 Noise management procedures

The potential noise generated by construction activities outside normal working hours will be assessed prior to the construction phase of the project and notification sent to the affected persons. Noise sensitive receptors will be identified by the EPC contractor and appropriate noise control measures implemented.

13.6.14 Traffic management procedures

The construction of the proposed project may have adverse impacts on traffic if not properly managed. Such effects include higher noise levels, generation of dust and additional wear and tear to local roads. The EPC contractor will develop, rollout and implement a traffic management plan to include careful planning of routes used by construction vehicles, restrictions on vehicle movements and wetting of road surfaces to reduce dust generation.

14 Social impacts

14.1 Approach to scoping

The aim of scoping is to identify the range of socio-economic issues and alternatives and to define the approach towards the social impact assessment (SIA) that will follow. In addition, the compilation of a baseline will contribute to an understanding of the socio-economic context and potential receptor communities in the study area.

The Scoping study for the SIA is based on secondary literature review of the existing Lamu County Integrated Development Plan (CIDP), national energy related policies, plans, statistics, reports, case studies, and guidance through the application of professional judgment. Widespread consultation of stakeholders was also undertaken during the scoping phase. The spatial scope will be defined during the SIA phase, as the area of influence will be determined in the context of the issues and impacts.

14.2 Information requirements

It is understood that consideration and development of alternatives (for example site layout or technology) is an iterative process. However as a starting point, in order to undertake the Scoping study, certain information is required from the designers in China. This includes details of the technical and ancillary infrastructure; the site footprint; and the proposed timeframes for construction and operation. Information on the transportation of equipment to site is also required. In addition, estimated inputs during all phases is required and this includes labor (and level of skills); materials and their source; and services and their source. Any commitment of the developer towards training and skills development is also key information.

Findings that emerge as the specialist studies advance is also required, such as thermal plume modeling, air dispersion modeling, noise modeling, visual impacts, ecological impact assessment and cultural heritage assessment.

14.3 Potential Social issues and impacts

For the purposes of this scoping study the impact variables were categorized in terms of change processes. A change process can be defined as change that takes place within the receiving environment as a result of a direct or indirect intervention. A potential impact follows as a result of the change process. However, a change process can only result in an impact once it is experienced as such by an individual/community on a physical and/or cognitive level.

The following subsections discuss the various change processes and the potential impacts that could be experienced by the receiving environment as a result of the proposed Project.

14.3.1 Demographic changes processes

It is expected that the construction and operation of the proposed coal fired power plant will lead to a change in the number and composition of the population within the Kwasasi area, which in turn may impact on health, safety and community cohesion. In terms of population change and in-migration of unemployed work seekers, there exists a potential for the influx of construction workers that will lead to a change in the number and composition of the local community, and impact on economy, health, safety and social well-being.

As this type of project has not been undertaken previously in East and Central Africa, it is envisaged that tens of technical staff from overseas will reside in the project area for the duration of the construction phase. This may bring about changes to the behavior of the local residents towards foreigners.

14.3.2 Geographical change processes

Geographical change processes refer to changes in land use, either on a temporary or permanent basis. The construction and operation of the proposed coal power plant will lead to a change in the land use, mostly as a result of surface infrastructure. The assessment of a land use change process from a social perspective therefore takes into account how the proposed Project might affect the behavior and/or lives of landowners and/or land users in the area.

Lamu County lacks a formal land use management plan. Based on the LAPSSET Study (JPC, May 2011), a land use master plan is envisaged to be developed up to the year 2030 in order to accommodate the seven components of the LAPSSET project; the proposed coal power plant was envisaged in the LAPSSET Study.

Currently the land use where the coal power plant is to be located is agricultural and the land tenure is communal. With the construction of the coal power plant, the land use will change to industrial. As the land tenure is currently communal, it is envisaged that the traditional users of the land will be compensated through a Resettlement Action Plan (RAP) process to be initiated by the National Government (Ministry of Energy and Petroleum). Consequently, once compensated, the project affected persons (PAPs) are expected to relocate on their own to a new location.

14.3.3 Economical change processes

Economical change processes relate to the changes brought about to the employment and general economic profile of the area as a result of the introduction of any development. Employment creates a source of income which in turn enables the employed individual to access services and a support

mechanism for his/her family, thereby enhancing not only the individual's quality of life, but also that of his/her household.

Some of the potential economic change processes and potential impacts are outlined below.

In terms of denying or enhancing economic opportunities for vulnerable communities, the proposed coal power plant will require skilled, semi-skilled and unskilled labor that will create job and income opportunities. The proposed project will create different levels of economic opportunities depending on the skill levels required and subsequently, different skills levels will have differently structured salary packages thereby creating lower income to higher income opportunities. There will be direct, indirect and induced gainful economic activities arising from the proposed coal power plant.

With respect to the sustainable employment change process, it is believed that the proposed coal power plant will create construction phase job opportunities and a number of operational phase job opportunities. Such sustainable employment opportunities will have a long term economic impact.

With respect to the change in employment equity of vulnerable groups, an expected change process is vulnerable groups having to compete with more appropriately qualified applicants from elsewhere. Subsequently, the potential impact is that the required skills might not be available in the Kwasasi area or Lamu County, which means that appropriate skills will have to be 'imported', thereby causing a reduction in the job and income opportunities available to Lamu County residents.

14.3.4 Socio-cultural change processes

Socio-cultural processes relate to the way in which humans behave, interact and relate to each other and their environment, as well as the belief and value systems which guide these interactions. Socio-cultural change processes that are associated with the construction and operation of the proposed Project include changes to aspects such as health and safety and sense of place. Some of the expected change processes and potential socio-cultural impacts are described below.

A change process that can potentially occur due to the coal power plant is the alteration in family structure. Aspects of change in family structure include (i) family cohesiveness, and (ii) impacts on immediate or extended family networks. Potential impacts associated with alteration of family structures includes socially acceptable integration including the risk of spreading sexually transmitted infections (STI) and HIV/AIDS with an impact on health. The spread of STI and HIV is a matter of great concern, also in view of the fact that construction workers move out of the project area into another area where the spread of these STI and HIV continues. Apart from the obvious health implications, HIV infection in particular also has an adverse economic impact.

Another expected change process that can occur is conflict. A potential impact of conflict associated with the coal power project includes hindrance in the social integration between newcomers and the Kwasasi and broader Lamu County communities leading to conflict, which in turn delays the construction process and

has economic implications for the Proponent. A potential impact of conflict is the lack of implementation of the Grievance Mechanism (GM) procedures for the project.

Another expected change process associated with the coal power plant is safety and crime. Presence of construction workers and job seekers leads people to believe that there will be an increase in crime, which impacts on the surrounding communities' sense of safety and security.

14.3.5 Social impact assessment

The data collected from the stakeholders will be documented as 'social facts' which reflect the key issues and concerns raised by them. The issues will be described and interpreted in a qualitative manner.

According to the NEMA Regulations, 'significant impact means an impact that by its magnitude, duration, intensity or probability of occurrence may have a notable effect on one or more aspects of the environment'.

In line with the Regulations, and based on the findings of the activities undertaken in the section on methodology, each potentially significant social impact will be assessed with regard to:

a) The nature of the impact (including the status which may be positive, negative or neutral);

b) The extent and duration of the impact;

c) The probability of the impact occurring;

d) The degree to which the impact can be reversed;

e) The degree to which the impact may cause irreplaceable loss of resources; and

f) The degree to which the impact can be mitigated; and

g) The cumulative impacts;

Within this framework, there is the responsibility to propose mitigation where relevant to reduce the significance of the impact.

15 Project budget

The project is currently in the preliminary design phase and subsequently accurate estimates of the project will be acquired through a competitive tendering process. According to EPC contractor, the project cost is estimated at **US$ 1,234,567,891** at an exchange rate of KShs 93 to the US Dollar and hence the EIA license fee amounts to **KShs 123,456,789.** However the maximum EIA license fee payable to NEMA is 40,000,000.00. and the proponent is required to pay the full amount to NEMA on submission of the EPR Study. Subsequently attached to this EPR study is a wire transfer of KShs 40,000,000.00 as the EIA License fee.

16 Conclusions and way forward

16.1 Conclusions

In accordance with good environmental practices, this EPR Study reviewed a number of different alternatives for developing a 1050MW coal fired power plant in Manda Bay, Lamu County and the environmental and social impacts associated with the development.

The following feasible alternatives have been identified for further consideration in the ESIA Study:

- Three candidate site alternatives (LAPSSET Study, 500 acres and 870 acres);
- Combustion technology alternative;
  - Focused on pulverized fuel combustion.
- Clean coal technologies focusing on:
  - Wet Flue Gas Desulfurization (FGD);
  - Electrostatic precipitators (ESP); and
  - Low nitrous oxide burners and/or Selective Catalytic Reduction (SCR).
- Cooling technology;
  - Once-through cooling;
- Ash disposal alternatives;
  - Focused on above-ground ash yard
- Site layout alternatives.

Specifically the following potential environmental impacts have been identified for further consideration in the ESIA Study:

- Operational phase impacts on the biophysical environment:
  - Impact on terrestrial fauna and flora;
  - Impact on aquatic fauna and flora;
  - Impact on ambient air quality;
  - Impact on founding conditions; and
  - Impact on groundwater resources.
- Operational phase impacts on the social environment:
  - Visual impacts;
  - Noise impacts;

- Impact on heritage resources;
- Impact on local economy in Lamu;
- Impact on land use and planning; and
- Impact on livelihood security.

- Construction phase impacts on the biophysical and social environment.

16.2 Way forward

As required by Section 58 of the EMCA and Legal Notice 101 titled Environmental (Impact Assessment and Audit) Regulations, 2003, this EPR Study will be submitted to NEMA for review and consideration. NEMA can either approve the EPR Study and issue an EIA License or ask the Proponent to develop a Terms of Reference (ToR) for the detailed ESIA Study.

If NEMA asks the Proponent to submit a ToR for the ESIA Study, it will contain among other things, the following aspects:

- An overview of the proposed coal fired power plant;
- A description of the environmental and social setting of the project area and its area of influence;
- The methodology for undertaking the ESIA Study;
- A plan of action for the ESIA Study including the various specialists studies required for a project of this type and the local setting in Kwasasi area, Hindi Sub-county, Lamu County where the project will be implemented;
- CVs of the team that will undertake the ESIA Study including the specialists studies

The ESIA Study will be carried out in accordance with EMCA and its subsidiary legislation as well as international guidelines such as the AfDB's and IFC's environmental and social safeguards for such a project.

17 References

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