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# **1 Executive Summary**

## **1.1 Introduction**

Amu Power Company Ltd. (APCL) proposes to develop a 1,050MW coal fired power plant using super-critical technology in the Kwasasi area of Hindi/Magogoni sub-county, Lamu County, Kenya. The power plant will be situated approximately 21km north of Lamu town as indicated in Figure 1-1. The project is part of the larger Lamu Port South Sudan Ethiopia (LAPSSET) transport corridor project emanating in Lamu in which, a coal fired power plant was envisaged as part of the transport corridor project.

APCL is a project development company formed by 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.

APCL has awarded an Engineering, Procurement and Construction (EPC) contract to design, build and operate the Lamu coal fired power plant to the Power Construction Corporation of China (POWERCHINA). The EPC contractor has vast experience in building and operating thermal power plants and has undertaken the installation of over 15,000 MW of turbine-generator units around the world.

Kurrent Technologies Ltd. was appointed by APCL to complete the Environment and Social Impact Assessment (ESIA) Study report for the necessary environmental authorization required in terms of Legal Notice 101 titled Environment (Impact Assessment and Audit) Regulations, 2003 (EIA/EA Regulations) promulgated under the Environment Management and Coordination Act, 1999 (EMCA). Kurrent Technologies Ltd. is a National Environment Management Authority (NEMA) registered Firm of Experts and is producing this report in accordance with Regulations 18 – 23 of the EIA/EA Regulations.

Additionally, the ESIA Study has been undertaken in accordance with the Integrated Safeguards System (ISS) of the African Development Bank and the 2012 Environmental and Social (E&S) standards of the International Finance Corporation (IFC).

This ESIA Study describes the detailed environmental assessment of the proposed project including an Environment and Social Management Plan (ESMP). NEMA is the lead agency in Kenya responsible for environmental authorization of the project.

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



## **1.2 Purpose and need for the project**

The purpose of the proposed 1,050MW coal fired power plant is to provide Kenyans with electricity at a cost effective price in order to grow the economy. The need for the project is based upon increased demand emanating from proposed industrial parks, LAPPSET projects, resort cities, iron and steel smelting industry and, the standard gauge railway.

According to the Draft National Energy and Petroleum Policy dated January 2015, 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.

The energy mix in Kenya is diverse and comprises a combination of renewable and fossil fuel type sources of electricity. Currently, about 65% of the energy mix comes from renewable energy sources while 35% comes from fossil fuel sources. In order to meet the growing demand of electricity, Kenya will need to implement power projects using a variety of power generation technologies.

As at December 2014, the installed capacity of electrical power was 2173MW; this power is generated by KenGen and Independent Power Producers (IPPs). This capacity is insufficient for Kenya's socio-economic development.

Several sectors of the economy are projected to grow under the devolved system of government such as mining, crude oil pipelines, standard gauge railway, manufacturing, steel manufacturing from local iron ore deposits, etc. These sectors will require significant amounts of electricity to drive their businesses. Additionally, the residential demand for electricity is continuing to increase with connections. According to the Draft National Energy and Petroleum Policy, January 2015, there were over 730,000 consumers connected to electricity in June 2004 while ten years later in June 2014, the number had exponentially increased to over 2,700,000 consumers.

The proposed 1,050MW coal fired power plant is being developed in order to meet the growing demand of electricity in Kenya. According to the Draft National Energy and Petroleum Policy, January 2015, peak electricity demand is projected to grow from 1512MW in December 2014 to 3,400MW by 2016 and to 5,359MW by 2018.

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).

According to the Draft National Energy and Petroleum Policy (January 19, 2015), it is proposed to increase power generation capacity by 5000MW from October 2013 to slightly over 6700MW by 2018. In order to meet the increased demand from commercial and residential consumers, Kenya must generate electricity from a variety of sources including renewable and fossil fuel power plants. The 5000MW power generation program envisages establishment of power generation projects from an energy mix comprising Geothermal (1,646MW), Natural Gas (1,050MW), Wind (630MW) and Coal (1,920MW) through Independent Power Producers (IPPs) under the Public Private Partnership (PPP) framework.

This will enable Kenyans to enjoy affordable and competitive electrical energy to transform Kenya's economy. Through this roadmap, the generation cost is projected to reduce from US¢11.30 to US¢7.41, while the indicative end-user tariffs are projected to reduce from US¢14.14 to US¢9.00 for commercial/industrial customers and from US¢19.78 to US¢10.45 for domestic customers.

According to the Draft National Energy and Petroleum Policy (January 19, 2015), coal is an affordable, competitive, reliable and easily accessible source of energy, especially for electricity generation. Indeed, with the current coal exploration going on in various parts of Kenya, it is anticipated that coal will provide about 2,000MW of electricity generation by 2017 and 4,500MW by 2030.

### **1.3 Description of the project**

The proposed 1,050MW coal fired power plant will use super-critical technology which has the benefits of producing the same amount of electricity with lesser coal than sub-critical technology.

The proposed coal fired power plant will incorporate clean coal technologies in order to meet the guideline air emission limits set out in the World Bank Group's 2008 Environment, Health and Safety Guidelines for Thermal Power Plants. Such clean coal technologies include electrostatic precipitators (ESPs) for managing fly ash and Wet Flue Gas Desulfurization (FGD) for managing Sulphur oxide emissions.

The key components of the proposed coal fired power plant include:

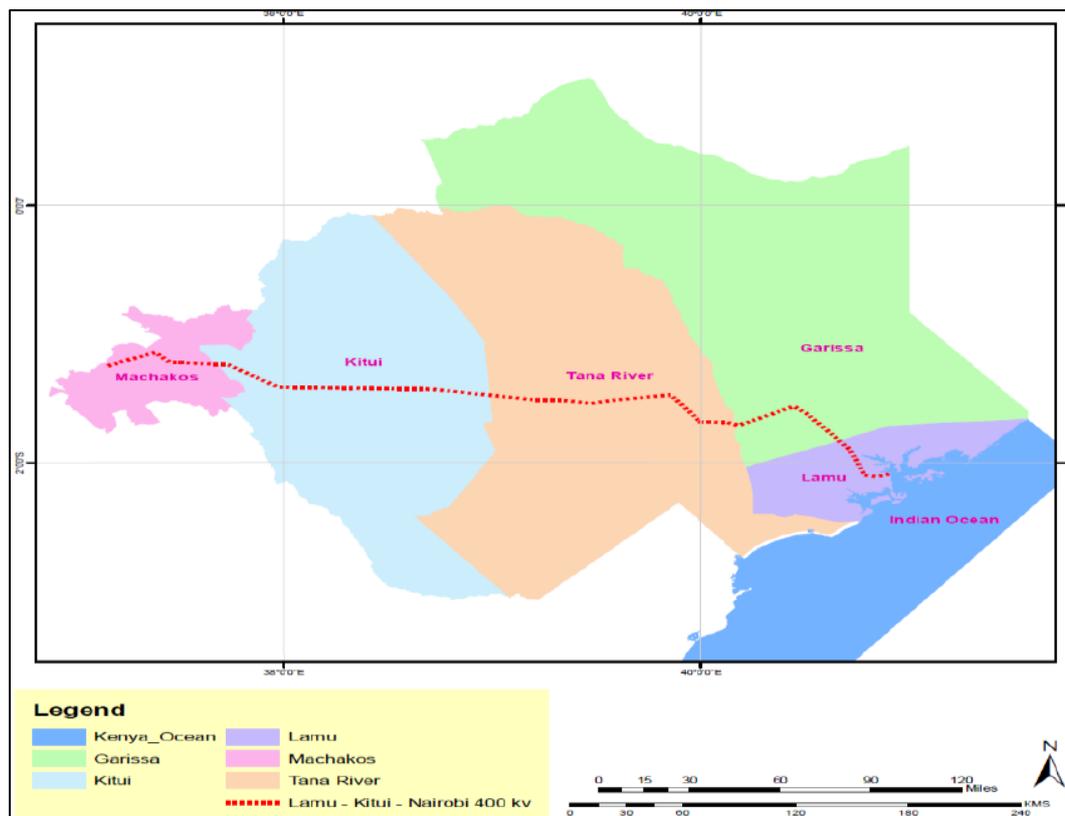
- 3×350MW high-pressure supercritical units with condensing steam turbines operating as base load capacity;
- Coal receiving berth at Kililana with coal off-loading and handling equipment;
- A coal conveyor system (~15km long) complete with transfer towers between the coal receiving berth at Kililana and the coal stock yard within the project site;
- Coal stock yard which will have 38 days' storage capacity, including 20 days of Security Stock;
- Ash yard designed to have a storage capacity of 15 years';
- Limestone receiving system and gypsum handling system;
- Once-through sea water cooling system;
- Flue gas air quality conditioning equipment including a 210m tall chimney. This includes a flue gas desulphurization system and electrostatic precipitators;
- Sea water desalination facilities to meet the demand for the power plant's process water, service/fire water as well as water for domestic use;
- Sub-station and switching facilities up to the 400 kV overhead line gantries for power evacuation into the KETRACO 400 kV system. The KETRACO 400 kV overhead transmission line is an associated facility to the proposed coal power plant and is being managed directly by KETRACO;
- Distributed control system (DCS) which will be used for monitoring and control of plant operation;
- Buildings, roads, and other structures for the Project;
- Auxiliary boiler and black-start diesel generator (DG); and
- A permanent workers' colony for the operational phase of the project having a capacity to accommodate 250 – 300 persons.

## 1.4 Associated facilities

The power generated by the 1,050MW Lamu coal fired power plant will be evacuated to Nairobi East via an overhead double circuit 400kV transmission line. This project is an associated facility to the coal power plant and will be developed by the Kenya Electricity Transmission Company (KETRACO).

The transmission line will be 520km long and will traverse the counties of Lamu, Garissa, Tana River, Kitui, Machakos and Nairobi. From Nairobi, the electricity will be distributed by Kenya Power across the country.

**Figure 1-2: Proposed route of the Lamu-Kitui-Nairobi East transmission line**



An independent ESIA Study for the above transmission line project has been undertaken by others for the transmission line project. A cumulative impact assessment have been addressed in Section 9 of this ESIA Study.

## 1.5 Alternatives considered

Alternative aspects of the development were considered which included location, technology and scheduling alternatives.

**Location alternatives:** The location of the proposed coal power plant is determined by the Government of Kenya. Under the Request for Proposal (RFP) for the coal fired power plant, it was stated that the site for building the project would be provided to the developer by the Ministry of Energy and Petroleum (MoEP).

The original LAPSET Study done in 2011 recommended a coal fired power plant to be situated in Shindakazi Island (part of Pate Island) which is at the entrance to the Manda Bay. However the MoEP decided against this location and instead identified a location in Kwasasi in the Hindi/Magogoni sub-county.

In the Kwasasi area, there were three alternative site configurations that were studied having sizes varying from 500 acres, 880 acres and 975.4 acres. While all three options were acceptable, the MoEP has provided APCL with a parcel of land 975.4 acres in size for the proposed power plant site.

Based on site visits, technical, environmental and operational reasons, Amu Power selected the current location (refer to Figure 1-1) which is about 975.4 acres in size.

**Technology alternatives:** There are three technologies that are available for coal fired power plants namely, sub-critical, super-critical and ultra-super-critical. The Request for Proposal for the coal fired power plant stated that the MoEP required the successful bidder to install technology that is extensively available and proven around the world. There is a large inventory of coal fired power plants around the world that use super-critical technology which is superior to sub-critical technology. There is a small inventory of ultra-super-critical power plants around the world.

From a technology perspective, Amu Power selected supercritical technology over sub-critical technology. This technology will enable the power plant to burn less quantities of coal to produce the same amount of electricity and also reduce the air emissions associated with such a power plant.

**Scheduling alternatives:** The proposed coal fired power plant is part of the MoEP's 5000+MW power generation program in 40 months commencing September 2013. Subsequently, the coal fired power plant is needed in order to supply the most cost effective base load electricity to existing consumers and reasonably foreseeable projects such as the Standard Gauge Railway (SGR), Konza City Technopolis, LAPSET projects in Lamu and the steel smelting and manufacturing sector. So far, geothermal energy which is required to contribute a significant amount of electricity has not materialized; neither has wind energy. The MoEP is therefore challenged to produce the ambitious 5000+MW from new generation capacity and consequently, the proposed coal fired power plant must start producing power by 2020.

**Coal sourcing alternatives:** The RFP for the project stated that the proposed coal fired power plant should be designed to burn both Kenyan and imported coal. Until the Kenyan coal resource is developed, the proposed coal fired power plant will utilize imported coal.

For imported coal, the price of this raw material will be determined between the Government of Kenya and the Government of the country where the coal is to be sourced from. A coal study undertaken for the project indicates that coal can be sourced from among other countries, South Africa, Mozambique, Indonesia and Australia. Coal for the power plant will be sourced from an imported country based on the specifications required in the RFP, quality and cost.

**Coal transportation alternatives:** The proposed coal fired power plant will utilize about 3,600,000 tons of coal per annum. It will have a 38 days storage capacity including a 20 day security stock. There are two alternatives to transport coal to the project site as outlined below.

Based on the selected site location (refer to Figure 1-1), imported coal can be received in large bulk ship carriers (e.g. Cape Max) which can anchor at the entrance of Manda Bay, off-load coal into smaller barges which then transport the coal to a coal receiving jetty near the project site. For this alternative, a new coal receiving jetty will need to be constructed near the power plant project site. In the second alternative, a large bulk ship carrier can dock at one of the three new berths under construction in Kililana and off-load coal onto a land based conveyor system connected to the project site.

If Kenyan coal is to be utilized, a rail line will need to be constructed by the Government of Kenya from Kitui to the project site, a distance of over 350km. This may or may not happen in the medium term (next 5 – 10 years).

## 1.6 Environmental and social impact assessment

Several potential impacts arising from the proposed development have been assessed by the specialists and KTL. The significance of potential impacts identified during the process was assessed according to an assessment criteria (extent, duration, magnitude and probability) to determine the significance of each environmental and social impact.

Using an established methodology (*See* Section 7 of this ESIA Report), impacts were assigned a significance rating on a scale from low to high and as positive and/or negative. Each potential impact was rated twice; prior to and after management measures had been implemented. Design and planning considerations informed impact management.

## 1.7 Key findings of the specialist studies

Specialist studies were undertaken on specific aspects of the environment, with the aim of ascertaining the potential project impacts and making recommendations for measures to avoid and/or mitigate/enhance these effects during the planning and design; preconstruction and construction; operation and closure phases. These recommendations informed the environmental assessment. As the proposed project is a coal power plant, most environmental impacts are envisaged to occur during the construction and operational phases respectively. No absolute no go areas were identified from the specialist studies undertaken, although areas of sensitivity were identified.

### 1.7.1 Thermal effluent

The proposed coal fired power plant will use a once-through cooling water system to cool and condense the steam for return to the boiler. According to the World Bank Group's EHS Guidelines for Thermal Power Plants 2008, the thermal discharge water temperature should not exceed ambient water quality standards by 3°C at the edge of a scientifically established mixing zone.

Given that Manda Bay has mangrove trees, sea grass beds and coral beds, the location of the Circulating Water discharge was identified in order to reduce/minimize adverse environmental impacts associated with thermal effluent discharged from the coal fired power plant.

Subsequently, a thermal plume modeling study (Appendix 01) was undertaken for the project to determine the optimal location of the circulating water (CW) discharge point that complies with the World Bank Group's guideline mentioned above.

The EPC contractor had proposed a preliminary location for the CW discharge point which was modeled using a US Environmental Protection Agency (EPA) approved methodology known as CORMIX for the near-field mixing zone; based on the modeling study, this location did not meet the above criteria. Subsequently, screening was carried out in slightly deeper water near the original CW discharge point to determine a "near-field" mixing zone that meets the World Bank Group criteria.

Based on the results of the new screening, it was established that the 3<sup>0</sup>C criteria can be met at an average seawater depth of ~5m using a discharge pipe about 600m long from the shore and having uni-directional perpendicular diffusers. For this location, advanced hydrodynamic modeling was carried out using the PLUME 3D modeling system to characterize the far-field behavior of the effluent plume. Based on the results of this study, it was established that the far-field thermal effluent criteria of the World Bank Group 2008 Environment Health and Safety Guidelines is met using the selected circulating water discharge location.

### **1.7.2 Air quality**

The proposed coal fired power plant is expected to provide base load capacity with an availability of between 80% and 100% of the time.

Without adequate mitigation measures, the construction, commissioning and operation of the proposed coal power plant may have potential negative impacts on the ambient air quality in the fall-out areas. It must be noted that the prevailing wind directions within the general project area are from the south and easterly regions. Wind directions from the other sectors occur relatively infrequently.

During the construction phase, air quality impacts are anticipated to arise from the following activities:

- General dust and more specifically, the PM10 fraction within it from earth working and on- site vehicle movement activities;
- Exhaust emissions associated with vehicles transporting materials and personnel to and from the site, i.e. off-site emissions; and,
- Exhaust emissions associated with construction activities on-site (e.g. equipment, heavy machinery and vehicle idling).

Based on an air quality risk assessment done in accordance with the United Kingdom Institute of Air Quality Management, "Guidance on the Assessment of Dust from Demolition and Construction," IAQM, London, 2014, it was established that the significance of air quality impacts arising from the above activities is low prior to mitigation measures.

During the operational phase, an air dispersion modeling study was undertaken to determine the ground level concentration of priority pollutants namely sulfur oxides, nitrous oxides, particulate matter and selected metals such as mercury, arsenic, nickel, lead and cadmium. The air dispersion modeling study was conducted using the US EPA approved AERMOD and CALPUFF air quality models for a 50 x 50 km area and the results compared with Kenyan Air Quality Regulations (Legal Notice 34 titled Environment Management and Coordination (Air Quality) Regulations 2014) and the 2008 World Bank Group (WBG) and International Finance Corporation (IFC) EHS Guidelines for Thermal Power Plants (see Appendix-02).

It was discussed and agreed that the air dispersion modeling study be undertaken for the following main operational phase scenarios:

1. Normal Operations of the Lamu Power Station including the three main boilers operating at 100% load;
2. Fugitive dust from coal and ash handling and storage activities including dust mitigation controls (including emissions from three main boilers);
3. Total suspended particulates (TSP) fallout for selected metals as a result of fugitive dust from ash operations; and
4. Black Start of Power Station.

The results of the air dispersion modeling study concluded that none of the priority pollutants modeled would exceed the stipulated Kenyan air quality discharge limits or the World Bank Group 2008 emission limits. Additionally, it was confirmed through the modeling study that the fallout areas would be to the north of the project site where there are no sensitive receptors. Impacts on human health are expected to be low at all locations; the stack design height of 210m should be implemented to further reduce the risk of air quality impacts.

### 1.7.3 Noise quality

A noise quality impact assessment (Appendix 03) was undertaken for the construction and operational phases of the project. Construction phase noise assessment was undertaken in accordance with British Standards Institute (BSI), 2008, 'BS5228 – Noise and Vibration Control on Construction and Open Sites'. This standard provides a noise calculation method, practical information on noise reduction measures, and promotes 'Best Practice Means' approach to control noise emissions during construction.

For the operational phase, noise modeling was undertaken using SoundPLAN Version 7.3 software and the results compared with the environmental noise limits recommended in the World Bank Group's General EHS Guidelines.

Due to the temporary and transient nature of construction noise, a Project threshold value has been set at 10 dB(A) higher than the World Bank Group's General EHS Guidelines limit (i.e. 55 dB(A) + 10 dB(A) = 65 dB(A)). This margin has been applied on the basis of typical assessment criteria outlined in BS5228. The criteria indicates that a 10 dB(A) exceedance of statutory background noise limits as being the point at which the project is liable for costs of temporary relocation of inhabitants affected by the construction noise. Based on the results for the construction phase noise assessment, it is expected that the construction noise threshold of 65 dB(A) will be met within a radius of approximately 50m - 75m from the edge of the construction site.

Based on the model results for the operational phase of the project, the boundary noise levels are not envisaged to exceed the World Bank Group's General EHS Guidelines daytime and night-time noise limit. With the added mitigation created by trees, grasses and various other naturally occurring screening measures, it is expected that boundary noise levels will be lower than those predicted in this assessment.

### 1.7.4 Climate change and Greenhouse Gas impacts

A climate change and greenhouse gas impact assessment was undertaken for the project. According to the climate change specialist report, the envisaged risks of climate change on utility scale thermal power plants include high temperature (air or oceans), flooding, drought and sea level rise. These potential impacts were identified and addressed in the specialist study.

On Greenhouse Gas emissions (GHGs), the Scope 1 (*direct emissions* from sources owned or under the operational control of the company) GHGs that could potentially be generated by the proposed coal power plant are estimated to be ~9.0 million tonnes CO<sub>2</sub>e per year when the plant is fully operational. Without mitigation, the proposed project will increase greenhouse gas emissions in Kenya by approximately 6% to 10% on 2010 figure of 73MtCO<sub>2</sub>e (it must be noted that it is from a low base). However, these percentages could reduce with other projects around the country being operationalized.

### 1.7.5 Biodiversity impacts

Most of the biodiversity related impacts associated with the proposed coal power plant would potentially occur during the construction phase of the project. The success of the mitigation measures described in this ESIA Study will be determined by preventing impacts from spreading outside the footprint areas. It is imperative for the EPC contractor to develop and implement an alien invasive species (AIS) prevention plan for the construction phase of the project.

Other potential impacts to biodiversity resulting from the project include dust, effluent, contamination, hydrocarbon spills, and to a minor extent, human-animal conflict situations. These potential impacts will represent the ultimate challenge of implementing the environmental and social management plan (ESMP) as these aspects will cause the spread and exacerbation of impacts into the natural environment caused by the proposed project.

The expected loss of natural resources from the project footprint area and its immediate environs will result in low and localized impacts on the natural environment. The overall impact to pans/wetlands in the vicinity of the project area would be low as mitigation measures can be adopted to avoid impacts to such important biodiversity areas. Additionally, any animals that use the area around the project site for ranging could potentially be affected by fencing the project site, but the mobility of most species renders the probability of this impact to be unlikely.

### 1.7.6 Impacts on soils

The soils within the project site are predominantly covered by fine sandy soils, black cotton soil which is underlain by highly weathered coral limestone, clay, silt and shales. From an agricultural perspective, the crops grown here are *sim sim* seeds and maize; *sim sim* is grown as a cash crop while maize is grown for subsistence. The construction and operation of the proposed coal fired power plant will have low adverse impacts on agricultural resources and productivity as most farming is done on a small scale over relatively small acreages.

Erosion of soils during the construction phase could have negative impacts on surface water quality unless appropriate mitigation measures are implemented. Impacts from soil erosion are considered to be of low significance after implementation of the recommended mitigation measures.

### 1.7.7 Surface and groundwater impacts

The project site has a generally flat topography ranging from about 0.1% - 0.2%. Being a flat area, the project area has a high potential for flooding and water logging especially in times of intense storms; intense and heavy storms of over 200mm in a day are common in Lamu County during the wet season.

Impacts on water quality relate to sedimentation and contamination during the construction and operational phases of the project respectively. During the construction phase, contamination of surface water from the spillage/leakage of fuels from vehicles and fuel/chemical/waste storage areas could potentially occur. During the operational phase, contamination of the sub-surface could potentially occur from the ash yard, vehicle parking areas, improper sewage treatment and disposal, etc. without adequate designs. Impacts on water resources are expected to be medium to low significance. The Kwasasi area is a water scarce area with a sparse population. A desalination plant will be constructed for utilities and processes and the workers' temporary and permanent colony.

The brine from the desalination plant will be injected into the once through circulating water discharge pipe and ejected into the Manda Bay.

### **1.7.8 Waste management**

Impacts associated with waste will generally emanate from effluent and management and burning of coal. Burning of coal produces coal combustion products (CCPs) which include fly ash, bottom ash and gypsum. There will be additional but minor amounts of process wastes which will be generated by the project during the construction and operational phases of the project.

In some countries that use coal fired power plants for power generation, CCPs are a by-product providing beneficial uses. For example, fly ash and bottom ash can be used in road building or concrete block manufacturing while gypsum is used in the cement manufacturing industry or manufacture of wall boards.

In the case of the proposed Lamu coal fired power plant, industries currently don't exist for the utilization of CCPs and consequently, these will be disposed as waste in the ash yard. Additionally, there are currently no sewage treatment facilities available in Hindi/Magogoni Sub-county or Lamu County as a whole so human activities will generate sewage as a waste.

Without adequate mitigation measures, potential impacts on surface and groundwater are anticipated to be contamination of the surface, sub-surface and groundwater. The coal stockyard and ash yard should be designed based on actual project site conditions (soil lithology and geology) and incorporate impermeable layers of protection such as compacted in-situ clay, impermeable membranes (e.g. geotextile membrane) leachate collection and treatment before receipt of ash from the process areas. Additionally, an on-going surface and groundwater monitoring program should be implemented for the operational phase of the project. A network of groundwater monitoring wells should be provided along the boundary of the project site based on the groundwater flow direction to monitor the quality of groundwater.

All sewage from human related activities should be treated in an adequately sized sewage treatment plant during the construction and operational phases of the project. An integrated water and waste management plan should be implemented for the project during the construction and operational phases of the project.

### **1.7.9 Visual impacts**

Landscape and visual impacts close to the power plant site are expected to be medium significance to high significance within a 5km radius from the center of the project site. As the Kwasasi area is dark at night, an issue of potential concern relates to lighting of the power plant and the impact this will have on the rural nature of the area. The vegetation cover of the region is an important element of the construction and operation of the power plant and should be revered as a critical component in the mitigation and potential negation of the visual impacts. Towards this end, the developer should plant indigenous trees that grow tall around the perimeter of the plot to reduce the visual intrusion created by tall structures such as the boiler units and to a certain extent the 210m stack.

### 1.7.10 Cultural heritage impacts

The archaeological and cultural heritage impacts arising from the construction and operation of the proposed coal fired power plant are expected to be of low to medium significance without mitigation. Based on the field survey, it was established that the proposed coal power plant site does not have ritual sites, shrines, sacred graves, sacred stones or sacred trees, however based on archaeological artefacts collected near the project area, there may be archaeological finds below the surface. Mitigation measures for archeology will include a "Chance Finds Procedure" in which an archeologist from the National Museums of Kenya should be engaged to implement the Chance Finds Procedure especially during the construction phase of the project.

The project site is located about 26km by road and north of Lamu town where the old stone town area of 16 hectares was inscribed as a UNESCO World Heritage Site in 2001. It is further recognized that a Heritage Impact Assessment was undertaken for the first three berths currently under construction in the Kililana area of Manda Bay to evaluate the potential impacts of that project on the cultural heritage within Lamu County.

Most of the people that live on Lamu Island cross over to the mainland for their daily work and business related purposes and return back to their abodes in the evenings. Economic activities such as farming, livestock rearing, bee keeping and other economic activities are prevalent on the mainland in towns such as Hindi, Mpeketoni and Mokowe. The County Government offices are also in the process of moving out of Lamu Island and onto the mainland where connectivity to services will become better over time.

The proposed coal power plant will create a demand for housing and other amenities surrounding the project site and it is expected that there will be an influx of migrants from other parts of Lamu County and the country at large. It is expected that towns such as Hindi, Mpeketoni and Mokowe will benefit from such peripheral business and social related activities. Such developments are not expected to influence the change in cultural heritage of Lamu Island as cultural practices will continue in Lamu town.

There could be potential impacts on the hunter-gatherer communities that generally live in the Baragoni area north of the proposed project site. These communities still practice their traditional ways of life including bee keeping. The potential impacts to such communities without mitigation measures may include, (a) displacement of the community from their existing settlement areas for infrastructure development, and (b) reduction and abandonment of cultural heritage practices such as bee keeping and hunting/gathering resulting from getting jobs at the coal fired power plant project.

### 1.7.11 Socio-economic impacts

The proposed 1,050MW coal fired power plant is expected to have positive and adverse socio-economic impacts during the construction and operational phases of the project. During the construction and operational phase, positive effects are envisaged to include additional cost effective electricity supply to the country, employment creation in Lamu County, economic development of the County (currently there is not a single factory in Lamu County), increased household income, increased taxes to the County and Central governments and CSR activities and projects by the developer.

There may be some adverse impacts which are challenging to quantify and mitigate. These are associated with visual impacts and sense of place, land acquisition and involuntary resettlement, disruption and loss of livelihoods, in-migration of people, public health, occupational safety and health, increased traffic and related accidents, and potential security related incidents. It is important to recognize that these adverse impacts may be felt in and around the project area and Lamu County, while the positive impacts will accrue to the economies within the project area and its environs, Lamu County and nationally.

While the negative impacts cannot be eliminated, the trade-offs between negative and positive impacts suggests that from a socio-economic perspective, the project will have more positive than adverse impacts. It is imperative that the construction and operation of the power plant is conducted in the most sustainable manner with the primary objective of eliminating and if not possible, minimizing the potential for deterioration of livelihoods and culture.

### 1.7.12 In-migration of workers

The proposed coal fired power plant will require about 3,500 workers during the peak construction period; of this number, about 60% of the jobs will be taken up by Kenyans while approximately 40% will be taken up by foreigners mainly from China. Construction of the power plant is expected to take about 42 months (three and a half years) to commission with the first turbine commissioned 36 months from the Notice-To-Proceed (NTP) date, the second turbine 39 months from the NTP and the third turbine 42 months from the NTP. During the operational phase, the power plant will require about 500 full-time workers over the lifetime of the Power Purchase Agreement (25 years). Of this number, about 50% will be Kenyans while the other 50% will be foreigners mainly from China.

The influx of foreign workers could potentially have adverse impacts on the:

- **Environment** (e.g. exploitation and loss of biodiversity, land-use change, land degradation, depletion of natural resources such as fuelwood, water, aquatic resources, etc., and erosion and loss of soil productivity);
- **Public infrastructure, services and utilities** (e.g. increased use of existing roads and transportation systems, increased pressure on education and health services, increased pressure on waste management systems; increased demand for electricity, water supplies, and sanitation; unplanned and uncontrolled development of squatter settlements; increased demand on communications networks; increased demand for housing; increased use of/demand for community, religious, and recreational facilities);
- **Local and regional economy and livelihood strategies** (e.g. increased poverty, increased cost of living; competition for economic resources and employment, e.g., loss of productive land to urban settlement; reduced availability and increased cost of land, food, fuel and housing; reduced reliance on local subsistence production systems; increased dependence on broader cash-based economy to meet needs; increased economic vulnerability for marginal groups such as women, elderly, minorities, etc.; and "Boom /Bust" cycles associated with initial construction, eventual closure);
- **Public health** (e.g. increased incidence of accidents and fatalities associated with project traffic; increased pollution of air, water, dust, noise, traffic; proliferation of communicable diseases including sexually transmitted infections, respiratory infections, waterborne diseases; insufficient number of health centers, staff and medical supplies; inadequate public hygiene facilities; and changes in nutrition status; the social and cultural environment (e.g. impacts on traditional beliefs, damage to cultural heritage); loss of knowledge, skills, and experience related to traditional livelihood activities; upheaval in traditional leadership, behavior, customs, values, and norms; changes in

power relationships, including undermining and changing of leadership and traditional authority structures; welfare imbalances and differential wage incomes, wealth accumulation and opportunities; dilution of social cohesion and cultural disruption (separation of households and communities); changing relationships between groups (gender, age, socioeconomic status, ethnicity); possible marginalization of women, ethnic minorities, and other vulnerable groups; loss of local identity; creation of land markets leading to changes in traditional land tenure systems; increased tension, disputes, and conflicts between locals and migrants concerning natural resources, employment opportunities, and other project benefits; increased incidence of social ills, including alcoholism, drug abuse, prostitution, gambling; increase in domestic violence; increase in criminality; decrease in law and order; and increased ethnic tension and violence.

### **1.7.13 Land acquisition and involuntary resettlement**

As stated previously, the Ministry of Energy and Petroleum (MoEP) is responsible for providing the land needed to develop the proposed 1,050MW coal fired power plant. The land tenure of the project site is defined as Community Land which constitutionally, is held in trust by the County Government of Lamu on behalf of the people of that County. At the time of undertaking the Social Impact Assessment (SIA) baseline studies for the proposed project, there were minimal people living within the project site. However, by mid-July 2015, the MoEP established that there were Project Affected Persons (PAPs) who were either residing or utilizing land earmarked for the proposed coal fired power plant for livelihood purposes. Subsequently, in August 2015, the MoEP initiated a Resettlement Action Plan (RAP) and engaged a RAP Consultant to carry out this study.

When the RAP was initiated, a multi-agency "RAP Steering Committee" and a "RAP Technical Committee" made up of various National and County Government institutions and, APCL was formed to steward the resettlement process for the project. The RAP Steering Committee was to provide the strategic direction and leadership while the RAP Technical Committee provided the technical details of developing and implementing the RAP.

The RAP Consultant was provided with a written Terms of Reference (TOR) by the MoEP which was aligned with the requirements of the African Development Bank's Operational Safeguard 2 on Involuntary Resettlement and the International Finance Corporation's Performance Standard 5 on Land Acquisition and Involuntary Resettlement.

At the time of submission of this ESIA Study, the RAP for the project was still on-going. The RAP Study will be released after it is finalized and approved by the County Government and Assembly of Lamu for subsequent implementation. There has been community involvement at the grassroots level through Community Committee(s) and independently formed by the PAPs; it is understood that the RAP process has been an inclusive one.

The potential adverse impacts associated with an improperly undertaken and executed RAP include loss of property and access to common land, community disintegration and, loss of income sources and livelihood. For example, during the public/stakeholder meetings undertaken as part of the ESIA Study, it was common to hear affected persons stating that they had stopped planting food and cash crops awaiting compensation.

The lack of a properly executed RAP Study can potentially lead to disenfranchisement of the PAPs which could potentially lead to negative sentiments against the proposed project. Further, it would become potentially challenging for APCL to acquire a social license to operate as a result of the community's perceived disenfranchisement.

### 1.7.14 Occupational safety and health

Most coal fired power plants face a number of Safety and Health (S&H) during the construction phase of the project. The potential hazards for workers in construction include, fall (from height), trenches collapse, scaffold collapse, electric shock and arc flash/arc blast, failure to use proper personal protective equipment and repetitive motion injuries, working in confined spaces, electric shocks, being struck by falling or moving objects, vehicle related accidents, accidents associated with lifting equipment, etc.

During the peak construction period, the proposed coal fired power plant will have approximately 2,978 workers on site. Without adequate controls, there will be potential adverse impacts on workers arising from inconsistent management of occupational safety and health. Some conventional construction hazards include:

- Falls which includes, people falling or things falling on people;
- Electrical contact with energized sources of plant and equipment or cables;
- Working on or near live equipment – workers who are asked to work on or near energized equipment (regardless of the energy source) must comply with plant requirements to be applied in all work situations where systems are to be de-energized and locked out by devices such as switches or valves; and
- Rigging and hoisting hazards.

There may also be industrial hygiene hazards that workers could potentially be exposed to such as chemical handling without the use of proper personal protective equipment or studying the Safety Data Sheet (SDS) for the chemical on safe handling.

The above hazards and risks associated with the construction phase may arise from the lack of a comprehensive written S&H Plan drawn up by the EPC Contractor for the construction phase of the project.

Additionally, the S&H regulator – DOSHS, lacks sufficient resources to regulate workplaces in Lamu County and there is currently no DOSHS office in Lamu. This is a significant S&H related weakness for the proposed coal fired power plant and could potentially lead to the lack of compliance with S&H related laws and regulations by the EPC Contractor during the construction phase which in turn could lead to accidents and incidents that do not get reported.

## 1.8 Mitigation measures

Potential environmental and social impacts associated with the proposed project should to the extent possible, be avoided. Examples of avoidance measures include (i) site selection to identify and, where feasible, avoid potentially sensitive resources and locations (ii) design of a power plant to international standards, (iii) incorporation of clean coal technologies in the design, (iv) use of low sulfur coal, (v) early identification of potential environmental and social impacts, (vi) consideration of environmental effects in the analysis of project alternatives such as supercritical vs subcritical alternatives, (vii) incorporation of drainage, erosion, and sedimentation control measures to protect water resources, (viii) incorporation of sanitation, housing, vector-control, food and water supply, and workplace safety guidelines for the project, and (ix) Development and implementation of a consultation and participation process with stakeholders and the community that allow for the identification of issues significant to the affected population. With respect to site selection, the proposed coal fired power plant site has been provided to APCL by the

Ministry of Energy and Petroleum and therefore the location for the coal power plant is confirmed.

The proposed project will to the extent practical, endeavor to avoid environmental and social impacts associated with its construction and operation. For those potential impacts which cannot be avoided, the mitigation measures outlined below are proposed for the sustainable construction and operation of the coal power plant.

### **1.8.1 Location of the project**

The location of the proposed coal fired power plant project is determined by the Ministry of Energy and Petroleum (MoEP). The MoEP identified an area within Kwasasi where the coal power plant should be located. APCL then undertook a geotechnical study to determine the sub-surface soil qualities for siting the power plant in order to confirm that the MoEP area was suitable geotechnically for the project. This was followed by various iterations of the site plan from a 500 acre rectangular site (2km x 1km) to an 870 acre inverted "L" site to an extended inverted "L" site measuring 975.4 acres.

### **1.8.2 Design of the project**

The proposed Lamu coal fired power plant is designed to international standards. Specifically, the power plant will be designed to appropriate Chinese, Kenyan, American and British/European standards for thermal power plants. These standards are enumerated in the ESIA Study.

### **1.8.3 Thermal effluent**

The coal fired power plant will utilize once-through-cooling water in the condenser to cool the steam from the boiler units and return it to the liquid phase; at the circulating water discharge point, the water temperature is envisaged to be about 9°C higher than the ambient water. The World Bank Group's 2008 General EHS Guidelines states that the temperature of wastewater prior to discharge should not exceed 3°C of ambient temperature at the edge of a scientifically established mixing zone which takes into account ambient water quality, receiving water use and assimilative capacity among other considerations.

A thermal plume modeling study has been undertaken to determine the optimal location of the circulating water discharge outlet. This study was undertaken using the US EPA approved method known as CORMIX and PLUME 3D to determine the "near-field" and "far-field" characteristics respectively of the thermal effluent emanating from the once through cooling water system.

As part of the thermal plume modeling study, several diffuser designs were evaluated and an optimal design chosen. Based on the results of the study, it was established that the  $\Delta T = 3^{\circ}\text{C}$  can be achieved within 100m (referred to as the "far-field") of the discharge point. Subsequently, this study can confirm that based on the thermal plume modeling study, the following design of the circulating water discharge pipe and diffuser will be used for the project:

- 600m long steel pipe having a diameter of ~2.6m buried in the sea bed;

- The last 50m of the pipe will be a diffuser which will have 20 ports each having a diameter of 0.58m; and
- The height of each port will be 1m with the first 0.5m being vertical and the next 0.5m welded at an angle of 45°.

#### **1.8.4 Air quality**

Air emissions from the project were identified as a key issue by regulatory agencies, the public, and stakeholders. The primary air emissions from the coal fired power plant during the construction and operational phases include oxides of sulfur (SO<sub>x</sub>), oxides of nitrogen (NO<sub>x</sub>) and particulate matter (PM<sub>10</sub>).

The assessment of air contaminant emissions predicted that it was extremely unlikely for any of the priority pollutants to exceed the air emission limit guideline values recommended by the World Bank Group's 2008 EHS Guidelines for Thermal Power Plants. Additionally, the design of a 210m tall stack will further assist in reducing air quality impacts arising from the proposed power plant.

Consequently, from the outset, initiatives and technologies to mitigate these emissions have been incorporated into the project by the Design Team, including but not limited to: the use of dust suppressants, low NO<sub>x</sub> burners to manage the NO<sub>x</sub> emissions, Electrostatic Precipitators (ESPs) for managing the PM<sub>10</sub> emissions, Wet Flue Gas Desulfurization (FGD) for managing SO<sub>x</sub> emissions and, continuous emission monitoring system (CEMS).

#### **1.8.5 Noise quality**

During construction, unwanted sound or noise may be emitted during activities associated with site preparation, physical construction and equipment installation, and road transportation. Engines used to power the heavy equipment (e.g., cranes, lifts, front end loaders, dump trucks) are sources of substantive noise emissions during the site preparation activities. Diesel generators and welding sets may generate noise during the construction of process units and buildings at the site.

During the operational phase, substantive emissions of noise may be generated through operation and maintenance of coal fired power plant equipment and during road transportation. Large process units such as the boilers, conveyor system, pumps, fans, and vehicle traffic may contribute to noise emissions from the Project.

The mitigation measures for noise prevention and control include the following:

- a) Mufflers be fitted on all engines and vehicles,
- b) Where possible, noisy construction activities be restricted to the daytime period to reduce noise environmental effects,
- c) Blasting and pile driving where required for the project infrastructure foundations, will only be conducted during the day time, Monday to Saturday, and not on statutory holidays,
- d) Stockpiles of overburden may be used between the construction activities on-site and off-site receptors, where the opportunity exists to provide shielding,
- e) If practical, fabricate process modules away from the project site, greatly reducing the machining, welding, and steam fitting tasks on-site that could generate noise,

- f) The provision of buses during construction for construction workers, where desired, to minimize construction-related vehicle traffic to and from the site on a daily basis,
- g) Use of mufflers on noisy process equipment, and enclosure of pump rooms, engine rooms, and compressors.

Based on the noise modeling study and mitigation measures, it was considered very unlikely for a project-related environmental noise emission to cause a guideline or standard to be exceeded, mainly because the distances between sources and noise sensitive receptors are relatively large. Project-related sound emissions during construction and operation were rated not significant in consideration of existing background levels, planned mitigation, and other future development in the area.

### **1.8.6 Coal stock yard and ash yard design**

The coal stock yard and ash yard will be designed to Chinese Standard GB 18599-2001: Standards for pollution control on the storage and disposal site for general industrial solid wastes. GB 18599-2001 states that if the coefficient of permeability is greater than  $1.0 \times 10^{-7}$  cm/s, there should be natural or artificial material to build an impermeable layer the thickness of which should produce an anti-seepage capacity which is equal to that of the clay layer of  $1.0 \times 10^{-7}$  cm/s permeability coefficient and of 1.5m thickness.

The stability of the coal stock yard and ash yard must be incorporated into the design of these two infrastructure components in order to reduce to As Low As Reasonably Practical (ALARP) the potential for dike/berm failure which could lead to a massive coal or ash spill into the Manda Bay.

### **1.8.7 Climate change and greenhouse gases**

Mitigation measures for climate change related impacts include (i) adaptation measures such as rollout of a community health program to reduce vector borne diseases, (ii) improving dust suppression mechanisms during high winds, (iii) rollout of community based program considering food security to take care of the vagaries of agriculture, (iv) implementing adequately designed flood control measures for the coal stock yard, ash yard, etc.

Mitigation measures for greenhouse gas emissions include (i) efficient sewage treatment plant with the organic rich waste filtered through man-made mangroves to clean the water naturally and to sequester carbon deep within the mangrove root systems (this has been applied successfully on a 300ha farm in Shenzhen, China), (ii) reducing fuel consumption by using energy efficient vehicles, (iii) designing the offices and workers colonies using appropriate "green buildings" methods, and (iv) progressive rehabilitation of unused land on site as well as a 'biodiversity offset' elsewhere in the region which will could act as a carbon sink.

### **1.8.8 Biodiversity**

A Critical Habitat Assessment (CHA) was undertaken as part of the Ecological Impact Assessment (EcIA) to determine areas of high biodiversity value within the project site and its environs. Based on an evaluation of the CHA within and around the project site coupled with the project related activities, the potential environmental effects on terrestrial and marine populations of species at risk that are present will be mitigated with standard construction practices and scheduling of project components (e.g. clearing only those areas of the project footprint that are required for construction purposes). Additionally, an alien invasive species (AIS) management plan will be implemented by the EPC Contractor during the construction phase.

Mitigation measures for the seawater cooling intake will include barriers and fish screens to minimize impingement and entrainment of fish. Mangroves that will be cut to pave way for the coal off-loading jetty and will be offset and planted at a location to be shown by the mangrove cutters association.

### **1.8.9 Soils**

Mitigation measures for potential soil erosion resulting from excavation and carting away of soils include silt control measures such as silt traps, silt fences, etc. Stockpiles of excavated materials should be stored in areas away from the Manda Bay or watercourse area to the north of the project site.

### **1.8.10 Surface and groundwater**

Mitigation measures for prevention of sedimentation are similar to those for prevention of soil erosion. The Water Balance diagram shows that there will be minimal discharge of treated wastewater and effluent into the environment and aquatic environment as all treated wastewater will be used for dust suppression purposes. During the construction phase, the EPC Contractor will construct an effluent treatment plant for managing liquid wastes. For oily wastes, the EPC Contractor will construct an adequately sized Oil Water Separator (OWS).

In order to prevent groundwater contamination from the ash yard, it should be designed to incorporate a 1.5m thick in-situ compacted clay layer over which an impermeable liner should be laid and a 0.15m thick sand bed provided. The ash yard will contain several groundwater monitoring wells for sampling and analysis of groundwater internally as well as external NEMA accredited laboratories. The leachate will be treated in the industrial wastewater treatment plant to be installed for the project.

### **1.8.11 Waste management**

Mitigation measures for management of wastes for the proposed coal power plant will include development of a waste management plan that will include issues such as waste minimization, generation, transport, disposal, and monitoring.

An inventory of all estimated waste quantities to be generated during the construction and operational phases of the proposed project has been generated by the EPC Contractor and the O&M Company. During the construction phase, the EPC Contractor will endeavor to prevent the generation of wastes or reduction of the wastes generated through careful planning. Where prevention is not possible, the EPC Contractor will endeavor to recycle and reuse any by-products of the construction activities. If waste materials are still generated after the implementation of feasible waste prevention, reduction, reuse, recovery and recycling measures, the EPC Contractor will treat the waste generated prior to transport through a NEMA licensed transport company for final disposal. The EPC Contractor will take all measures to avoid potential impacts to human health and the environment.

Any hazardous wastes generated during the construction and operational phases will be properly stored to prevent and control accidental releases in bunded areas that have impermeable surfaces. Employees will be given specific training on the safe handling of hazardous wastes. On-site and Off-site transportation of waste will be conducted so as to prevent or minimize spills, releases, and exposures to employees and the public. As for non-hazardous wastes, transportation of hazardous wastes will be done by a NEMA licensed transporter.

### **1.8.12 Landscape and visual**

The mitigation measures proposed in the Landscape and Visual Impact Assessment specialists study are associated the construction phase. They include (i) reducing unnecessary disturbance of land needed for clearing, grubbing, excavation of the project area, borrow pits, access roads, etc. (ii) selection of colors for the infrastructure that blend in with the surrounding landscape; this will have the greatest impact on the visual success or failure of the project, (iii) restoring contrasts from earthworks by fitting the proposed project infrastructure to the existing landforms in a manner that minimizes the size of cuts and fills, (iv) restoring and rehabilitating to as near original as possible all disturbed areas of construction, and (v) incorporating effective light management into the design of the lighting to ensure that the visual influence is limited to the power station, without jeopardizing operational safety and security.

### **1.8.13 Cultural heritage**

There were no surface archaeological artefacts found within the project site, subsequently, it is recommended that a watching brief be implemented over all excavated areas within the project footprint area during the construction phase. The watching brief should include an archaeologist from the National Museums of Kenya (NMK) to be present during at all times during excavation works. Additionally, the NMK "Chance Finds Procedure" should be implemented for the project.

From a cultural heritage perspective, some of the mitigation measures include (i) consideration given to Swahili architecture in the design and/or construction of the permanent workers' colony in order to maintain the cultural landscape, (ii) providing financial support to Swahili institutions within Lamu County that are involved with cultural preservation, (iii) provision of prayer room within the workers colony or the building of a mosque near the project footprint area for the Muslim workers, (iv) promoting and supporting annual cultural festivals such as the *Maulidi*, (v) induction of project related workers and visitors on the culture and traditions of the Lamu people, (vi) promoting local foods serving Swahili dishes within the project site, (vii) promotion of local dress code in the project area that is aligned with Swahili values, and (viii) implementing a peer educator program for HIV/AIDS for workers within the project area.

#### **1.8.14 In-migration of workers**

In order to manage in-migration of the large workforce, APCL will employ a number of strategies as discussed herein. The project site will be fenced with security provided on a 24/7 basis; the construction phase project camp site will be located within the fenced area and there will be only one access into and out of the project site. This physical barrier will create a buffer zone to manage incoming and outgoing goods, services and persons during the construction phase of the project.

APCL will work with the Lamu County Government and LAPSET Corridor Development Authority (LCDA) to support the development of spatial planning and resource allocation for land use in the vicinity of the project site to avoid spontaneous and unplanned growth in housing.

APCL will develop and implement a workforce recruitment policy which will include workforce targets, prioritization, the location and use of local recruitment centers in the 10 wards of Lamu County, hiring policy and practice for day/casual laborers, medium-to-long-term localization plans and, worker mobilization and demobilization strategies. During the construction phase, the EPC Contractor will provide worker accommodation to those migrant workers who do not have an abode. The EPC Contractor's camp should be designed in accordance with the requirements contained in the IFC/EBRD (2009) publication titled *Workers' Accommodation: Processes and Standards*.

For supply of all locally sourced input materials, APCL will define the route, driver codes-of-conduct, established trucking stops and tracking systems to monitor trucks. Other mitigation measures will be developed as the project definition with respect to the staff strength become more clear.

#### **1.8.15 Socio-economic**

Mitigation measures for the potential adverse socio-economic impacts include (i) development and implementation of a Resettlement Action Plan (RAP) that is compliant with the requirements of the African Development Bank Operational Safeguard 2 and International Finance Corporation Performance Standard 5 on Land Acquisition and Involuntary Resettlement, (ii) provision of job opportunities to the people of Lamu County during the construction and operational phase (there will be about 1791 direct job opportunities during the construction phase), (iii) EPC contractor to procure as much of the construction materials for the project from Lamu County and, (iv) development and

implementation of project specific a health and safety (H&S) plan based on potential H&S risks envisaged for the project.

### **1.8.16 Occupational safety and health**

In order to manage the potential Occupational Safety and Health (OSH) aspects and impacts during the construction phase, the EPC Contractor will develop and implement a comprehensive Safety and Health (S&H) Management Plan (MP). The S&H MP will be designed in accordance with the requirements of OHSAS 18001 and shall be a precondition prior to the commencement of any construction works on site.

The EPC Contractor shall be required to regularly update their documented S&H MS based on a thorough and comprehensive S&H risk management framework that must be deployed throughout the construction phase. As required under Section 6(3) of Kenya's Occupational Safety and Health Act, 2007 (OSHA), the EPC Contractor shall carry out a formal and appropriate S&H risk assessment of the construction phase of the project and submit a report to the nearest Directorate of Occupational Safety and Health Services (DOSHS) OSH Officer.

The EPC Contractor will provide continual formal task specific S&H training to all their staff based on a documented training needs analysis. It will be mandatory for the EPC Contractor to undertake daily Tool-Box-Talks (TBTs) and records of all formal and informal training shall be maintained on site for inspection.

All activities carried out on site shall be done based on documented S&H risk assessments, Examples of these include Job Safety Analysis (JSA), Permit-To-Work (PTW) System, Noise Level Survey, etc. From each risk assessment, the EPC Contractor shall develop and implement a documented Safety Method Statement (SMS) for safely carrying out any activity on site.

To manage community health and safety issues, the EPC Contractor shall develop and implement a written Emergency Response Plan (ERP) for all off-site emergencies. The ERP must be developed based on a formal emergency response risk assessment of emergency scenarios.

The EPC Contractor shall ensure that they comply with all statutory requirements of reporting stipulated in the latest version of the OSHA and its subsidiary legislation always. Examples of statutory requirements include undertaking (i) S&H risk assessments, (ii) S&H audits, (iii) plant safety inspections using DOSHS Approved Persons, etc.

The above mitigation measures are an example of the types of things that comprise an S&H MP that the EPC Contractor shall be required to implement during the construction phase of the project and should not be considered conclusive.

During the operational phase, the O&M Company shall develop and implement a formal S&H Management System in alignment with the requirements of ISO 31000 – Risk Management Standard, ISO 45000 – S&H Management Systems, ISO 14001 – Environmental Management System, ISO 9001 – Quality Management System and the International Finance Corporation (IFC) Environmental and Social Management System (ESMS).

### 1.8.17 Land acquisition and involuntary resettlement

As stated in the potential impacts section above, that the failure to develop and implement a thorough Resettlement Action Plan (RAP) could potentially lead to disenfranchising the Project Affected Persons (PAPs).

The Ministry of Energy and Petroleum (MoEP) initiated a RAP Study in August 2015 and engaged a Consultant to undertake the Study. The Consultant is in the process of undertaking the RAP Study which must be undertaken in accordance with:

- (a) Applicable Kenyan land laws;
- (b) The African Development Bank's (AfDB's) Integrated Safeguard System (ISS) and specifically Operational Safeguard 2 on Involuntary Resettlement; and
- (c) The International Finance Corporation (IFC) Performance Standard 5 (PS5) on Land Acquisition and Involuntary Resettlement.

The RAP Study is being led by the MoEP and consequently, it is expected that as a minimum, the Study will comply with applicable laws and regulations in Kenya on compulsory acquisition of land.

## 1.9 Environment and Social Management Plan

The purpose of the Environmental and Social Management Plan (ESMP) is to ensure that social and environmental impacts, risks and liabilities identified during the ESIA process are effectively managed during the construction, operations and closure of the proposed Lamu coal power plant project. The ESMP specifies the mitigation and management measures to which APCL is committed, and shows how the Project will mobilize organizational capacity and resources to implement these measures. It also shows how management measures aimed at mitigation and enhancement will be scheduled.

Best practice principles require that every reasonable effort be made to reduce and preferably to prevent adverse impacts, while enhancing positive benefits, especially within the communities most directly affected by the proposed project. These principles have guided the ESIA process. For the proposed coal power plant, potential negative impacts will be avoided through a robust design and engineering process.

The ESMP is a key product of the ESIA process and is generated based on management and/or mitigation measures that will be taken into consideration to address impacts during the planning and design, pre-construction and construction activities, and operations, as necessary.

The ESMP is a living document that will be periodically reviewed and updated. It may be necessary to update the version presented in this ESIA Study (See Section 10) during the detailed design phase, prior to the commencement of construction.

During the construction phase, accountability for implementing the ESMP will reside with the Senior Most Person in the EPC Contractor's organization in Kenya and during the operational phase, accountability for implementing the ESMP will reside with the senior most person in the O&M Company.

Responsibility for the ESMP will reside in the Health, Safety and Environment (HSE) functional management of the EPC contractor for the construction phase while responsibility for the ESMP will reside in the HSE functional management within the O&M Company during the operational phase.

## **1.10 Public/stakeholder consultation**

As part of the ESIA study, a public/stakeholder consultation program was undertaken in order to:

- Provide information about the proposed project
- Contribute to the design of the stakeholder engagement process
- Assist in identifying potential impacts and reasonable alternatives
- Ensure that their views and concerns are incorporated into project design and implementation with the objectives of reducing or offsetting negative impacts and enhancing benefits from the project
- Contribute relevant local information and traditional knowledge to the ESIA and ensure that community issues have been considered in the environmental and social specialist studies

The public consultation was focused on engaging community residents, businesses, local/public authorities, community leaders, County Government as well as other individuals or groups that expressed an interest in the project. APCL is committed to effective and open consultation to ensure that potentially affected members of the public are fully aware of the project and have the opportunity to make their views known.

The receipt of information on public and stakeholder comments and concerns will help ensure that all important issues are considered in the environmental assessment and effectively addressed.

Stakeholder consultation is an ongoing process and consultations will be undertaken as the project progresses. Minutes of meetings held and digital photographs taken during the meeting are appended in the Social Impact Assessment specialist Study (Appendix 8).

The publicity of the stakeholder meetings was done through APCL CLOs, local elders, public notice posters, and formal invitation letters. A combination of various information and consultation methods was used. These included key informant consultations, meetings with the public and media activities. The table below shows the meetings conducted during the scoping and detailed ESIA phase.

<b>Date and Place</b>	<b>Stakeholder group and meeting purpose</b>
9th January 2015 Subira Hotel, Hindi, Lamu mainland	Ward administrator, Hindi and Senior Chief, Village headmen, community leaders (from affected communities) and mangrove cutters representative. Project Introductory meetings
9th January 2015 Lamu Museum, Lamu Island	National Museum of Kenya representatives (Lamu museum) Project Introductory meetings
9th January 2015	Assistant County Commissioner, Lamu County

Date and Place	Stakeholder group and meeting purpose
Lamu Island	Project Introductory meeting
24th January 2015 Mwana Arafa Restaurant Gardens, Lamu Island	Save Lamu Representatives Workshop
24th January 2015 Mwana Arafa Restaurant Gardens, Lamu Island	Lamu Youth Alliance Representatives Workshop
25th January 2015 Mwana Arafa Restaurant Gardens, Lamu Island	Male Opinion leaders Representatives Workshop
25th January 2015 Mwana Arafa Restaurant Gardens, 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
27th January 2015 Ardhi House, Mokowe, Lamu	Lamu County Land Management Board Project Briefing Meeting
27th January 2015 Kwasasi (Proposed project site)	Kwasasi Residents Dissemination and consultation public meeting
27th January 2015 Hindi Digital Sports Centre and News Hindi, Lamu mainland	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 social hall, Pate Island	Pate residents Dissemination and consultation public meeting
2nd February – 3rd February 2015, Sarova Panafric hotel, Nairobi	Lamu County Government workshop
10th February 2015, Serena Hotel , Nairobi	Media editors Kick-off briefing
11th February 2015, Standard Media Group Offices Nairobi	Standard media group editors Kick-off briefing

Date and Place	Stakeholder group and meeting purpose
12th February – 13th February 2015, Tamani Jua Resort, Malindi	Lamu members of County Assembly workshop
24th February 2015 Crowne Plaza Hotel, Nairobi	Media houses press briefing
1st April 2015 Mwana Arafa Restaurant Gardens, Lamu Island	Lamu County Administration kick-off workshop
22 <sup>nd</sup> June 2015 Lamu Island	Key Informant Interview Ministry of Gender, youth and social services Lamu County Government
23 <sup>rd</sup> June 2015 Ardhi House, Mokowe	Key Informant Interview Ministry of Education Lamu County Government
23 <sup>rd</sup> June 2015 Public health Office, Lamu Island	Key Informant Interview Ministry of Health and Environment Lamu County Government
24 <sup>th</sup> June 2015 Ministry of Agriculture Office, Lamu Island	Key Informant Interview Ministry of Agriculture Lamu County Government
23 <sup>rd</sup> June 2015 Chief's camp, Hindi	Focus Group Discussion with vulnerable stakeholder groups – Members of the Pastoralist communities
24 <sup>th</sup> June 2015 Chief's camp, Hindi	Focus Group Discussion with vulnerable stakeholder groups – Women from communities proximate to the project site
24 <sup>th</sup> June 2015 Chief's camp, Hindi	Focus Group Discussion with vulnerable stakeholder groups – Elders from indigenous minority communities
25 <sup>th</sup> June 2015 Chiefs camp, Pate Island	Focus Group Discussion with vulnerable stakeholder groups – Farmers

The minutes and registration logs for the stakeholder disclosure and consultation meetings are included in Appendix 8A in Volume 2 of the ESIA Study.

## **1.11 Conclusion**

This ESIA Study has been undertaken based on information provided by APCL, Sargent & Lundy (Owner's Engineer up to Financial Close), Sichuan Electric Power Design & Consulting Co. Ltd. – SEDC (Power Plant Design Company), appropriate field studies and past ESIA experience of the specialists appointed by Kurrent Technologies Ltd. (KTL).

The overall conclusion of the ESIA Study is that if the mitigation measures recommended in this report are implemented, the proposed 1,050MW coal fired power plant will have low impact significance on the biophysical and social environment. A number of impacts are short-term and of a temporary nature and can be readily addressed through the hierarchical principles namely (1) Elimination, (2) Substitution, (3) Engineering Controls, (4) Administrative Controls and, (5) Personal Protective Equipment.

Additionally, the implementation of the Environmental and Social Management Plan (ESMP), Stakeholder Engagement Plan (SEP) and Grievance Mechanism (GM) will support APCL's efforts in acquiring a social license to operate.

APCL has already commenced a program of corporate social responsibility (CSR) initiatives which were identified with community inputs. These initiatives should continue throughout the lifetime of the project to enable social benefits to accrue to the communities in Lamu County.

It has been established throughout the ESIA process that the project affected communities are supportive of the proposed power plant as they perceive it as a springboard to uplift the socio-economic status of the area which has lacked development since independence. The proposed project is the first industrial activity in Lamu County and therefore several socio-economic impacts are predicted.

While the proposed project will not have direct impacts to the cultural heritage of the stone town in Lamu (16ha) which is inscribed as a UNESCO World Heritage Site for its Outstanding Universal Value (OUV), there could potentially be indirect effects on the cultural heritage of the project affected communities associated with socio-economic development. Such changes include access to better schools, medical facilities in lieu of homeopathy, modern shopping centers and the amenities associated with them, etc. these types of developments may change the perceptions of those people that use such developments to the detriment of cultural values ascribed by the current generation of leaders and elders.

The Government of Kenya is responsible for undertaking the Resettlement Action Plan (RAP) for the project while the National Land Commission (NLC) is the implementing agency for the RAP. APCL is part of the steering committee set up for the development and implementation of the RAP and their role is to ensure that to the extent possible, the Government will develop and implement the RAP in accordance with the requirements of the African Development Bank's Operational Safeguard 2 on Involuntary Resettlement and the IFC Performance Standard 5 on Land Acquisition and Involuntary Resettlement.

The conclusions of this ESIA Study are the result of comprehensive studies and specialist assessments. These studies were based on issues identified through the ESIA scoping process and the parallel process of public participation. The public consultation process has been rigorous and extensive, and every effort has been made to include representatives of all stakeholders within the process.

The findings of the specialist studies undertaken within this ESIA provide an assessment of the potential positive and adverse impacts anticipated as a result of the proposed project. The findings conclude that there are no environmental fatal flaws that should prevent the proposed project from proceeding, provided that the recommended mitigation and management measures are implemented.

The ESIA process is iterative and as stated above, is valid based on the information and data available at the time of conducting the ESIA Study. KTL has used reasonable care, skill and judgement to undertake the ESIA Study using the information provided to it by the Proponent, Consultants directly appointed by the Proponent and other stakeholders engaged in the process of undertaking the study.

## 1.12 Structure of the ESIA Report

This report is Volume I of the ESIA Study undertaken for the proposed Lamu coal power plant project and represents the outcome of the ESIA phase of the process; it contains the following sections:

**Section 1** is an Executive Summary of the environment and social impacts associated with the proposed project.

**Section 2** provides an overview of the regulatory and legal context for power generation projects and the ESIA process.

**Section 3** describes the need for the proposed project.

**Section 4** provides Description of the Project.

**Section 5** provides a description of the baseline environment and social setting of the project.

**Section 6** contains an evaluation of the project alternatives including site, technology, energy type, etc.

**Section 7** discusses the assessment methodology used in the ESIA Study

**Section 8** analyzes the potential environmental and social impacts associated with the proposed project using the methodology described in section 7.

**Section 9** presents an overview of the Stakeholder Engagement Plan (SEP), Grievance Mechanism (GM) and framework for the Resettlement Action Plan (RAP)

**Section 10** evaluates the cumulative impacts associated with the proposed project in relation to associated facilities and in particular the proposed 520km long 400kV Overhead Transmission Line connected to the proposed project.

**Section 11** presents the Environment and Social Management Plan (ESMP) for the proposed project.

**Section 12** contains the conclusions about the potential environmental and social aspects and impacts of the proposed project.

**Section 13** contains a list of Appendices associated with the ESIA Study.

In compiling this ESIA Study, a number of specialist studies were undertaken by the Firm of Experts. These studies are appended in Volume II of this ESIA Study and are listed in Table 1-1 below for ease of reference.

**Table 1-1: Specialist studies undertaken as part of the ESIA Study for the Lamu coal power project**

Appendix in Volume II of this ESIA Study	Specialist Study
<b>Appendix 01</b>	Marine thermal discharge Study
<b>Appendix 02</b>	Air Quality Study
<b>Appendix 03</b>	Noise Quality Study
<b>Appendix 04</b>	Climate Change and GHG Impact Assessment Study
<b>Appendix 05</b>	Ecological Impact Assessment Study
<b>Appendix 06</b>	Geology and Soils Study
<b>Appendix 07</b>	Hydrology Study
<b>Appendix 08</b>	Hydrogeology Study
<b>Appendix 09</b>	Social Impact Assessment Study
<b>Appendix 10</b>	Stakeholder Engagement Plan
<b>Appendix 11</b>	Grievance Mechanism
<b>Appendix 12</b>	Cultural Heritage Impact Assessment study
<b>Appendix 13</b>	Visual Impact Assessment Study
<b>Appendix 14</b>	Baseline air, water, soil and sediment sampling and analysis reports and certificates