Environment and Social Impact Assessment (ESIA) Study for the Proposed 1,050MW Coal Fired Power Plant Project, Kenya

Report Prepared for

Amu Power Company Limited

Report No. KT/4085/ESIA/V1/R1

July 16
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July 16

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NEMA Lead Expert Registration No. 0120

Mr. Francis Njogu
Managing Director – Amu Power Company Limited
## Project Details

<table>
<thead>
<tr>
<th>Title of Project</th>
<th>1,050MW Coal Fired Power Plant, Lamu County, Kenya</th>
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<tr>
<td>NEMA Reference Number</td>
<td>NEMA/PR/5/2/14779</td>
</tr>
<tr>
<td>Owner’s Engineer (Up to Financial Close)</td>
<td>Sargent and Lundy, Chicago, USA</td>
</tr>
<tr>
<td>NEMA licensed Firm of Experts</td>
<td>Kurrent Technologies Ltd. (Kenya)</td>
</tr>
<tr>
<td>NEMA License Number</td>
<td>0191</td>
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### Specialists

<table>
<thead>
<tr>
<th>Study name</th>
<th>Specialist</th>
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<tr>
<td>Marine Thermal Discharge Study</td>
<td>Ward Karlson Consulting</td>
</tr>
<tr>
<td>Air Quality Study</td>
<td>Ward Karlson Consulting</td>
</tr>
<tr>
<td>Nosie Quality Study</td>
<td>Ward Karlson Consulting</td>
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<tr>
<td>Ecological Impact Assessment Study</td>
<td>Geoffrey Mwangi, Dr. George G. Ndiritu, Dr. Peter Njoroge, Mr. Vincent Muchai, Mr. Laban Njoroge, Mr. Kennedy Wambua</td>
</tr>
<tr>
<td>Geology and Soils Study</td>
<td>Mr. Bernard Muhangu – Reg. Geologist</td>
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<tr>
<td>Hydrology study</td>
<td>Mr. Bernard Muhangu – Reg. Geologist</td>
</tr>
<tr>
<td>Hydrogeology study</td>
<td>Mr. Bernard Muhangu – Reg. Geologist</td>
</tr>
<tr>
<td>Social Impact Assessment study</td>
<td>Ms. Belinda Muya and Mr. Gideon Owaga</td>
</tr>
<tr>
<td>Cultural Heritage Assessment study</td>
<td>Dr. Freda Nkirote and Ms. Angela Kabiru</td>
</tr>
<tr>
<td>Visual Impact Assessment Study</td>
<td>Aurecon South Africa</td>
</tr>
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</table>
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Where field investigations have been carried out these have been restricted to a level of detail required for achieving the stated objectives of the work.

This work has been undertaken in accordance with the Quality Management System of Kurrent Technologies Ltd.
## 2 Acronyms and abbreviations

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Definition</th>
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</thead>
<tbody>
<tr>
<td>AfDB</td>
<td>African Development Bank</td>
</tr>
<tr>
<td>ALARP</td>
<td>As Low As Reasonably Practical</td>
</tr>
<tr>
<td>APCL</td>
<td>Amu Power Company Limited</td>
</tr>
<tr>
<td>API</td>
<td>American Petroleum Institute</td>
</tr>
<tr>
<td>asl</td>
<td>Above Sea Level</td>
</tr>
<tr>
<td>BAT</td>
<td>Best Available Technologies</td>
</tr>
<tr>
<td>BMP</td>
<td>Best Management Practices</td>
</tr>
<tr>
<td>BSI</td>
<td>British Standards Institute</td>
</tr>
<tr>
<td>CDL</td>
<td>Chart Datum Level</td>
</tr>
<tr>
<td>CLO</td>
<td>Community Liaison Officer</td>
</tr>
<tr>
<td>DB</td>
<td>Distribution Board</td>
</tr>
<tr>
<td>DOSHS</td>
<td>Directorate of Occupational Safety and Health Services</td>
</tr>
<tr>
<td>DWT</td>
<td>Dead weight tons</td>
</tr>
<tr>
<td>EDL</td>
<td>Effluent Discharge License</td>
</tr>
<tr>
<td>EMCA</td>
<td>Environment Management and Coordination Act, 1999</td>
</tr>
<tr>
<td>EPR</td>
<td>Environment Project Report</td>
</tr>
<tr>
<td>ERC</td>
<td>Energy Regulatory Commission</td>
</tr>
<tr>
<td>ESIA</td>
<td>Environment And Social Impact Assessment</td>
</tr>
<tr>
<td>ESMP</td>
<td>Environment And Social Management Plan</td>
</tr>
<tr>
<td>ESP</td>
<td>Electro-Static Precipitator</td>
</tr>
<tr>
<td>ETP</td>
<td>Effluent treatment plant</td>
</tr>
<tr>
<td>FGD</td>
<td>Flue Gas Desulfurization</td>
</tr>
<tr>
<td>FY</td>
<td>Fiscal Year</td>
</tr>
<tr>
<td>H&amp;S</td>
<td>Health and Safety</td>
</tr>
<tr>
<td>Acronym</td>
<td>Definition</td>
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<tr>
<td>Ha</td>
<td>Hectare</td>
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<tr>
<td>HIA</td>
<td>Heritage Impact Assessment</td>
</tr>
<tr>
<td>HSD</td>
<td>High Speed Diesel</td>
</tr>
<tr>
<td>I&amp;APs</td>
<td>Interested and Affected Parties</td>
</tr>
<tr>
<td>IFC</td>
<td>International Finance Corporation</td>
</tr>
<tr>
<td>IPP</td>
<td>Independent Power Producer</td>
</tr>
<tr>
<td>JSA</td>
<td>Job Safety Analysis</td>
</tr>
<tr>
<td>KenGen</td>
<td>Kenya Electricity Generating Company Ltd.</td>
</tr>
<tr>
<td>KETRACO</td>
<td>Kenya Electricity Transmission Company</td>
</tr>
<tr>
<td>Km²</td>
<td>Square Kilometers</td>
</tr>
<tr>
<td>KP</td>
<td>Kenya Power</td>
</tr>
<tr>
<td>KPA</td>
<td>Kenya Ports Authority</td>
</tr>
<tr>
<td>KTL</td>
<td>Kurrent Technologies Ltd.</td>
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<tr>
<td>kV</td>
<td>Kilovolt</td>
</tr>
<tr>
<td>kWh</td>
<td>Kilowatt Hour</td>
</tr>
<tr>
<td>L.N.</td>
<td>Legal Notice</td>
</tr>
<tr>
<td>LAPSSET</td>
<td>Lamu Port South Sudan Ethiopia Transport Corridor Project</td>
</tr>
<tr>
<td>m²</td>
<td>Square meters</td>
</tr>
<tr>
<td>m³/day</td>
<td>Cubic meters per day</td>
</tr>
<tr>
<td>m³/hour</td>
<td>Cubic meters per hour</td>
</tr>
<tr>
<td>masl</td>
<td>Meters Above Sea Level</td>
</tr>
<tr>
<td>MCA</td>
<td>Member of the County Assembly</td>
</tr>
<tr>
<td>MCE</td>
<td>Member of the County Executive</td>
</tr>
<tr>
<td>mg/l</td>
<td>Milligrams per liter</td>
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<tr>
<td>MJ/kg</td>
<td>Mega joules per kilogram</td>
</tr>
<tr>
<td>MoEP</td>
<td>Ministry of Energy and Petroleum</td>
</tr>
</tbody>
</table>
### Acronym | Definition
--- | ---
MP | Member of Parliament
MPA | Mega Pascal
MSD | Medium Speed Diesel
Mt | Million tons
MW | Megawatt
NEMA | National Environment Management Authority
NFPA | National Fire Protection Association
NLC | National Land Commission
NMK | National Museums of Kenya
NO\(_x\) | Oxides of nitrogen
OEM | Original Equipment Manufacturer
OGV | Ocean going vessel
OSHA | Occupational Safety and Health Act, 2007
OUV | Outstanding universal value
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
ppm | Parts Per Million
PPP | Public Private Partnership
ppt | Parts per thousand
S&L | Sargent & Lundy
SCR | Selective Catalytic Reduction
SEDC | Sichuan Electric Power Design & Consulting Co. Ltd.
SIA | Social Impact Assessment
<table>
<thead>
<tr>
<th>Acronym</th>
<th>Definition</th>
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</thead>
<tbody>
<tr>
<td>SO$_2$</td>
<td>Sulfur dioxide</td>
</tr>
<tr>
<td>SO$_x$</td>
<td>Oxides of sulfur</td>
</tr>
<tr>
<td>STI</td>
<td>Sexually Transmitted Infection</td>
</tr>
<tr>
<td>ToR</td>
<td>Terms of Reference</td>
</tr>
<tr>
<td>UKC</td>
<td>Under Keel Clearance</td>
</tr>
<tr>
<td>UNFCCC</td>
<td>United Nations Framework Convention on Climate Change</td>
</tr>
<tr>
<td>VIA</td>
<td>Visual Impact Assessment</td>
</tr>
<tr>
<td>WHC</td>
<td>World Heritage Council</td>
</tr>
<tr>
<td>WHO</td>
<td>World Health Organization</td>
</tr>
<tr>
<td>WHS</td>
<td>World heritage site</td>
</tr>
<tr>
<td>WWTP</td>
<td>Waste Water Treatment Plant</td>
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3  Terminology and Definitions

<table>
<thead>
<tr>
<th>Terminology</th>
<th>Definition</th>
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<tbody>
<tr>
<td>Alien species</td>
<td>Animals and plants invading and becoming established in areas where they do not normally occur</td>
</tr>
<tr>
<td>Alternatives</td>
<td>Alternatives are different means of meeting the general purpose and need of a proposed activity. Alternatives may include location or site alternatives, activity alternatives, process or technology alternatives, temporal alternatives or the “do-nothing” alternative.</td>
</tr>
<tr>
<td>Ambient</td>
<td>Refers to the surrounding environment and/or conditions</td>
</tr>
<tr>
<td>Ambient sound level or ambient noise</td>
<td>The totally encompassing sound in a given situation at a given time and usually composed of sound from many sources, both near and far. Note that ambient noise includes the noise from the noise source under investigation. The use of the word ambient should however always be clearly defined (compare with residual noise).</td>
</tr>
<tr>
<td>Aquifer</td>
<td>A bounded underground accumulation of water in certain types of geological formations</td>
</tr>
<tr>
<td>Biodiversity</td>
<td>The number and variety of living organisms on earth, the millions of plants, animals, and micro-organisms, the genes they contain, the evolutionary history and potential they encompass, and the ecosystems, ecological processes, and landscapes of which they are integral parts.</td>
</tr>
<tr>
<td>Compaction</td>
<td>Compression of the soil such that it is difficult to plough, and water cannot drain through it effectively or an increase in the density of something.</td>
</tr>
<tr>
<td>Cultural resources</td>
<td>A broad term covering any physical, natural and spiritual properties and features that are adapted, used and created by humans, in the past and the present. Cultural resources include traditional systems of cultural practice, belief or social interaction.</td>
</tr>
<tr>
<td>Cumulative impacts</td>
<td>Impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities (e.g. discharges of nutrients or heated water to a river that combine to cause algal bloom and subsequent loss of dissolved oxygen that is greater than the additive impacts of each pollutant). Cumulative impacts can occur from the collective impacts of individual minor actions over a period of time and can include both direct and indirect impacts.</td>
</tr>
<tr>
<td>Direct impacts</td>
<td>Impacts that are caused directly by an activity and generally occur at the same time and at the place of the activity. These impacts are generally associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable.</td>
</tr>
<tr>
<td>Domestic Waste</td>
<td>Solid waste, composed of garbage and rubbish, which normally originates from residential, private households, or apartment buildings. Domestic waste may contain a significant amount of toxic or hazardous waste from improperly discarded pesticides, paints, batteries, and cleaners.</td>
</tr>
</tbody>
</table>
## Terminology

<table>
<thead>
<tr>
<th>Terminology</th>
<th>Definition</th>
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</thead>
<tbody>
<tr>
<td><strong>Do-nothing alternative</strong></td>
<td>The “do-nothing” alternative is the option of not undertaking the proposed activity or any of its alternatives. The “do-nothing” alternative also provides the baseline against which the impacts of other alternatives should be compared.</td>
</tr>
<tr>
<td><strong>Economic growth</strong></td>
<td>Percentage change in GDP, generally measured in terms of a calendar year.</td>
</tr>
<tr>
<td><strong>Ecosystem</strong></td>
<td>Organisms together with their abiotic environment, forming an interacting system, inhabiting an identifiable space.</td>
</tr>
<tr>
<td><strong>Effluent</strong></td>
<td>That water which flows out of a man-made system into a river, usually wastewater.</td>
</tr>
<tr>
<td><strong>Emissions</strong></td>
<td>Referring to pollutants released into the atmosphere.</td>
</tr>
<tr>
<td><strong>Employment</strong></td>
<td>Number of people employed in jobs in the formal sector of the economy.</td>
</tr>
<tr>
<td><strong>Endangered species</strong></td>
<td>Taxa in danger of extinction and whose survival is unlikely if the causal factors continue operating. Included here are taxa whose numbers of individuals have been reduced to a critical level or whose habitats have been so drastically reduced that they are deemed to be in immediate danger of extinction.</td>
</tr>
<tr>
<td><strong>Endemic</strong></td>
<td>An “endemic” species is a species that grows in a particular area (is endemic to that area) and has a restricted distribution. It is only found in a particular place. Whether something is endemic or not depends on the geographical boundaries of the area in question and the area can be defined at different scales.</td>
</tr>
<tr>
<td><strong>Environment</strong></td>
<td>The surroundings within which humans exist and that are made up of: i). The land, water and atmosphere of the earth; ii). Micro-organisms, plant and animal life; iii). Any part or combination of (i) and (ii) and the inter-relationships among and between them; and iv). The physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being.</td>
</tr>
<tr>
<td><strong>Environment Impact Assessment</strong></td>
<td>Environment Impact Assessment (EIA) means the process of collecting, organizing, analyzing, interpreting and communicating information that is relevant to the consideration of the application.</td>
</tr>
<tr>
<td><strong>Environmental impact</strong></td>
<td>The degree of change in an environment resulting from the effect of an activity on the environment, whether desirable or undesirable. Impacts include both the direct or indirect consequences of an activity.</td>
</tr>
<tr>
<td><strong>Environmental Impact Assessment Report</strong></td>
<td>In-depth assessment of impacts associated with a proposed development. The second Phase of an Environmental Impact Assessment.</td>
</tr>
<tr>
<td><strong>Environmental Management Plan</strong></td>
<td>A legally binding working document, which stipulates environmental and socio-economic mitigation measures that must be implemented by several responsible parties throughout the duration of the proposed project.</td>
</tr>
<tr>
<td><strong>Erosion</strong></td>
<td>Wearing away or rock and soil by physical or chemical action, especially by wind or water, leading to removal of particles.</td>
</tr>
<tr>
<td><strong>Fauna</strong></td>
<td>The animal life of a region.</td>
</tr>
<tr>
<td>Terminology</td>
<td>Definition</td>
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</tr>
<tr>
<td>Flora</td>
<td>The plant life of a region.</td>
</tr>
<tr>
<td>Groundwater</td>
<td>Subsurface water in the saturated zone below the water table.</td>
</tr>
<tr>
<td>Habitat</td>
<td>The normal abode or locality of a living organism defined by the set of physical, chemical and biological features. the natural home of species of plants or animals.</td>
</tr>
<tr>
<td>Hazardous</td>
<td>Processes or substances which have the potential to cause significant danger or harm to human health or the environment (e.g. hazardous waste).</td>
</tr>
<tr>
<td>Heritage</td>
<td>That which is inherited and forms part of the National Estate.</td>
</tr>
<tr>
<td>Hydrology</td>
<td>The study of the occurrence, distribution and movement of water over, on and under the land surface.</td>
</tr>
<tr>
<td>Indigenous</td>
<td>Born, growing, or produced naturally (native) in an area, region, or country.</td>
</tr>
<tr>
<td>Indirect impacts</td>
<td>Indirect or induced changes that may occur as a result of the proposed activity (e.g. the reduction of water in a stream that supplies water to a reservoir that supplies water to the activity). These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity.</td>
</tr>
<tr>
<td>Industrial</td>
<td>Resource use patterns linked to or influenced by commercial / industrial benefits.</td>
</tr>
<tr>
<td>Land</td>
<td>Terrestrial bio-productive system that comprises soil, vegetation and other biota, as well as the ecological and hydrological processes that operate within the system.</td>
</tr>
<tr>
<td>Legal requirements</td>
<td>Identification and listing of the specific legislation and permit requirements which could potentially be infringed upon by the proposed project, if mitigation is necessary should the proposed development impact on a heritage resource.</td>
</tr>
<tr>
<td>Migration</td>
<td>The number of people entering and leaving the country. Internal migration refers to the relocation of people within the country.</td>
</tr>
<tr>
<td>Monitoring</td>
<td>In an environmental context, the repetitive and continued observation, measurement and evaluation of environmental data to follow changes over a period of time to assess the efficiency of control measures.</td>
</tr>
<tr>
<td>Negative impact</td>
<td>A resultant change due to an activity that reduces the quality of the environment (e.g. by reducing indigenous species diversity and the reproductive capacity of the ecosystem; by damaging health; property or by causing nuisance).</td>
</tr>
<tr>
<td>Noise</td>
<td>Any acoustic phenomenon producing any aural sensation perceived as disagreeable or disturbing by an individual or group. Noise may therefore be defined as any unwanted sound or sound that is loud, unpleasant or unexpected.</td>
</tr>
<tr>
<td>Perennial</td>
<td>Flow throughout the year.</td>
</tr>
<tr>
<td>Pollutant</td>
<td>A substance that contaminates.</td>
</tr>
<tr>
<td>Terminology</td>
<td>Definition</td>
</tr>
<tr>
<td>-------------------------------</td>
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</tr>
<tr>
<td><strong>Pollution</strong></td>
<td>Defilement or unfavorable alteration of the surroundings, normally as a result of human actions. In the water environment, any foreign substance that impairs the usefulness of water.</td>
</tr>
<tr>
<td><strong>Pollution prevention</strong></td>
<td>Complete prevention of releasing hazardous substances having polluting properties to any public stream or water body.</td>
</tr>
<tr>
<td><strong>Positive impact</strong></td>
<td>A resultant change due to an activity that improves the quality of the environment (e.g. restoring natural species diversity and ecosystem functioning, by removing nuisances or improving amenities).</td>
</tr>
<tr>
<td><strong>Rare and endangered species</strong></td>
<td>Species, which have naturally small populations, and species which have been reduced to small (often unstable) populations by man's activities.</td>
</tr>
<tr>
<td><strong>Red data species</strong></td>
<td>Species listed in terms of the International Union for Conservation of Nature and Natural Resources (IUCN) Red List of threatened species.</td>
</tr>
<tr>
<td><strong>Rehabilitation</strong></td>
<td>The restoration of a disturbed area which has been degraded as a result of activities such as mining, road construction or waste disposal, to a land use in conformity with the original land use before the activity started.</td>
</tr>
<tr>
<td><strong>Significant impact</strong></td>
<td>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.</td>
</tr>
<tr>
<td><strong>Soil</strong></td>
<td>A mixture of organic and inorganic substances, the composition and structure of the latter is derived from the parent rock material. Soil also contains bacteria, fungi, viruses and micro-arthropods, nematodes and worms.</td>
</tr>
<tr>
<td><strong>Solid Waste</strong></td>
<td>Any solid, semi-solid, liquid, or contained gaseous materials discarded from industrial, commercial, mining, or agricultural operations, and from community activities. Solid waste includes garbage, construction debris, commercial refuse, sludge from water supply or waste treatment plants, or air pollution control facilities, and other discarded materials.</td>
</tr>
<tr>
<td><strong>Stakeholder</strong></td>
<td>Individuals or groups concerned with or affected by an activity and its consequences. These include authorities, local communities, investors, work force, consumers, environmental interest groups and the general public.</td>
</tr>
<tr>
<td><strong>Surface Water</strong></td>
<td>All water naturally open to the atmosphere (rivers, lakes, reservoirs, ponds, streams, seas, estuaries) and all springs, wells, or other collectors directly influenced by surface water.</td>
</tr>
<tr>
<td><strong>Topography</strong></td>
<td>Referring to natural features on the surface of the earth.</td>
</tr>
<tr>
<td><strong>Topsoil</strong></td>
<td>The top few centimeters of soil that contains most of the soil organic matter and nutrients.</td>
</tr>
</tbody>
</table>