AES SONEL

Kribi Power Project

Environmental and Social Impact Assessment Report
Executive Summary

January 2010

Revision Schedule

Environmental and Social Impact Assessment Report – Executive Summary
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Rev	Date	Details	Prepared by	Reviewed by	Approved by
01	27/01/10	Revised Executive Summary	**Julie Raynor** Principal Consultant	**Eva Policarpo** Consultant	**Andrew McNab** Director

Scott Wilson
6-8 Greencoat Place
London
SW1P 1PL

Tel 020 7798 5000
Fax 020 7798 5001

www.scottwilson.com

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ABBREVIATIONS

ARSEL	Agence de regulation du secteur de l'électricité
EIA	Environmental Impact Assessment
EMF	Electromagnetic Fields
EMP	Environmental Management Plan
ESIA	Environmental and Social Impact Assessment
IFC	International Finance Corporation
IHT	Institute of Highways and Transportation
NGOs	Non Governmental Organisations
PPA	Power Purchasing Agreement
RAP	Resettlement Action Plan
SIA	Social Impact Assessment
SIG	Southern Interconnected Grid
SMP	Social Management Plan
SW	Scott Wilson
WHO	World Health Organisation

1 Introduction

AES SONEL, the national power utility of Cameroon, is currently developing the Kribi Power Project (the Project). The project is designed to meet expanding electricity demands and is part of a medium-term strategic development programme for the supply of electricity in Cameroon.

The Project will be located in the equatorial region of Cameroon (see Figure ES1). It will comprise the construction of a 216 MW gas fired power plant, approximately 9 km north-east of Kribi, and the erection of a 225 kV transmission line between the plant and the existing Magombe 225/90 kV substation at Edéa (see Figure ES2). The Project will be fuelled by natural gas from the Sanaga sud gas field (approximately 14 km northeast and offshore from Kribi). A separate Environmental Impact Assessment (EIA) is being undertaken for the gas project and pipeline to the site.

The Project will be owned by a subsidiary of AES SONEL and all the electricity produced will be delivered to the Southern Interconnected Grid (SIG) and sold to AES SONEL through a Power Purchasing Agreement (PPA).

In line with the requirements of the Ministry of Environment and Protection of Nature (MEPN), AES SONEL commissioned Scott Wilson (SW), an international environmental and engineering consultancy, to undertake the Environmental and Social Impact Assessment (ESIA)[1] for the Kribi Power Project.

The ESIA study and reports have been undertaken to both Cameroonian legislation and internationally recognised guidance and standards adopted by the World Bank and International Finance Corporation (IFC). It is considered that the Project is classified as a "Category A" under World Bank OP 4.01, because the project will require some economic or physical displacement as well as land acquisition. As such the ESIA has been undertaken within the requirements of the guidelines.

The MEPN formally approved the ESIA Report for the Kribi Power Project (Scott Wilson, October 2006) on 5 April 2007. This approval was subject to minor amendments (amendments to typographical errors) and the undertaking of an Indigenous Persons Plan (including Pygmies).

Subsequently the following reports, relating to the ESIA, have been prepared for the Kribi Power Project:

- An addendum to the ESIA Report (Scott Wilson, October 2007) – addressing the approval requirements, the use of nine reciprocating engines instead of four gas turbines and the movement of the plant site approximately 200 m east of the location originally assessed.
- A second addendum to the ESIA Report (Scott Wilson, October 2008) - addressing an increase Plant capacity from 150 MW to 216 MW and the use of 13 gas engines.
- Stack Height Assessment (Scott Wilson, November 2009) - assessing stack heights of 30 m and above, in the context of IFC Environmental, Health and Safety Guidelines for Thermal Power Plants.

[1] Environmental and Social Impact Assessment (ESIA) is a process used to investigate the potential implications of a project on the environment and community

- A full Environmental and Social Management Plan (ESMP) (Scott Wilson February 2009) - to supersede the provisional ESMP included in the original ESIA.

A revised ESIA has been prepared to consolidate the original ESIA (Scott Wilson, 2006 and the above reports into one document. In addition, further analysis has been incorporated given recent changes in international standards (Air Quality). This document presents the executive summary of the above report (Scott Wilson, January 2010).

The methodology adopted for the Project is therefore based on the requirements of Cameroonian Legislation as set out in EIA Decree No. 2005/0577 of 23rd February 2005 and World Bank OP 4.01. The key stages, which are not independent and in some instances have been undertaken in conjunction, are:

- **Scoping exercise** – this initial stage establishes the terms of reference for the detailed ESIA studies by identifying the key potential environmental and social impacts of the project. The scoping exercise was undertaken in January / February 2006 and a Scoping Report was prepared (Scott Wilson, February 2006). It involved an analysis of the proposed project proposals, a field visit to the project area and review of existing information on the environmental conditions of the area.
- **Field visits** - four field visits were undertaken between January and April 2006. These enabled; the project proposals to be viewed in the field; input to the development of the project proposal in line with best practice; baseline studies to be undertaken and public consultation to be initiated.
- **Identification of appropriate Cameroonian legislation and guidelines** (see Section 2).
- **Consultations** – these have been held with Ministries, government authorities and affected communities (see Section 4).
- **Baseline data** – review of both published and unpublished data, and gathering of project specific data (primary data). This information is presented within each of the environmental and social disciplines.
- **Potential impacts** – were identified from analysis of the proposed operation in relation to their environmental and social setting.
- **Mitigation measures –** are methods to remove or reduce the potential impacts identified. These have been identified and an evaluation of the level of predicted impacts that will remain after the implementation of these measures has been undertaken.
- **Development of both a framework and a full Environmental and Social Management Plan.**

This report has been structured with the same overall sections as the ESIA report, as follows:

- Section 1 - Introduction
- Section 2 - The Project
- Section 3 - Policy, Legal & Administrative Framework
- Section 4 - Scoping & Consultation
- Section 5 - Environmental Impact Assessment (Description of baseline environmental conditions, identification of the important environmental issues and assessment of potential

impacts to the environment, mitigation measures and residual impacts (impacts remaining after mitigation))

- Section 6 - Social Impact Assessment *(Approach as EIA)*
- Section 7 - Environmental and Social Management Plan

2 Legislative Background

The ESIA has identified the relevant Cameroonian statutory requirements, regulations, permits and licences required for the development to proceed. The key EIA legislation is Decree No. 2005/0577 of 23rd February 2005, which defines the process for undertaking EIA and Ministerial Order No. 0069/MINEP of 8th March 2006, which defines the categories of operations subject to EIA.

The report has also been prepared with reference to International Finance Corporation (IFC)/World Bank Guidelines. Where appropriate, due reference is also made to international standards in order to establish a regulatory framework for the project that is in line with local and international requirements. It is acknowledged that AES SONEL envisage that financial support for the project from the World Bank. Consequently this report has been prepared with reference to World Bank and IFC guidance.

As there are no existing national standards in Cameroon for water quality, air quality and noise limits, international standards have been adopted for this ESIA.

The relevant institutions that implement and monitor environmental law in Cameroon are:

- Agence de regulation du secteur de l'électricitié (ARSEL);
- The Inter-Ministerial Committee of Environment and Protection of Nature;
- Consultative national commission of environment and sustainable development;
- The Minister in charge of Energy and Water Resources and
- The Minister in charge of the Environment.

Other ministries include the Ministry of Agriculture, Minister of Transport, the Ministry of Culture, and the Ministry of Town Planning and Housing.

The ESIA report also identifies the 15 international environmental and social Protocols, Agreements and Treaties to which Cameroon is a party or ratified and the three regional agreements.

3 The Project

3.1 Need for the Project

The electricity infrastructure of Cameroon is dominated by the Southern Interconnected Grid (SIG) (see Figure ES3). There is also an independent northern grid and a significant number of off-grid remote generating stations supplying power to major townships. Within the SIG, power is mostly produced at hydro facilities, which currently supply approximately 90% of the demand. The SIG also has six thermal plants that provide additional power. This provides system security and is available for peak demand.

Various schemes to satisfy the long-term demand for power are under consideration by the Government. However, demand for power is increasing at a rate of approximately 5% per year for the public sector and the Kribi Power Plant is proposed to help meet the growing need. The Project is currently scheduled for commissioning in early 2008.

3.2 Project Setting

The entire project will be located within the equatorial coastal lowlands of southwest Cameroon (see Figures ES1 and ES2). Average temperatures in the area 28°C, humidity is between 60 and 100%, and the region has high a high average rainfall of 3,000 mm.

As shown on Figure ES2, the project lies within both the Littoral and South Regions, as follows:

- Power Plant and 65% of southern stretch Transmission line will lie within the Kribi Subdivision of the Ocean Division in the South Region; and
- The northern 35% of the transmission line and connection with the SIG at Mangombe substation at Edéa lie within the Edéa Subdivision in the Sanaga-Maritime Division in the Littoral Region.

The project area is characterised by flat, alluvial coastal plains with mangrove swamps and forest cover. Away from the coast the topography changes to very low rolling hills with shallow valleys. Natural forest vegetation dominates the landscape (primary and secondary forests). The majority of the project land take is within these forest areas.

The predominant economic activity within the zone affected by the proposed development is subsistence or shifting agriculture. Villages and associated land clearance therefore lie along the length of the 100 km transmission line and produce from both farming and hunting is sold at the roadside or in local markets. The Plant is located at Mpolongwe, third class chiefdom inhabited by the Mabi tribe that has their paramount chief situated at Bikondo (a village outside of the project area). The transmission line crosses fifteen villages in the South Region; amongst them, the most important are Fifinda (inhabited by Ewondo tribe) and Elogbatindi (inhabited mainly by Bassa/Bakoko tribe). There is also Batanga Tribe alongside the transmission line, whose Paramount Chief lives outside of the Project Area. In the Littoral Region, the line crosses eleven villages mostly inhabited by Adié and Bassa/Bakoko tribes.

3.3 Project Description

The Kribi Power Plant Project will comprise:

- **The Power Plant -** the construction of a 216 MW power plant fuelled with natural gas at the Mpolongwe Site; and
- **Energy Transmission Facilities -** the construction of energy transmission facilities comprising:

  (i) a step-up substation (11 to 225 kV) at the plant site at Mpolongwe;

  (ii) a circa 100 km 225 kV double circuit transmission line between the plant and the Mangombe 225/90 kV substation at Edéa;

  (iii) the connection of the transmission line at the Mangombe substation with installation of new 225 kV line bays.

3.3.1 The Power Plant

The Site

The Mpolongwe 2 area will contain the proposed plant site. As shown on Figure ES2 this area lies approximately 9 km north of Kribi and is adjacent to the main road about 1 km inland from the coast. The plant itself will occupy almost 4 ha within an overall 16 ha area, which will also allow the development of a construction compound for the project. An office building, welfare facilities, workshops and stores will also be constructed at the plant site.

The land is gently undulating and lies between 10 and 20 m above mean sea level. The site is predominantly forest cover. There are also a number of buildings on the western edge of the site within the way leave of an existing 90 km power line. Three families live in these buildings have been identified.

The Mpolongwe River (see Photo 3.3.1) and two of its tributaries drain the proposed site. They are perennial and are used as a water source by local inhabitants.

The Government has granted AES SONEL the right to use this untitled land under a Public Utility Decree, which was signed in August 2005. A copy of the Decree is provided in Appendix C of the ESIA Report (Scott Wilson, October 2006).

Access Road

The plant site is located on the main Edéa – Kribi road, which is tarred and in very good condition. The carriageway is 7 m wide with tarred verges up to 1 m. Traffic volumes are low (see Section 5.7). The daily flow of vehicles is, on average, 410 vehicles. There is an existing dirt track approximately 120 m long leading from the main road towards the plant site (see Photo 3.3.2). This will have to be upgraded, and another 150 m of access road constructed.

For the construction of the project, all the main plant and equipment will be imported via the port at Douala. From Douala all the plant and equipment will be transported by road to Edéa and then onto Kribi.

Power Plant Equipment

The power plant has been designed with thirteen reciprocating engines installed as base case for this study. Each of the engines will have an individual emission stack about 32 m high. Natural gas will be burned, which will be supplied from the Sanaga Sud gas field and brought onshore to the site via a 200 mm pipeline.

There will be no gas storage on site so the engines will be duel-fuel (gas and diesel) to ensure there is a continuous power supply if gas is unavailable. On-site diesel tanks will have an approximate capacity of 2000m^3. This will be sufficient to keep the plant running at full capacity for 3 to 4 days. It is anticipated that continuous operation using diesel will not exceed 8 days per year at a maximum 30% load factor. The process for NOx suppression during these periods will be finalised during the detailed design phase.

Step-up Station and Local Power Supply Demand

Power will be exported from the site via a new 225 kV double circuit transmission line. A step-up substation will be built for connection to the transmission line. At the Mangombe substation, at Edéa, new 225 kV bays will be added to connect the new line to the existing grid.

Peak demand for power supply is between 18:30 and 22:30 hrs. Seasonally, peak demand coincides with the dry season i.e. from December to June. For the purpose of the ESIA it is assumed that to accommodate the peak demand, the plant will operate 24 hours per day at 216 MW for 6 months of the year.

The project will not supply electricity to the communities along the route but is designed solely to feed in the SIG. As the majority of localities along the project route are already electrified, AES SONEL is investigating alternative ways to supply electricity to the few un-electrified communities. This supply is out of the scope of the Kribi Power Project.

3.3.2 The Transmission Line

The transmission line will be 99.5 km in total length. The line will be constructed within a corridor (wayleave), which will be a total width of 30 m, i.e. 15 m each side of the line axis.

Along the transmission line, towers will be spaced at a nominal distance of 350 m and a total of approximately 285 towers will be required. The towers will be approximately 40 m high and the line will be double circuit.

There is already an existing 90 kV transmission line, which runs from Edéa to Kribi. The new line will follow this general route for approximately 90% of the distance and runs directly parallel for 40%. This will enable the length of new wayleave to be reduced as the lines will be able to share the wayleave where parallel. As the existing and new line also follow the main road, access to the line corridor will be easily managed. Only a few, new, short access tracks will be required to gain access to the towers for construction. Access between the towers will be via an internal haul road within the wayleave.

The selected route passes through secondary tropical forest (approximately 30-40% of the route), fallow lands for 40 – 50% and subsistence style farmland for approximately 20%. The area is sparsely inhabited, and this route was selected to avoid as far as possible crossing the villages and forest areas. A total of 26 villages have been identified along the route however the only urban area to be crossed will be close to the Mangombe substation at Edéa, where the

existing power lines over fly some houses that were built after the existing 225 kV lines from the main hydro stations (Song Loulou) and to the main cities (Douala and Yaoundé) were constructed.

3.3.3 Construction Phase

The construction phase for the whole project will be approximately 15 months. Construction of the plant and transmission line will take place simultaneously. Activities during the construction phase will include *inter alia*: land clearance; establishing site access and construction compound; groundwork and foundation preparation; importing materials plant and equipment, construction of transmission towers and the power plant (and ancillary building, offices, workshops, etc); stringing and tensioning of the tower sections; and clearance of construction sites and waste materials once works are complete.

During the construction phase employment is expected to peak at 550 to 600 workers. The workforce will include manual labourers, electrical, mechanical and civil technicians and engineers, and site managers.

The anticipated split between national and expatriate workers will be 95% to 5% respectively with 10% of the workforce are expected to be sourced locally. Wherever possible it is intended that workforce be sourced locally, however given the quantity and skills of workers required, it will be necessary to import some the required employees.

Due to the vicinity of Kribi and Edéa towns to the project, it is anticipated that most of the construction workforce will live in these two towns. For the purpose of this ESIA it has been assumed that no new accommodation will be required. Contractors will organise daily transport for staff. Whilst on site welfare facilities will be provided for all workers.

Construction water will be taken from surface water sources. Potable water will be either bottled or it will be taken from existing potable sources along the route.

3.3.4 Operational Phase

During the operational phase approximately 60 specialised staff (engineers and technicians) will ensure the plant operates 24 hours/day. Non-specialised staff will include guards and cleaners and will be employed locally.

Kribi town is only 9 km south of the site and therefore no staff housing will be provided at the site. All staff will be housed in Kribi town, unless already housed in the local communities. Water supplies will be the same as for the construction phase. Wastewater will be managed by being treated prior to discharge through a soakaway system or watercourse.

Wayleave Management

Managing vegetation in the wayleave will be an important operational phase activity. The following are important issues:

- in the wayleave vegetation will not exceed 2 m in height;
- management and clearing of vegetation will take place on an annual basis;
- burning of vegetation will not be permitted; and

- no areas will be entirely stripped of vegetation as this will lead to soil erosion.

Regarding land use in the operational phase, the above issues must be adhered to and, in addition, no irrigation will be allowed. Growing of low-level crops and grazing by stock will be permitted. However any farming that is undertaken in the operational phase in the wayleave will be at the risk of the farmer and AES SONEL will reserve the right to clear the land as required for the safety of the project.

3.3.5 Decommissioning Phase

The design life of the plant is 25 years after which time the future will be defined, i.e. to extend the plant life or to decommission the plant. When it is decided to close the plant a full de-commissioning plan will be drawn up and implemented.

A similar approach is being taken with the transmission line, which has a typical lifespan of 50 years.

3.4 Consideration of Project Alternatives

3.4.1 Plant Alternatives

An independent study for plant alternatives was undertaken by Power Planning Associates in 2005, which included an assessment of the alternatives for the location, plant types, and fuel. The conclusion was that the best alternative was to locate a natural gas-fired plant with simple cycle gas turbines within the Kribi area. A copy of this report is presented in Appendix D of the main ESIA report (Scott Wilson, October 2006).

3.4.2 Plant Site

Following the initial decision that there would be a gas fired plant near Kribi, five sites were assessed as potential locations for the plant with respect to size, flatness, quality of soil, access roads, availability of fresh water, land use etc. It was concluded that the preferred site was Mpolongwe as shown on Figure ES2. A copy of this investigation is presented in Appendix E of the main ESIA report (Scott Wilson, October 2006).

3.4.3 Transmission Line

The route of the transmission line was also assessed. Deviations of the route were considered with reference to existing houses, plantations and farmland to ensure that the route selected minimised disruption.

Single and double circuit options were also considered. A double circuit option was chosen as, although more expensive than a single circuit, allows for security of supply and potential future expansion.

4 Scoping and Consultation

4.1 Scoping

In line with both national legislation (Cameroon's EIA Decree, 2005 / 0577, 23rd February 2005) and international best practice (World Bank, OP 4.01) the ESIA was undertaken in two phases. The first phase, scoping, established the terms of reference for the ESIA, i.e. the identification of the potential environmental and social impacts of the proposed project that will need detailed examination in the second phase, the ESIA itself.

The scoping study involved review of the proposed project proposals, visit to site in January 2005 by the ESIA team and review of existing environmental and social baseline information about the area. A scoping report was produced (Scott Wilson, February 2006), which was submitted to the Ministry of Environment and Protection of Nature in February 2006. Approval was received on 19 April 2006, a copy of the letter provided is presented in Appendix F of the ESIA report (Scott Wilson, September 2006).

4.2 Consultation

Consultation for the ESIA has also been undertaken in accordance with the requirements of the EIA Decree of Cameroon 2005 / 0577, which requires:

- The determination of the acceptability of the EIA, which involves consultation and public hearings and which will also include meetings undertaken during the study.
- The proponent to provide 30 days notification prior to the first consultation meeting.
- Minutes of meetings to be included in the EIA report.
- After confirmation of acceptability of the EIA report, public consultation to be undertaken. Following 30 days, a report of the findings is presented to the Minister.

In addition, as this is a Category A project (World Bank classification, see Section 1), the project sponsor is required to provide a summary of the project objectives and potential impacts for the initial consultation. AES SONEL will therefore need to make the draft ESIA report available in a public place that is convenient to the affected groups and local NGOs.

The strategy adopted for consultation for the Project is both consistent and transparent. This approach ensures that the concerns and problems of all stakeholders can be identified and addressed early in the process. In compliance with the World Bank/IFC policies (on resettlement, land acquisition and compensation) a framework for public consultation has been drawn up. This includes all aspects of public consultation and participation, with a process to address the grievances of affected people. Particular emphasis is placed on engaging the people who are likely to experience the day-to-day impacts of a project. Vulnerable and minority groups are given particular mention in the policies of the World Bank and IFC, and this has been followed through for the Project.

The scoping and ESIA have involved identification of stakeholders through formal and informal public meetings, document review, household surveys and unscheduled informal discussions. Subsequent formal public meetings have been held to update stakeholders on the project

plans. These have been conducted primarily in French with translation into other local languages where necessary. The following parties were consulted up to April 2006:

- Government Agencies - *the Kribi and Edéa Divisional Officers, ARSEL and the Ministry of Environment and Protection of Nature; and*
- Communities – *the affected villages in the project area, namely Bebambwe 1 and 2, Londji, Bipaga, Ebea, Pama, Bivouba, Mbebe, Elogbatindi, Bonguen, Dehane, Appouh Koukoue, Malimba Farm, Ekite Pilote, Malimba Urbain, Ekite 1 village, Ekite 3 village, Londji Health Centre staff, and Mpolongwe 1.*

Key issues raised have included compensation and resettlement, electricity provision and employment. These have been examined within the ESIA report. Consultation will be on-going through the project and inline with both Cameroonian legislation and World Bank guidance a further stage of formal consultation will be undertaken once the draft ESIA report is complete and made available for review.

5 Environmental Impact Assessment

5.1 Introduction

This section is based on the outcomes of the scoping exercise and presents the results of the environmental impact assessment (EIA).

5.2 EIA Methodology

The overall approach to the EIA is summarised in Section 1.

The scoping study enabled the environmental impacts with the most potential significance to be identified. Thereafter, the methodology was devised to ensure that sufficient baseline data was gathered to assess the impacts. Primary data collection has been undertaken where secondary data were inadequate. Sections 5.3 to 5.10 summarise the findings of the EIA on a discipline-by-discipline basis.

5.3 Air Quality

Air quality is generally good in the rural areas of the proposed plant and there is no large-scale industrial development in the vicinity. The only sources of emissions are from traffic along the Kribi – Edéa road and point sources associated with dwellings. Due to the low volumes of traffic and limited housing in the area both sources are regarded as insignificant in terms of effects on baseline air quality. Similarly, the transmission line crosses mainly rural land. There is a large aluminium smelter near the end of the line at Edéa and this is the only potential source of air pollution in the project area.

As there are no formal air quality monitoring stations within Cameroon, there were no readily available existing baseline data on the project area. A monitoring survey was therefore set up for the project (using diffusion tubes) to measure background levels of Nitrogen Dioxide (NO_2) and Sulphur Dioxide (SO_2), and O_3 (ozone). The results showed that current levels of NO_2 and SO_2 were well below guideline values set by the World Health Organisation (WHO). Background levels for ozone were typical of equatorial regions. Overall, baseline air quality in the vicinity of the proposed plant site and transmission line route is good but with some possible deterioration within Edéa.

During the construction phase the potential impacts on air quality, for both the plant site and the transmission line are (i) dust generation from on-site activities, and (ii) vehicle exhaust emissions. Dust generation has a nuisance value and may present a health risk. However these effects are easily mitigated and impacts were assessed as being adverse, but minor in significance and of short duration.

During the operational phase, the potential impact is associated with emissions from the power plant when being powered by either natural gas or diesel. The impacts were fully modelled using air dispersion software and were assessed as being adverse but of minor significance. In the case of diesel power, pollutant emissions will be higher than for gas however the impact will be very short term as the plant is to be fired by diesel only for a maximum of 8 continuous days per year.

A variety of mitigation measures will be adopted to minimise dust generation. These will be included in the Environmental Management Plan (EMP), which will ensure the measures are implemented in the operational phase.

5.4 Surface Water

The Kribi/Edéa area is characterised by low-lying, gently rolling countryside with numerous small streams and rivers running within shallow valleys. The main river catchment within the project area is that of the Nyong River which crosses the transmission line route at approximately 35 km south of Edéa before discharging to the Atlantic Ocean north of Kribi. The more minor catchment of the Lokoundje River drains much of the southern section of the project area and crosses the transmission line route approximately 16 km north of the proposed plant site area. The Sanaga River, the country's main watercourse, passes through Edéa where a short length of the final section of the transmission line route crosses its catchment. In addition to these three main rivers in excess of 50 smaller rivers, streams and drainage ditches cross the main transmission line corridor.

The only current impact on the streams is by local inhabitants who use them to wash clothes and for other domestic purposes (see Photo 5.4.2). Streams are however the main water source for 65% of local residents. Even where groundwater is available, surface sources are preferred. Using surface water for drinking has been the most significant cause of sickness in the local population and demonstrates that streams are polluted. There is no existing monitoring system for either quality or quantity of surface water, however monitoring will be conducted within the overall project development. However, as the potential impacts on water quality and water demand were assessed as minor, no baseline-monitoring programme was required for the ESIA.

Key potential impacts on water resources are (i) contamination through soil erosion or spillage of potentially contaminative materials such as fuels, and (ii) altering the quantity of available water by over abstraction or changing run-off within the catchment.

Mitigation measures will be implemented to protect soil resources. These will prevent erosion and thereby protect surface water. Suitable sanitary systems will be provided for all site workers to prevent pollution of water resources and good practice implemented to ensure no spillage of oils, etc. The impact on surface water resources is therefore assessed as minor due to the low potential for pollution from either soil erosion**.** fuel oils spillage or foul drainage to discharge to local rivers and streams. This potential impact will be during all phases of development for the power plant and construction and decommissioning works of the transmission line.

5.5 Groundwater

Taking account of the low lying nature of the project area, the presence of permeable soils, the prevalence of surface water systems and the high rainfall, it is concluded that shallow groundwater is likely to be present across the entire project area. This conclusion is supported by the survey on water use and ground investigation conducted at the plant site. Data on water quality is being collected as part of on-going site investigations but was not available at the time of writing the ESIA. However as most of the project area is within a rural setting significant groundwater pollution from human activity is unlikely to have occurred.

At the plant site and along much of the transmission line route water supply for the local villages is primarily from surface water sources. However data from the household survey (Scott Wilson, April 2006) indicates that approximately 35% of the supplies to villages are from wells fitted with hand or foot pumps. Groundwater is therefore the predominant water supply for some villages, primarily being used for drinking water. No wells are present at or near to the plant site.

During construction, the project will require small amounts of water however this will be taken primarily from surface sources. As such groundwater will not be subject to any significant impact in terms of reduced quantities within existing wells.

In the operational phase it is intended to use groundwater for the supply of water for domestic and welfare purposes at the plant. Based on estimated staffing levels, the total daily amount of groundwater used will be approximately 2.25m^3. Pump rates will therefore be very low (< 0.03l/s).

Mitigation measures implemented for the construction phase will be temporary but will ensure that any impacts on groundwater are insignificant. Latrines will be either pits or portable. Temporary bunding will be used around areas where oil tanks are stored. Other chemicals, such as greases and cleaning agents, will be stored in secure units to prevent theft or tampering. The floor of the unit will have a raised lip to contain minor spills.

Mitigation measures for the operational phase will include:

- Enclosing the diesel storage tank within a water-tight bund that has the capacity to store at least 110% of the total stored volume;
- All pipe work for fuel delivery and discharge above ground;
- Catch pits constructed below each unit of the transformer;
- Drains from the workshops will be fitted with oil separators; and
- All foul sewage will be directed through a septic tank for treatment prior to discharge via a soakaway.

Full maintenance and management for these systems will be included in the project EMP (see Section 7). Overall, the impacts on groundwater are assessed as being adverse and insignificant or minor. Minor impacts will be long term during the operational phase for the plant area from potential pollution of groundwater at the Plant Site.

5.6 Noise

There are no existing, significant noise sources in the vicinity of the proposed plant site or transmission line. The main potential source is the Kribi – Edéa road however this carries a low volume of traffic so the background noise level from this is minor.

To establish existing levels of noise around the plant, a baseline noise survey was undertaken for the ESIA (3rd to 6th April 2006). Three stations were set up and readings taken over a 24 hour period. Readings showed little variation between day and might but the sources of noise varied. During the day noises originated from the road and daily activities of residents whilst during the night, noises were caused by wildlife within the forest.

Potential noise impacts from the Kribi Power Plant will be from traffic and site activity during the construction phase and the small increase in traffic volumes, corona discharge (the noise generated by high voltage lines), and from the power transformers and gas engines during the operational phase. Traffic noise for both phases is assessed as being insignificant. The noise generated by high voltage lines is affected by the actual voltage and climatic conditions. In wet conditions audible noise levels increase however overall impacts will be insignificant.

Mitigation measures for the construction phase include:

- Regular maintenance of plant and equipment;
- Cutting, grinding, etc will take place in an enclosed space;
- Noisy operations will be sited maximum distances from sensitive receptors;
- Controlling and limiting traffic movements around sites.

Without mitigation noise levels at the plant in the operational phase would exceed current ambient noise levels and the World Health Organisation (WHO) recommended levels. Mitigation measures have therefore been devised to protect local residents. These include construction of a noise bund (concrete block wall or similar), in close proximity to the turbines to attenuate noise at off site receptors. Silencing systems will also be fitted to the top of the stacks to reduce noise generated at this elevated level. These are suitable measures for dealing with noise from the gas turbines and will reduce noise levels sufficiently to comply with WHO guidelines.

Overall, when mitigation measures are implemented for the operational phase, the impact of noise generated by the plant is assessed as being adverse, long term but of minor significance. The noise from corona discharge has been assessed as having insignificant impact. All noise generated in the construction phase is short-term and of minor significance.

5.7 Traffic

The transport routes to and from the Kribi power plant site, particularly during the construction phase when traffic generation will be at its greatest, will be along the main road from Douala to Edéa and from Edéa to Kribi (see Figures ES1 and ES2). This first section of road is part of the main route from the major port at Douala to Yaoundé and through to the rest of the central and eastern regions of the country and the border with the Central African Republic. This is therefore one of the major route-ways within the country. The second section, to Kribi, services only the coastal area near the town and inland parts of the southern province. There are no major ports or heavy industry in this area and as such this is not a major transport route. These are main roads that are all built to high standards and are well maintained (see Photos 5.7.1 to 5.7.4).

Baseline data for traffic flows has been taken from published information. The data shows that traffic volumes are moderately high for the Douala to Edéa road (3,664 vehicles per day in 2005), whereas traffic volumes along the Edéa to Kribi are very low (approximately 500 vehicles per day in 2004).

Potential traffic impacts from the power project include increased road congestion, noise, vibration & air quality, and increased safety risks.

During the construction phase traffic will be generated from a series of activities including initial site clearing, construction of access roads, installation of plant and equipment, and construction of the transmission line. It is estimated that peak lorry movements will be up to 300 movements per day. These journeys will be associated with importing materials to and from site. Transport of staff in this period will generate up to 100 movements per day.

During the operational phase transporting staff will involve only 15 to 20 movements per day. The main product that will be delivered to the plant will be restricted to fuel. It is estimated that a maximum of 200 loads will be required over the course of a year. Overall, the traffic flow during the operational phase is very low and will have no significant impact on the environment.

The percentage increase (5%) in traffic as a result of the movements generated by the project on the Douala – Edéa road falls well below accepted guidelines figure (25%) above which significant impacts may be caused (UK Institute of Highways and Transportation Guidelines, 2000). Therefore the project will cause no significant impact on this section of highway. However, the Edéa – Kribi road will experience up to a 100% increase during the peak period and potential impacts will occur, e.g. risk of accidents. However, despite this high % increase (due to low current flows) overall traffic movements on this road will still be low in comparison to its potential design capacity.

Mitigation measures to deal with increased congestion are limited because there is only one access road available. Similarly, the materials and people to be transported cannot be reduced. During the construction phase, in particular, vehicles will operate at full capacity wherever practicable to minimise the number of movements. Special vehicle convoys will also be planned for off-peak periods, which will avoid increasing congestion during busy periods of the day.

With reference to noise, vibration and air quality the main mitigation measures will include restricted traffic speed in sensitive areas (through villages) and regular maintenance of vehicles so they operate at optimum condition.

The overall impacts of traffic from the Kribi Power Project are restricted to the construction phase and assessed as being adverse in nature, short term and minor in significance due to the increase in road traffic for this phase of work.

5.8 Soils and Land Use

The baseline conditions within the project area were established by reference to published materials (Bernard, Yerima and Van Ransy, 2005) and via on-site observations. Additional information on site-specific sub-surface ground conditions, for the plant site location, was obtained from the geotechnical investigation undertaken by National Civil Engineering Laboratory (Labogenie, 2006) (see Photo 5.8.1). Soils are generally reddish (iron oxide) in colour with deep, highly weathered profiles. Parent rock materials were occasionally present at the surface and weathering of these materials has resulted in coarse sand and stone. Soil depths above parent rock were greater than 3 m (see Photo) with borehole data indicating soil depths greater than 7 m. Soils are highly leached with low nutrient capacity and are generally of low land use capability.

Land use has been recorded as part of a topographical and census survey undertaken of the project area by AES SONEL in 2006. These surveys have shown the following land use cover along the wayleave of the proposed transmission line route; 20% agriculture, 40 - 50% fallow

lands, and 30 – 40% forest (see Photos 5.8.2 to 5.8.4). Forest cover and fallow land dominate land use within the overall plant site area.

The primary impacts on soils and land use are associated with the need for land take and vegetation clearance. Impacts arise in both construction and operational phases and most changes will be permanent in nature. Secondary impacts may arise where soils are disturbed which may lead to erosion, and where soils are polluted by spills of fuels, etc.

Direct land take for the construction phase will be approximately 7.5 ha at the plant site which will include areas for temporary construction compounds, and under 1 ha on the transmission line route for the foundations of the towers. During the operational phase direct land take for the plant will be approximately 4.75 ha as the construction compound will be restored. However a total area of 16 ha will be fenced off around the power plant and local communities will be excluded from this area throughout the operational phase. Existing agricultural and informal community land use within this 16 ha will therefore be lost. The total land required for the 225 kV wayleave will be approximately 285 ha within which land use restriction will be applied (see Section 3.3.4) and all tall vegetation removed.

There are set land requirements for the plant and tower bases and hence this land take cannot be avoided. The route of the transmission line was designed to avoid as many properties and important land uses (e.g. plantations, subsistence farms, sacred groves and graves) as possible.

Good on-site management in the construction phase will assist in minimising the amount of disruption to local land users. With regard to the operational phase, compensation for loss of land use will be negotiated. Another method of mitigation is to allow continuation of agriculture within the wayleave on conditional terms and in compliance with strict vegetation management guidelines. However this would be at the risk of AES SONEL needing access to the line and for maintenance for safety reasons. As land use capability within the project area is low, population density and therefore pressure on land resources is also low impacts on land use is therefore considered to be insignificant and long-term.

Soil contamination may result from spillage of e.g. fuels. Mitigation measures will be employed (as for those protecting groundwater) and the implementation of these will be covered in the EMP. In addition, waste management will be controlled by methods given in the EMP.

Soil erosion will be controlled by a number of methods including keeping ground clearance to a minimum, controlling run-off, and re-planting areas once construction is finished.

Overall with the implementation of these good working practices the impact on soils is assessed as being adverse, long term and either of minor significance or insignificant.

5.9 Flora and Fauna

The plant site covers an area of 16 ha consisting of recent scrubby fallows, old fallow and patches of disturbed forest. A small proportion of the site is occupied by cultivated crops including banana and cassava. From Kribi to Edéa, the transmission line will cross several habitat types. The most common are disturbed Riverine forest, disturbed swamp forest, disturbed Raphia forest, fallows of various ages and mature forest on rocky soil. To confirm the status of the project area baseline ecological surveys were undertaken by Scott Wilson.

The survey found that a large majority of the plant species identified within the project area are common in littoral forests and all are found in Douala Edéa reserve. Most of them are also present within Mankombe proposed Reserve. None of the animals identified in the survey were protected species and, as such, do not have direct importance in terms of their conservation value. However, larger mammals are used by the local population for food and as a source of income (sale of meat).

It was concluded that the overall conservation value of the project area is very low. This is due primarily to the level of existing disturbance, which has resulted in a severely degraded habitat. It is very poor in bio-indicators of important value and none of the flora (plant) and fauna (animal) species identified in the survey require special protection.

The Kribi Power Project will require land take for the construction sites and vegetation clearance and on-going management within the transmission line corridor. Potential impacts on the flora and fauna include:

- Permanent loss of habitats from clearance for construction of the plant and line;
- Habitat severance due to wayleave clearance;
- Potential for increased hunting, firewood and timber collection from new access routes; and
- Disturbance of wildlife and potential increase in road kills, etc. due to project construction and operation.

The proposed mitigation measures are therefore based on minimising the area of land take, utilising already disturbed areas (e.g. existing road and wayleave corridor), vegetation management (retention of vegetation in wayleave to 2 m height where practicable), control of noise during construction and at the plant site during operation, and vehicle speeds.

Whilst the project will result in the loss and alteration of this habitat, and has the potential to cause disturbance to wildlife, the overall impact is low due to the relatively small area of land take, the low conservation status of the area affected and the current level of disturbance within this area. The impacts of the project for both the construction and operational phases are therefore assessed as being of adverse minor significance.

5.10 Landscape and Visual

The general landscape character is one of rolling hills with secondary forest vegetation comprising mature trees in excess of 30 m in height (see Photos 5.10.1 and 5.10.2). This landscape is interspersed with human settlements, subsistence farming activity and a main road and power line infrastructure corridor. The road has recently been improved and now comprises a 7 m wide carriageway with up to 1 m tarmac verge (see Photo 5.10.3). The existing 90 kV power line consists of self-supporting steel lattice towers of between 27 m and 33 m in height with a nominal 30 m wide wayleave within which all tall vegetation is removed (see Photo 5.10.4). There are a total of 24 villages identified along the 99.5 km transmission line route. Within the villages along the route low voltage local distribution power line poles are also present.

In general terms the combination of tall forest vegetation and the low hills, presenting no high vantage points, results in very limited long distance views across the landscape from either the road or from houses within the villages along the transmission line route. From road and house

level all main views are therefore limited to the close surroundings or occasional long views along the current road line.

Photos 5.10.1 to 5.10.6 present the vegetation existing landscape and views.

Clearance of vegetation along the wayleave of the proposed transmission line, construction of high voltage towers and clearance and construction of the power plant have been identified as the main impacts with potential to adversely affect the landscape. The primary factors are the new visual elements.

Mitigation measures were considered at the outset of the design process when consideration was given to operational factors as well as the environment. Therefore, the route of the transmission line was planned to follow the existing 90 kV power line and main road from Kribi to Edéa. Some deviation has been designed to ensure maximum separation from existing settlements, which will reduce visual intrusion. The plant site has been selected to provide good separation from existing properties; it is set back 200 m from the nearest property and 250 m from the road. In addition, this site has allowed a belt of mature vegetation to be retained. Some of this will need to be cleared for construction but re-planting can be undertaken as soon as construction is finished.

Generally views from any property are limited by the forest and only short, intermittent views of the existing transmission line are visible. The project will not introduce a new visual element along the transmission line corridor but will simply add a similar element to that of the existing line. The power plant is a relatively small area set back from the road and surrounded by the forest vegetation. The visual impacts of this, although a new feature in the landscape, will be minimal due to the level and natural screening. Overall, the impacts for landscape and visual elements have therefore been assessed as adverse long term and minor.

6 Social Impact Assessment

6.1 Introduction

In response to the scoping exercise carried out by Scott Wilson (January and February 2006), a social impact assessment (SIA) of the project area has been undertaken. It has comprised an assessment of the population and demographics, economic environment and social services infrastructure.

6.2 SIA Methodology

The SIA methodology included the use of formal questionnaires and informal consultation with affected people. Information gathered for the SIA included a mixture of primary and secondary data. Existing secondary data such as census records and background information on Cameroon was reviewed. As the majority of secondary data on the project area was either incomplete or out of date, a sample household survey was carried out by Scott Wilson in March 2006 to capture up to date project-relevant information and to provide an accurate baseline against which the significant potential impacts could be measured.

Two teams were employed to undertake the surveys. Three men and two women were selected for each team to achieve a gender balance and enable respondents to feel comfortable when answering questions. A Batanga speaker was included in each team to facilitate good communication with the local population.

Consent to interview households was obtained from the households and the village chief, if available. Interviewees were given an overview of the project. Data collected was analysed and taken back to affected villages to verify the analysis to ensure that a true reflection of the information given by householders.

6.3 Population and Demographics

The project area lies in two provinces: the Littoral Region (northern area) and the South Region (southern area) as shown on Figure ES 2. Eighty two per cent of the Littoral Region population are urban dwellers; the majority of urban dwellers live in Douala. In the South Region only 28% live in urban areas, such as Kribi. In both areas the population is young with over 40% of the population being under 15 years.

Independent of the SIA and in line with Cameroonian legislation, a full property census was undertaken by the Compensation Commission established by the Kribi and Edéa Divisional Officers as specified by the Public Utility Decrees signed by the Minister of State Property and Land Tenure for the project (May to June 2006). Initial findings of the census indicate the following are within land take required by the project and will therefore need to be resettled:

On the plant site:

- 8 households, including crop owners;
- 17 crop owners;
- 2 graves; and

- 0 titled lands.

On the transmission line route:

- *86 households* (18 and 68 in the Kribi and Edéa subdivisions respectively)
- *665 crop owners* (342 and 323 in the Kribi and Edéa subdivisions respectively)
- *55 graves* (12 and 43 in the Kribi and Edéa subdivisions respectively). An additional 5 graves have been reported inside a house in Edéa, but the Commission has not formally identified these. The existence of these graves will be verified during the Resettlement Action Plan (RAP) process (see Section 6.3.3).
- 34 Titled lands (4 and 30 in the Kribi and Edéa subdivisions respectively).

Land take for the project will include tracts of agricultural land, which is mostly held by customary land tenure rather than legal title. As the livelihoods of the local population are mostly land-based, the power project may have a considerable effect on the community and their livelihoods.

Land requisition along the corridor of the transmission line is potentially the most significant social impact on the local population and demographics. With requisition of land there are a number of potential impacts:

- Associated resettlement;
- Conflict with host populations; and
- Loss of cultural property.

In addition, the project will also potentially be affected by in-migration.

The key mitigation measure to minimise the impact of the project on the population is project design and the location of the plant and the transmission line in uninhabited areas. Five alternative plant sites were reviewed and the preferred site was chosen to minimise the need for resettlement. The transmission line route was also selected to avoid settlements and cultural property as far as possible. In addition, the proposed line is located adjacent to the existing 90 kV power line. This has enabled the new line to share the existing wayleave where the two lines are parallel and therefore reduce direct land take.

Where resettlement is required, this will be mitigated by a Resettlement Action Plan (RAP) that has been drafted in compliance with requirements of the World Bank Operating Policy 4.12 (Scott Wilson, July 2007). A framework for the RAP was provided in the original ESIA (Appendix M, Scott Wilson October 2006). Resettlement will be completed before physical works begin on the plant or transmission line. With the implementation of the RAP the impact for land requisition and resettlement are assessed as adverse, long-term and minor. Should resettlement be to more productive land the impact will be beneficial.

Conflict with host populations will be minimised by the resettlement of households, wherever possible, within their existing villages. In line with World Bank OP 4.12 mitigation measures will also include consultation with communities and government, prompt payment of compensation or resettlement, arrangements for addressing any conflict between households being resettled and the host population, and measures necessary to augment services (e.g. water and power

supply) to ensure host areas are comparable. With this mitigation, the impact of conflict has been assessed as long-term, but insignificant.

In-migration will primarily be in the construction phase when there will be a maximum of 550 – 600 employees required of which approximately ten percent are expected to be sourced locally. Impacts may be STIs HIV/AIDs etc. Sensitisation of the local communities and contract workers about safe sex and general behaviour should minimise negative impacts. However, this short-term influx of over 500 people is assessed as adverse and significant.

6.4 Economic Environment

The project area lies within both the Littoral and South Regions as follows:

- *Power Plant and 65% of the southern section of the Transmission Line* lie within the Kribi subdivision of the Ocean Division in the South Region; and
- *The northern 35% of the line and connection with the SIG at the Mangombe substation* at Edéa lies within the Edéa Subdivision in the Sanaga-Maritime Division in the Littoral Region.

The Littoral Region has a vibrant local economy with urban and rural markets being found throughout the Region. Douala is the main town and has the highest urban density in the Province. This is as a result of the potential employment opportunities and the concentration of good infrastructure such as the port, international airport, roads and railways. It also provides a hub of the export and import of products going to and coming from the other regions of Cameroon and neighbouring countries (Chad and The Central African Republic). The region has a large capacity for producing electricity through two hydroelectric plants located on the Sanaga River.

Kribi is the key town in the Project area in the South Region. Kribi town itself is a coastal tourist area with many hotels and guesthouses.

Outside Kribi and Douala, land use, as discussed in Section 5.8, is dominated by forest and land adjacent to villages is used for agriculture. Agriculture is therefore the predominant economic activity in the project area. It comprises occasional large-scale units using modern techniques that are dominated by foreign companies who produce rubber, palm oil, fruits and legumes, or traditional subsistence farming where the main crops are cassava, banana, and cocoa. Villagers also practise livestock production and some small-scale business activities.

The project area is characterised by moderate to severe poverty. Observations made during the household survey confirmed this status with over 50% of inhabitants living below the poverty line. The main sources of income in those villages were, in descending order of importance, agriculture (40%), informal sector (24%), formal sector (23%), hunting and fishing (7%), allowances from relatives (3%) and others (3%).

The key negative impacts on the economic environment are the loss of land and compensation discrepancy through land right disputes. These tend to be short-term effects and can, with proper management, be adequately mitigated. However the project has potentially significant longer-term positive impacts relating to increased national power supply and associated regional economic benefits plus local economic effects from both shorter term and long term increases in employment and trade.

To mitigate the adverse impacts the process for compensation will be provided within the RAP (see Section 6.3). Compensation will be undertaken with reference to the World Bank OP 4.12 guidelines and will focus on providing full and appropriate redress for any economic loss suffered by the project affected people.

Overall, the beneficial impacts on the economic environment are significant in the short and long term through the increase in national power supply, employment for the project and associated expenditure. These impacts will occur at both a regional and local level. However, loss of land and associated loss of revenue is a significant impact, but if properly managed this will be mitigated by the implementation of the RAP for the project.

6.5 Social Services and Infrastructure

There are a number of primary schools in the project area, although none are understood to be located within the land required for the project. Literacy in the project area is also is high, which was supported by the findings of the household survey undertaken by SW. There are two health centres in the Kribi subdivision in the rural project area, one in Londji and one in Elogbatindi. There are also a number of government and private hospitals and health clinics in Kribi and Edéa.

With a few exceptions in the Sanaga-Maritime Division, all the affected villages have access to tarred roads; Edéa-Kribi, Edéa-Douala and Edéa-Kopongo. However, as very few people own or have access to cars, the roads are used mainly for walking or 'hitching a ride' to the larger towns, such as Kribi and Edéa. The roads are, however, regularly used by local buses that travel between Kribi and Edéa.

Surface water resources are the main water supply for local inhabitants for all domestic purposes (see also Section 5.4). A number of households reported having suffered from water-borne diseases. Several child deaths were reported as a result of diarrhoea and other water-borne diseases. This would suggest that current water supply is not entirely safe for human use. All of the houses surveyed only have access to open pit toilets.

Mobile phones are the most common form of communication in the project area. None of the surveyed households had fixed landlines, but observations would suggest that a good proportion of households had access to mobile phones.

The availability and use of electricity is very varied in the project area. A large number of villagers have access to electricity although not all the houses are connected to the electricity network. According to the survey and site observations, the majority of villages have the capacity to access electricity. What is meant by capacity is that many households may have the technology to connect to pylons, but they may not have the money to pay electricity bills or the pylons have gone into disrepair and have ceased to be connected to a national grid. Some wealthier households may have their own generators thus making them independent of the local electricity infrastructure. The village of Dehane has no electricity capacity at all.

Key potential impacts on infrastructure from the Project will be pressure on existing health services and degradation of water supplies. This latter impact is dealt with in Section 5.4. With regard to health services, the construction phase is when there is potential to put considerable strain on the local medical services. In mitigation, the Contractor will be required to provide additional basic medical services, such as an on-site health post. During the operational life of the project, staff numbers will be approximately 60 and all of these will live in towns where

existing facilities can accommodate their medical needs. Effective mitigation will also involve good sensitisation about sexually transmitted diseases and HIV/AIDS, as discussed in Section 6.3.

In addition, there may be more minor impacts on education, electricity and communication services. It is concluded that the potential for large numbers of school-age children moving into the area is low as the construction phase will be a short-term operation and the operational phase will only employ 60 people full-time. The impact on existing educational services will therefore be insignificant. The impact on communications will be neutral to positive. There may be an indirect positive impact if the project generates income and more people are able to afford mobile phones. Similarly with electricity, increased local income generated by the project would mean that more people could be expected to afford to pay for electricity. However overall additional long-term employment is relatively low and therefore major increases in access to local services is unlikely.

6.6 Electromagnetic Fields – Community Health

This section of the ESIA deals with the potential issue of electro-magnetic fields (EMF) and their impact on community health.

Electric and magnetic fields are present wherever electricity is used. For the last twenty years it has been widely debated if these fields are damaging to human health. There is a range of divergent views, but the balance of scientific evidence to date suggests that Electromagnetic Fields (EMFs) do not cause disease. However, international organisations such as the International Commission on Non-Ionising Radiation Protection (ICNIRP) and independent states have set guidelines on exposure limits on EMFs to minimise the potential for shocks and interference with the body's nervous system.

For the purposes of this study a comprehensive literature review was undertaken of the most relevant and up to date information on this topic. From this the potential for impacts to arise from the proposed power transmission line were assessed.

Electromagnetic fields are produced both naturally and as a result of human activity. Wherever electricity is used there will also be electric and magnetic fields. The Kribi Power Project, through the operation of the proposed transmission line, will generate both electric and magnetic fields, which will show the highest ground level values straight beneath the line.

There are no specific, physical mitigation measures proposed to offset potential impacts from EMF effects. However, EMF levels will be within recognised international limits below or close to the line. In addition, the line will however be within a wayleave where no residential properties, or any built development, will be permitted. For the current design this will result in the nearest that any property can come to the line being approximately 15 m. Whilst no significant impacts are identified this separation distance will act as a mitigation measure by further reducing the potential exposure levels of any long term occupied buildings.

In addition to this the potential fear of EMF impacts should be considered within the mitigation measures. Whilst a specific campaign of information on EMF effects is not recommended, staff involved in line planning, survey and construction should be instructed in the effects set out within the ESIA and therefore be in a position to answer questions or provide information should queries arise.

7 Environmental and Social Management Plan

A framework Environmental and Social Management Plan (EMP) was prepared as a stand-alone section of the ESIA in accordance with both the requirements of Cameroonian and World Bank legislation. A full ESMP was subsequently prepared (Scott Wilson,), which contains the following sections:

- **Introduction** – Background to the study, an overview of the project description and methodology.
- **Environmental Standards and Quality Objectives** – A summary of relevant national and international legislation and AES SONEL/KPDC policy.
- **Organisational Capacity** – KPDC management structure with respect to responsibility for environmental and social issues.
- **Register of Environmental and Social Impacts**
- **Environmental and Social Action Plan** – outline of planned mitigation measures and monitoring actions, performance indicators and responsibilities.
- **Monitoring Evaluation and Reporting** – monitoring programme
- **Non-compliance Procedures and Emergency Response Plan**
- **Stakeholder Consultation Plan and Grievance Procedures**
- **Training**
- **References** – A listing of documents referred to in the preparation of this document.
- **Figures**

Appendix A: References

Bernard, Yerima and Van Ransy (2005) Major Soil Classification Systems Used In The Tropics: Soils of Cameroon; Trafford Publishing

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Scott Wilson (July 2007) Kribi Power Project Resettlement Action Plan (RAP);

Scott Wilson (October 2007) Kribi Power Project Environmental and Social Impact Assessment (ESIA) Report, Addendum relating to Gas Reciprocating Engines;

Scott Wilson (December 2008) Kribi Power Project Environmental and Social Impact Assessment Addendum Amendment of the Kribi Gas Plant from 150MW to 216MW.

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